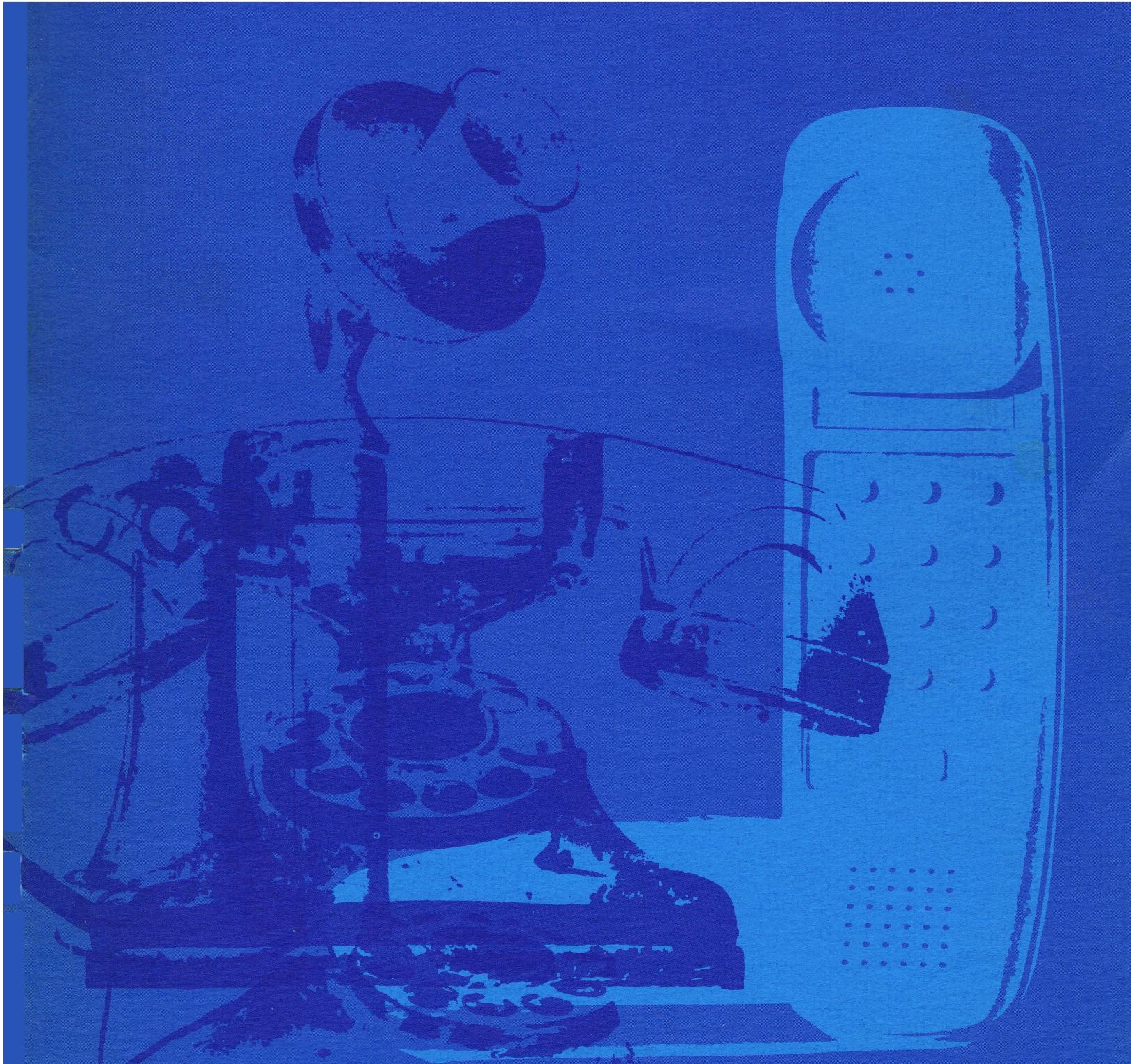


Events in Telephone History



Events in Telephone History

AMERICAN TELEPHONE and TELEGRAPH COMPANY
PUBLIC RELATIONS AND EMPLOYEE INFORMATION DEPARTMENT
195 BROADWAY, NEW YORK, N.Y. 10007

Events in Telephone History

This chronological record of important dates in the history of the telephone was compiled over a period of years and was first published in 1958.

“Events in Telephone History” is intended as a reference work, primarily for Bell System public relations people, and for telephone employees who frequently receive queries from the public. The items shown are brief, non-technical and include answers to many frequently asked questions. Reference material is listed for many of the items.

In a work of this size, omissions are inevitable. And while every effort was made to keep the material as accurate as possible, errors in source material may cause some date conflicts.

If errors or important omissions are detected, please notify the Historian, A.T.&T. Co., 195 Broadway, New York, New York 10007, so that the changes may be included in any future revision of this booklet.

EVENTS IN TELEPHONE HISTORY

Please Note: "Events in Telephone History" is reprinted every three years, but supplementary pages are published to cover two intervening years—in the last edition, 1971 and 1972, for example. Supplementary pages for this 1974 edition may be obtained from the Booklet Editor in your company or from the Public Relations Department File Room at AT&T in the first quarter of 1975 and 1976.

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"DON JUAN" 8/1926

DOOLITTLE, THOMAS B.

Bridgeport telegraph switchboard, 5/1877; Hard-drawn copper wire, 12/1877; Pay stations, 12/1878; Boston-N.Y. wire report, 3/1884; A.T.&T. incorporation, 2/1885

DOWD, PETER A. 9/1878, 11/1879

DOWNER, ROSWELL C. 5/1877

DRY CORE CABLES 1890

DUBUQUE, IOWA, EXCHANGE 1/1879

DUFFERIN, EARL OF 9/1877

DUTCH GUIANA, service to 12/1942

E

EARLY BIRD

Launching 4/1965
Commercial telephone service 6/1965

EARTHQUAKES

San Francisco, 4/1906; Eureka, California, 12/1954; Tehachapi, California, 7/1952; Bakersfield, California, 8/1952

EASLICK, DAVID K. 5/1970, 7/1973

EASY MOVE PLAN 4/1966

ECHO, PROJECT 8/1960

ECHO II 1/1964

ECHOLS, ROY C. 5/1960

ECKLEY, FREDERICK R. 12/1962, 6/1964, 4/1966

ECUADOR, service to 12/1945

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EDISON, THOMAS A.
Telephone transmitter, 4, 12/1878; Train telephony, 9/1881; Carbonized anthracite transmitter, 2/1886

EDP BILLING, first 12/1960

EGYPT, service to 10/1932, 12/1946

ELECTRICAL AND PATENT DEPT., AM. BELL TEL. CO. 11/1883, 1/1891

ELECTRICAL RESEARCH PRODUCTS, INC. 12/1926

ELECTROLYTIC CONDENSER 5/1921

ELECTROMAGNETIC HARMONIC GENERATORS 1934

ELECTRONIC EAVESDROPPING LAW 3/1965, 2/1966

ELECTRONIC LARYNX, announced 8/1959, 9/1961

ELECTRONIC SWITCHING, announced 3/1955
Morris, Ill., trial 11/1960; Succasunna, N.J., 7/1962, 5/1965; ESS 101, 1, 11/1963; Chase, Md., 1/1966

ELMEN, G. W. 1916

ELIZABETH, N. J., AIR CRASH 1/1952

ELLINGHAUS, WILLIAM M. 4/1970, 9/1970

EL SALVADOR, service to 11/1936

EMERGENCY NUMBER "911" 1/1968, 3/1968, 7/1968

EMERY, J., JR. 5/1877

EMPLOYEE GROUP LIFE INSURANCE 6/1958

EMPLOYEES' STOCK PLANS
First, 1/1915; Installment plan, 5/1921; 2,800,000 share issue, 7, 10/1947; 1, 4/1958; 4/1959; 1/1960; 1/1963. Suspension, 6/1968

ENGINEERING DEPARTMENT, A.T.&T.
Organized, 1902; Consolidation with Western Electric, 1907; Reorganized, 7/1919

ENGINEERS DEPT., AM. BELL TEL. CO. 1/1891

ENGLAND, service to, *see* Transatlantic cable

EQUAL EMPLOYMENT OPPORTUNITY COMMISSION 12/1970

ESPENSCHIED, LLOYD
Transatlantic transmission, 10/1915; Wave echo patent, 1919; Coaxial conductor, 5/1929

ETHIOPIA, service to 12/1957

EUROPE, service to, *see* Transatlantic cable

EVERT, WILLIAM G. 9/1878

EXCHANGES
First commercial, 1/1878; First in Illinois and also first Bell exchange in Illinois, 6/1878; Early history,

general note, 8/1878; 50-line, 1902; 10,000-Line 10/1902; Semi-mechanical, 1915; First full machine switching, New York City, 10/1922; First, designated national landmark, 1/1964

See also Switchboards

EXCISE TAX REDUCTION 4/1954; 6/1965; 3, 4/1966

EXHAUST CONTROL, telephone vehicles 10/1966

EXPLORER SATELLITE 1/1958

F

FACSIMILE NEWSPAPER 5/1962

FACSIMILE TRANSMISSION, *New York Times* 8/1956

FAIRCHILD, MRS. DAVID 11/1954, 8/1956

FARGO, N. D., EXCHANGE 1/1881

F. B. I. TELETYPE INSTALLATION 1935

FEDERAL COMMUNICATIONS COMMISSION
Regulatory powers, communications industry, 7/1934; Approves acquisition of Western Union Pacific area telephone business, 4/1951; TWX recommendation, 10/1965; Authorizes Comsat purchase of satellite ground station, 1/1967; Interstate rate case, 4/ 1967, 7/1967, 10/1967; Authorizes first commercial television service between U.S. and Australia, 3/1968; Carterphone decision, 6/1968; New Bell System tariffs, 12/1968; Regulating cable television industry, 6/1970; Ground rules for proponents of satellites and cables, 6/1970

Hearings on A.T. & T. rates 3/1971

Rules on use of transatlantic satellites
and cable 5/1971

Authorizes Western Union to build
earth station 5/1973

Authorizes COMSAT to purchase satellites ... 5/1973

Authorizes A.T.&T. to build and operate
earth stations 9/1973

FEDERAL TELECOMMUNICATIONS SYSTEM 7/1964

FIJI ISLANDS, service to 12/1957

FINLAND, service to 1/1930, 12/1947

FIRE ALARM SYSTEM 10/1878

FIRES
Anderson, Ind., 1/1934; Birmingham, Ala., 3/1934; Norfolk Naval Base, Va., 1/1941; Circus, Hartford, Conn., 7/1944; River Grove, Ill., 12/1946; Bar Harbor, Me., 10/1947; Rugby, N. D., 3/1954

FIRMAN, LEROY B. 1879

FISH, FREDERICK P. 7/1901

FISK, DR. JAMES B. 1/1959, 2/1973

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FLAG, BELL SYSTEM, adopted	1923
FLEMING, SIR AMBROSE	10/1906
FLETCHER, A. B.	2/1877
FLETCHER, HARVEY	1/1922
FLOODS	
Miss. & Ohio Rivers, 3/1927; Eastern states, 3/1936;	
Ohio-Mississippi, 1/1937; Vanport, Oregon, 5/1948;	
California, 11/1950; Kansas-Missouri, 7/1951; Rio	
Grande, 6/1954	
FM CHANNELS, FCC filing	1/1948
FOOTBALL, first broadcast	10/1922
FORBES, WILLIAM H.	9/1887
Biog. note	3/1879
FORD FOUNDATION, noncommercial television	
proposal	8/1966
FOREIGN EXCHANGE SERVICE	5/1912
FORE RIVER SHIP AND ENGINE COMPANY	1854
FORMOSA, service to	12/1949
FOWLER, E. P.	1/1922
FRANCE, service to	12/1945
FRANKLIN INSTITUTE, PHILADELPHIA	3/1957
FRENCH EQUATORIAL AFRICA, service to	3/1955
FRENCH WEST AFRICA, service to	2/1952
FRESE, GERTRUDE	1/1947
FROST, H. P.	1/1878
G	
"GALLOWES-TYPE" TELEPHONE	6/1875
GALVESTON, TEX., EXCHANGE	1/1879
GENERAL ELECTRIC COMPANY	
Cross-licensing, A.T.&T.	7/1920
"Switched service" system adopted	3/1964
GENERATORS, electromagnetic harmonic	1934
"GENIUS OF ELECTRICITY" STATUE	10/1916
GENERAL SERVICES ADMINISTRATION	
Approves Affirmative Action Program,	
Upgrade and Transfer Plan	9/1972
GENOA, ITALY, service to	3/1929
GEORGE VI, coronation broadcast	5/1937
GERMANY, service to	12/1946, 12/1947
GHERARDI, BANCROFT	7/1914, 4/1938
GIRBALTAR, service to	3/1929

GIFFORD, WALTER S.

Director, Council Natl. Defense, 12/1916; Elected President, A.T.&T., 1/1925; First television demonstration, 4/1927; Fundamental policy speech, 10/1927; First round-the-world call, 4/1935; Medal For Merit, 2/1946; Chairman of Board, 2/1948; Retires, 12/1949; Ambassador to Gt. Britain, 12/1950; Died, 5/1966.

GILL, FRANK	1/1923
GILLEN, WILFRED D.	8/1965
GILLILAND, EZRA T.	
Biographical note, 5/1879; Train telephony, 9/1881;	
Resigns from Bell Labs., 11/1883; Village system,	
1884	
GILMER, BEN S.	8/1965; 2/1967; 1/1968; 4/1970
GLENN, COL. JOHN	2/1962
GLIDDEN, CHARLES JASPER	9/1927
GLOUCESTER, S. S.	10/1920
GOETZE, ARTHUR B.	9/1956, 3/1959
GOLD & STOCK TELEPHONE COMPANY	4, 8, 12/1878
GOODSON, RICHARD A.	7/1965, 4/1970
GORMAN, PAUL A.	10/1958, 4/1959, 1/1964,
	6/1969, 12/1969
GOULD, JAY	11/1881
GRAY, ELISHA	
Biographical note	1869
Transmitter	4/1878
GRAY, WILLIAM	1888
GRAYBAR ELECTRIC COMPANY	1928
GREECE, service to	12/1941, 12/1947
GREEN, JOHN A.	8/1957
GROSVENOR, MRS. GILBERT	3/1947, 11/1954, 8/1956
GROUND OBSERVER CORPS MANEUVERS	11/1950
GUAM, service to	5/1951
GUN DIRECTOR, electrical	11/1943

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HAIGH, J. LLOYD	8/1877
HAITI, service to	12/1937
HALL, EDWARD J., JR.	
Boston-N. Y. wire, 3/1884; A.T.&T. incorporation,	
2/1885; Recommends N. Y.-Phila. line, 5/1885;	
Night rates canceled, 9/1907	

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HANDSET

Brown, R. G.	4/1878
Combined	1937
First availability	1927
Shoulder rest	6/1954
300-type conversion	8/1955

"HANSEL AND GRETTEL," first opera broadcast . . . 12/1931

HARDING, WARREN G. 1/1921, 6/1923

HARMONIC TELEGRAPH 1873

HARRISON, W. H. 6/1942

HARTLEY, R. V. L. 10/1915

HAUGHWOUT, LYDIA 3/1966

HAVANA-KEY WEST CABLE 4/1921

HAWAII, service to 12/1931

HAWAII CABLE

Planned, 8/1955; Laying started, 7/1957; Service opened, 10/1957; Second cable, 7/1964

HAWAII-CALIFORNIA OPERATOR DIALING 6/1950

Hayes, Hammond V.

Biog. note, 12/1885; Common battery switchboard patent, 12/1888; Heads A.T.&T. Engineering Dept., 1902; 10,000-line exchange memorandum, 10/1902; Becomes Chief Engineer, 1/1905

HEIFETZ, JASCHA 4/1942

HEISING, R. A. 1915

Rectifier modulation 1916

HELENA-BUTTE, MONT., TOLL LINE 12/1885

HENDERSON, REVEREND THOMAS 1870

HENRY, JOSEPH 3/1875

HIBBARD, ANGUS S. 1/1889

Selective ringing 3/1896

HILL, CHARLES 9/1956

HOLLAND, DR. JEROME H. 8/1972

HOLMDEL LABORATORY 10/1962, 12/1966

HOLMES, E. T. 5/1877

HOLMES BURGLAR ALARM SERVICE 8/1878

HOLMES ELECTRIC PROTECTIVE CO.

Stock sale 4/1950

HONDURAS, service to 12/1935

HONG KONG, service to 12/1949, 8/1966

HOOVER, HERBERT 4/1927, 3/1929

HORIZONTAL RHOMBIC ANTENNAS 10/1929

HOUGH, RICHARD R. 12/1966

HOULTON, ME., RECEIVING STATION 1927

HOYT, R. S. 3/1912

HUBBARD, GARDINER GREENE

Born, 1822; Meets A. G. Bell, 1871; Contract with T. A. Watson, 9/1876; Offers telephone to Western Union, 10/1876; Trustee of Bell Telephone Company, 7/1877; Dies, 12/1897

HUBBARD, MABEL G. (BELL)

Marries Bell, 7/1877; Dies, 1923

HUBBARD, SAMUEL 12/1878

HUDSON, JOHN E.

Gen'l Mgr., Am. Bell Tel. Co., 3/1885; President, A.T.&T., 9/1887; Biog. Note, 4/1889; Dies, 10/1900

HUGHES, WILLIAM A. 10/1958

HULL, JEROME W. 3/1968

HUNGARY, service to 12/1947

HUNT, A. S. 8/1947

HUNTINGTON, IND. 3/1968

HURRICANES, see Storms

I

ICELAND, service to 10/1935, 12/1947

IDAHO, first exchange 9/1883

ILLINOIS, first exchange 6/1878

ILLINOIS BELL TELEPHONE COMPANY 12/1920

IMTS (Improved Mobile Telephone Service) . . . 3/1965

INDIA, service to 7/1933, 12/1946

INDIANA BELL TELEPHONE COMPANY 2/1920

INDIANAPOLIS

Exchange 1/1879

Telephone building moved 10/1930

INDONESIA, service to 4/1931

INDUCTION 6/1900

INFORMATION SERVICE, N.Y. 2/1906

INGERSOLL, CAN., EXCHANGE 5/1880

INKTRONIC PAGE PRINTER 11/1967

INSTALLERS' TRUCK RADIO COMMUNICATION . . . 6/1955

INSTITUTIONAL ADVERTISING 1908

INSURANCE PLAN, Bell System 6/1958

INTELSTAT 10/1966

INTELSTAT IV 3/1971

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INTERNATIONAL DIRECT DISTANCE DIALING—
See Direct Distance Dialing—International

INTERNATIONAL RADIO CONSULTATIVE
COMMITTEE 6/1951

INTERNATIONAL RADIOTELEGRAPH CONVENTION
TREATY 11/1927

INTERSTATE COMMERCE COMMISSION, formed ... 2/1887
amended ... 6/1910

INTER STATE TELEPHONE COMPANY 1/1881

INWARD WATS SERVICE 6/1965

IOWA, first exchange 9/1878

IRAN, service to 12/1949

IRELAND, service to 3/1929, 12/1946

ITALY, service to 12/1939

IVES, HERBERT E. 4/1927

J

JACKKNIFE SWITCH 8/1879

JACKSONVILLE, FLA., EXCHANGE 5/1880

JACOB, F. 1886

JAMAICA, service to 11/1936; 2, 4/1963

JAPAN, service to 12/1934, 12/1946, 6/1964

"JAZZ SINGER, THE" 10/1927

JEWETT, FRANK B.
Coaxial cable demonstration, 11/1936; Physical sci-
ence fellowships, 9/1944; Retires (biog. note), 9/1944

JOLSON, AL 10/1927

JORDAN, service to 12/1956

JUNEAU, ALASKA, service to 12/1937

K

KAHLER, WILLIAM V. 3/1962

KANSAS CITY-OMAHA LINE 5/1896

KAPPEL, FREDERICK R.
Biog. note, 9/1956; 8/1961; Pupin medal, 2/1966;
Retires as A.T.&T. board chairman 2/1967; Retires
as board member, 4/1970

KAYES, MRS. MARY L. 5/1955

KELLY, DR. MERVIN J. 1/1959

KELVIN, LORD 6/1876

KERSTA, LAWRENCE G. 4/1966

KEYSTONE TELEPHONE COMPANY 9/1945

KEY WEST-HAVANA CABLE 1/1931

KILGOUR, B. L., JR. 12/1965, 2/1969

KIMBALL (WATSON), ELIZABETH SEAVER 1854

KINGSBURY, NATHAN C.
Stock commitment, 12/1913; Engineering Depart-
ment reorganization, 7/1919

KOCH, WALTER K. 12/1966

KOREA, service to 12/1939, 12/1947

KOREAN WAR, priority set up 7/1950

KUWAIT, service to 12/1956

L

L-5 SYSTEM 7/1970, 8/1970

LANGMUIR, IRVING 1912

LARYNX, electronic 8/1959, 9/1961

LASA, PROJECT 10/1965

LASER, *see* Optical Maser

LAS VEGAS, N. M., EXCHANGE 1/1881

LATVIA, service to 4/1931

LAW TELEGRAPH COMPANY 8/1878

"LEAVE-WORD" CALLS 4/1953

LEBANON, service to 2/1952

LEEWARD & WINDWARD ISLS., service to 12/1947

"LEPRECHAUN," computer 6/1957

LEVIATHAN, S. S. 12/1929

LEWIS, WALTER 1/1878

LIBERIA, service to 4/1965

LIBYA, service to 12/1957

LICENSE CONTRACT
Service charge 4½%, 11/1902; 4%, 1/1926; 2%,
1927; 1½%, 1/1928; 1%, 10/1948

"LIGHT KNIFE" 4/1967

LILLEY, ROBERT D. 7/1965, 4/1970, 2/1972

LINDEMAN, CARL O. 2/1960, 7/1965

LINDHOLM, WILLIAM L. 7/1965, 4/1970, 2/1972

LISBON, service to 10/1932, 12/1941

LITHUANIA, service to 1/1930

LITTLE ROCK, ARK., EXCHANGE 1/1879

LOADING, first commercial application 5/1900

LOCKWOOD, THOMAS D.
Joins National Bell, 7/1879; Sender patent, 1906;
Dies (biog. note), 4/1927

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LONDON, ONT., EXCHANGE	1/1879
LONG, GEORGE A.	1888
LONG DISTANCE	
First call, 7/1876; First two-way conversation, 10/1876; Boston-Salem, 11/1876; Boston-North Conway, 12/1876; Boston-N.Y., 4/1877; First commercial line, Canada, 5/1879; International, first, 1/1880; First commercially successful line, 1/1881; N.Y.-Boston, 3/1884; Day and night rate differentiation, 11/1887; "Blue Bell" design, 1/1889; N.Y.-Chicago line, 10/1892; Boston-Chicago line, 2/1893; N.Y.-Cincinnati line, 12/1893; Chicago-Nashville, 11/1895; Kansas City-Omaha, 5/1896; N.Y.-St. Louis, 6/1896; N.Y.-Charleston, 6/1897; N.Y.-Minneapolis, 8/1897; N.Y.-Omaha, 9/1897; N.Y.-Norfolk, Va., 10/1897; N.Y.-Kansas City, 11/1898; Toll periods reduced, 10/1899; First conversation underground cable, 1902; Underground cables, 3/1909; Transcontinental line, 7/1914, 2/1915; N.Y.-Los Angeles, 5/1915; Tolls, CLR method, 1925; Traffic control bureau, 8/1925; Direct dialing cutover, 1, 4/1956; Miami-Boston cable, 4/1965	
See also Rates, Long Distance	
LONG DISTANCE LINES DEPARTMENT	1907
"LONG LINES," see Cable Ship	
LONG LINES DEPARTMENT	
Name established	11/1917
Operating areas changed	3/1966
Title designations	6/1970
LONGMAN, EVELYN BEATRICE	10/1916
LOS ANGELES, EARTHQUAKE	3/1933
LOS ANGELES-CATALINA RADIOTELEPHONE	8/1923
LOUDSPEAKER DEMONSTRATION, BELL	9/1922
LOUISVILLE, KY., EXCHANGE	1/1879
LOWELL, MASS.	
Telephone numbers	12/1879
LSA DIODES	2/1967
LYTLE, H. B.	4/1882

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MACAO, service to	1/1953
MACAVOY, PAUL W.	5/1970
MACDONALD, ANGUS	3/1888
MACHINE SWITCHING, see Switching systems	
MADAGASCAR, service to	2/1952

MADEIRA Is., service to	2/1952
MADRID, service to	1/1928
MAGNETIC DIALERS	1/1962
MAGNETIC TRANSMITTER TELEPHONES	1/1876
MALAYA, service to	5/1954
MALAYSIA, service to	8/1966
MALONE, FRANK M.	8/1965, 7/1968, 9/1970
MALTA, service to	12/1949
MANCHESTER, N. H., PBX	12/1879
MANLEY, J. M.	1934
MANN-ELKINS ACT	6/1910
MANSHIP, PAUL	
Bust of A. G. Bell	3/1947
Plaque honoring Bell	11/1954
MARCONI, GUGLIELMO	
First transatlantic signal	12/1901
Wireless message, Glace Bay, N.S.-England	12/1902
MARKETING DEPARTMENT (A.T.&T.)	4/1959
New	1/1973
MARKETING DEPARTMENT	
MARLER, GEORGE CARLYLE	9/1956
MARRISON, W. A.	
Control crystal, radio	6/1924
Quartz crystal clock	1927
MARYLAND, first exchange	1/1879
MASON, W. P.	1937
MASSACHUSETTS, first exchange	4/1878
MAXCY, ELLIS C.	4/1962
MAY, WALTER, JR.	6/1937
MAYNARD, GEORGE C.	12/1878
McBERTY, F. R.	1906
McCAFFREY, H. D.	12/1885
McCONNAUGHEY, GEORGE C.	9/1956
McFARLANE, LEWIS B.	7/1876
McGILL, WILLIAM J.	4/1972
McHUGH, KEITH S.	5/1959
McKENZIE, CATHERINE	1847
McNAMEE, GRAHAM	5/1923
McNEELY, E. J.	8/1961, 1/1965
McQUARRIE, J. L.	1906
MECHANICAL DEPT., AM. BELL TEL. CO.	
Formed, 11/1883; Hayes tenure, 12/1885; Supplemented, 1/1891	

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MEDIPHONE	1/1962
MEHLHOUSE, HARVEY G.	12/1969, 11/1971, 2/1972
MEMORY SERVICES, customer trial	5/1965
MERCER, WILLIAM C.	12/1971
MERCURY, PROJECT	1/1960, 9/1961
MERIDEN, CONN., EXCHANGE	1/1878
MERRITT, B. F.	3/1879
MESSAGE ACCOUNTING, AUTOMATIC Newark center, 2/1950; Centralized, 11/1953; Chi- cago, 6/1950	
METROPOLITAN TELEPHONE AND TELEGRAPH Co.	5/1880
MEXICO	
Border service	2/1883
Telephone service to	9/1927
MICHIGAN, first exchange	8/1878
MICHIGAN BELL TELEPHONE Co. "Number Please"	12/1945
MICHIGAN BELL	10/1973
"MICKEY MOUSE"	2/1947
MICROPHONE, condenser	1916
MICROWAVE RELAY	
Broad band antenna	5/1954
Demonstration	10/1945
Four link	10/1946
N.Y.-Boston	11/1947
Single link	8/1946
Two link	10/1946
See also Radio relay systems	
MIDWAY ISLAND, service to	4, 6/1964
MILAN, service to	3/1929
MILITARY TELEPHONE NETWORK, nationwide	1/1964
MILLER, T. G.	4/1935
MINNEAPOLIS EXCHANGE	1/1879
MISSISSIPPI, first exchange	1/1881
MISSOURI, first exchange	5/1878
MOBILE, ALA., EXCHANGE	11/1879
MOBILE TELEPHONE SERVICE	
St. Louis, Mo., 6/1946; Plane to ground, 5/1947; Bos- ton-Washington highway, 9/1947; Dial trial, 7/1959	
MOBILE YARD SYSTEM, Penn. R.R.	1/1951
MODULATOR, Alexanderson-Colpitts	1912

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NEW JERSEY BELL TELEPHONE COMPANY	
Formed	9/1927
40th anniversary observed	10/1967
Takes over Eastern T. & T. Co.	9/1944
Changed designation of "information"	
service to directory assistance	6/1968
New electronic central office, Trenton	12/1968
NEW ORLEANS EXCHANGE	1/1879
NEWSPAPER, first use of telephone	2/1877
NEW YORK, TELEPHONE COMPANY OF	8/1877
NEW YORK-CHARLESTON, W. VA., LINE	6/1897
NEW YORK-CHICAGO LINE	10/1892
Underground cable completed, 4/1925	
NEW YORK-CINCINNATI LINE	12/1893
NEW YORK-DENVER	
Memorandum	4/1909
Service established	5/1911
NEW YORK-KANSAS CITY LINE	11/1898
NEW YORK-LONDON	
Radiotelephone, first public test	3/1926
Radiotelephone (commercial)	1/1927
20th anniversary	1/1947
NEW YORK-MINNEAPOLIS LINE	7/1897
NEW YORK-NORFOLK, VA., LINE	10/1897
NEW YORK-OMAHA LINE	9/1897
NEW YORK-PACIFIC COAST LINES	1, 5/1915
NEW YORK-ST. LOUIS LINE	6/1896
NEW YORK STATE, first exchange	3/1878
NEW YORK TELEPHONE COMPANY	
Established, 6/1896; Consolidation with N.Y. & N.J. Telephone Co., 9/1909; Holmes Co. stock sold, 4/1950	
"NEW YORK TIMES," facsimile edition	8/1956
NEW YORK WORLD'S FAIR, Bell System	
Exhibit	4/1964, 10/1965
NEW ZEALAND, service to	12/1945
NICARAGUA, service to	7/1933
NICOLSON, A. M.	4/1918
NIGHT RATES	
Established	11/1887
Reductions canceled	9/1907
<i>See also</i> Rates, long distance	
NIKE ZEUS	8/1962
NOBEL PRIZES	
Davisson	11/1937

Brattain, Shockley and Bardeen	12/1956
Townes	10/1964
NORTH AMERICAN DEFENSE (NORAD)	
Facilities	7/1966
NORTHERN ELECTRIC COMPANY, LIMITED	7/1882
Incorporation	1/1914
NORTHERN TRANSCONTINENTAL TELEPHONE	
LINE	1/1927
NORTHWESTERN BELL TELEPHONE COMPANY	1/1921
NORWAY, service to	12/1946
"NUMBER, PLEASE?"	6/1895
"NUMBER, PLEASE" radio program	12/1945
NURNBERGER, THOMAS S.	5/1970
NUTT, EMMA AND STELLA	9/1878

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OFFICE OF TELECOMMUNICATIONS POLICY	9/1970
OFFICES IN NEW JERSEY	5/1970
OGDEN, UTAH, EXCHANGE	5/1880
OHIO, first exchange	9/1878
OHIO BELL TELEPHONE COMPANY	9/1921
OKINAWA, service to	10/1948
OKLAHOMA, first exchange	6/1893
OMAHA, exchange	1/1879
OMAN, service to	3/1955
195 BROADWAY	
Building begun, 1913; First section completed, 1916; First U.S. Flag flown, 5/1916; Addition opens, 11/1922; WEAf studios, 5/1923	
"ONE POLICY, ONE SYSTEM, UNIVERSAL SERVICE" 1908	
OPERATION & ENGINEERING, DEPT. OF	7/1919
"A" Division established	11/1955
Letter to Bell companies (Korean War)	8/1950
OPERATOR DIALING	
Local calls, 1915; Connecticut, 1929; California-Hawaii, 6/1950	
<i>See also</i> Toll dialing	
OPERATOR'S TRAINING SCHOOL, first	1/1902
OPTICAL MASER	10/1960, 1/1961
OREGON, first exchange	8/1878
OSBORNE, HAROLD	1847
OSCILLATOR, DE FOREST	1912
OSCILLATOR CIRCUIT	2/1942
OSLO, service to	1/1928

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OTTAWA, CAN., EXCHANGE	5/1880
"OUR MR. SUN"	11/1956
"OVER-THE-HORIZON"	
TRANSMISSION	10/1954, 8/1957, 12/1959, 1/1960
OVERTONES, REPAIR SERVICE	2/1953
OWENS, CORNELIUS W.	7/1965, 11/1966, 9/1970, 2/1972

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PACIFIC CABLE	2/1962; 4, 6/1964
Guam-Philippines link	12/1964
See also Hawaii cable	
PACIFIC NORTHWEST BELL TELEPHONE Co.	2/1960
Incorporated	7/1961
PAINE, ALBERT BIGELOW	1845
PALESTINE, service to	7/1933, 12/1946
PANAMA, service to	7/1933, 12/1941, 4/1963
PANAMA-PACIFIC EXPOSITION	7/1914
PANEL SWITCHING SYSTEM	1906
First machine type	12/1921
PAPUA, service to	12/1946
PARAGUAY, service to	12/1935, 11/1960
PARIS, service to	1/1928
PARKER, DR. MOSES GREELEY	12/1879
PARTY LINES	
Refusal to yield line	5/1955
Selective ringing	3/1896
Two- and four-party service	1891
PATENTS, BELL	
First, 3/1876; Second U.S., 1/1877; Canadian rights assigned, 7/1877; Suit against Dowd, 9/1878; Dowd suit settled, 11/1879; Photophonic transmitter, 1880; Bell rights sustained, 3/1888; First Bell patent expires, 3/1893	
PATENTS, OTHER	
Arnold-Langmuir suit	1912
Doherty amplifier	8/1940
Electrolytic condenser	5/1921
Cross-licensing agreement	7/1920
Crystal-cutting method	1937
Horizontal rhombic antennas	10/1929
Oscillator circuit	2/1942
Ziegler crystal-mounting	1940
PAUL VI, POPE, visit by	10/1965
PAYROLL DEDUCTION INSURANCE PLAN	1927

PAY STATIONS

Early, 12/1878; First in N.Y. (attended), 1880; Coin-operated, 1888; First installation, 1889; Five-cent rate, N.Y., 6/1906; Multi-coin collector, 1912; N.Y., New Haven R.R., 9/1950; Prepay cutover, 9/1950; Ten-cent changeover, 1/1951	
PEANUT TUBE	1918
PEARL HARBOR	12/1941
PEDRO, DOM, Emperor of Brazil	6/1876
PENNSYLVANIA, first exchange	11/1878
PENSION PLAN, BELL COMPANIES	1/1913
\$100 minimum	11/1949
Salary base change	2/1959
PERMALLOY	1916
PERMINVAR	1916
PERU, service to	10/1932
PETERSON, E.	1934
PETTENGILL, H. J.	2/1883
PHALEN, CLIFTON W.	10/1955, 5/1959, 7/1965, 11/1966
PHANTOM CIRCUITS	1886
Duplex cables	1908
PHELPS, LOUIS J.	9/1881
PHILADELPHIA CENTENNIAL EXPOSITION	6/1876
PHILADELPHIA-N.Y. LINE	5/1885
PHILIPPINES, service to	7/1933, 12/1946
PHILLIPS, E. F.	4/1882
PHONAUTOGRAPH	7/1874
PHONE CENTER	7/1970
PHONEVISION, ZENITH	
FCC grants permission, 2/1950; Chicago trial, 1/1951	
PHONOGRAPH, first "Orthophonic"	10/1925
PHOTO-FINISH TIMING APPARATUS	5/1932
PHOTOPHONE	1880
PICTUREPHONE® SERVICE	
Experimental transmission, 8/1956; First transcontinental call, 4/1964; Service inaugurated, 6/1964; Charges reduced, 6/1965; Product trial, 7/1965; New TV camera tube for, 2/1967; Redesigned model demonstrated, 12/1967; Westinghouse trial, Pittsburgh-New York, 2/1969; First commercial exchange service, Pittsburgh, Pa. 7/1970; First subscriber inter-city service, 6/1972	
PICTURE TRANSMISSION	
First over telephone wires, 5/1924; First commercial, 4/1925; Color, first, 6/1927; AP, private line, 1/1935	

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PIEZO-ELECTRIC OSCILLATOR CRYSTAL	4/1918
"PLANS FOR PROGRESS"	6/1962
PLANT, H. B.	6/1937
POETKER, FRANCIS JONES	3/1971
POLAND, service to	1/1930, 12/1947
POLE CLIMBING EQUIPMENT	2/1954
POPE, HENRY W.	11/1911
PORTABLE RADIO, emergency	6/1955
PORTLAND, ME., EXCHANGE	1/1879
PORTLAND, ORE., EXCHANGE	8/1879
PORTUGUESE INDIA, service to	5/1954
POST & COMPANY, CINCINNATI	6/1879
POST OFFICE, U.S.	
Assumes control of telephone & telegraph systems	7/1918
POTTER, R. K.	11/1945
POWERLINE CARRIER, <i>see</i> Rural powerline carrier circuits	
PREPAREDNESS TEST	5/1916
PRESIDENTIAL ELECTION, first broadcast returns	11/1924
PRIVATE BRANCH EXCHANGE (PBX)	
First, 12/1877; Early establishment, 12/1879; 740E, 3/1950; Dictation recording trunks, 10/1954	
PRIVATE LINE SERVICE	
Morse telegraph, 1/1887; First teletypewriter service contract, 6/1917; Telephotograph service, 4/1925; Telegraph, 1880; Telephone, first offered, 11/1886; First users, 1/1887; Short period, 1887; First press use, 1/1888; First full period contract, 6/1893; U.P. contract, 6/1917; Telephoto service, 4/1925, 8/1935; Color photo transmission, 6/1927; Transcontinental photograph network, 1/1935; Rates, 6/1917, 4/1919, 2/1943; Military, nationwide, 1/1964; General Electric, 3/1964; Federal Telecommunications System, 7/1964; Customer-furnished equipment, 6/1971; Preferential rates, 7/1971	
PROCKNOW, DONALD E.	11/1971; 2/1972
PROVIDENCE, R. I., EXCHANGE	1/1879
PUBLIC ADDRESS SYSTEM	3/1921
PUBLIC TELEPHONE, <i>see</i> Pay Stations	
PUERTO RICO, service to	11/1936
PUPIN, MICHAEL I.	6/1900, 3/1935
PURVES, T. F.	1/1923

Q

QUARTZ CRYSTAL CLOCK	1927
QUEBEC, CANADA, EXCHANGE	5/1880
QUEEN MARY, H.M.S.	6/1937

R

RADAR

Espenschied principle	1919
Oscillator circuit	2/1942
Terrain clearance indicator	10/1938
Warning network planned	7/1950

RADIO

KDKA, Pittsburgh, 11/1920; WEAf (WBAY) opens, 7/1922; First commercial sponsorship, 8/1922; First wire-connected simultaneous broadcast, 1/1923; First coast-to-coast broadcast, 2/1924; Rep. & Dem. conventions broadcast, 6/1924; Long Lines transmission rates, 7/1926; First control crystal, 6/1924; "Invasion from Mars" broadcast, 10/1938; Over-the-horizon transmission, 10/1954; Emergency portable, 6/1955

RADIO CORPORATION OF AMERICA

Cross-licensing, A.T.&T.	7/1920
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RADIO-RELAY SYSTEMS

N.Y.-Boston (experimental), 11/1947; N.Y.-Chicago, 8/1950; Los Angeles-San Francisco, 9/1950; Omaha-Denver, 7/1951; Transcontinental, 8-9/1951; European suggestions, 5/1952; Right-of-way, 6/1953; Terminal equipment increase, 4/1955; Three stations destroyed, 5/1961

RADIOTELEPHONE

First successful attempts, 4-11/1915; Shore-to-battleship, 5/1916; Anti-submarine tests, 1917; Air-to-ground, 7/1917; Between airplanes, 8/1917, 4/1918; First service established, 7/1920; Ship-to-shore, 10/1920; Demonstration from H. T. Thayer's home, 3/1922; Overseas, development of, 1/1923; L.A.-Catalina, closed, 8/1923; N.Y.-London, 3/1926; Houlton, Me., receiving station, 1927; N.Y.-London (commercial), 1/1927; N.Y.-Australia, 9/1929; Transatlantic, 24-hr. basis, 9/1929; Ship-to-shore (commercial), 12/1929; Montreal-Newfoundland, 1/1939; Ultra high-frequency, 5/1946; First rural service, 8/1946; Death Valley resorts, 4/1947; Air-to-ground, commercial, 12/1957; Ship-to-shore improved communications, 5/1969

RAILROADS

Telephony and telegraphy, 9/1881; Telephone, moving train, 5/1929; Passenger train telephone service, 8/1947; Penn. R.R. private system, 5/1950

RALEIGH, N. C., EXCHANGE	1/1879
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RAST, L. E.	9/1970
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RATES, LONG DISTANCE

"After nine"	4/1963
Block and section method	7/1913
Evening rates discontinued	6/1935
Increased by Postmaster General	1/1919
Mileage measurements	1896
Night reductions canceled	9/1907
Reductions, 10/1926, 12/1927, 3/1929, 1/1930, 9/1936, 1/1937, 5/1940, 7/1941, 2/1943, 7/1945, 2/1946, 6/1958, 1/1960, 4/1963, 11/1964, 2/1965, 11/1967	
Sunday rates	1/1936
Tariff revisions	3/1952
Interstate rate making principles	7/1969
Interstate rate increases	11/1970, 1/1971

RAY, JOHN H. 10/1942

RECEIVER

Gray	4/1878
Reed	1/1876
<i>See also</i> Telephone instruments	

RECORDED ANNOUNCEMENTS, disconnects and changed numbers 5/1955

RECTIFIER MODULATION 1916

RED NETWORK 10/1923

REED RECEIVERS 1/1876

RELAY

Launched, 12/1962; First transmission, 1/1963

REPEATER

Campbell improvement	3/1912
Shreeve	1904
Transistorized carrier system	4/1954
Under-ocean cables	7/1950

REPORTING SYSTEM, PUBLIC EMERGENCY 9/1955

"RESEARCHES IN TELEPHONY" 5/1876

RESONATING CIRCUITS 5/1893

RETRACTILE CORDS, COLORED 8/1954

RICHMOND, VA., EXCHANGE 1/1879

RIDGE TELEPHONE LINE 12/1878

RIVER GROVE, ILL., central office fire 12/1946

ROBERTSON, JOHN 1886

"ROLAMITE" 10/1967

ROME, ITALY, service to 3/1929, 12/1945

ROMNES, H. I. 3/1959, 1/1964
Elected A.T.&T. President, 1/1965; Named A.T.&T. board chairman, 2/1967; President, 4/1970, 10/1971, 2/1972; Deceased, 11/1973

ROOSEVELT, FRANKLIN D. 3/1933

ROOSEVELT, HILBORNE L. 8/1877

ROTARY SWITCHING 1906

ROUMANIA, service to 11/1931, 12/1947

ROUND-THE-WORLD CALL, FIRST 4/1935

ROWE, LUCIUS S. 4/1962

RURAL ELECTRIFICATION ADMINISTRATION 1941

RURAL POWERLINE CARRIER CIRCUITS

Development work started	1939
Public use, first	12/1945
REA cooperatives	1941, 6/1947
Transistorized	4/1954

RWANDA, service to 4/1963

RYAN, F. M. 6/1924

RYSSELBERGHE, FRANCOIS VAN 1882

S

SAGE PLAN, AIR DEFENSE 2/1955, 6/1966

St. HELENA, service to 12/1957

St. JOHN, N. B.-BANGOR, ME., CONVERSATION 4/1881

St. MAARTENS, service to 7/1963

SALT LAKE CITY, EXCHANGE 1/1881

SAMOA, service to 6, 9/1963

SAMUEL, R. G. 1923

SANDERS, THOMAS 1839, 1872

SANDIA LABORATORY 11/1949

SAN DIEGO EARTHQUAKE 3/1933

SAN FRANCISCO

Earthquake	4/1906
Golden Gate Exposition	12/1939

SARAH FULLER'S SCHOOL 1871

SATELLITES, *see* Communications satellites

SAUDI ARABIA, service to 12/1956

SAWYER, W. H. 4/1882

SCAMA SWITCHING SYSTEM 10/1963

SCRIBNER, CHARLES E. 8/1879, 6/1926

SCRIVENER, ROBERT C. 8/1968

SEATTLE WORLD'S FAIR 4/1962

SENDER, SWITCHING SYSTEM 1906

SEOUL, KOREA 10/1950

SERVICE ATTITUDE MEASUREMENT (SAM) PLAN 1960

"SERVICE TO THE NATION IN PEACE AND WAR" 1928

—S—(Cont'd)

- SHANGHAI, service to 12/1937
- SHARE OWNERS, A.T.&T.
 700,000 8/1947
 800,000 1/1949
 Millionth share owner celebration 5/1951
 2 Millionth share owner 7/1961
- SHAWK, GEORGE W. 1869
- SHOCKLEY, WILLIAM 12/1956
- SHORTWAVE
 Lawrenceville, N. J., transmitting center, 6/1929;
 U. S.-Australia channel, 12/1938
- SHREEVE, H. E.
 Repeater, 1904; Mechanical repeater, 4/1909; First
 transatlantic transmission, 10/1915
- SIAM, service to 10/1932
- SINGAPORE, service to 12/1939, 8/1966
- SISE, CHARLES FLEETWOOD 3/1880
- "SKYPHONE" 7/1962
- SMITH, ISAAC C. 5/1877, 1/1878
- SMITH, WILLIAM WILEY 9/1881
- SMITHSONIAN INSTITUTION EXHIBIT 3/1957
- SOLAR BATTERY
 Development 4/1954
 Service trial 10/1955
 Test successful 4/1956
- SOLAR CELLS 3/1958
- SOLID-BACK TRANSMITTER (WHITE) 3/1892
- SOUTH AFRICA, service to 10/1932, 12/1946
- SOUTH AMBOY, N. J., EXPLOSION 5/1950
- SOUTH AMERICA, service to 1/1930, 11/1960, 8/1966
- SOUTH CENTRAL BELL TELEPHONE COMPANY
 12/1967, 7/1968
- SOUTHEAST ASIA COMMONWEALTH CABLE
 (SEACOM) 3/1967
- SOUTHERN BELL TELEPHONE COMPANY
 Formed, 7/1926; Blackout operating test, 10/1938;
 5 millionth telephone, 3/1956; Becomes largest oper-
 ating company, 9/1966; Forms new five-state com-
 pany, 12/1967
- SOUTHERN TRANSCONTINENTAL LONG DISTANCE
 LINE 12/1923
- SOUTHWESTERN BELL TELEPHONE COMPANY 9/1921
- SPAIN, service to 10/1940
- SPANISH MOROCCO, service to 1/1928, 3/1929
- SPARLING, WALTER S. 8/1957, 12/1962
- SPEAKERPHONE, HANDS-FREE 7/1954
- STAGER, ANSON 1869
- STEP-BY-STEP SWITCHING 3/1891, 11/1892
- STETHOPHONE, ELECTRICAL 6/1924
- STOCK, A.T.&T.
 Dividend increase 5/1961, 8/1972, 11/1973
 \$9 dividend rate established 3/1921
 Offerings 1/1958, 11/1963, 5/1971
 Stock split 4/1959, 6/1964
 New stock dividends 11/1971
- STOCK EXCHANGE, NEW YORK
 Talking computer 3/1965
 Ticker design 6/1964
- STOCKHOLM, service to 1/1928
- STOCK ISSUE, FIRST BELL 8/1877
- STOCK PLANS, *see* Employees' stock plans
- STOCKTON, HOWARD 9/1887
- STOKES, HOWARD G. 1/1912
- STOKOWSKI, LEOPOLD 4/1933
- STOLLER, H. M. 4/1918
- STONE, JOHN S.
 Resonating circuits 5/1893
 Vacuum tubes 1912
- STORMS
 Blizzard of '88, 3/1888; Washington, D. C., 3/1909;
 East and Northwest, 11/1921; Sleet, Chicago east-
 ward, 2/1924; Sleet, Southwest, 12/1924; Sleet, N.D.,
 10/1932; Dust, 1935; Hurricane, East Coast, 9/1938;
 Florida hurricane, 9/1947; Ice, 1/1950; Hurricane,
 Cape Cod, 9/1950; Florida hurricane, 10/1950;
 Windstorm, N. Y. & New England, 11/1950; Wash-
 ington-Oregon, 1/1954; N.-S. Dak., 3/1954; N. Y.,
 Pa., 7/1954; Hurricane Carol, 8/1954; Hurricane
 Edna, 9/1954; Hurricane Hazel, 10/1954; Nation-
 wide, 1955; East Coast, 3/1958; West Coast, 10/
 1962; Hurricane Betsy, 9/1965
- STRAIGHTFORWARD TRUNKING 9/1929
- STRALEY, WALTER W. 4/1966
- STRIKE 4/1947, 11/1950, 4/1968, 5/1968,
 7/1971; 2/1972
- STROWGER, ALMON B. 3/1891
- SULLIVAN, MARK R. 2/1960
- SWITCHBOARD AND TELEPHONIC APPARATUS
 COMMITTEE 12/1887

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SWITCHBOARDS

Central office, first commercial	1/1878
Common battery	12/1888, 1/1894, 6/1896, 5/1964
Jackknife switch	8/1879
Law telephone	8/1878
Multiple, first	1879
<i>See also</i> Exchanges	

SWITCHING SYSTEMS

Automatic, first	12/1879
CCSA	3/1964
Crossbar, <i>see</i> Crossbar systems	
Electronic, <i>see</i> Electronic switching systems	
50-line	1902
Machine, first full	10/1922
Panel type, Atlantic office	12/1921
Rotary	1906
SCAMA	10/1963
Sender	1906
Strowger system	3/1891
10,000-line	10/1902
Village system	1884
<i>See also</i> Dial systems	

SUDAN, service to	10/1948
SUMATRA, service to	11/1931
SURCHARGES, ASSOCIATED COMPANIES TARIFF	2/1944
SWEDEN, service to	12/1946
SWITZERLAND, service to	1/1928
SYMONDS (BELL), ELIZA GRACE	1809
SYMPHONY ORCHESTRA, FIRST BROADCAST	4/1933
SYNCOM	8/1963
SYRIA, service to	12/1934, 1/1953

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TAHITI	12/1960
TAINTER, SUMNER	1880
TANGIERS, service to	12/1949
TAPE-TO-CARD CONVERTER	3/1951
TARIFFVILLE WRECK	1/1878
TARIFF REGULATIONS	8, 10, 12/1968, 1/1969
TASI	3/1960, 9/1960
TAYLOR, L. H., AND COMPANY	1/1887
TD-2 SYSTEM, LOS ANGELES-AMARILLO	10/1954
TD-3 SYSTEM,	
ALEXANDRIA, ARK.-ARKABUTLA, MISS.	1/1968
"TEL-A-VISIT" SERVICE	6/1966

TELEGRAPH-TELEPHONE, SIMULTANEOUS

TRANSMISSION	1882
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TELEPHONE AND TELEGRAPH SYSTEMS

Taken over by Government	7/1918
Returned to private ownership	7/1919

TELEPHONE BOOTHS

Air-conditioned	5/1966
All-metal outdoor	12/1953
"Dial-tone first"	8/1966

TELEPHONE COMPANY OF NEW YORK	8/1878
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TELEPHONE DESPATCH COMPANY	9/1878
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"TELEPHONE HOUR"

First broadcast, 4/1940; Midnight rebroadcast, 9/1941; Studio audiences, 11/1941; Time shifted, 4/1942; "Musical America" award, 6/1946; Phi Beta annual award, 6/1946; A. G. Bell centennial program, 3/1947; Medinah Temple broadcast, 10/1947, 6/1958	
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TELEPHONE INSTRUMENTS

Antique, parts installation	10/1965
Color	6/1954
500-type	6/1950
"Gallows-type"	6/1875
Hand receiver, first	5/1877
Handsets	4/1878, 1927, 1937
Handset shoulder rests	2/1952
New sets tested	1949
Princess, introduced	9/1959
Rubber, first order	10/1877
Trimline	8/1963, 8/1965
Wall sets	11/1954
Watson development	1854
Touch-a-matic	3/1973

TELEPHONE NUMBERS, FIRST USE	12/1879
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TELEPHONE OPERATOR, FIRST WOMAN	9/1878
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TELEPHONE PIONEERS OF AMERICA	11/1911
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"TELEPHONE TIME"	7/1955, 4/1956
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TELEPHONE WIRE

First copper	12/1877
First experimental	4/1877
First PBX	12/1877

TELEPHONES

Business rental, first	5/1877
Number in Bell System	7/1878, 2/1880, 1900, 1905, 1910, 1918, 5/1924, 1/1963, 12/1971
Private service rental, first	5/1877
30th millionth	6/1948
50 millionth, Pres. Eisenhower	11/1953
60 millionth	3/1957
100 millionth	5/1967

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TELEPHOTOGRAPH, first offered 4/1925

TELETYPEWRITER

Automatic tape system 5/1940
 Calif. Dept. of Justice network 6/1950
 Delta Airlines test 9/1961
 Exchange service 11/1931
 FBI 1935
 Interstate police system 10/1930
 Magnetic tape 4/1957
 Nationwide dial conversion 8/1962
 Newspaper, first use by 6/1917
 No. 28 3/1954
 100 w.p.m. 12/1962
 Oscillator circuit 2/1942
 Rate reduction 3/1944
 State police system, first 12/1929

TELETYPE CORPORATION

Purchased by Bell System 10/1930
 Develops new page printer 11/1967

TELEVISION

A.T.&T. annual meeting 4/1953
 Baltimore pickup 10/1946
 Bicycle race broadcast 5/1939
 Canadian link 1/1953
 Color, *see* Color television
 Commercial East Coast network 5/1948
 Conn-Louis fight 6/1946
 Eastern-Midwestern networks connected 1/1949
 Educational 12/1961
 First public demonstrations 4/1927
 Ford Foundation proposal 8/1966
 Long Lines channel rates 1/1951, 10/1954
 Mobile pickup unit, first 1/1950
 Motion picture transmission 11/1937
 N. Y.-Washington, experimental service 6/1946
 Phonovision trial 1/1951
 Political conventions, national 8/1956
 Presidential inauguration, coast-to-coast
 telecast 1/1953
 Repub. Nat'l Convention 6/1940
 Satellite transmission 1/1963
 Science program, first 11/1956
 Telephone line transmission 3/1957
 Theatre, *see* Theatre television
 3-D 4/1953
 Transcontinental service 9/1951
 Two-way 4/1930
 Washington-N. Y. coaxial link 2/1946
 441-line 5/1940
 441-line, 800-mile channel 5/1941
 525-line 12/1945

TELPAK

Proposed 1/1961
 Service charges 9/1966

TELSTAR I

Study, 1, 5, 7/1961; orbit, 7/1962, 11/1962; termination, 1/1963

TELSTAR II

Launched, 5/1963; VHF adjustment, 5/1965

TERMINAL STATIONS 1/1947

THAILAND, service to 5/1954

THAYER, HARRY B.

New York-Denver memorandum, 4/1909; President, A.T.&T., 6/1919; Radiotelephone demonstration, 3/1922; Overseas radiotelephony, 1/1923; Retires, 8/1928

THEATRE TELEVISION

Intercity 6/1951
 Marciano-Charles fight 6/1954

THERMOPHONE 1917

THOMPSON, J. W. 6/1895

THOMSON, GEORGE P. 11/1937

THOMSON, SIR WILLIAM 6/1876

THRIFT PLANS, BELL SYSTEM 10/1925

TIME SERVICE BUREAU 8/1928

TIROS I 4/1960

TIROS II 11/1960

TITAN MISSILE 2/1960

TOLL CALLS

Alternate routing 7/1954
 CLR method 1925
 Coupon books 1949

TOLL DIALING

Coast-to-coast 10/1949
 Crossbar, No. 4 8/1943
 4A, full office conversion 5, 11/1954
 International 3/1952

TOLL LINES, EARLY

California 12/1878
 Springfield-Holyoke, Mass. 4/1879

TOLL OPERATING PRACTICES REVISION 7/1950

TONE RINGING 6/1955

TOPEKA, KANS., EXCHANGE 1/1879

TORONTO EXCHANGE 1/1879

TORTOLA ISLAND, service to 12/1957

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TOUCH-TONE® SERVICE	
Trial, 11/1960; Introduction, 11/1963; Coin tele- phones (mobile), 1/1969	
TOUCH-A-MATIC	3/1973
TOWNES, CHARLES H.	10/1964
“TRADEMARK SERVICE”	6/1930
TRAFFIC SERVICE POSITIONS	
(TSP)	2/1964, 6/1965, 1/1969
TRANSATLANTIC CABLE	
Plans announced, 12/1953; Completion, 9/1955; Last section spliced, 8/1956; Service opened, 9/1956; Second, contracts signed, 9/1957; Second, opened, 9/1959; Single-cable system, 7/1960; TASI system, 9/1960; Commonwealth, 12/1961; U. S.-England, 10/1963; Fourth, to Continental Europe, 9/1965; Fifth highest capacity, 3/1970 <i>See also</i> Underseas cable	
TRANSATLANTIC RADIOTELEPHONE, <i>see</i> Radiotelephone	
TRANSATLANTIC RATES	5/1930, 7/1936
TRANSATLANTIC CABLE	
Completed, 12/1942; Service interruption, mud-slide, 4/1952; Atlanta-Los Angeles, 11/1947; Blast-resist- ant, 12/1964	
TRANSATLANTIC SATELLITES AND CABLE	5/1971
TRANSCONTINENTAL LINES	
N. Y.-San Francisco (experimental), 7/1914; Service opens, 1-25/1915; Fourth, 12/1937	
TRANSISTOR	
Invented	12/1947
First public demonstration	6/1948
New type	1/1956
Nobel prize, inventors	12/1956
Solar battery test	4/1956
Underseas cable	6/1966
25th Anniversary	7/1973
TRANSMITTERS	
Berliner (variable pressure contact)	5/1878
Blake	12/1878
Carbonized anthracite element	2/1886
Edison	4/1878
Solid-back (White)	3/1892
<i>See also</i> Telephone instruments	
TRIEM, W. R.	8/1947
TRINIDAD, service to	2/1944
TROPOSPHERIC SCATTER PROPOGATION	8/1957
TRUMAN, HARRY S.	1/1949
TRUNKING, STRAIGHTFORWARD	1929

TUCSON, ARIZ., EXCHANGE	1/1881
TUNISIA, service to	12/1934
TURIN, ITALY, service to	3/1929
TURKEY, service to	1/1953
TWX SERVICE	1/1969
TWX TELEPRINTER EXCHANGE SERVICE	7/1970

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UNDERSEAS CABLE	
Puerto Rico, 1/1960; Bermuda, 2/1960; Caribbean, 10/1960; Jamaica, 12/1961; United Kingdom, 12/ 1961; British Commonwealth, 12/1963; High-capac- ity, 6/1966; Shore-end sections buried beneath ocean floor, 7/1967; Fifth transatlantic highest capacity, 3/1970 <i>See also</i> Hawaii cable, Pacific cable, Transatlantic cable	
UNLISTED TELEPHONE NUMBERS, charge for	7/1959
U. S. S. R., service to	11/1943
UNITED STATES INDEPENDENT TELEPHONE	
ASSOCIATION	6/1897
Joint meeting, O. & E.	3/1953
UNKNOWN SOLDIER CEREMONIES, WORLD	
WAR I	11/1921
UPGRADE AND TRANSFER PLAN	9/1972
URUGUAY, service to	1/1930

V

VACUUM TUBES	10/1906
Three-element	1912
VAIL, THEODORE NEWTON	
Born, 1845; Meets Watson, 5/1878; Manager, Bell Telephone Co., 5/1878; General manager, 7/1878; President, A.T.&T., 3/1885; Resigns, 9/1887; Re- sumes A.T.&T. presidency, 4/1907; Institutional ad- vertising, 1908; Underground cable memorandum, 3/1909; Board chairman, 6/1919; Memorial Fund established, 1/1920; Dies 4/1920	
VAIL MEDAL	
Berry, Mrs. Julia C.	7/1946
Cash award increase	5/1956
Haughwout, Lydia	3/1966
Cash award increase	1/1969
VANGUARD I SATELLITE	3/1958
VARIABLE RESISTANCE TRANSMITTERS	2/1876
VENEZUELA, service to	10/1932, 8/1966

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VIENNA, service to	1/1928
VIETNAM, service to	12/1957
VILLAGE SYSTEM	1884
VINCENT, MARCEL	8/1968
VIRGIN ISLANDS, service to	12/1946, 12/1964, 8/1966
VISIBLE SPEECH	1819, 1871
R. K. Potter	11/1945
"VOICE WITH THE SMILE WINS, THE"	1/1912
VOICEPRINTS	4/1966
VOLTAGE MEASURING	1915

W

WACHOB, ROBERT M.	8/1965
WAKE ISLAND, service to	4, 6/1964
WALWORTH MANUFACTURING CO.	10/1876
WAR GAMES, BELL SYSTEM TEST	5/1940
WASHINGTON, D.C.	
Central office switchboard, first	12/1878
Sleet storm	3/1909
WASHINGTON (STATE), first exchange	3/1883
WASSON, E. HORNSBY	4/1959, 7/1965, 3/1968
WATSON, THOMAS A.	
Born, 1854; Contract with G. G. Hubbard, 9/1876;	
Orders first rubber handsets, 10/1877; First trip	
West, 2/1878; Second trip West, 5/1878; Meets Vail,	
5/1878; Dies, 12/1934	
WAVE GUIDE RESEARCH	1931
WBAY, radio station	7/1922
WCAP, radio station	7/1923
WEAF, radio station	
Originates as WBAY, 7/1922; First commercial	
sponsorship, 8/1922; 195 Broadway, 5/1923; Red	
Network, 10/1923; Broadcasting Company of Amer-	
ica, 5/1926; Sold to NBC, 11/1926; First operatic	
broadcast, 1/1927	
WEATHER FORECAST SERVICE	4/1939, 10/1940
WEBB, B. B.	10/1915
WEGEL, R. E.	1/1922
WEINHART, H. W.	1918
WELLS, H. G.	10/1938
WENTE, E. C.	
Condenser microphone	1916, 3/1921
Thermophone	1917

WEST VIRGINIA, first exchange	5/1880
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WESTERN ELECTRIC COMPANY

Predecessor, 1869; Leases N.Y.C. shop, 3/1879; Consolidates manufacturing licenses, 11/1881; Agreement with American Bell, 2/1882; Purchasing and warehousing contract, 1901; Research staffs consolidated, 1907; Inspection function assumed, 8/1907; Incorporated in New York, 11/1915; Cross-licensing, A.T.&T., 7/1920; First dial system installation, 7/1921; Sells Graybar Co., 1928; Allentown, Pa., plant, 10/1948; Federal anti-trust suit, 1/1949; Sandia Laboratory, 11/1949; Prices reduced, 4/1952; Columbus, Ohio, plant, 6/1957; Research center, 9/1959; Yonkers distributing center, 1/1961; Automation, 3/1961; Office building, 5/1958, 3/1961; Service reorganization, 5/1963; New regional headquarters, 6, 8/1964; Price reductions, 6/1964, 3/1965; Minority stock interest acquired, 9/1966; Phoenix Plant, 8/1968; New Corporate Education Center, N. J., 6/1969

WESTERN ELECTRIC MANUFACTURING COMPANY	1872
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WESTERN UNION TELEGRAPH COMPANY

Building, 1873; Enters telephone business, 4/1878; Competition with Bell, 12/1878; Withdrawal agreement with Bell, 11/1879; 30% stock acquired by A.T.&T., 12/1910; A.T.&T. sells stock, 3/1914; West Coast telephone business acquired, 4/1951; FCC recommends sale of TWX to, 10/1965; Provides TWX service to customers, 1/1969; Acquisition of TWX teleprinter exchange service, 7/1970; Acquisition of TWX, 4/1971; Authority to build earth station, 5/1973

WESTINGHOUSE ELECTRIC COMPANY

Cross-licensing, A.T.&T.	7/1920
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WESTREX	9/1958
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WHITE, ANTHONY C.	3/1892
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WHITE, ERSKINE N.	10/1963
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WHITE ALICE (transmission web)	3/1958
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WHITEHEAD, CLAY T.	6/1970
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WHITTAKER, WILLIAM J.	12/1965
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WHALEN, KENNETH J.	11/1968, 7/1973
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WILLIAMS, CHARLES, JR.

Speech transmission experiment, 6/1875; First experimental telephone wire, 4/1877; Receives Canadian patent rights, 7/1877; Bell Telephone Co. headquarters, 6/1878; Sell license, 11/1881

WILSON, LEROY A.

Biog. note, 10/1944; President, A.T.&T., 2/1948; Dies, 6/1951

—W—(Cont'd)

WILSON, WOODROW	7/1918
WINDSOR, ONT., EXCHANGE	5/1879
WINGERT, LOWELL F.	6, 12/1966
WIRE, hard-drawn copper	3/1884
WIRE TRANSPOSITION	11/1888
WISCONSIN, first exchange	11/1878
WOMEN, FIRST ASST., TO PRES., BELL SYSTEM ..	1/1947
First Director of a Bell affiliate	3/1971
First to serve as A.T.&T. Director	4/1972
WORLD SERIES, first broadcast	10/1923
WORLD WAR I	
Government control of communication systems	7/1918

WORLD WAR II

Bell System defense activities	1941
WRATHALL, L. R.	1934

Y

YOST, CASPER E.	9/1889
YUGOSLAVIA, service to	7/1933, 12/1947

Z

ZENITH RADIO CORPORATION	2/1950
ZIEGLER, A. W.	1940

Some Important Pre-telephone Dates in Communication History

1844

MAY 24—First public demonstration of Morse's electric telegraph, Baltimore-Washington — "What Hath God Wrought?"

1861

OCTOBER 24—Telegraph communication coast-to-coast across the United States began.

1858

AUGUST 5—First Atlantic telegraph cable completed. Failed after 26 days. Voltage too high.

1866

JULY 27 — Second Atlantic telegraph cable opened; permanent communication by wire U. S. to Europe established.

1869

MAY 10—First transcontinental rail line completed at Promontory Point, Utah.

EVENTS IN TELEPHONE HISTORY

1790

Alexander Bell, *b.* 1790; *d.* April, 1865; *m.* Elizabeth Colvill, 1814. Grandfather of Alexander Graham Bell.

1809

Eliza Grace Symonds (Bell) *b.* 1809; *d.* 1897. Mother of Alexander Graham Bell.

1819

MARCH 1 — Alexander Melville Bell, *b.* 1819; *d.* Aug. 7, 1905; father of Alexander Graham Bell; *m.* Eliza Grace Symonds, 1844; *m.* again following her death. Among other things, he devised code called Visible Speech, which has been widely used in teaching pronunciation; code symbols guide used in arranging tongue, lips and throat to produce given sounds.

1822

AUGUST 25 — Gardiner Greene Hubbard, *b.* 1822; *d.* Dec. 11, 1897. Joined with Thomas Sanders to finance Alexander Graham Bell's experiments and share in his patents. For convenience, this has been called Bell Patent Assn., but was nameless during few years assn. was active.

1839

JULY 16 — Thomas Sanders, *b.* 1839; *d.* Aug. 7, 1911. Associated with Gardiner Greene Hubbard in financing Bell's experiments; also shared in patents. Sanders was

in business (leather and hides), Haverhill, Mass., when he first met Bell.

1845

JULY 16 — Theodore Newton Vail, *b.* 1845, Carroll County, Ohio; *d.* April 16, 1920. First general manager, Bell Telephone Co., later president, American Telephone & Telegraph Company from Aug. 14, 1885, to Sept. 19, 1887, and again from April 30, 1907, to June 18, 1919. Chairman of the board, June 18, 1919, to his death. (See "Theodore N. Vail," by Albert Bigelow Paine.)

1847

MARCH 3 — Alexander Graham Bell, *b.* 1847, Edinburgh, Scotland; *d.* Aug. 2, 1922; *m.* Mabel Gardiner Hubbard, July 11, 1877. See biographies by Catherine McKenzie (1928) and Robert V. Bruce (1973). A handy and detailed text is "The Career of Alexander Graham Bell," prepared by the Pub. Rel. Dept., A.T.&T. Co., for the centennial of his birth in 1947. A complete memoir by Harold Osborne is available at A.T.&T. Pub. Rel. Dept. "The Chord of Steel," by Thomas Costain, concentrates on Bell's life in Brantford, Ontario. Also see "Make a Joyful Sound," by Helen Waite.

1854

JANUARY 18 — Thomas A. Watson, *b.* 1854; *d.* Dec. 13, 1934; *m.* Elizabeth Seaver Kimball (1858-1948), Sept., 1882. He was an expert technician at the Charles Williams, Jr., shop, 109 Court St., Boston; was assigned to make apparatus for Bell's experiments late in 1873.

1854 (Cont'd)

Became intimate with Bell and assisted in all pretelephone experiments; also he made the first galleys-type telephone and supervised the manufacture of other early telephones including the "Centennial" type, plus box and hand telephones. He was the inventor of call bells, shared in the receiver hook patent, etc. Later, he became president of the Fore River Ship and Engine Company. (See Watson's autobiography, "Exploring Life.")

1861

APRIL 14 — John Joseph Carty, *b.* Cambridge, Massachusetts; *d.* December 27, 1932. With Telephone Dispatch Company and New England Telephone and Telegraph Company, 1879-1887; electrician, Metropolitan Telephone and Telegraph Company, New York, 1887-1893; chief engineer, Metropolitan, 1893-1907; chief engineer, Am. Tel. & Tel. Co., 1907-1919; vice-president, Am. Tel. & Tel. Co., June 18, 1919, to June 30, 1930. Devised phantom circuit (Pat. 1886) and many other inventions. Widely known writer and speaker on electrical subjects. (See "John Joseph Carty, an Appreciation," by F. L. Rhodes.)

1869

JANUARY 2-9 — During this week the partnership of Shawk and Barton was formed to take over an electric shop which Western Union Telegraph Company had decided to abandon at Cleveland, Ohio; this partnership ultimately became Western Electric Company. (See notes for 1872 and following years.)

The first change came quickly when George W. Shawk sold his interest to Elisha Gray, so that within a few months the firm became Gray and Barton, with Gen. Anson Stager, a Civil War veteran, as a silent partner. Stager stipulated that the business move to Chicago, which was accomplished before the end of 1869.

Enos M. Barton (Dec. 2, 1842-May 3, 1916) was a telegraph operator when he entered partnership with Shawk. (He had learned operating to pay his way through the University of Rochester, New York, had continued at it through the Civil War and into 1869.) He persuaded his mother to mortgage her farm for \$500 in order to raise the money for this partnership. Barton became president of Western Electric Company in 1885, from which position he retired in 1908.

Elisha Gray, *b.* August 2, 1835, at Barnesville, Ohio; *d.* Jan. 21, 1901. He worked his way through Oberlin College as a carpenter. His work in physics at Oberlin quickly narrowed to electrical applications. He invented a self-adjusting telegraph relay, a telegraphic switch and a repeater. He continued in the firm of Gray and Barton only two years, after which he devoted himself entirely to electrical research. Gray was working on a harmonic telegraph at the same time as Bell, and perfected what he called a telephone to transmit musical sounds. The idea of transmitting vocal sounds occurred to him, and on Feb. 14, 1876, he filed a caveat (a confidential report of an invention which is not fully perfected) in the U. S. Patent Office. His caveat indicates that he was on the same track as Bell, but had not worked out his transmitter as fully. And on that same day, but a few hours earlier, Alexander Graham Bell had filed a

patent application for his telephone, thus anticipating Gray. Gray's most important invention thereafter probably was the telautograph which transmits facsimile handwriting and drawings. At the time of his sudden death in 1901, he was experimenting on underwater signaling to vessels at sea.

1870

AUGUST 1 — Alexander Graham Bell, with his parents, arrived in Canada and within 10 days settled at Tutelo Heights, near Brantford, Ontario. The move from England was made because his two brothers had died of tuberculosis and he was threatened with it. His father was influenced in making the move by his old classmate, The Reverend Thomas Henderson, who arranged for his lecture engagements and obtained an option on a house in a location where the climate was very healthful. It is now an historic house known as the Bell Homestead and open to the public.

1871

APRIL 1 — Bell, substituting for his father, commenced a series of lectures to teach the deaf to use Visible Speech in forming words at "Sarah Fuller's school"—otherwise the Boston School for the Deaf, 11 Pemberton Square. At this time, he met Gardiner Greene Hubbard.

1872

MARCH 29 — The firm of Gray and Barton became Western Electric Manufacturing Company, of Chicago, through consolidation with another of the Western Union Telegraph Company's shops.

OCTOBER 1 — Bell took up permanent residence in the United States at 35 Newton Street, Boston, where he conducted normal classes for teachers of the deaf until October, 1873. He met Thomas Sanders, of Haverhill, Mass., and received George T. Sanders, 4 years old, as a pupil.

1873

GENERAL — Erection of the Western Union Telegraph Building was begun at Broadway and Dey Street, New York City—part of the site of present A.T.&T. Company headquarters.

JULY 5 — A charter was granted for the incorporation of the City and Suburban Telegraph Association, immediate forerunner of The Cincinnati and Suburban Telephone Co.

OCTOBER — Bell went to live at the home of Mrs. George T. Sanders, mother of Thomas Sanders, 292 Essex Street, Salem, to continue the instruction of her grandson, George. Bell also carried on professional work at 18 Beacon Street, Boston, in rooms connected with Boston University. This arrangement continued until 1875.

During 1873, Bell began his experiments on a harmonic telegraph, which led to his invention of the telephone.

1874

JULY 26 — Bell had been carrying on studies with a laboratory device called the phonautograph, which made mechanical tracings of sound vibrations. He made an

1874 (Cont'd)

improved phonograph, using the bones and drum of a human ear procured for him by a friend, Dr. Clarence Blake. Bell explained how his experiments with this improved instrument led him to his conception of the telephone as follows: "I was much struck by the disproportion in weight between the membrane and the bones that were moved by it; and it occurred to me that if such a thin and delicate membrane could move bones that were, relatively to it, very massive indeed, why should not a larger and stouter membrane be able to move a piece of steel in the manner I desired? At once the conception of the membrane speaking telephone became complete in my mind. . . . The arrangement thus conceived in the summer of 1874 was substantially similar to that shown . . . in my patent of March 7, 1876." Bell described to his father, while on a visit to the family home at Brantford, Ontario, on this date his conception of his electric speaking telephone using his undulating current principle. (See "Career of Alexander Graham Bell," A.T.&T. Public Relations Department, for more detail.)

OCTOBER 27 — Bell took out first papers for citizenship in the United States. (He was admitted to citizenship on second papers, November 10, 1882.)

1875

FEBRUARY 27 — Bell, Hubbard and Sanders signed the Bell Patent Association agreement under which Hubbard and Sanders furnished the money, Bell did the inventing, and all shared in any patents Bell might obtain.

MARCH 2 — Bell interviewed Joseph Henry, who told him, "Get it!" when he said he feared he lacked technical knowledge to invent the telephone. Joseph Henry, at this time secretary of the Smithsonian Institution, Washington, D. C., was an American scientist who had done notable work with the electromagnet about 1830—his discoveries and demonstrations often are said to have been the scientific research that made Morse's magnetic telegraph practical.

JUNE 2 — Twang of reed transmitted over harmonic telegraph wire confirmed Bell's speech transmission theory, at Charles Williams, Jr.'s, shop, 109 Court Street, Boston.

JUNE 3 — First "gallows-type" telephone tested by Bell and Thomas A. Watson in an attic room at 109 Court Street. It transmitted recognizable speech sounds, but not intelligible speech.

SEPTEMBER — Bell began the writing of his telephone patent specifications at Brantford.

1876

JANUARY 17 — Bell moved to 5 Exeter Place, Boston, in order to have the use of a room on the third floor as a laboratory. He was still experimenting with the "gallows-type" and other forms of magnetic transmitter telephones—reed receivers.

FEBRUARY 14 — Bell filed his patent application. His experiments with variable resistance transmitters began about this time.

MARCH 3 — First telephone patent (U.S. No. 174,465) allowed. It was issued to Bell on March 7.

MARCH 10 — Transmission of first complete sentence, "Mr. Watson, come here, I want you!" by variable resistance transmitter.

MAY 10 — Opening of Philadelphia Centennial Exposition.

MAY 10 — Bell read paper, "Researches in Telephony," before American Academy of Arts and Sciences, Boston. He also exhibited telephone apparatus; magnetic telephones in gallows and horizontal types; liquid variable resistance transmitter.

MAY 25 — Bell lectured on telephone before the Society of Arts, Massachusetts Institute of Technology, Boston.

JUNE 25 — Bell exhibited telephone apparatus at Philadelphia Centennial Exposition; with demonstration for Dom Pedro, Emperor of Brazil, and Sir William Thomson, British physicist (later Lord Kelvin).

AUGUST 10 — The world's first long distance telephone call (one-way) was received at Paris, Ontario, by Bell from his father and uncle at Brantford, Ontario, over telegraph lines 8 miles and 68 miles long. Referring to this call, Bell said: "This Brantford experiment is of historical interest . . . because it led to the discovery of the proper combination of parts in a telephone to enable it to become operative upon a long line; and because upon this occasion occurred the first transmission of the human voice over a telegraph line in which the transmitting and receiving telephone was miles apart."

Permission to use this telegraph line was granted by Lewis B. McFarlane, a telegraph manager, who entered the telephone business in 1879, was president of The Bell Telephone Company of Canada from 1915 to 1925 and chairman of the board from 1925 to 1930.

SEPTEMBER 1 — Date of Thomas A. Watson's contract with Gardiner Greene Hubbard whereby, for devoting his time to the development of the harmonic telegraph and the telephone, he was to receive a one-tenth interest in all of Bell's patents. The agreement at first called for only half of Watson's time as Williams did not want him to drop all work at his shop. This half-time arrangement lasted "for a few weeks" according to Watson's autobiography. Although dated September 1, the contract was not signed by Watson till September 4.

AUTUMN — Gardiner Greene Hubbard offered to sell the telephone invention to Western Union Telegraph Company for \$100,000, and the offer was refused. This is mentioned in Thomas A. Watson's autobiography, and in the reminiscences of Chauncey M. Depew.

OCTOBER 9 — The world's first two-way long distance telephone conversation over an outdoor wire (borrowed telegraph line of the Walworth Manufacturing Co.) between Cambridgeport and Boston, Mass., between Bell and Watson.

1876 (Cont'd)

NOVEMBER 26 — Two-way "long distance call" between Boston and Salem, 16 miles over borrowed telegraph line. Bell, Watson and others shared in this demonstration.

DECEMBER 3 — Long distance talk, Boston to North Conway, N. H., 143 miles, over telegraph line between Bell, Watson, Hubbard and others. Not too satisfactory a demonstration, however.

1877

JANUARY 30 — U. S. Patent No. 186,787, the second fundamental telephone patent, issued to Bell. It covered important mechanical features of apparatus.

FEBRUARY 12 — First use of the telephone in news reporting: Bell lectured at Lyceum Hall, Salem. Henry M. Batchelder, a part-time correspondent of the *Boston Globe*, telephoned a report of the lecture to the 5 Exeter Place Laboratory, where Thomas A. Watson, Bell's assistant, repeated it to A. B. Fletcher, another *Globe* writer.

APRIL 3 — First telephone conversation between Watson in Boston and Bell in New York, over borrowed telegraph line; successful but extremely difficult; a test only.

APRIL 4 — First experimental telephone wire run from shop of Charles Williams, Jr., 109 Court St., Boston, to his home at Somerville, Mass., 3 miles.

APRIL 5 — Bell lectured at Music Hall, Providence, R. I., using circuit from Boston for demonstration.

MAY — The first telephone advertisement (a four-page folder) issued.

MAY 1 — First telephones rented for business use, on a private line between Boston and Somerville, Mass., from Roswell C. Downer's home, 170 Central St., Somerville, to the office of Stone & Downer, bankers, 28 State St., Boston (3 miles).

MAY 4 — Also May 7 and 8. Bell lectured in Music Hall, Boston, at invitation of distinguished group. For full list of sponsors, see "Beginnings of Telephony"—Rhodes, p. 42.

MAY 11 — Bell gave "preview" demonstration of telephone over wire from Brooklyn, N. Y., to the St. Denis Hotel, Eleventh Street and Broadway, New York City. Guests were prominent New Yorkers who had invited him to give a public lecture on May 17 at Chickering Hall. For full list, see "Beginnings of Telephony"—Rhodes, p. 42.

MAY 15 — First hand telephone (like the later wall or deskstand receiver) made of wood. Mentioned in letter of Theodore N. Vail to William A. Childs, president of the Law Telegraph Company.

MAY 17 — Experimental exchanges — E. T. Holmes opened the first experimental switchboard exchange at 342 Washington St., Boston, Mass., with about 5 lines. Isaac C. Smith, at Hartford, Conn., about July 10, 1877, made a switchboard to connect several lines rented to doctors and drug stores. Shortly after Sept. 1, at Bridge-

port, Conn., Thomas B. Doolittle installed telephones on several lines connected to the telegraph switchboard of the Bridgeport Social Telegraph Association, of which Doolittle was manager and promoter.

MAY 17 — Also May 18-19. Bell's Chickering Hall lectures were delivered in New York City, with Watson talking and singing from the Atlantic and Pacific Telegraph Company's office on Peace Street, near Church Street, New Brunswick, N. J.

The telephone also was exhibited at the American Institute Fair, 3rd Avenue and 63rd Street, New York, from about these dates to the end of May.

MAY 30 — First service rental paid for telephones (private line) by J. Emery, Jr., 32 Chestnut St., Charlestown, Mass. He signed the first telephone lease on June 8. Note: Downer (see May 1) appears to have installed the first "commercial" service, Emery to have been first to pay his bill (\$20 for 2 telephones for 1 year was paid May 30 and \$10 for another telephone on June 8).

JULY 9 — The telephone business was formally organized with the drawing up of papers that created the Bell Telephone Company, Gardiner Greene Hubbard, Trustee.

JULY 10 — Bell assigned 75% of his Canadian patent rights to his father, who organized and operated the telephone business throughout Canada until The Bell Telephone Company of Canada was founded on April 29, 1880. The inventor assigned 25% of these Rights to Charles Williams Jr. of Boston, in payment for 1000 telephones to be delivered to Bell Sr.

JULY 11 — Bell married to Mabel Gardiner Hubbard.

JULY 21 — Alexander Graham Bell constructed a telephone line from his parental home at Tutelo Heights to the telegraph office in Brantford and demonstrated his telephone for the guests assembled at the Bell Homestead to meet his bride. Recitations, songs and musical solos were transmitted from Brantford, a distance of 3¼ miles.

AUGUST 1 — First Bell stock issue — 5000 shares to 7 original stockholders: Alexander Graham Bell, 10; Mabel G. Bell, 1497; Gardiner G. Hubbard, 1387; Gertrude McC. Hubbard, 100; Thomas Sanders, 1497; Thomas A. Watson, 499; Charles Eustis Hubbard, 10.

AUGUST 4 — Bell and his bride sailed for England. They returned to the United States, November 10, 1878.

AUGUST 10 — Robert W. Devonshire, first employee of the Bell System, was hired at Boston as bookkeeper. Devonshire, who was made a vice-president of the American Telephone & Telegraph Company on December 16, 1913, was honored at a testimonial dinner August 17, 1927, fifty years after he was first employed.

AUGUST 23 — Four telephones demonstrated at Chicago—first public demonstration there.

AUGUST 27 — The Telephone Company of New York formed by Charles A. Cheever and Hilborne L. Roosevelt, as Bell agency, to begin business August 31. One

1877 (Cont'd)

of its first lines appears to have been supplied to J. Lloyd Haigh, who was manufacturing wire for the suspension cables of Brooklyn Bridge, and who had a line on one of his own wires from his office in New York to his plant in Brooklyn—it ran across the partly finished bridge. Officers were: President, Hilborne L. Roosevelt; Gen Mgr., Charles A. Cheever; Supt., W. K. Applebaugh; Asst. Supt., Willard L. Candee.

AUGUST 29 — The first installation of more than two telephones on a private line was made under the direction of Prof. A. M. Bell at Hamilton, Ontario, in the homes of Messrs. Baker, Cory and Mewburn. The lease for these and a fourth telephone was signed on October 1, 1877.

SEPTEMBER 21 — Telephones were first leased in Canada by Prof. A. M. Bell to the Prime Minister for use on a private line from his office to Rideau Hall, the residence of Governor General, the Earl of Dufferin. Two box and 2 wooden hand telephones were rented for \$42.50 per year. The box telephones were used as transmitters and the wooden hand telephones as the receivers.

OCTOBER 27 — T. A. Watson ordered first 100 rubber hand telephones.

DECEMBER 4 — Copper wire and first PBX. On the date given, the first hard-drawn copper wire was strung at Ansonia, Conn. Thomas B. Doolittle, promoter and manager of a mutual telegraph company at Bridgeport, who had become interested in the telephone, made arrangements to begin manufacture of hard-drawn copper wire with the Ansonia Brass Company. The first lines were strung in the brass company plant on what amounted to a private exchange system.

These early hard-drawn copper lines were not wholly satisfactory, but Doolittle's process was perfected within two to four years. The hard-drawn wire made possible better transmission over longer distances than had been possible with iron wire, and copper wire up to this time had been heat-treated or annealed, which made it a good conductor but rendered it too soft to be used on open spans, for it would break of its own weight unless made too thick (or of too heavy a gauge) to be of practical value.

1878

JANUARY 1 — The Continental Insurance Company, 100 Broadway, Manhattan, rented a private line to its branch offices on Court Street, Brooklyn, using a cable under the East River. This is considered the first paid subscriber in Brooklyn.

JANUARY 15 — Probably the first use of the telephone in a public emergency—Issac C. Smith's experimental exchange at Hartford, Conn. (see 1877), was used to waken 21 physicians and send them to care for victims of a wreck near Tariffville, on the Connecticut Western Railroad.

JANUARY 28 — The first commercial telephone exchange in the world was opened at New Haven, Conn..

with 21 subscribers. George W. Coy was the licensee. With Walter Lewis and H. P. Frost, he had organized the District Telephone Company of New Haven.

JANUARY 31 — Exchange at Meriden, Conn., opened.

FEBRUARY — Thomas A. Watson made an extended trip West to induce agents to establish telephone exchanges.

FEBRUARY 12 — The New England Telephone Company received its certificate of incorporation. This was a licensing, not an operating company. It held an assignment of rights to the Bell patents for New England, and it had no connection with the present New England Telephone & Telegraph Company, which was formed five years later.

FEBRUARY 17 — First exchange in California opened at San Francisco.

FEBRUARY 21 — First telephone directory published by the New Haven District Telephone Co. (21 listings).

MARCH 18 — First exchange in New York State opened at Albany.

APRIL — Competition in the telephone business developed from the Western Union Telegraph Company through its newly established subsidiaries, the American Speaking Telephone Company and the Gold & Stock Telephone Company. These companies used Thomas A. Edison transmitters and Elisha Gray receivers.

The Handset Telephone—Robert G. Brown, who became chief operator at the Western Union (Gold & Stock) exchange in New York City, devised in 1878 [possibly in April but more probably in May] the handset, mounting an Edison transmitter and a Gray receiver on a bar of metal. Brown was sent to France in 1879 to open an exchange at Paris. There, his handset was lightened to make it more easily handled by women operators. It became popular in France and Europe despite limitations that made it unacceptable in the United States, and for years was known as the French or Continental telephone. Brown died at St. Petersburg, Florida, October 2, 1947, at the age of 93. Incidentally, it was necessary to train women operators in France from the first, for all boys and young men were claimed by the army.

APRIL — The first exchange in Delaware opened at Wilmington.

APRIL 19 — The first exchange in Massachusetts opened at Lowell.

MAY 1 — First exchange in Missouri opened at St. Louis.

MAY 21 — Thomas A. Watson made a second trip West, and on this trip stopped at Washington, D. C., to become acquainted with Theodore N. Vail and to see the Berliner transmitter (covered by the inventor's caveat of April 14, 1877). Watson recommended that the Bell Company arrange to buy the right to use the transmitter.

1878 (Cont'd)

BERLINER — This was done and Emile Berliner, until then a drygoods clerk at Washington, and a recent immigrant to the United States, was hired as a technical expert at Boston. He did much to make his own and, later, the Blake transmitter of commercial value, although his claim of invention finally was ruled out by the Supreme Court (May 10, 1897) on the ground that an English inventor had anticipated it.

THE BERLINER TRANSMITTER — Berliner's was called a variable pressure contact transmitter, which means that it transmitted an undulating or talking current to the line by using a loose electrical contact. Ordinarily a good or firm contact in all electrical connections is wanted. But a loose contact is a means of varying the intensity of the current. In a transmitter, it is good. Later transmitters, including those of today, use this principle.

MAY 22 — Theodore N. Vail accepted the position of general agent or manager of the Bell Telephone Company then being formed as a national licensing corporation — successor, with the New England Telephone Company, to the trusteeship under Hubbard. He gave up a government position that paid more than \$4,500 a year to accept an offer of \$2,500 with a \$1,000 bonus if his work was satisfactory the first year. This was to increase to \$5,000 the second year if the service developed sufficiently. Vail, in accepting, said he asked "only a reasonable guarantee of permanency."

JUNE 18 — First telephone exchange in Illinois opened at Chicago by the American District Telegraph Company, 118 LaSalle St.

JUNE 26 — First Bell Telephone exchange in Illinois opened at Chicago, 125 LaSalle St.

JUNE 29 — The Bell Telephone Company was organized to license and promote telephone service under the Bell patents in areas not already covered by the assignment of patent rights to the New England Telephone Company. The Bell company was formed at Boston and maintained headquarters there at 109 Court Street (Charles Williams' shop), but "headquarters" in the form of Mr. Vail was established at 66 and 68 Reade Street, New York, on September 2, 1878, and remained there until about February, 1879, when it was established in the Mutual Life building at Boston — later at 95 Milk Street. (Dissolved by decree of court, December 8, 1903.)

JULY 1 — Theodore N. Vail began work as general manager. There were, by this time, 10,755 Bell telephones in service.

JULY 15 — The first telephone exchange outside the United States was opened at Hamilton, Ontario, Canada, by the District Telegraph Company of Hamilton, under license from Prof. A. M. Bell. Hugh C. Baker, president of the company, thus commenced a noted career in the telephone business.

AUGUST 2 — First exchange in Oregon opened at Portland.

AUGUST 5 — First exchange in Michigan opened at Detroit with 53 subscribers.

AUGUST 14 — The Bell Telephone Company of New York (licensee) was formed to buy the Telephone Company of New York, which had been operating private lines, but had made no effort to open an exchange. Soon after this, the Law Telegraph Company, 145 Fulton Street, began to replace its printing telegraph instruments with telephones, under license from the Bell Telephone Company of New York. Thus, in the spring of 1879, three exchanges were opened in New York: one by the Bell Company, at 82 Nassau Street; one by the Law Telegraph Company at 140 Fulton (moved across from 145) and a competing exchange of the Gold & Stock Telephone Company, at 198 Broadway.

Early Telephone Exchanges, general note: Some of the first exchanges opened by Bell licensees were built for telephone service from the "ground up," so to speak. The nucleus of most Gold & Stock (Western Union subsidiary) exchanges was the wire network already serving for district telegraph or ticker service. (In many towns, Gold & Stock exchanges opened ahead of the Bell.) The nucleus for some later Bell licensees was the wire network of the Holmes burglar alarm service or a callbox service called American District Telegraph Company. The Law Telegraph Company originally was just what its name implies: a service of intercommunication among law firms. This service was well handled and after a time its managers devised a Law telephone switchboard, a tabletop affair, which was efficient for its day and came to be widely used in the '80's and early '90's.

SEPTEMBER — First exchange in New Hampshire opened at Manchester. First exchange in Iowa opened at Keokuk.

SEPTEMBER 1 — First exchange in Ohio opened at Cincinnati, serving 18 subscribers.

Emma M. Nutt was hired as the first woman telephone operator a few hours ahead of her sister, Stella A. Nutt, at the Telephone Despatch Company's exchange in Boston. Both had been employed as telegraph operators. Miss Emma Nutt served as operator, chief operator at several exchanges, and finally on the traffic staff until she retired in 1915, dying June 4, 1926. After working only a few years, Stella married William G. Evert and left the company employ.

SEPTEMBER 12 — Suit commenced by the Bell Telephone Company against Peter A. Dowd, head of the American Speaking Telephone Company (Western Union Telegraph subsidiary), to protect the Bell patents against Edison and Gray infringements.

OCTOBER 8 — First Bell telephone fire alarm system used exclusively for that purpose installed for city of Burlington, Ia.

NOVEMBER — First exchange in Wisconsin opened at Neenah.

NOVEMBER 14 — First exchange in Pennsylvania opened in Philadelphia.

DECEMBER 1 — First five telephones connected with a central office switchboard at Washington, D. C. The White House was No. 1; Capitol, No. 2; Associated Press, No. 3; Treasury Department, No. 4; and the In-

1878 (Cont'd)

stitute for the Deaf and Dumb (later Gallaudet College), No. 5. The central office, a 24-wire peg switch, was established by George C. Maynard. Mr. Maynard, an electrical engineer who had been in the Signal Corps of the Army during the Civil War, obtained the rights to introduce the telephone in Washington from Gardiner G. Hubbard.

DECEMBER 13 — Telephones were first manufactured in Canada at Brantford, Ontario, by James H. Cowherd, who constructed some of the early experimental apparatus for Alexander Graham Bell. Mr. Cowherd died suddenly on February 27, 1881, and for some time no satisfactory telephones were manufactured.

DECEMBER 20 — The first Francis J. Blake transmitter—to which the Bell Telephone Company had acquired rights in November—was issued for commercial use. The Blake transmitter, like the Edison, was an improvement upon the loose contact principle. Both Edison's and Blake's more important patent applications upon this subject covered specific materials for the contacts. All of these patents (including Berliner's described under note for May 21) were for methods of producing undulating current described in Bell's original patent.

The Blake transmitter is important in Bell history because of the competition with Western Union companies under way at this particular time. Edison's (Western Union) transmitter was better than Bell's original. Blake's was better than Edison's; as long as competition lasted, it gave the Bell company an advantage in securing subscribers.

Some early toll lines in California—Samuel Hubbard, brother of Gardiner Greene Hubbard, a co-founder of the Bell System, introduced Bell telephones in California in 1876. When Western Union tried to enter the business, agents for its subsidiary, the Gold & Stock Telephone Company, did the same. Telephones were so enthusiastically received that San Francisco became the third city in the world to open a telephone exchange, February 17, 1878. Gold mining by then was an established industry, with money to spend. Telephones were used extensively in mines, and evidence exists of the establishment of many toll lines between mining towns. These were usually built by mining companies for their own use, but all had at least a semi-public character.

The earliest known toll line (6 miles), between Little York and Liberty Hill, was opened January 22, 1878. By April, 1878, a combination of telegraph and telephone lines was in operation in Butte, Yuma, Tehama and Sierra counties. It was built by Western Union Telegraph interests in combination with several mining or mine supply companies and a bank. The Amador Telephone Company put a line in service between Jackson, Sutter Creek and the Oneida Mine, 25 miles, some time before June 1, 1878. The Ridge Telephone Line, from French Corral to Milton, 60 miles, was completed December 3, but sections were in service as early as September.

Early pay stations. According to "Connecticut Pioneers in Telephony," Thomas B. Doolittle operated pay stations in Bridgeport and Black Rock in 1878 (page 67).

1879

GENERAL — During 1879, while Brooklyn Bridge was being completed, four cables, each with 7 conductors, were placed in the tube of a handrail on a footpath across the unfinished structure, for service between New York and Brooklyn. The outer sheathing for a time was gutta percha, although other materials also were tried on these lines at this stage of progress. The conductors had cloth insulation with metallic sheaths over the insulation to cut down induction noises and crosstalk. Other cables tried at this period had gutta percha insulation for each conductor. One, the Brooks cable (1879-1880), used cotton insulation wrapped spirally with fine copper wire, half a dozen or more conductors being pulled through an iron gaspipe. All cables tried at this time, of course, were adaptations of telegraph cables which had undergone considerable development — notably for submarine use, as in the Atlantic cable (1866) and its many successors.

During 1879, the first multiple switchboard was tried at Chicago. Roughly, multiple wiring means that any operator in your telephone office has within reach an outlet to call you, and that any of several operators can answer on your line when you want to make a call to someone else. The principle was developed by Leroy B. Firman, general manager, American District Telegraph Company, Chicago, when his exchange there became overcrowded. Ultimately it was patented in his name. (See "Beginnings of Telephony.")

JANUARY 1 — First exchange in Maryland opened at Baltimore.

Other first exchanges opened during 1879 were:

February	Louisville, Ky.
February 15	Minneapolis, Minn.
February 24	Denver, Colo.
March	Indianapolis, Ind.
March 15	New Orleans, La.
April 1	Richmond, Va.
April 2	Providence, R. I.
April 26	Toronto, Canada
May 1	Montreal, Canada
June	Omaha, Nebr.
June 1	Burlington, Vt.
June 4	Topeka, Kans.
June 15	Dubuque, Ia.
August 1	Augusta, Ga.
August 15	Camden, N. J.
August 21	Galveston, Tex.
August 26	Charleston, S. C.
September 1	Portland, Me.
September 1	Brantford, Canada
September 20	Raleigh, N. C.
September 22	London, Canada
November 1	Little Rock, Ark.
November 15	Mobile, Ala.
December	Nashville, Tenn.

FEBRUARY 17 — National Bell Telephone Company formed. (Certificate of incorporation issued March 13.) The purpose of this organization was to combine the first New England Telephone Company and the Bell Telephone Company into a nationwide licensing company in order to speed the establishment of telephone service in cities throughout the country. The new corporation proved to be highly successful in this. (Dissolved by decree of court, December 8, 1903.)

1879 (Cont'd)

MARCH 11 — Col. William H. Forbes became president of the National Bell Telephone Company. He remained president of this company and of its successor, American Bell Telephone Company, until September 1, 1887. He was a member of the board of directors, Chairman of the Executive Committee, A.T.&T. Company, from September 2, 1885, to January 6, 1893, and from December 28, 1893, to September 23, 1897. Born at Milton, Mass., November 2, 1840, he was the son of John Murray Forbes, China merchant and head of J. M. Forbes & Company, of Boston. He died, when almost 57, on October 11, 1897, at his summer home on Naushon Island, and was buried at Milton. (See "Forbes — Telephone Pioneer," by Arthur S. Pier.)

MARCH 21 — Shop at 62-68 New Church Street, New York City, leased by Western Electric Manufacturing Co., later becoming New York factory of the Western Electric Company.

Sources: "The Early History of the Telephone in New York City," by B. F. Merritt, from which the statement was verified with F. Lovette, Historian, Western Electric Co., May 19, 1949.

APRIL 2 — The District Telephone Company of New Haven, predecessor of present Southern New England, on this date purchased two private wire lines between Springfield and Holyoke, Mass., where it then operated exchanges. Conversion of these lines to toll service a few days later placed them among the earliest commercial telephone toll lines in the East. The distance covered was about 8 miles.

MAY 15 — Canada's first commercial long distance telephone line opened between Hamilton and Dundas, Ont.

SPRING — In the spring of 1879, the Gilliland Electric Company of Indianapolis contracted to build telephone instruments and switchboards for Bell licensees.

Ezra T. Gilliland (born Cuba, N. Y., 1847; died May 13, 1903) made telephones and switchboards under Bell licenses at Indianapolis from the spring of 1879 until Western Electric acquired his license shortly before coming into the Bell System in 1882. About February,

1884, Gilliland joined the American Bell Company engineering department at Boston. He resigned in September, 1885, as soon as he knew of Vail's resignation that year. Thereafter he is said to have made a fortune distributing Edison's phonograph in England. He later established an electrical manufacturing plant at Adrian, Michigan, which manufactured and marketed inventions which he made at a laboratory in Florida.

JUNE 24 — Davis & Watts, Baltimore, contracted to build instruments and switchboards for Bell licensees.

JUNE 27 — Post & Company, Cincinnati, contracted to build instruments and switchboards for Bell licensees.

JULY 26 — This is the date when Thomas D. Lockwood joined the National Bell Telephone Company at Boston, as assistant inspector and electrician. He later became general patent attorney.

AUGUST 5 — Patent issued to George Lee Anders on bells for selective ringing on 2-party lines.

AUGUST 23 — Charles E. Scribner, later chief engineer of Western Electric Company, patented the jack knife switch—of immense importance in simplifying the process of making switchboard connections. (See June 25, 1926.)

SEPTEMBER 18 — Bell Telephone Company of Philadelphia organized under license from the National Bell Telephone Company to Thomas E. Cornish.

OCTOBER — A telephone line 26 miles long between Boston and Lowell, Mass., was completed by the Pioneer Telephone Company, a special corporation set up at Theodore N. Vail's suggestion to build a line connecting the offices of the Lowell District Telephone Company and the Telephone Despatch Company. This was the first long distance telephone line built as a commercial project. It was much used by the mills at Lowell to communicate with offices in Boston. But—at the beginning at least—it could be used for telephone messages only when conditions were exactly right. Otherwise it was used to transmit Morse code and for a considerable while a telegraph operator named Holden was its regular attendant

Beginnings of Bell Telephone Laboratories of Today

Lockwood says in his reminiscences that when he joined the company the following force was at work to look after technical problems of the telephone business: Thomas A. Watson, general inspector; Emile Berliner; and George L. Anders.

Berliner had two assistants, Joseph H. Cheever and W. L. Richards (later head of the Bell System Historical Museum at 463 West Street). This trio worked on inspection and adjustment of Bell magneto telephones and Blake transmitters.

George Lee Anders was an inventor in the service of the American Bell Company during 1879-1880. He resigned in November of the latter year, devoting himself mostly to switch devices and selective bells for party lines.

Lockwood functioned as assistant to Watson in exercising general supervision over the whole department, planning exchange apparatus and writing pamphlets.

1879 (Cont'd)

at the Boston end. This Morse business became an embarrassment to the line's sponsors, since the telephone company was not supposed to transmit public telegraph messages after the settlement with Western Union Telegraph Co. on November 10. (See below.)

NOVEMBER 10 — The suit that had been brought by the National Bell Telephone Company against Peter A. Dowd of the Western Union Telegraph Company management was settled by agreement. Western Union acknowledged the validity of Bell's patents and agreed to stay out of the telephone business. The National Bell agreed to buy Western Union telephone properties, and stay out of the public message telegraph field in territories occupied by WU.

DECEMBER 9 — First automatic switching system patented by Connolly, Connolly and McTighe. The system was not successful, but this was the first of some 2500 patents on machine switching or "dial" telephone systems. Dials were not used on earlier switching systems — connections were set up by buttons or rotary switches — but today "dial" is used quite commonly to refer to machine switching.

Telephone Numbers — The latter part of 1879 and the early part of 1880 saw the first use of telephone numbers at Lowell, Mass. The story is well substantiated that during an epidemic of measles, Dr. Moses Greeley Parker feared that Lowell's four operators might succumb and bring about a paralysis of telephone service. He recommended the use of numbers for calling Lowell's more than 200 subscribers, so that substitute operators might be more easily trained in the event of such an emergency. The telephone management at Lowell feared that the public would take the assignment of numbers as an indignity, but the telephone users saw the practical value of the change immediately and it went into effect with no stir whatsoever.

Early PBX's—1879—If we regard Doolittle's set-up (Dec. 4, 1877) as experimental, the most clear-cut claim to establishment of the first PBX now seems to come from Dayton, Ohio, where the Dayton Bell Telephone Company, which began service between August 23 and August 30, 1879, opened a PBX at the Soldiers' Home on September 18. This was a PBX by today's standards, with 7 stations and at least one trunk to the local exchange. The facts are clearly covered by contemporary news reports.

At Manchester, N. H., during 1879, Charles F. West set up a private board for the use of operating officials of the Northern New Hampshire Railroad (now part of the Boston & Maine) at Concord, N. H. This appears to have been purely an intercommunicating system with no exchange connection. The approximate month of opening has been stated by West as November.

At Columbus, Ohio, a similar intercommunicating system of 42 telephones was put in service at the Columbus Asylum for the Insane about July 20, 1879. The city exchange — Columbus Telephone Exchange — had then been in service since January 1, but there is no indication that the Asylum system was connected to the city exchange until about September 26, 1880.

1880

GENERAL — The first telephone pay stations (not coin boxes, but attended telephones) in New York City were opened during 1880 in certain offices of the American District Telegraph Company. Exact dates are not available. (See 1878.)

Invention by A. G. Bell of the Photophone by means of which his assistant, Sumner Tainter, talked to him over a beam of light a distance of 1300 feet. (Patent #235,496, Dec. 14, 1880, for Photophonic Transmitter.)

Private line service. The Metropolitan Company, New York City, leased private telegraph circuits for alternate, not simultaneous, use with telephones. (See Jan., 1887.)

JANUARY 20 — First international telephone line opened between Detroit and Windsor, Canada.

JANUARY 24 — Incorporation of the Cleveland Telephone Company, Cleveland, Ohio, under Bell license.

FEBRUARY 20 — 60,873 telephones in the United States. This is the earliest figure reported in the Annual Reports of the American Bell Telephone Company.

MARCH 4 — Professor Alexander Melville Bell sold his Canadian telephone rights to the National Bell Telephone Company in the United States.

MARCH 9 — Charles Fleetford Sise began negotiations in Montreal on behalf of the National Bell Telephone Company to bring together the conflicting telephone interests under The Bell Telephone Company of Canada. Mr. Sise was elected vice-president & managing director at the company's first meeting on June 1, 1880, became president in 1890 and chairman of the board in 1915. He died on April 9, 1918.

MARCH 20 — The American Bell Telephone Company, successor to the National Bell Telephone Company, was formed to carry on the consolidation of Bell and Western Union properties. The certificate of incorporation was dated April 17. This company remained parent company of the Bell System until December 30, 1899. (Dissolved by decree of court, December 16, 1921.)

APRIL 29 — The Bell Telephone Company of Canada was incorporated to operate the telephone business throughout Canada and to manufacture telephones and associated equipment. Among the petitioners for the charter were Professor Alexander Melville Bell and Hugh C. Baker. At the end of the year the company operated 13 exchanges and 2100 telephones.

MAY 12 — Metropolitan Telephone and Telegraph Company incorporated, taking over property of Bell Telephone Company of New York, and Gold and Stock Telegraph Company.

MAY 15 — First exchange in West Virginia opened at Wheeling; other first exchanges opened during 1880 were:

January 5	Ottawa, Canada
February 21	Quebec, Canada
March 17	Windsor, Canada
March 26	Chatham, Canada
April 1	Ingersoll, Canada
May 24	Jacksonville, Florida
September	Ogden, Utah
October	Deadwood, S. Dakota

1880 (Cont'd)

SEPTEMBER 7 — First meeting of the National Telephone Exchange Association at Niagara Falls, N. Y. This Bell organization held regular conventions until 1890, inclusive. Many important service improvements resulted from these gatherings where early telephone officials compared practices and discussed improvements in equipment.

DECEMBER 8 — First dividend (3%) declared by the American Bell Telephone Company. The total was \$178,500. It was paid January 1, 1881.

1881

GENERAL — During 1881, the first telephone cable conduit, a wooden box covered with pitch or asphalt, was placed in service at Pittsburgh, Pa.

JANUARY 1 — First Bell telephone dividend paid. (See Dec. 8, 1880.)

JANUARY 10 — First exchange in Mississippi opened at Vicksburg. Other first exchanges opened during 1881 were:

March 22	Cheyenne, Wyo.
April	Fargo, N. Dak.
April	Salt Lake, Utah
April 1	Tucson, Ariz.
August 1	Las Vegas, N. Mex.

JANUARY 12 — The first commercially successful long distance line, 45 miles between Boston and Providence, was opened for business. (See "Beginnings of Telephony," Rhodes, pp. 94-95.) This was built by the Inter State Telephone Company, which corporation was set up July 7, 1880, to finance by subscription and build this section of a line that ultimately was to reach to New York. Local companies were to complete other sections over their own pole lines, but these were delayed until 1883-1884. Soon after this section was opened, John J. Carty made telephone history by converting the original two single wires into one all-metallic or two-wire circuit which so improved talk over the line that it soon became evident that long circuits, at least, must be two-wire.

JANUARY 14 — Chicago Telephone Company was incorporated; a forerunner of Illinois Bell Telephone Company. (See 12/1920 listing.)

MARCH 21 — Second Inter State Telephone Company formed in Connecticut to build from Providence to New York. This company was sold to the Southern New England Company in 1882.

MARCH 29 — The American Bell Telephone Company issued its first annual report to the stockholders, covering the period from May, 1880.

APRIL 10 — Experimental telephone conversation between St. John, N. B., and Bangor, Me., over a W. U. telegraph wire.

MAY 15 — Construction of Canada's second long distance line between Toronto and Hamilton, Ontario, begun.

JUNE 11 — First telephone cable connection between the U. S. and Canada, Detroit to Windsor, completed.

SEPTEMBER 13 — Telephony for railroad trains. On this date a patent for inductive train telegraph was issued to William Wiley Smith. This patent also contemplated telephone transmission to railway trains. E. T. Gilliland, of the Bell System, took a half interest in the patent. (See *Scientific American*, Feb. 21, 1885.) Smith and Gilliland later acquired an interest in patents of Louis J. Phelps on the same subject. Eventually Thomas A. Edison became interested in the system and the Phelps-Smith-Edison-Gilliland interests were amalgamated to form the Consolidated Railway Telegraph Company of New York. The telegraph feature of the system was given extensive trial by the New York Central Railroad and others, beginning in 1885. Telephone tests were never of commercial quality, and interest in telegraphy aboard trains flagged after 1888. Eventually the railroads decided the service did not justify the expense of installation.

NOVEMBER 26 — Western Electric Manufacturing Company, at Chicago, became simply Western Electric Company, following purchase of Jay Gould's interest in the predecessor company by the American Bell Telephone Company. At about this time, Western Electric acquired the licenses of the Gilliland Electric Company, Indianapolis, and of Charles Williams, Jr., at Boston. This gave them the only existing licenses to make Bell equipment, as those issued to the Post and the Davis and Watts companies (see 1879) had expired.

1882

FEBRUARY 1 — First exchange in Nevada at Virginia City.

FEBRUARY 6 — Agreement between American Bell and Western Electric whereby the latter became sole suppliers of Bell telephones and telephone equipment. The Western Electric Company of Illinois was later (see 1915) reincorporated under the laws of the State of New York.

MARCH — First exchange in Montana, at Miles City.

APRIL 16 — Five miles of telephone cable was placed in the ground between Attleboro and West Mansfield, Mass., with the aid of a plow attached to a locomotive. The trench was back-filled with a heavy plank fastened to a railroad car. This was the first attempt to plow in telephone cable. It took place on a Sunday and E. F. Phillips and W. H. Sawyer, manufacturers of the cable, and H. B. Lytle, of the Telephone Despatch Company, had trouble finding a farmer who was willing to rent his plow for work on the Sabbath.

JULY 24 — The Mechanical Department of The Bell Telephone Company of Canada commenced the manufacture of telephones, using machines purchased from Charles Williams, Jr., Boston, Mass.

The Superintendent was Charles W. Brown from Williams' factory.

This manufacturing plant became the Northern Electric & Manufacturing Company Limited in 1895 and the Northern Electric Company Limited in 1914.

NOVEMBER 10 — Alexander Graham Bell admitted to citizenship in the United States by the Supreme Court, District of Columbia. (See October 27, 1874.)

1882 (Cont'd)

GENERAL — In 1882, Prof. Francois Van Rysselberghe, of the University of Ghent, Belgium, demonstrated the first practical system for simultaneous telephony and telegraphy over a set of wires. This became the basis for the A.T.&T. Company's development of such services later on. But the problem of the Bell companies in 1882, and for a good many years thereafter, was to provide telephone service; they had scant facilities compared with those already available to the telegraph companies. Therefore they were in no haste to develop telegraph facilities as a "by-product" of telephone construction, but they did find it necessary to do this as time went on.

1883

FEBRUARY 26 — Service established across the Mexican border between Brownsville, Texas, and Nuevo Laredo, Matamoras and Paso del Norte. (According to a letter from H. J. Pettengil, Southwestern Bell Telephone Company; *International Telephone Review* for January, 1928, Vol. IV, p. 4, places the Matamoras opening in October.)

MARCH 7 — First exchange in State of Washington opened at Seattle.

MAY 24 — Formal opening of Brooklyn Bridge.

JUNE 25 — Bell licensees in Illinois outside of Chicago metropolitan area, as well as others in Indiana, Ohio, and a few in Iowa, consolidated in the newly organized Central Union Telephone Company, a forerunner of Illinois Bell Telephone Company.

SEPTEMBER 15 — First exchange in Idaho opened at Hailey.

OCTOBER 19 — New England Telephone and Telegraph Company incorporated.

NOVEMBER — Construction of New York-Boston line through Connecticut began in 1884. (See below.)

Bell Telephone Laboratories evolution — an experimental shop was organized to supplement the activities of the Electrical and Patent Department, Am. Bell Tel. Co., in 1883 and in June, 1884, name was changed to the Mechanical Department, though the functions it performed would in later days be called development and research. E. T. Gilliland was put in charge; in November, 1885, he resigned. (See article by R. H. Hill and Thomas Shaw, *Bell Tel. Magazine*, Autumn, 1947, p. 155.)

1884

MARCH 27 — First successful long distance conversation between New York and Boston after Watson and Bell's test on April 3, 1877. It took place over a telephone circuit of two hard-drawn copper #12 wires. This line was regarded as an experiment, sponsored by the American Bell Company and built by companies along the route — a great part of the work being done by the Southern New England Company. At the New York end, during the test, Emile Berliner was in charge and Theodore N. Vail was present. At the Boston end, W. W.

Jacques was in charge. T. B. Doolittle also was on hand at New York and E. T. Gilliland at Boston. The line worked for about an hour and a half before a cable failed at a river crossing. It took several months to iron out that and other troubles, but the work and the accumulated test records pointed the way to successful long distance service. Thomas B. Doolittle, in a report to E. J. Hall, Jr., said of this line: "The experimental wires between Boston and New York have fully demonstrated the practicability of telephone communication to distant points, and that is all, and all that was expected of them." This was the first large-scale use of hard-drawn copper wire. (See note of Dec. 4, 1877.)

SEPTEMBER 4 — The New York-Boston line was opened for commercial service, about 292 miles. (Rates: \$2 daytime; \$1 at night.)

GENERAL — During the year 1884, the need for a telephone system that could function 24 hours a day without operators or central offices in very small towns became apparent. E. T. Gilliland, head of the Mechanical Department, American Bell Telephone Company, supervised work on a system that came to be called either the Gilliland or the village system. It was not meant to connect more than fifteen telephones and in today's vocabulary would be called a wiring plan; that is, a line ran from each telephone to each of the others in the system. The user could plug in from his own set direct to anyone he wished to call. The village system was in service from about 1885 (first system at Leicester, Mass.) to 1888, after which it was replaced with manual as growth warranted. In its day, it was considered an "automatic" or machine-switching system, and was exhibited as such in the American Company space at the Columbian International Exposition at Chicago, in 1893.

During 1884, toll lines were opened for service between Colorado Springs and Pueblo, and between San Francisco and Sacramento. (Chronology compiled by C. H. Gilbert, of Long Lines, retired.)

1885

FEBRUARY 28 — The Certificate of Incorporation of the American Telephone and Telegraph Company, with its broad claim of intent to establish telephone communication to cities on the American continent and elsewhere around the world by wire, cable and "other appropriate means," was executed in New York City by Edward J. Hall, Jr., Thomas B. Doolittle, Joseph P. Davis and Amzi S. Dodd. The full text of the certificate appears as an appendix to Arthur W. Page's "The Bell Telephone System."

MARCH 3 — The A.T.&T. Company's Certificate of Incorporation was filed with the New York State Department at Albany. Theodore N. Vail became president of the new company. At the time he was also serving as president of the Metropolitan Telephone and Telegraph Company in New York and as general manager of the American Bell Telephone Company. He resigned as general manager of the American Bell during the summer of 1885, however, keeping on with the other two posts for two years. He was succeeded as general manager of the American Bell by John E. Hudson, who for a time bore the title of General Manager and Solicitor.

1885 (Cont'd)

MAY 12 — Edward J. Hall, Jr., filed his recommendation for the building of the first line of the new A.T.&T. Company's commercial system — between New York and Philadelphia. Although in regular use by this time, the New York-Boston line described under date of March 27, 1884, was regarded as "experimental," and furthermore was jointly owned by American Bell and several local companies that shared in building it.

Mr. Hall's recommendation refers to the New York-Boston line and in connection with it says: "We know that a metallic circuit can be operated between New York and Boston . . . but we do not know that additional parallel circuits can be successfully worked." He goes on to say that methods for making parallel circuits work were being considered by Mr. Gilliland.

For the line between New York and Philadelphia he specified special calling and receiving sets and suggested ways to make it possible for some local subscribers to make calls from their telephones over the long distance line. Most local subscribers would not be able to do this but would have to go to special toll or long distance telephones. Hall also suggested arrangements for splitting toll charges between local companies and the A.T.&T., some of which still hold good in principle. Construction started August 18.

DECEMBER 7 — Hammond V. Hayes joined the American Bell Telephone Company at Boston, succeeding Ezra T. Gilliland as head of the year-old Mechanical Department (development and research). On January 1, 1905, Hayes became chief engineer, in which post he remained until July 1, 1907, when he resigned to continue as consulting engineer for a time, and to act as engineer and later chief engineer for the Submarine Signal Corporation, of Boston. During his career with American Bell, the members of his staff and others whom he advised were responsible for the development of a number of fundamental improvements to telephone service, such as paper-insulated cables with small-gauge wires, the solid-back transmitter, the common battery switchboard, coil loading and the initial efforts to use telephone repeaters and carrier and radio telephony. He also initiated several practices of traffic engineering. Born August 28, 1860, he died at Boston, March 22, 1947. (For more biographical data, see *Bell Telephone Magazine* and *Bell Laboratories Record*, 1947.)

DECEMBER 21 — The first official telephone message over the New York-Philadelphia line was a report from H. D. McCaffrey at the Philadelphia end of the final details of construction. Commercial service did not open on this line for about a year because of difficulty in getting terminal sites in Philadelphia.

GENERAL — During 1885, a toll line between Helena and Butte, Montana, was placed in service.

1886

GENERAL — The most successful of many phantom telephone circuits was proposed by J. J. Carty of the Bell System during this year. A phantom circuit is created by an arrangement of wiring and coils; it makes it possible to use four wires (2 circuits) to carry three

telephone conversations and one telegraph message. Carty worked from a suggestion made in 1883 by F. Jacob, of the Bell System.

A process for pressing the lead sheath directly upon the core of telephone cables was developed in 1886, by John A. Barrett, of the American Bell Company, and John Robertson, manufacturer and inventor of a lead press, of Brooklyn, N. Y. This process eventually resulted in today's dry core, lead-sheathed cables. Alpth sheath requires a somewhat different process.

FEBRUARY 19 — Thomas A. Edison filed application for a patent on a transmitter in which the variable resistance element was a container filled with granules of carbonized hard coal. Granules of carbonized anthracite continue in use today.

NOVEMBER 24 — A.T.&T. first offered private line service.

1887

JANUARY 15 — By now the A.T.&T. Company had begun work with simultaneous telegraph and telephone systems, proposing to lease the telegraph services to subscribers. The first private line Morse telegraph service was provided to L. H. Taylor and Company, brokers, between New York and Philadelphia. (The Metropolitan Company in New York City had leased some private telegraph circuits in 1880, but they were for alternate, not simultaneous, use with telephones.)

Short period private line service (1 hour or less) offered by A.T.&T.

Standard cable specifications adopted by license companies at first cable conference called by A.T.&T. in September.

FEBRUARY 4 — Interstate Commerce Commission formed. It was amended in 1910 to give it authority to regulate interstate telephone business. (See June 8, 1910.)

SEPTEMBER 1 — Howard Stockton became president of the American Bell Telephone Company, succeeding Col. William H. Forbes. He served until April 1, 1889, when he was succeeded by John E. Hudson. Stockton was born in Philadelphia, was a Civil War veteran, and died at Boston, April 22, 1932, at the age of 90.

SEPTEMBER 19 — Theodore N. Vail resigned as president of the A.T.&T. Company. He was succeeded by John E. Hudson, who also continued his duties as general manager and solicitor of the American Bell Telephone Company.

NOVEMBER 1 — The first differentiation between day and night long distance telephone rates went into effect, with night rates in most, but not all, instances lower than day rates.

DECEMBER 19 — Switchboard and Telephonic Apparatus Committee met at Boston in the first of a series of conferences of great importance in the development of equipment. A series of cable conferences also began on September 7, 1887.

1888

EARLY SPRING — The first Gray telephone pay station, which required deposit of a coin to gain access to the telephone instrument, was brought out by William Gray. His first patent, applied for at this time, was issued Aug. 13, 1889. Although this in itself was no great improvement over many preceding devices intended to collect and refund coins on public telephones, it was the forerunner of a long line of widely used and quite successful public pay telephones. George A. Long of the Gray Company was responsible for many inventions that improved it.

Note: A question raised by a West Coast newspaper was, "Were pay telephones the first coin-operated devices to be invented?" The answer is "No"; coin-operated toys and even an electric till (or cash register) were devised long before Bell invented the telephone.

JANUARY 2 — First private line Morse telegraph (interchanged with private line telephone service) used by the press between Boston and New York. Contract between A.T.&T. and the *Boston Globe*.

MARCH 12 — The blizzard of 1888; huge snowdrifts in New York City and the eastern section of the United States; overall restoration of telephone lines was not completed until May. Blizzard inspired "The Spirit of Service" painting by F. L. Merrill, posed by Lineman Angus A. MacDonald.

MARCH 19 — The United States Supreme Court sustained Bell's patent rights in every particular in a notable decision on appeals of the five most important suits filed by the American Bell Telephone Company's counsel to protect the patents.

NOVEMBER 13 — Patent issued on an elementary scheme of wire transpositions which had been worked out by John A. Barrett, who had been assigned to this work for the Bell System, beginning in 1885. Transposition or criss-crossing of overhead wires at certain mathematical intervals prevents cross-talk between circuits on the same pole line; if no transpositions are made and the wires simply run parallel, the conversation on any one circuit usually can be heard on any parallel lines.

DECEMBER 15 — Patent issued to Hammond V. Hayes, later chief engineer, A.T.&T. Company, on the common battery switchboard. In earlier telephone systems, each telephone was equipped with a set of batteries which required constant testing and replenishing. The common battery switchboard makes it possible for one main battery at the central office to supply current for nearly all telephones connected to it. A few telephones at great distances from the office may need supplemental batteries.

1889

GENERAL — During 1889, the first public coin telephone was installed at Hartford, Conn., on the ground floor of the old Hartford Bank, Main Street and Central Row. This, at least, was the first Gray pay station; might be called the first "practical" public coin telephone.

Most A.T.&T. long distance calls at this time originated at company pay stations or at special "direct loop" stations installed for subscribers. Local exchange development of metallic circuits was negligible.

JANUARY 5 — The "Blue Bell" design was approved for advertising long distance telephone stations, from a design submitted by Angus S. Hibbard, general superintendent, A.T.&T. Company, to Edward J. Hall, Jr., vice-president.

APRIL 1 — John E. Hudson succeeded Howard Stockton as president of American Bell Telephone Company. Hudson, a practicing lawyer, Harvard graduate and Greek scholar, had become counsel for the company October 4, 1880, and later general counsel. Born August 3, 1839, at Lynn, Mass., he died suddenly October 1, 1900, after completing arrangements for American Telephone & Telegraph Company to take over the assets of American Bell.

SEPTEMBER 1 — Casper E. Yost (*b.* 1841; *d.* 1920), after retiring from business, was induced to enter telephone career at Omaha. Known among telephone contemporaries as the "dean of telephone presidents," Mr. Yost was president of the Nebraska Telephone Company (1891-1919), of the Northwestern Telephone Exchange Company (1902-1904, 1907-1919) and of the Iowa Telephone Company (1898-1919). A Telephone Pioneer chapter was named in his honor in 1922.

1890

GENERAL — From 1890 to 1900, virtually the entire Bell System exchange wire plant was made over from single-wire to two-wire circuits.

During 1890, New York City's first coin boxes were put in use at Barclay Street ferryhouse.

About 1890, the Western Electric Company began to deliver dry core 50-pair, 18-gauge cables with paper insulation and lead sheathing. "Dry core" refers to the fact that to begin with it was thought necessary to use various sealing compounds of wax, resin or oil to prevent moisture from entering the cables; the amount of compound used was reduced by stages during the period 1886-1890 until finally the core was covered "dry" or untreated.

1891

GENERAL — During 1891, two- and four-party-line telephone service was offered in New York City as an inducement to customers.

The earliest exchanges all had party-line service — once in a while as many as 20 to a line. This service had unsatisfactory qualities and for many years in the Eighties the trend was toward individual lines. Now, however, party-line service at lower rates than individual was offered to encourage more people to have telephones.

JANUARY 1 — Engineers Department of American Bell Telephone Company formed to supplement the work of the Mechanical Department, and the Electrical & Patent Department. Joseph P. Davis, made chief engineer, had been engaged in cable development work, and this department's primary purpose was to standardize plant construction and operating methods.

1891 (Cont'd)

MARCH 10 — The Strowger machine-switching system was patented. The legend is that Almon B. Strowger (1839-1902) thought that telephone operators purposely were giving him busy signals and wrong numbers. So, using a collar box and handy bits of metal, he devised a central office switching system wherein the telephone user should not be dependent on operators. Believe the legend or not, but keep the collar box in mind.

Strowger used principles that had been proposed in the Connolly-McTighe patent of December 9, 1879. But he simplified the switch contacts and provided means for causing a wiper (a thin metal blade) to be moved first vertically, then horizontally. Impelled by electro-magnets, his wiper would climb up inside the collar box—that is, inside a cylinder of contacts—to any given row. (For example, the row providing connections to telephones numbered in the Sixties.) Then the wiper would be rotated to any desired contact in the row (say 6, to call No. 66).

Strowger's first central office could serve only 99 telephones, and each subscriber had to have a very strong battery in his telephone set, and furthermore, five wires had to be provided from the telephone set to the central office. But these drawbacks were engineered out in a few years and Strowger's became known as the step-by-step system—because his wiper switches would be operated in sequence, setting up connections through several banks of equipment numbered for thousands, hundreds, tens and units until each digit of a telephone number was lined up in a complete circuit through the central office to the called party's telephone. Then the telephone user had to turn a crank to ring the desired party. After talking, he had to push a button to clear his line.

On the earliest Strowger sets, the telephone user sent in the pulses of current necessary to activate the wiper switches in the simplest possible way—to get 66, he would punch six times each on a "tens" and a "units" button. To get 99, he had to deliver 18 punches. In actual service this method lasted about four years. (See August 27, 1896.)

1892

MARCH 24 — Application filed for patent on the "solid-back" transmitter of Anthony C. White, a Bell engineer. This improvement upon the Edison carbon granule transmitter provided a cylindrical chamber for the granules with a solid back and a movable front. The front, attached to the transmitter diaphragm, could compress or release the granules more effectively than in previous designs, and while the White transmitter has been improved many times since 1892, its general design has formed the basis of all succeeding variable resistance transmitters—the type in most common use.

OCTOBER 18 — New York-Chicago long distance line opened, 950 miles. This was an overhead wire line of heavy gauge copper (two No. 8 gauge conductors). A. G. Bell took part in opening ceremony at New York in main A.T.&T. office at 18 Cortlandt St.

GENERAL — In this year only 12% of telephone subscribers were connected by metallic circuits; 49% in 1898; 96% in 1906.

NOVEMBER 3 — First commercial step-by-step machine switching exchange in the world opened at La Porte, Indiana, by the Automatic Electric Company, of Chicago, under Strowger patents.

NOVEMBER 16 — During 1892, 100-pair, 19-gauge cables came into use. Some 20,000 miles of Bell System wire was working underground by this time.

1893

FEBRUARY 7 — Opening of long distance service, Boston to Chicago.

MARCH 7 — Expiration of the first Bell patent made it possible for anyone who so desired to make telephone equipment and sell telephone service. A combination of circumstances brought a great many independent exchanges and systems into being. In many cities, companies opened in competition with Bell exchanges and the public found it necessary to subscribe to both Bell and the competing service.

MAY 17 — John Stone Stone, Bell System engineer, reported on the possible use of "Resonating Circuits" (or wire circuits tuned to wave lengths as in modern radio). This report marks the beginning of the Bell System's interest in carrier current telephony, although the state of the telephone art made Stone's proposal somewhat impractical at this time.

JUNE 8 — First contract with A.T.&T. for full-period private line telephone service signed by Penn. R.R. Co. (between Philadelphia and New York).

JUNE 15 — First exchange in Oklahoma opened at Oklahoma City.

DECEMBER 12 — Long distance service opened New York to Cincinnati.

1894

JANUARY 9 — The first complete common battery (non-multiple) exchange was put in service at Lexington, Mass.

JANUARY 30 — Bell's basic telephone patents expired.

1895

JUNE 28 — A letter from J. W. Thompson, City Manager for the Chicago Telephone Company, to Miss Mesick, Chief Operator, Main, says, "In answering calls the query 'Number Please?' spoken in a pleasant tone of voice and with rising inflection must be invariably employed." This is the earliest official instruction we have found for this phrase which became known all over the world. It was not recommended for the whole Bell System until about 1904, and probably not used by all companies until nearly 1912.

The earliest response of telephone (boy) operators appears to have been, "What do you want?" or sometimes, "Hello!" but there is no telling exactly. Telephone directories of the early Eighties, in giving instructions how to use the telephone, tell subscribers that the operator will respond with "Number?" or "What number?"

1895 (Cont'd)

Under one system used until after 1886, the operator did not respond at all—the telephone user depressed a key and simply gave his number over a call wire.

NOVEMBER 12 — Long distance service opened between Nashville, Tenn., and Chicago.

1896

GENERAL — Circuit miles were replaced as basis for intercity rates by railroad mileage between irregularly shaped "squares" for distances up to 500 miles. "Section mileages" were used for greater distances. Sections were irregular areas about 75 miles square and mileage was measured to the "Key" office in the section.

MARCH 3 — System for selective ringing on 4-party lines patented by Angus S. Hibbard, formerly general superintendent, A.T.&T. Company, but, after 1893, general manager of the Chicago Telephone Company. Selective ringing makes it possible to ring any of the four parties on the line without all bells sounding.

MAY 9 — Opening of long distance lines, Kansas City-Omaha.

JUNE — The first complete common battery multiple switchboard was put in service at Worcester, Mass.

JUNE 18 — New York Telephone Company established; took over the Metropolitan Telephone and Telegraph Company that had been serving about 15,000 telephones in Manhattan and the Bronx, and the Westchester Telephone Company that served about 1,000 telephones in Westchester County.

JUNE 24 — Opening of the New York-St. Louis long distance line.

AUGUST 27 — Dial telephones — the first machine-switching telephones with finger wheels resembling those of today—were placed in service in the city hall at Milwaukee, Wisconsin, by the Automatic Electric Company of Chicago. Previous installations by this company, which had been formed to develop the Strowger patents, were equipped with push buttons, as described in the item for March 10, 1891.

The purpose of the dial was to make it easier to send the proper number of impulses to the central office, since the dial wheel, while being pulled back to its rest position by a coiled spring, could be made to brush across a contact any given number of times. This later made it possible to equalize the length and strength of the impulses so that they would be most effective electrically and mechanically.

The dial mechanism was probably suggested by electro-mechanical systems called dial telegraphs, many of which were invented and used in the early days of telegraphy, long before the telephone. A close predecessor of the telephone that was called the "district telegraph" had a dial with a spring device that would send a given series of impulses to a central office. There was a code for each of 6 positions on the dial; it would convey a prearranged message, such as "Send a messenger," or "Send a doctor." The district telegraph could signal only the 6 prearranged messages.

Incidentally, the Bell System used a dial to set up connections on inter-office trunks between Worcester and Gloucester, Mass., beginning about Sept. 21, 1885 — and for a few years thereafter—possibly the first instance of operator toll dialing." This use was in connection with an installation of Gilliland's village system. (See 1884-General.)

1897

JUNE 1 — Opening of line, New York to Charleston, West Virginia.

JUNE 22 — Actual date of organization of United States Independent Telephone Association at a meeting in Detroit, Michigan, beginning at 12 noon.

This meeting was called by an executive committee appointed at a previous meeting in Chicago, Ill., May 27 and 28, and composed of two men from each of the more than 15 states there represented, and "was clothed with power and directed to take all the steps necessary to complete organization of independent telephone interests . . ." (See *Telephony*, Sept. 27, 1947, p. 35; Sept. 3 and 20, and Oct. 25, 1947.)

AUGUST 31 — Opening of line, New York-Minneapolis, Minn.

SEPTEMBER 15 — Opening of line, New York-Omaha, Nebraska.

OCTOBER 4 — Opening of line, New York to Norfolk, Virginia.

DECEMBER 11 — Gardiner Greene Hubbard died.

GENERAL — The first multiple board with common battery for both talking and signaling, and employing lamps for line and supervisory signals, was installed at Louisville, Kentucky, during 1897; this type of board became known as the No. 1 relay board, and was widely used in large exchanges. (See *Bell Telephone Magazine*, Autumn, 1947, p. 160.)

1898

NOVEMBER 12 — First common battery switchboard in New York City installed in Harlem, 129 E. 124th St.

NOVEMBER 15 — Opening of service between New York and Kansas City, Mo. During the year long distance service from New York to Norfolk, Va., had been extended to Richmond and Atlanta.

1899

OCTOBER 16 — Basic Long Lines toll period reduced from 5 to 3 minutes for points west of Pittsburgh. (Points east of Pittsburgh reduced July 1, 1901.)

DECEMBER 30 — American Telephone & Telegraph Company took over the business and property of the American Bell Telephone Company, becoming parent company of the Bell System, while continuing as the long lines operating company.

1900

GENERAL — 855,900 telephones in the Bell Telephone System.

MAY 29 — Loading was first applied commercially to circuits in a cable between Jamaica Plain and West Newton in the suburbs of Boston. Improvised coils used. (See notes for 1902; also *Bell Telephone Quarterly*, April, 1923, p. 94 and following.)

JUNE 19 — Prof. Michael I. Pupin, of Columbia University, patented a method for using the loading coil to carry talk over greater distances. Pupin and Dr. G. A. Campbell, of the Bell System, working independently, each had proved that loading coils placed at regular and frequent intervals in a telephone circuit—particularly a circuit in a cable—would improve its transmission efficiency. Pupin's patent application was found to antedate Campbell's by only a month. His patent was purchased by the Bell System, and his and Campbell's discoveries were put to use as rapidly as possible.

Curiously, at the beginnings of telephony, everyone worked hard to get rid of induction on telephone lines. Now they worked to put it back in loading coils, which are devices that use induction. But when supplied at proper intervals they have the effect of making an initial electrical wave or undulation travel a greater distance. They do not do this by adding to its strength—as a repeater does—but they slow down or reduce its attenuation or tendency to grow weaker.

OCTOBER 1 — Alexander Cochrane, a director of the American Bell Telephone Company and of A.T.&T. Company, was made president *pro tem* of A.T.&T. Company upon the sudden death of John E. Hudson. Cochrane served as president *pro tem* until July 1, 1901, when Frederick Perry Fish became president.

1901

GENERAL — Contract executed under which Western Electric Company undertook purchasing and warehousing of all telephone and office supplies for the Bell Telephone Company of Philadelphia. This was the beginning of Western Electric's service as purchaser and supplier, as well as manufacturer, for Bell System companies.

Cable capacity was increased to 300-pair, 19-gauge, and 400-pair, 22-gauge.

JULY 1 — Frederick P. Fish, a distinguished patent lawyer and a director of A.T.&T. Company, was made president of the company. Fish served until May 1, 1907, when he was succeeded by Theodore N. Vail. Fish, born at Taunton, Mass., was graduated from Harvard College (1875) and Harvard Law School (1876). He was a director of many educational and banking institutions. He died November 6, 1930, at the age of 75.

JULY 1 — Basic Long Lines toll period reduced from 5 to 3 minutes for points east of Pittsburgh. (See October 16, 1899.)

DECEMBER 12 — First Transatlantic Signal — Marconi signaled the letter "S" across the Atlantic from England to Newfoundland. The first radio message was sent a year later.

1902

GENERAL — During August, 1902, the first long distance conversations by underground, loaded cable took place between New York and Newark, N. J., 10 miles.

Some 600-pair, 22-gauge cables were now being made.

Also, during 1902, the Bell System tried out a 50-line machine switching exchange at Queens, N. Y. This is sometimes referred to as the Queens system. By 1905, a total of 44 exchanges of the same kind had been installed. They were produced in 20-line and 100-line capacities — could go no larger. They had a single-motion switch instead of Strowger's vertical and rotating motion. The telephone sets had dial plates with 20 and 100 holes, and the user simply moved a dialing bar to the correct number. To call Number 76, for example, the telephone actually sent 76 pulses of the connecting machinery (Ballard-Rorty type).

The Engineers Department (under Joseph P. Davis) and Mechanical Department (under Hammond V. Hayes), Am. Tel. & Tel. Co., were merged into a single organization called the Engineering Department. They were placed under a three-man committee, reporting to Mr. Davis, with Hammond V. Hayes one of the directing committee. Hayes was responsible for preparing the annual reports of the Engineering Dept. for Mr. Davis until January 1, 1905, when Davis resigned, having for some years been in ill health. Mr. Hayes was made chief engineer (a new title in the organization, and first time used by Mr. Hayes) of the combined Engineering Dept. (See January, 1905.)

Sources: Article by R. B. Hill and Thomas Shaw, *Bell Tel. Magazine*, Autumn, 1947, p. 155.

JANUARY 13 — The first operator's training school in New York City was opened at Irving Place and 18th Street. It was the first of its kind and a "pioneer step in vocational training."

OCTOBER 23 — At the request of President Fish, Engineer Hammond V. Hayes sent a memorandum to Albert Bullard of the A.T.&T. Engineering Department that authorized development of a 10,000-line machine-switching exchange. It also suggested study of the Strowger system as an aid to discovering what difficulties must be overcome.

NOVEMBER 29 — *The License Contract*. Up to this time the associated companies of the Bell System had paid a rental upon each telephone instrument leased to them. Rentals had begun at about \$10 a year and the charge at one time was as high as \$14. Now the rentals ceased and the services of A.T.&T. to the companies were charged at 4½% of each company's gross annual revenue. This was reduced to about 4% in 1926, 2% in 1927, 1½% in 1928, and to 1% in October, 1948.

DECEMBER 21 — Guglielmo Marconi sent wireless telegraph message from Glace Bay, Nova Scotia, to England.

1903

JANUARY 19 — President Theodore Roosevelt exchanged greetings with King Edward VII, by wireless telegraph.

1903 (Cont'd)

APRIL 15—First issue of any Associated Company magazine in the Bell System. "The Cumberland Telephone Journal"—8 pages. Published by the Cumberland Telephone and Telegraph Co.

1904

GENERAL — During 1904, a form of "repeater" or amplifier that restored strength to voice currents weakened by transmission over long distances was first tried successfully on a circuit between Boston and Amesbury, Mass. This repeater, designed by H. E. Shreeve of the Bell System, was of the "mechanical type," which means that the currents needing renewal passed through the working parts of a telephone receiver and transmitter combined in one instrument, so that the transmitter would put fresh battery currents on the line. "The telephone shouted into its own ear." Shreeve repeaters were first used commercially near Pittsburgh on the New York-Chicago line.

An elaborate series of measurements worked out by E. H. Colpitts, A.T.&T. Company, during 1904, was of great importance in later transposition systems, particularly on cables. By transposing or criss-crossing wires, instead of letting them run parallel, induction noise and cross-talk are reduced.

1905

Bell System telephones in 1905, 2,241,367.

JANUARY 1 — Joseph P. Davis, head of the Engineering Dept., Am. Tel. & Tel. Co., resigned and Hammond Vinton Hayes succeeded him under a newly created title for this organization—chief engineer. (See article by R. B. Hill and Thomas Shaw, *Bell Tel. Magazine*, Autumn, 1947, p. 155; also, 1902—General.)

1906

MACHINE SWITCHING — Bell System engineers in 1906 introduced a new development for machine switching. It was, and is, called a sender. Trying to put it in everyday language, some have called it an electric brain, and O. E. Buckley, while president of Bell Telephone Laboratories, once called it a traffic director. Its later developments have been labeled director and register.

At any rate this sender has been part of Bell System machine-switching equipment since 1906. It is a device which takes the electric impulses that come from the telephone user's dial, and stores them for a few moments. Meanwhile, the actual switching mechanisms begin to seek the contacts that will reach the called number. As the switches move they send back "revertive" impulses to the sender. And when these revertive impulses match those in storage, the sender stops the switch in the right position. This was devised by Bell System engineer E. C. Molina, whose first patent application on it was

filed April 20, 1906. T. D. Lockwood, who drew up the patent papers, said it was one of the most fundamental inventions on which he had ever filed.

By 1906, Bell System studies of the problems of machine switching, begun in 1902, had reached a point where two groups of engineers had been formed (in Western Electric Company), each working on a special variation of the equipment.

Under F. R. McBerty (later president of North Electric Company), a system called "rotary" was being developed. It gets its name from the fact that its switches never move in a vertical direction (as Strowger's did), but only rotate.

After years of development it was decided that the rotary system would be too costly in big city exchanges, so it was never used commercially by the Bell System. Further developed by the I.T.&T., and the Federal T.&T. companies, the first commercial installation of it in America was cut into service by an independent company at Rochester, N. Y., in the fall of 1948. McBerty died Feb. 18, 1950, at Mansfield, Ohio.

Under J. L. McQuarrie (later president of the International T.&T. Company), there was utilized some equipment called the panel system which came into wider use in the Bell System because it was especially adapted to large cities. In this system, the switches do not rotate, but selector rods carry a number of brushes that climb vertically before a panel of contacts. In both systems the sender is used to stop the switches at the right position. And, in both, the power for moving the switches is taken from a drive shaft operated by a motor, whereas in the Strowger equipment the switches are moved by the pull of magnets under control of relays actuated directly by pulses from the subscriber's dial. McQuarrie died at Vineyard Haven, Mass., March 1, 1939.

FEBRUARY 1 — New York Telephone directory included a paragraph referring to Information Service for the first time.

APRIL 1 — First telephone directory featuring classified business advertising on yellow pages issued at Detroit by the Michigan State Telephone Company.

APRIL 18 — Earthquake and fire swept San Francisco destroying 490 blocks of the city. Service to city's 50,000 telephones completely disrupted; only two central offices escaped serious damage. Within two months, 9,000 telephones were back in service. Another 20,000 restored by January 1.

JUNE 1 — Five-cent rate introduced in New York City for local calls from public telephones. The new charge began in South Brooklyn, Queens and Staten Island, and was extended throughout the remainder of the city on July 1.

SEPTEMBER — Opening of the New York-Philadelphia underground cable. Construction began October 9, 1905.

OCTOBER 20 — Dr. Lee De Forest read a paper before an A.I.E.E. meeting on his audion — first of the vacuum tubes as we know them today.

Marconi got his first signals across the Atlantic by starting the radio waves with a spark coil and receiving

1906 (Cont'd)

them with a device called a coherer (because iron filings in it would cohere in the presence of electromagnetic waves).

A little later, Sir Ambrose Fleming made the first vacuum tube device, a tube with a plate and a filament inside it. He called it a valve and it was a more effective detector or receiver of radio waves than the coherer. It did much to make wireless telegraphy possible.

Now, De Forest, who had been working on radio problems for years, added a third element to the vacuum tube. He put a grid between the plate and the hot filament, and came up with a device which proved to be a most effective detector of radio signals — and which, it developed, could be used to send or generate radio waves more effectively than anything that had gone before.

Also, the audion had possibilities as a repeater or amplifier of telephone currents, and after these possibilities had been developed it was destined to be of tremendous importance in both long distance and radio telephony.

1907

APRIL 30 — Theodore N. Vail was elected president of American Telephone & Telegraph Company for the second time, succeeding Frederick P. Fish.

JULY 1 — John J. Carty was appointed Chief Engineer, A.T.&T. Company, succeeding Hammond V. Hayes (who remained under retainer as consulting engineer until 1913).

GENERAL — Consolidation of research staffs: At the beginning of 1907, the A.T.&T. Company Engineering Department in Boston — an outgrowth of the old Mechanical Department — had laboratories in a ground floor annex on Oliver Street, and was broadly responsible for Bell System engineering, development and research work.

This department established engineering standards for plant design, prepared central office specifications, and advised the associated companies on current plant and traffic problems. It used circulars and bulletins to the field on the use of new developments.

In conference committees and correspondence, it outlined the service requirements for telephone cable and the bulk of the telephone apparatus manufactured by the Western Electric Company. Western Electric engineers at New York and Chicago then carried on the necessary development work. Western Electric also had laboratories at Boston in which it carried on considerable research and development work.

In the summer of 1907, following Carty's appointment, the A.T.&T. headquarters engineering staff was moved to New York. Some of its members went to offices in A.T.&T. headquarters at or near 15 Dey Street. But the main effect of the move was to consolidate A.T.&T. and Western Electric research and development staffs at the Western plant at 463 West Street (later the Bell Telephone Laboratories). The amalgamated organization expanded almost from its inception and nearly two decades later became the Bell Laboratories.

Headquarters moved, too: In connection with the above move, nearly the whole of system headquarters

was brought to New York. One or two departments remained nominally at Boston for many years, however, and a skeleton organization of the former parent company, the American Bell, remained there carrying out the process of liquidation.

Long Lines: The A.T.&T. Company long lines engineers always had been in New York and remained there, of course. Some of its offices were moved from 15 Dey Street to a nearby building. This section of the company now was designated the Long Distance Lines Department.

The immediate cause of the above consolidations was retrenchment, made necessary by the financial stringency or panic of 1907.

AUGUST 1 — Up to this time, all telephones and apparatus made by Western Electric Company, whether in New York or Chicago, had been taken to Boston for testing and inspection by a section of the A.T.&T. Company headquarters engineering staff. Now, inspection was taken over by Western Electric Company as a part of its manufacturing processes.

SEPTEMBER 1 — Reduced rates, in effect since earliest days of intercity service, were canceled "in view of large number of calls lost and delayed in the evening hours and due to the congestion of traffic which occurs when night rates take effect." (Notice by E. J. Hall to Associated Press.)

1908

GENERAL — During this year the term "Bell System" was introduced in national advertising. Also, the theme "One Policy, One System, Universal Service" was originated by Theodore N. Vail to express his policy of eliminating dual telephone services wherever possible. Dual services were a result of competition which had been active since the expiration of the Bell patents in 1894; in a great many cities both Bell and an Independent exchange system were operating. The result was a heavy cost to telephone users and, quite often, impaired service. Vail launched an aggressive policy to either buy the competing service or abandon the field to it.

Another of Vail's policies was to use what is called informative advertising, telling the story of the Bell System as an institution of American life. These advertisements began June, 1908, and have continued to appear regularly ever since.

During 1908, work was begun by Bell System engineers to design long distance (overhead) cables which would permit the use of phantom circuits. The first of these — called a "duplex" cable — was installed between Boston and Neponset in 1910.

1909

MARCH 4 — A complete shut-off of communication to and from Washington, D. C., was caused by a sleet storm. As this happened during the inauguration of President William Howard Taft, it pointed up the vulnerability of overhead wire lines in a striking way. Therefore, it resulted in a memorandum from Theodore N. Vail, to J. J. Carty, chief engineer, to get the wires underground as soon as possible. This inspired renewed

1909 (Cont'd)

efforts to develop underground long distance cables. City underground systems by this time were working well.

APRIL 8 — Chief Engineer Carty, in a memorandum to Vice-President Harry B. Thayer, proposed to extend long distance service from New York to Denver, but he asked for an increased engineering staff to develop a more powerful telephone repeater. He said: "If we successfully load the Denver line, and thereby accomplish speech between New York and Denver, the development of a successful repeater would enable us to accomplish speech between San Francisco and New York."

Note: The Shreeve mechanical repeater, mentioned under 1904, was not effective on a "loaded" line — that is, on a circuit of the type then considered most desirable, equipped with loading coils according to Campbell's calculations. The coils operate on a different principle from that of a repeater; they do not reinvigorate or build up the voice currents, but they "reduce attenuation" or make the currents travel farther.

SEPTEMBER 1 — The New York Telephone Company and the New York & New Jersey Telephone Company (serving Long Island and Northern New Jersey) were consolidated as the New York Telephone Company. The new corporation continued to operate in a section of New Jersey, however.

1910

Bell and Bell-connecting telephones, 5,883,000.

JUNE 8 — Interstate Commerce Act amended by the Mann-Elkins Act to make it applicable to telephone companies. Thus the Commission was given jurisdiction over telephone companies in these matters: just and reasonable charges; passes and franks; preferences and prejudices; filing contracts; reports to the commission; investigations; furnishing information; joint rates; uniform system of accounts; and preservation of records.

DECEMBER 20 — American Telephone & Telegraph Company acquired control of 30 percent of Western Union Telegraph Company stock by purchase. Note: Vail was president, Western Union, Nov. 23, 1910, to April 15, 1914.

1911

GENERAL — During 1911, the Bell System announced plans to consolidate its associated operating companies into state-wide or territorial units — the beginning of the present-day setup.

Design was completed for underground cable, capable of giving satisfactory transmission between Washington, D. C., and Boston. Cable was in service "by 1913." (See Eng. section of A.T.&T. annual report for that year.)

During 1911, Western Electric Company began manufacturing rotary automatic (dial) exchanges for sale in Europe. As previously noted, Bell engineers were not yet satisfied that they had machine-switching equipment ready for use in America's multi-office exchanges. But there was a demand for machine-switching equipment for smaller offices abroad; hence Western's decision.

MAY 8 — Service established between New York and Denver: The limit for open wire telephone lines, equipped with loading coils, but without repeaters.

NOVEMBER 2 — Organization meeting of the Telephone Pioneers of America was held at Hotel Somerset,

Boston, Mass., as a result of the suggestion and active efforts of Henry W. Pope, who at one time was traffic manager for the Southern Bell, and later on undertook special assignments for the A.T.&T. Company. Alexander Graham Bell and 246 members were present at this first meeting.

1912

GENERAL — *Vacuum Tubes*: Dr. Lee De Forest invented the three-element tube in 1906-1907, but it was not until about the beginning of 1912 that he succeeded in adapting it under some circuit conditions to operate as a true amplifier. On October 30-31 and November 1, 1912, with an associate, John Stone Stone, a former A.T.&T. staff engineer, he demonstrated his amplifying audion to engineers of A.T.&T. and Western Electric Company. The device was still a weak and imperfect thing, incapable of carrying any considerable voice load properly, yet it was capable of amplifying speech.

Among those Bell engineers who witnessed the demonstrations was H. D. Arnold, then fresh from the study of electron physics in Dr. Robert A. Millikan's laboratory of University of Chicago. Whereas there always had been confusion of thought concerning the effect of gas (or air) upon the operation of the audion, Arnold immediately recognized that what was wanted was a pure heat effect, free of gas complications. He set to work to produce a higher vacuum tube, using evacuation methods then only recently available. He succeeded and, once and for all, took the three-element tube out of the realm of uncertainty and unreliability, and made of it a definite, reliable amplifying tool.

About the same time that Arnold was doing this in the laboratories of the Bell System, principally in 1913, Langmuir in the laboratories of General Electric Company, studying X-ray tubes and power rectifiers, arrived at substantially the same result. In a patent contest lasting many years, the Supreme Court of the United States gave to Arnold the credit of having been the first to attain the truly high vacuum tube and agreed with Arnold's original viewpoint that this step, important though it was, did not constitute invention over the prior art.

The high vacuum tube solved the telephone repeater problem. It also brought other developments:

Oscillator: De Forest, in 1912, converted the tube into a generator of high-frequency currents. Many others did it independently, but De Forest was favored in a Supreme Court decision. This made it possible to use the tube in generating or sending "radio" waves — whether over wires or on the air.

Modulator: The invention of the vacuum tube modulator soon followed. This solved the problem of enabling low-power voice energy to control the considerably higher power waves required for radio-telephone transmitting, and enabled this control to be exercised remotely over a telephone line, thereby giving through transmission between wire and radio circuits. Earlier attempts at radiotelephony had depended upon the carbon microphone. Dr. E. F. W. Alexanderson, of General Electric, and E. H. Colpitts, of the Bell System, shared honors for this invention, which they reached about the same time, 1913-1914.

GENERAL — Early in 1912 a multi-coin collector telephone was put in service throughout Manhattan and the Bronx.

Cable capacity now was 900-pair, 22-gauge.

1912 (Cont'd)

JANUARY — First use of the slogan *The Voice with the Smile Wins* in booklet distributed by New York Tel. Co., "Winning Friends by Telephone." Written by Howard G. Stokes.

MARCH 9 — Dr. G. A. Campbell, research consultant for the Bell System, published a memorandum which led to a great improvement in telephone repeaters of the mechanical or Shreeve type. It showed how to compensate their tendency to "sing." As a result, the mechanical repeater was made good enough to be used as an alternate installation on the first transcontinental line, and to be fairly widely used for several years. It was not as good as the vacuum tube repeater, however, and finally all installations of it were replaced with vacuum tubes. R. S. Hoyt used Campbell's work to develop a simple, balancing repeater circuit that is still in use.

MAY 1 — Long Lines private line channels furnished in connection with Foreign Exchange Service.

OCTOBER 1 — Patent issued on Bell engineer E. C. Molina's counting relay system—of great importance in dial telephone central offices. It was an improvement on the sender — see 1906.

1913

GENERAL — During 1913, the building at 195 Broadway was begun. It was at first jointly owned by American Telephone and Telegraph Company and Western Union Telegraph Company.

The Interstate Commerce Commission issued a general accounting order, providing a uniform system of accounts for telephone companies, which continued as the basic accounting system of the Bell System until it was revised by the Federal Communications Commission in 1936.

JANUARY 1 — The plan for employee pensions and death and disability benefits was inaugurated in A.T.&T. and the Bell companies.

JULY 1 — Block and section method of determining rate distance first used in rating intra-New York state message telephone traffic. By 1919, practically all traffic was rated on this basis.

OCTOBER 18 — First vacuum tube telephone repeater installed at Philadelphia on New York-Baltimore line. (See vacuum tube notes under 1912.)

DECEMBER 13 — A letter from Nathan C. Kingsbury, vice-president, A.T.&T. Company, to the Attorney General of the United States committed the A.T.&T. to dispose of its telegraph stock. It also promised to provide long distance connection of Bell System lines to Independent telephone systems (where there was no local competition) and further agreed not to purchase any more Independent telephone companies except as approved by the Interstate Commerce Commission. This letter is often referred to as the "Kingsbury Commitment."

1914

GENERAL — By the latter half of 1914, vacuum tube technique had advanced to the point where telephone engineers could set about the development of carrier systems over telephone wires and radiotelephone systems.

JANUARY 5 — Northern Electric Company, Ltd., of Canada, was incorporated through merger of Imperial Wire and Cable and Northern Electric & Manufacturing Company, Ltd. Northern Electric is the manufacturing branch of the Bell System in Canada.

MARCH 19 — A.T.&T. Company sold its holdings of Western Union Telegraph Company stock to comply with its promise to the Attorney General. (See December, 1913.)

JUNE 17 — Last pole of transcontinental telephone line placed at Wendover, Utah, on Nevada-Utah state line.

JULY 29 — First tryout of the transcontinental telephone line, New York to San Francisco. (Experimental only.) While on a visit to the Pacific Coast in 1909, Vail, Carty, and Bancroft Gherardi (plant engineer, A.T.&T. Co.) had promised the management of the Panama-Pacific Exposition, which then was planned to open in 1914, to have service between the East and West Coasts by that time, if possible. The Bell System was ready on time, but the opening of the Exposition was postponed until 1915.

1915

GENERAL — During 1915 the first 1200-pair cable development was announced; equivalent to 12 lines of 20 cross-arm poles.

During 1915, two semi-mechanical offices were cut into service at Newark, N. J. In these offices, which were designed in anticipation of transitions to dial-in exchanges with many central offices, the telephone user gave the number to the operator as usual, but the operator completed the call through machine-switching equipment. In short this was "operator dialing" of local calls such as now is the practice with many long distance calls.

During September, 1915, Bell engineer R. A. Heising devised a vacuum tube instrument for measuring voltages at radio frequencies. This was another historic Bell System "first," of great importance in radio research.

JANUARY 1 — First "Plan to Aid Employees of Bell System to Become Stockholders of A.T.&T." Price per share \$110. Stock bought on market and held by trustees until paid for.

JANUARY 25 — The first transcontinental telephone line, New York-San Francisco, was opened with appropriate ceremonies at each end. Among the notables at New York was Bell. Tom Watson was at San Francisco—and finally—over a replica of the first telephone—Bell said, "Mr. Watson—come here—I want you!" repeating the first complete sentence transmitted by telephone.

1915 (Cont'd)

Theodore N. Vail was at Jekyll Island, Georgia. (See "John J. Carty," by F. R. Rhodes, for details of ceremony.)

FEBRUARY 11 — Opening of transcontinental telephone service, San Francisco to Philadelphia, during which (ceremonies) the Liberty Bell in Philadelphia was tapped several times and the sound heard in San Francisco. (See *Pacific Tel. Magazine*, Feb., 1915, p. 25.)

APRIL 4 — Radiotelephone communication effected between Montauk Point, L. I., and Wilmington, Delaware, 250 miles, by Bell System engineers.

MAY 6 — Opening of transcontinental telephone service between New York and Los Angeles. (See *Pacific Telephone Magazine*, May, 1915, p. 3, and *New York Telephone Review*.)

MAY 18 — Radiotelephone and wire communication effected; wire lines to Montauk Point, radio to St. Simon's Island, Georgia, 1,000 miles, and thence by wire back to the starting point, 15 Dey Street, New York City. This was a demonstration for J. J. Carty, chief engineer, to prove the feasibility of wire-radio channels; results were encouraging, but equipment lacked power to be conspicuously successful.

AUGUST 26 — Beginning of trials of transmitting speech across the Atlantic.

AUGUST 27 — Speech from Arlington, Va., over radiotelephone, heard at Darien, on the Isthmus of Panama, by Bell System engineers working in conjunction with the United States Navy Department.

SEPTEMBER 29 — Speech transmitted by wire from New York to Arlington, Va., thence by radiotelephone to Mare Island at San Francisco, 2,500 miles. Speech over this line also was heard at Honolulu the same night.

OCTOBER 21 — The first trans-Atlantic radiotelephone transmission was accomplished when H. R. Shreeve, at the Eiffel Tower, in Paris, heard the words "... and now, Shreeve, good night" addressed to him by B. B. Webb, through the transmitting station at Arlington. This also was heard at Mare Island and Honolulu. With Shreeve at Paris was A. M. Curtis. R. V. L. Hartley was at Mare Island, and Lloyd Espenschied, at Honolulu — all Bell System engineers.

NOVEMBER 5 — First naval order sent by radiotelephone by Josephus Daniels, Secretary of the Navy, to Rear Admiral Usher at Brooklyn Navy Yard.

NOVEMBER 17 — The present Western Electric Company was incorporated under the laws of the State of New York, and took over the business of the Western Electric Company, of Illinois.

1916

GENERAL — In 1916, G. W. Elmen, engineer in the Western Electric Company research department, seeking a material that could be magnetized more easily and

more permanently than pure iron (then assumed to be the best material for that purpose), developed alloys of iron and nickel that came to be called permalloy. This material, light in weight, but capable of being easily magnetized, has been of great value in telephony—in telephone receiver magnets, for instance. Elmen's discovery led to development of other alloys, notably permivar, so called because its permeability to magnetism is invariable over a considerable range. (See *Bell Telephone Quarterly*, October, 1927, article by Frederick L. Rhodes.)

Also in 1916, E. C. Wentz, another Bell research engineer, produced a condenser microphone. A microphone is a very sensitive transmitter. Wentz's is not a magnetic transmitter like Bell's, nor a variable resistance transmitter like Edison's, Blake's or Anthony White's. It is one in which the diaphragm becomes an integral part of a charged condenser; any movement of the diaphragm produces a comparable change in the charge in that condenser. Wentz's microphone was of great importance as a research tool in investigating speech and hearing. Also, through its use it became possible for the first time to pick up sounds for transmission or recording with such fidelity as to permit reproduction with an adequate illusion of naturalness. After its development, radio and public address systems could enter their present field of transmitting not merely verbal information but also emotional and esthetic effects.

A development of 1916 that did not come into wide use until much later was Bell engineer R. A. Heising's system of rectifier modulation. This technical development is used in carrier systems, where it provides a way to save costs in getting the undulating talking current from transmitter into carrier waves. The system did not reach full effectiveness until copper oxide rectifiers were available—toward 1926.

GENERAL — The first section of the building at 195 Broadway (begun in 1913) was completed this year. It was roughly two-thirds of the present structure, with the main frontage on Dey Street and a narrower frontage—the tower where the "Genius of Electricity" stands—on Fulton Street. On Broadway, the building took only about half the present frontage, enough to give the number 195. The building was occupied through the spring, summer and fall of 1916. No notable opening ceremonies have been reported, probably because of the piecemeal nature of the moves to occupy it, which were roughly, first, Western Union, second, Western Electric, and finally A.T.&T. departments and headquarters staff. Western Union owned an interest in this building until 1930, when that company moved into its own headquarters further uptown, and A.T.&T. purchased its interest in 195. (See November 1, 1922.)

MARCH 16 — Demonstration of wire and wireless long distance telephony by Chief Engineer Carty for the National Geographic Society. At a banquet at Washington, D. C., a roll call of the following points along the wire lines was held: Seattle, Ottawa, El Paso, Jacksonville and San Francisco. Radiotelephone talk from Arlington, Va., to New York was brought in by wire to Washington. L. V. Espenschied, at Arlington, spoke to Carty, Secretary of Interior Lane and others. The radio demonstration closed with transmission of a recording of the "Star-Spangled Banner."

1916 (Cont'd)

APRIL 30 — Enrico Caruso sang over the transcontinental telephone line, Atlanta, Ga., to San Francisco, for the San Francisco Press Club.

MAY 6 — First use of radiotelephone from shore to battleship, Secretary of Navy Daniels to Capt. Lloyd H. Chandler, U.S.S. *New Hampshire*, at sea off Hampton Roads, Va. (During a mobilization test by A.T.&T. for the U. S. Navy.)

MAY 6-7-8 — Preparedness test: All Navy yards of the U. S. were connected to the office of Secretary of the Navy Josephus H. Daniels, as if in readiness for war.

MAY 13 — First flag flown from 195 Broadway in honor of New York's Preparedness Parade. This was a United States flag, 25x40 feet in size, flown on a staff 137 feet above the roof—360 feet from the curb. (Do not confuse with Bell System house flag, adopted in 1923.)

OCTOBER 24 — "Genius of Electricity" statue raised to the roof of 195 Broadway. This was modeled by Evelyn Beatrice Longman (later Mrs. N. H. Batchelder). Her design won the award in a contest in which eight prominent sculptors took part. First title was "Electricity." In the drawings on directory covers it has been re-named "Spirit of Communication." Batchelder was the son of H. M. Batchelder, the Boston journalist who telephoned the first news report (of a telephone lecture by Bell at Salem, February 12, 1877) to the *Boston Globe*.

DECEMBER 10 — Walter S. Gifford, chief statistician, A.T.&T. Company, made Director of the Council of National Defense.

DECEMBER 11-15 — First nationwide conference of Bell System engineers held in New York.

1917

GENERAL — Early in 1917, the first practical trials of the radiotelephone in connection with anti-submarine operations took place. Satisfactory communication between sub chasers about five miles apart was obtained. Equipments were sent overseas for further trial under war conditions.

During 1917, H. D. Arnold, I. B. Crandall and E. C. Wentz, Bell System engineers, developed the thermophone, of great value in measuring the accuracy of the microphones used in radio work. Another Historic First for Bell Engineering research.

APRIL 6 — U. S. declared a state of war existing with Germany and Austria-Hungary.

JUNE — First private line teletypewriter service contract signed by A.T.&T. with the United Press for three services. (A.T.&T. had furnished service on an experimental basis since 1915.)

JUNE 19 — Private line teletypewriter service rates introduced for press and extended shortly thereafter to commercial users.

JULY — First two battalions (of a total of 12) of Bell System Signal Corps troops sailed for France.

JULY 2 — Bell System engineers demonstrated one-way radiotelephone transmission from airplane to ground.

JULY 4 — Ground to air transmission demonstrated.

AUGUST 18 — Two-way, air-ground communication maintained for first time.

AUGUST 20 — Communication between two airplanes in flight was achieved. Demonstrated informally for U. S. Government authorities, August 22.

All of the air demonstrations listed in July and August took place at Langley Field, Virginia. R. A. Heising's modulation circuit was perhaps the basis of this development.

OCTOBER 24 — Bell Telephone Memorial unveiled at Brantford, Ontario, by the Duke of Devonshire.

NOVEMBER 14 — Name of Long Distance Lines Department, A.T.&T. Company, changed to Long Lines Department.

1918

GENERAL — During 1918, carrier current systems were first introduced in Bell System service to provide four additional circuits between Pittsburgh and Baltimore. Carrier systems are a means of adding more voice channels to existing telephone wire or cable lines. They are an application of radio techniques to wire or coaxial circuits. You put radio frequencies on your circuit with what is in essence a small radio sending set, take them off with a receiving set. To prevent different bands of frequencies from getting into the wrong receivers, electrical filters which pass only currents of specified frequency are used. Dr. G. A. Campbell, of the Bell System, concluded important research on these filters in 1917, and his conclusions and the subjects-matter of his patent applications were being put to use now.

At the beginning of 1918, Bell System and connecting telephones passed the 10 million mark, having doubled in ten years.

In summer, 1918, H. W. Weinhart, Bell System engineer, produced the peanut tube—a vacuum tube for use on ships and airplanes, a little more than 2 inches high and capable of operating on a single dry cell battery.

APRIL 10 — A. M. Nicolson, Bell System engineer, applied for patent on method of using piezo-electric oscillator crystal in radio sending and pickup devices. Many rival claims caused prolonged interference, but Nicolson's research and discoveries resulted in a basic patent issued August 27, 1940—another Bell System "first." The crystals have proven useful in submarine detection, and in carrier current communication systems.

APRIL 22 and JULY 12 — Applications filed for H. M. Stoller, Bell engineer, covered an electronic regulator that made practical the wind-driven generator used in airplane radiotelephony.

JULY 24 — President Woodrow Wilson issued a proclamation assuming control of the telephone and telegraph systems in the United States, placing them under direction of the Post Office Department, "from and after

1918 (Cont'd)

the 31st day of July, 1918." This proclamation was issued under authority of a joint resolution of Congress. Postmaster General A. S. Burleson assumed supervision, possession, control and operation of telephone and telegraph properties on August 1. (See July 30, 1919.)

1919

GENERAL — During 1919 the Bell System announced for the first time plans for the introduction of machine switching (dial telephones) in its exchanges. As is indicated elsewhere, cost studies and development work on these systems had been under way since about 1884. Until this time either plans were not ready or material was lacking to attempt machine switching in the Bell's big city exchanges.

In 1919, Lloyd Espenschied, Bell System engineer, applied for his first patent on a system for using the reflection or echo of electric waves to indicate obstacles to travel. Although this system was intended at the time to warn an engineer of hazards ahead of a locomotive, the principles Espenschied discovered were used later in airplane terrain clearance altimeters and still later in radar systems. Development was held back until the proper kind of vacuum tubes could be made and it was not until 1936 that Espenschied was granted patents on a practical airplane radio altimeter.

JANUARY 21 — Certain Long Lines rates increased about 20% by Postmaster General's Order #2495. Service was classified between station and person, day and night. Airline mileage measurements between blocks and sections were adopted for message rates within the U.S.

APRIL 1 — Long Lines private line service rates increased 20% by Postmaster General's Order #2490.

JUNE 18 — Theodore N. Vail retired as president, American Telephone & Telegraph Company, and became chairman of the board. Harry Bates Thayer was elected president to succeed Vail.

Harry Bates Thayer, born Aug. 17, 1858, North Littlefield, Vt. Graduated from Dartmouth, 1879. Joined Western Electric Company as shipping clerk, 1881; manager for Western Electric in New York, 1884; vice-president, 1902; president, 1908 to 1919. In 1909 he was elected a vice-president of A.T.&T. Company while serving as president of Western Electric.

JULY 1 — Organization chart issued which showed the Engineering Department, A.T.&T. Company, reorganized into two groups: the Department of Operation & Engineering and the Department of Development & Research. J. J. Carty was the vice-president in charge of development and research; N. C. Kingsbury, in charge of operation and engineering.

JULY 30 — Postmaster General Burleson signed an order returning the telegraph and telephone systems to private ownership as of August 1.

NOVEMBER 8 — First large machine switching exchange in the Bell System was cut into service at Norfolk, Virginia. This exchange used the step-by-step

system and was installed for the Bell System by the Automatic Electric Company of Chicago—using Automatic Electric equipment.

1920

GENERAL — On or shortly before the first of the year the A.T.&T. Company received, for the Bell System, a Certificate of Merit for services to the nation during the first World War.

JANUARY 1 — The Theodore N. Vail Memorial Fund was established, "to perpetuate the ideals of this great leader through recognition of employee acts and services in emergencies which reflect his concepts of responsibility for the public service." The income from this fund provides awards for telephone employees in recognition of noteworthy public service; the original statement of purpose was amended to include acts by employees of other than Bell System companies.

FEBRUARY 6 — Indiana Bell Telephone Company formed.

APRIL 16 — Theodore N. Vail died at Johns Hopkins Hospital, Baltimore.

JULY 1 — Cross-licensing patent agreement was set up between A.T.&T. Company and General Electric Company, at the request of the United States government—to promote the development of radio communication and make inventions covered by patents (especially developed during the war under military direction) generally accessible. This agreement later was extended to include Radio Corporation of America, Western Electric Company and Westinghouse Electric Company.

JULY 16 — The world's first radiotelephone service, between Los Angeles and Santa Catalina Island, California, opened. In establishing this link, Bell radio and telephone technicians joined hands to do a job never done before—the bridging of a gap between sections of wire telephone plant to provide a public telephone service. It was carried out somewhat ahead of its day because the service was needed and submarine cable could not be made because of World War I shortages.

OCTOBER 21 — A demonstration of wire and radio-telephone conversation ship-to-shore between New York and the S.S. *Gloucester*, at sea in the Atlantic, featured a connection to the island of Santa Catalina in the Pacific.

NOVEMBER 2 — Radio broadcasting of programs started from KDKA, Pittsburgh.

DECEMBER 23 — Illinois Bell Telephone Company formed as result of Chicago Telephone Company purchasing properties of the Central Union in Illinois.

1921

JANUARY 1 — Properties of the Nebraska Telephone Company (in Nebr. and S.D.) and of the Northwestern Telephone Exchange Company (in Minn. and N.D.) merged with those of the Northwestern Bell Telephone Company which had come into existence on Dec. 9,

1921 (Cont'd)

1920, when the Iowa Telephone Company changed its corporate name. W. B. T. Belt, president of the three predecessor companies, became the first Northwestern president.

MARCH 4 — First use of Bell System public address system at a Presidential inauguration: President Warren G. Harding's address was heard by 125,000 people at Washington, D. C., through loudspeakers. The "mike" used was E. C. Wente's (Bell System engineer) condenser microphone.

MARCH 6 — Committee of National Electric Light Association and Bell System engineers held its first meeting to work out problems connected with joint use of poles, induction troubles and safety.

MARCH 29 — At annual meeting of A.T.&T. Company stockholders the \$9 dividend rate was established to make the stock sufficiently attractive to investors to insure a flow of investment capital to the company at all times when it should be needed for expansion and improvement of service.

APRIL 11 — Opening of the first Havana-Key West deep sea cable. The program included talks from Havana to Santa Catalina Island, 5,500 miles away.

MAY — Bell engineers applied for a patent (granted in 1924) on an electrolytic condenser. This device was used as a filter to prevent the "noise" from charging generators in central offices from interfering with telephone service. Previous to this, for 25 years or more, in manual offices, specially designed, very expensive generators had been used. The development of many dial offices that required more generators made it necessary to find this less expensive way of providing current for charging the office batteries. Furthermore, it permitted a great reduction in the size of radio and amplifier equipment and ultimately made practicable the alternating current radio tube. It is used in practically all modern electronic equipment.

MAY 1 — Bell System employees were offered A.T.&T. stock on the installment plan. This was a "buy any time" plan, which was terminated at the time of the bank holiday, during the depression that began in 1929. Previously, limited offers of stock had been made to employees on January 1, 1915; March 1, 1916; December 1, 1919.

MAY 14-15 — Exceptional aurora borealis affected telegraph service. Powerful earth currents not only interrupted the direct current, grounded circuits used for Morse telegraphy, but burned out heat coils and charred cable insulation at many places in America and Europe.

JULY 30 — The first machine switching office using Western Electric equipment and installed by Bell System employees was cut over at Dallas "2" office. (Note: The office at Norfolk, Va., 1919, was Strowger, installed by Automatic Electric; this was "ours" except that Automatic Electric dials were used at the request of the Automatic Electric Company. Mfd. by AE to our specifications—J. T. L. Freeman.)

SEPTEMBER 15 — Bell Telephone Securities Company, which had been organized a few days before to secure new telephone capital and expand ownership of the Bell System, undertook as its first activity to cooperate in a 3-month campaign to sell preferred stock of the Southwestern Bell Telephone Company in the states in which that company operates.

SEPTEMBER 20 — Ohio Bell Telephone Company formed by consolidation of the Ohio State and Ohio Bell predecessor companies.

NOVEMBER 11 — Exercises at burial of the "Unknown Soldier" at Arlington, Virginia, heard by 150,000 people in gatherings at Arlington, New York and San Francisco, over loudspeakers interconnected by long distance telephone lines.

NOVEMBER 27 — Beginning of a period of exceptionally heavy sleet storms in the winter of 1921-1922. They affected the New England states, Minnesota, Nebraska, North and South Carolina. Michigan and Wisconsin had a disastrous storm Feb. 21-23, 1922, and Michigan had a second storm on March 29. Overall cost of repair was about \$7,500,000.

DECEMBER 10 — Atlantic office, first panel type full machine switching office in the United States, was cut into service at Omaha, Nebraska.

First Bell System panel type dial service cutover at Omaha, Nebr.

1922

JANUARY 15 — Experiments by Dr. Harvey Fletcher, and R. E. Wegel, of the Bell System, in cooperation with Dr. E. P. Fowler, New York City ear and throat specialist, in the measurement of hearing announced. From their work, Bell Laboratories later developed the 1A and 2A audiometers for physicians to use in aiding deaf patients.

MARCH 5 — Ship-shore wire and radiotelephone communication demonstrated by Bell System engineers from President Harry B. Thayer's home at New Canaan, Conn., through a radiotelephone station at Deal Beach, N. J., to the S.S. *America*, 370 miles at sea.

JULY 25 — Station WBAY opened at 24 Walker Street, to fill a need for a New York City station for "toll broadcasting"—that is, a station which would provide facilities for broadcasting, but would originate no programs, instead leasing its program time to anyone who wanted to rent it. The station's call letters were changed to WEAf, August 16.

AUGUST 2 — Alexander Graham Bell died at his summer home, Beinn Breagh, near Baddeck, Cape Breton Island, Nova Scotia.

AUGUST 4 — Telephone service suspended for one minute, just before sunset (6:25 to 6:26 p.m.), on the entire telephone system of the United States and Canada, during the funeral service for Dr. Bell.

AUGUST 28 — First commercial sponsorship of a radio broadcast. The Queensborough Corporation, of Jackson Heights, N. Y., used WEAf for the promotion

1922 (Cont'd)

of Hawthorne Court, from 5:00 to 5:10 p.m., on August 28, 29, 30, 31 and September 1, at the rate of \$100 for each 10-minute talk.

SEPTEMBER 28 — Bell System loudspeaker demonstration before Telephone Pioneer convention at Cleveland featured 3-way conversation between Cleveland, San Francisco and Havana.

OCTOBER 14-21 — First full machine switching unit in New York City was placed in service at Pennsylvania Exchange, 206-240 West 36th Street. The first 1700 lines were cut over October 14. Cuts were completed on October 21.

OCTOBER 28 — First football game broadcast over a wire hook-up, Chicago to New York, repeated by loudspeakers and by WEAf at New York, covered Princeton's defeat of University of Chicago, 21-18.

NOVEMBER 1 — Addition to 195 Broadway opened—about a third of the present building, fronting on Broadway (old 205 Broadway) and Fulton Street.

1923

Bell System house flag adopted 1923. Release to Bell editors based on "interpretation" by R. G. Samuels, Dec. 12, 1923, from O. & E. Bulletin, Dec. 3, 1923.

JANUARY 3 — Mabel Hubbard Bell (Mrs. Alexander Graham Bell) died.

JANUARY 4 — First simultaneous broadcasting by wire-connected radio stations (first chain or network broadcast) linked WEAf, New York, and WNAC, Boston, for part of the program at the annual dinner of the Massachusetts Bankers' Association, at the Copley Plaza Hotel, Boston.

JANUARY 14 — First of three steps in development of overseas radiotelephony: One-way radiotelephone demonstrations by Bell System engineers. President Thayer, Vice-President Carty and others talked from Thayer's office at 195 Broadway to London for two hours, through the Rocky Point station of Radio Corporation of America. At London, Frank Gill, European chief engineer for International Western Electric Company, Major T. F. Purves, chief of the British Postal System, and others listened through headsets until the demonstration was concluded over a loudspeaker. Time difference between New York and London sometimes causes this to be reported as January 15, on which date the talks were received in London.

FEBRUARY 14 — Meetings at New York and Chicago of American Institute of Electrical Engineers were linked by long distance lines connected to loudspeakers so that both followed the same program.

MAY 16 — WEAf studio moved from 24 Walker Street to 195 Broadway.

MAY 21 — First appearance on WEAf of Graham McNamee, probably the most widely known announcer of early radio.

MAY 23 — Inauguration of interdenominational broadcasts by Dr. S. Parkes Cadman: "The National Radio Pulpit," first religious effort in radio.

JUNE 21 — First radio address by a United States President, Warren G. Harding, from St. Louis, Mo., at 10 p.m. Subject: "The World Court."

JULY 3 — WCAP, pioneer radio station in Washington, cut into service. It was owned and operated by the C. & P. company until August 3, 1926.

AUGUST 1 — Radiotelephone system between Los Angeles and Santa Catalina Island closed; superseded by submarine cables.

OCTOBER 10-15 — First broadcasts of World Series baseball games—from New York's Yankee Stadium and Polo Grounds.

OCTOBER 14 — Red Network established, starting with WEAf and WJAR, Providence, R. I.

DECEMBER 6 — President Calvin Coolidge's message to Congress broadcast from 6 stations linked by telephone wire lines. Stations: Providence, New York, Washington, St. Louis, Kansas City and Dallas.

DECEMBER 22 — Southern Transcontinental Long Distance Telephone Line opened for service, connecting Chicago and Los Angeles through Denver, El Paso, Tucson and Phoenix.

1924

FEBRUARY 3-5 — Sleet storm leveled 5,200 poles from Chicago eastward through Pennsylvania and New York. Lines were repaired in three days.

FEBRUARY 8 — First coast-to-coast broadcasting hook-up. Gen. J. J. Carty, vice-president A.T.&T. Company, spoke from Chicago over line connecting San Francisco, New York, Havana—his talk being broadcast by 7 stations from Havana to San Francisco.

MAY 1 — More than 15,000,000 telephones in Bell System.

MAY 19 — Transmission of pictures over telephone wires first publicly demonstrated by Bell System engineers, Cleveland to New York.

JUNE — Heart and chest sounds amplified in demonstration of electrical stethophone by Bell System Engineers—before a convention of the American Medical Association.

JUNE 10-12 — Proceedings at Republican National Convention, at Cleveland, broadcast on hook-up of stations in 12 cities. The same network was used for the Democratic Convention, which began June 24 and lasted until July 9.

JUNE 19 — W. A. Marrison, under direction of F. M. Ryan, cut the first crystal for control of broadcasts from WEAf. The control so established continues today on successor, WRCA.

1924 (Cont'd)

SEPTEMBER 12 — National Defense Day ceremonies broadcast over hook-up using 38,000 miles of Bell System circuits across nation.

SEPTEMBER 24 — Demonstration by Bell System engineers of submarine cable transmission (telegraph) at speed of 1,900 letters per minute, about four times the speed of older cables. Improvement came from using permalloy loaded cable with electronic apparatus at terminals. The cable used was between New York and Horta, in the Azores.

NOVEMBER 4 — First broadcast of presidential election returns—as Calvin Coolidge defeated John W. Davis.

DECEMBER 18-19 — Sleet storm leveled 34,000 poles in Missouri, Kansas, Oklahoma, Texas and adjoining states. Emergency restoration required ten days; complete restoration took many months.

1925

GENERAL — During 1925, the combined line and recording method of handling toll calls was introduced experimentally in the Bell System. Over the years up to this time, a toll method had been worked out where the long distance operator who received a call from a customer made note of the details of the number or party wanted, and sent the ticket by messenger or conveyor to a position where the call could be completed. The CLR method provides for the handling of the toll call by the operator who takes it from the customer. This plan—aided by improved equipment and techniques—speedily cut the time for completion of long distance calls from about 7 minutes at the beginning of 1925 to 2 minutes or less. Note that the plan was recommended for adoption by all Bell companies in 1926.

JANUARY 1 — As of this date, the Western Electric Research Laboratories, formed in 1907, and part of the engineering department of A.T.&T., were consolidated to become Bell Telephone Laboratories, Inc. The department of Development and Research remained at A.T.&T. Company until it was consolidated with the Laboratories in 1934.

JANUARY 20 — Walter S. Gifford elected president, A.T.&T. Company. Born Salem, Mass., Jan. 10, 1885; was graduated from Harvard (Cum Laude) 1904; joined Western Electric Company as clerk, payroll department, July 5, 1904.

MARCH 4 — President Calvin Coolidge's inauguration speech broadcast from wire hook-up of 21 stations.

APRIL 4 — A.T.&T.'s Long Lines Dept. first offered telephotograph service on a commercial basis from 24 Walker St. between New York, Chicago and San Francisco. First customers were press associations.

APRIL 11 — Last splice made on New York-Chicago underground long distance cable; route, 861 miles; cable placed in service October 1.

AUGUST — First long distance traffic control bureau established by Long Lines at Chicago.

OCTOBER 1 — Thrift Plans — First plan started, deductions from salary for savings. U.S. Gov't Life Insurance included, January 1, 1925; life insurance, specific companies, September 1, 1927; all companies later. Some other dates: Hospital Service, November 1, 1937; Surgical added, May 1, 1943; U.S. Savings Bonds, July 1, 1938; Nat'l Service (Gov't) premiums, September 1, 1944.

OCTOBER 6 — "Orthophonic" phonograph demonstrated by Bell scientists at Waldorf-Astoria Hotel, then at 34th Street and Fifth Avenue, N.Y.C. Involved in this development were an electrical method for cutting records and new methods for mechanical reproduction of them. The reproduction approached the original renditions in quality.

1926

GENERAL — The speed of toll connections was about two minutes on the average, compared with more than five minutes at the end of 1915.

JANUARY 1 — A.T.&T. License Contract charge to associated companies reduced from 4½ to 4 per cent. (See 1902.)

MARCH 7 — First public test of radiotelephone service between New York and London.

MAY — Broadcasting Company of America, wholly owned subsidiary of A.T.&T., formed to take over and operate WEAf.

JUNE 25 — Charles Ezra Scribner died. He probably held more patents (441) than any man in an electrical industry, except Thomas A. Edison, who was a close friend. Scribner improved the first multiple switchboard to go into commercial use. He was born at Mt. Vernon, Ohio, Feb. 16, 1858; educated in the schools of Toledo. At 18 (1876) he attracted the attention of Enos M. Barton, at Chicago, with a homemade model of a telegraph repeater. As a result, he entered the laboratory of Western Electric Manufacturing Company a year later. He worked at Chicago with Western until 1908, developing a great deal of telephone equipment. In 1908, he moved to New York as chief engineer of Western Electric, from which position he retired in 1916. He was awarded a gold medal at the Paris Exposition in 1900; in 1913-1915 he was vice-president of the American Institute of Electrical Engineers; also was a member of the Engineering Foundation and a trustee of the U. S. Engineering Society.

JULY 1 — Long Lines rates established for radio (program transmission) networks.

JULY 1 — Southern Bell Telephone & Telegraph Company and the Cumberland T.&T. Company merged as the Southern Bell Telephone and Telegraph Company.

AUGUST 6 — First full-length motion picture with synchronized sound accompaniment (music, but little speech) presented by Warner Brothers, using equipment developed by Bell Telephone Laboratories and marketed by Western Electric Company; "Don Juan" with John Barrymore in title role. (See October 6, 1927.)

1926 (Cont'd)

OCTOBER 1 — Reduction in certain long distance rates announced by A.T.&T. Company; evening rates introduced and midnight discount, established in 1919, was discontinued.

NOVEMBER 1 — A.T.&T.'s Broadcasting Company of America sold its experimental radio broadcasting station WEAf (later WNBC, WRCA) to the National Broadcasting Company. A.T.&T. Annual Report for 1926 says: "The Company undertook to develop radio broadcasting in order to ascertain how it could be made most useful in its business. The experimental station was very successful in transmitting music and other entertainment acceptable to the listeners and also in furnishing a medium through which business men could make friends for their businesses by providing entertainment for the public. The further the experiment was carried the more evident it became that the objective of a broadcasting station was quite different from that of a telephone system. Consequently, it was concluded, after several years of experimentation, to sell the broadcasting station which this company had built up."

DECEMBER 15 — Chicago-St. Louis telephone cable opened for service.

DECEMBER 17 — Organization begun of Electrical Research Products, Inc., wholly owned subsidiary of Western Electric Company, to market by-product inventions of Bell Telephone Laboratories.

1927

GENERAL — During 1927, telephone instruments were sold to the associated companies of the Bell System, and the payment under the license contract was reduced from 4 to 2 percent. (See 1902-1926.)

Handset telephones were first made available in the Bell System. To begin with, a higher rate, usually 25 cents a month for a period of about two years, was charged for them.

A new receiving station opened during the year by the A.T.&T. Company at Houlton, Me., cut the strength of static interference with transoceanic radiotelephone channels by some 5,000 times.

W. A. Marrison, of Bell Telephone Laboratories, finished and put in operation a clock using quartz crystal as the oscillating standard — "the most accurate clock in the world."

About September, the payroll deduction insurance plan for Bell System employees was announced.

JANUARY 1 — First Rose Bowl game broadcast from California over first NBC coast-to-coast hook-up.

JANUARY 7 — Opening of commercial radiotelephone service between New York and London. During the year this service was made available to all Bell-connecting telephones throughout the United States, Canada and Cuba.

JANUARY 17 — Northern Transcontinental telephone line, Chicago-Seattle, officially opened. (The third line.)

JANUARY 21 — First operatic broadcast over WEAf, garden scene from "Faust," over Red and Blue networks, coast to coast.

MARCH-APRIL — Heavy floods on the Mississippi and Ohio, with crests March 25, April 8, April 20 at Cairo, brought forth inspired emergency service from telephone operators and plant and supply forces.

APRIL 5 — Thomas D. Lockwood died. He had 47 years' service, ending with his retirement in 1919. Throughout most of it, although not a legal graduate, he held the position of general patent attorney for the parent companies of the Bell System. He was author of "Practical Information for Telephonists," New York, 1882, and many notable letters and reports. He was born December 30, 1848, at Birmingham, England, and had very little formal education, but had an extraordinary faculty for comprehending the intricacies of patents and patent law. He won recognition as an authority on both the Bible and engineering subjects.

APRIL 7-16 — *Television*: A public demonstration of television by wire from Washington, D. C., to Bell Telephone Laboratories in New York City was made on April 7. Herbert Hoover, then Secretary of Commerce, and Walter S. Gifford, president of A.T.&T. Company, conducting the principal conversation. Visual images were received *only* at the New York end. Later the same afternoon, visual images were received at New York by *radio* from the Laboratories' experimental station at Whippany, New Jersey.

Demonstration of television by radio—both image and sound received from a single transmitter—was made on April 16, from Whippany to Bell Laboratories in New York.

These were not the first demonstrations of television in the world. A Scottish inventor, John Logie Baird, had demonstrated a system for radio television between two rooms for the Royal Institution in 1926, and had demonstrated a telecast from London to Glasgow in February, 1927.

The Laboratories' demonstrations, however, were the first distance demonstrations.

To round out the picture, here is the evaluation of Bell Laboratories' contributions to television as noted by Dr. Herbert E. Ives of the Laboratories in 1945:

"Combination of the photoelectric cell and the vacuum tube repeater 1924, in the first commercial picture transmission system, now in everyday continent-wide use by the daily press over the wires of the Bell System.

"Pioneer developments in television: First U. S. actual long distance television transmissions by wire (Washington to New York) and by radio (Whippany, N. J., to New York) 1927. Two-way television as an adjunct to the telephone (experimental demonstration operated in New York for two years, 1930-31); television of extended outdoor scenes, television in color, transmission from motion picture films, in the early 1930's.

"Early recognition and teaching of the very wide bands required for television, and of development of wide band wire channels now in general use for interconnection of television broadcasting stations."

1927 (Cont'd)

JUNE 26 — First color photographs sent over wire from San Francisco to New York, for the *New York World*.

JULY 30 — First community dial office in the Bell System opened at San Clemente, California. (See May 27, 1928.)

SEPTEMBER 11 — Charles Jasper Glidden died. Born Lowell, Mass., Aug. 29, 1857. Glidden joined in the long distance experiments in 1877 from Manchester, N. H., to Boston, 57 miles. He started the telephone exchange at Lowell, March 1878, and built a long distance line to Boston in 1879. As head of a group called the Lowell Syndicate, he combined several New England and western telephone companies in a group which at one time comprised about one-sixth of the Bell System. He retired from active business in 1900 and devoted himself to promotion of the automobile and aeronautics.

SEPTEMBER 26 — Delaware and Atlantic T.&T. Company became New Jersey Bell Telephone Company.

SEPTEMBER 29 — Formal opening of telephone service U.S.-Mexico; also, Mexico-London, via New York. A tornado at St. Louis caused last minute re-routing of circuits for the opening ceremonies. Service opened to the public next day, September 30.

SEPTEMBER 30 — New Jersey property of New York Telephone Company purchased by New Jersey Bell Telephone Company.

OCTOBER 6 — Presentation of "The Jazz Singer," with Al Jolson in the title role; commonly regarded as the first "talking" picture, as opposed to "sound" pictures like "Don Juan" which had musical accompaniment, but little speech. Even "Jazz Singer" was not "100 percent" talking—that came a little later—when the success of Jolson proved its desirability.

OCTOBER 20 — Address of Walter S. Gifford, president, A.T.&T. Company, before National Association of Railroad and Utilities Commissioners in convention at Dallas, outlined the fundamental Bell System policy: "The most telephone service and the best, at the least cost consistent with financial safety."

NOVEMBER 25 — International Radiotelegraph Convention Treaty signed at Washington—an agreement on interference and wave-length regulation between the nations of the world. (See *Bell Telephone Quarterly*, January, 1928, p. 42.)

NOVEMBER 29 — Formal opening of service Montreal-Mexico City.

DECEMBER 1 — Further reduction in long distance rates announced by A.T.&T. Company; saving to users estimated as \$1½ million annually.

1928

GENERAL — During 1928, probably early in the fall, the allegorical group by Chester Beach, "Service to the Nation in Peace and War," was placed in the lobby at 195 Broadway.

At the end of the year, Graybar Electric Company was sold by Western Electric Company to the employees of Graybar, styled Graybar Management, Inc. Graybar Company had been set up in 1925 as a subsidiary, to handle Western's merchandising business in electrical supplies. Graybar's sales of electric and power equipment had increased greatly; Western Electric manufactures had become a relatively small part of the business. Hence the sale—under the Bell System policy of keeping to the communications business and not covering other fields.

JANUARY 1 — Charges under the License Contract between A.T.&T. Company and the associated companies of the Bell System were reduced from 2 to 1½ percent.

JANUARY 19 — Transatlantic service opened, U.S. to Brussels and Antwerp, Belgium, and as follows throughout the year:

January 30	Amsterdam
February 10	Berlin
February 20	Stockholm
March 28	Paris
June 29	Denmark
July 6	Oslo
July 18	Switzerland
October 13	Madrid
November 3	Vienna
November 12	Budapest
November 24	Czechoslovakia (Prague)
November 26	Ceuta, Sp. Morocco

FEBRUARY 16 — Joint meeting of American Institute of Electrical Engineers and the British Institution of Electrical Engineers held over radiotelephone channels, with the respective groups assembled in New York and London.

MAY 27 — Opening of first 350A Community Dial Office in Bell System, at Arcadia, California. The installation at San Clemente, July 30, 1927, was our pioneering effort in unattended rural offices. It led to development of the 350A (Western Electric catalogue code number) type of dial office which is still manufactured and sold by Western Electric and is still "popular."

Note: "First" where applied to CDO offices refers only to the Bell System. Automatic Electric of Chicago and North Electric, of Galion, Ohio, had installations of this type in service when the Bell companies entered the field.

AUGUST 15 — Time Service Bureau — Meridian 7-1212—established for New York City.

AUGUST 17 — Harry Bates Thayer, chairman of the board, A.T.&T. Company, retired after 50 years of Bell System service.

1929

GENERAL — During 1929-1930, straightforward trunking was introduced to improve service in big cities where there were many central offices. The previous method of making connections from any given C.O. to a subscriber connected to any other C.O. in the same city was for the "A" operator who took the call from the customer to pass the desired number to a "B" operator

1929 (Cont'd)

in the distant office over a call-wire circuit. Upon receiving the call, the "B" operator assigned an inter-office trunk to that call, and rang the desired party.

As traffic increased in large cities, the call-wire circuit had become something of a bottleneck. It was possible for more than one "A" operator to come in on it at the same time, which caused delay and occasional confusion.

Under straightforward trunking, the "A" operator tested a bank of trunks until she found an idle path; then put the call through when the "B" operator answered the trunk signal. This made it certain that the "B" operator could handle only one call at a time.

During the latter part of 1929, tape-armored long distance cable for burial in trenches was introduced in Bell System plant.

Operator toll dialing was inaugurated in Connecticut.

FEBRUARY 1 — The third reduction in Long Distance rates was announced by A.T.&T. Company; estimated saving to users, \$5 million annually.

MARCH 1 — Transoceanic service extended to Luxembourg, and throughout the year as follows:

April 17	Gibraltar
April 17	Sp. Morocco
August 26	Ireland
August 28	Milan
August 29	Rome (via London)
September 19	Turin and Genoa

MARCH 27 — Telephone installed on President Herbert Hoover's desk. First so used. Up to this time, the President talked from a booth outside his executive office.

MAY 6 — Telephoning from a moving train demonstrated on Canadian National Railways, under direction of J. C. Burkholder, formerly of Bell Telephone Laboratories, who joined the Canadian National Telegraphs in 1928.

MAY 23 — Application filed by Lloyd Espenschied and Herman A. Affel, of Bell Telephone Laboratories, for the original patent on a system for using a coaxial conductor (coaxial cable) as a wide-band, long-distance transmitting medium. The application mentioned possible use for television transmission. (Patent granted Dec. 8, 1931.)

JUNE 1 — The A.T.&T. Company opened a new short-wave transmitting center at Lawrenceville, N. J., for commercial service to Europe and Argentina.

JUNE 25 — Newspapermen in a Bell Laboratories plane flying from Hadley field in northern New Jersey talked from air to ground and on to correspondents in London. An earlier demonstration of two-way talk between a plane in flight and land telephones was staged for newspapermen, May 1.

JUNE 27 — First public demonstration of television in which three colors were transmitted simultaneously, at Bell Telephone Laboratories, New York.

SEPTEMBER 10 — Transoceanic radiotelephone service extended to a 24-hour basis. For a year previously,

it had been operated from 6:30 a.m. to 10 p.m., New York time. At the beginning of transatlantic service (Jan. 7, 1927) service was from 8:30 a.m. to 1 p.m., Eastern Standard Time.

SEPTEMBER 25 — First radiotelephone conversations between New York and Australia. Bell System officials exchanged greetings with Australian Telephone officials. Commercial service to Sydney was opened in 1930. These channels were via London. Direct service, U. S.-Australia via San Francisco, was opened Dec. 20, 1938.

OCTOBER 11 — E. Bruce, Bell Telephone Laboratories, filed application for patent on "horizontal rhombic antennas"—an important Bell System first, which could be used to narrow the directional beam on very long radio circuits, and also could send over a wider range of frequencies.

DECEMBER 8 — Commercial ship-shore radiotelephone service opened to S. S. *Leviathan*, 200 miles at sea. On Dec. 22, talk between an airplane in flight over New York City to the *Leviathan* was demonstrated.

DECEMBER 23 — Inauguration of the first state police teletypewriter system took place in Pennsylvania.

1930

GENERAL — The negative feedback amplifier was announced early in 1930 by Harold S. Black, of Bell Telephone Laboratories. An epoch-making invention in electronics, this amplifier has been adopted in practically all types of communication circuits—telephone, carrier and radio—because of its stability and ability to amplify with great reduction of distortion and noises.

JANUARY 1 — Fourth reduction in long distance rates announced by A.T.&T. Company; estimated annual savings to users about \$5 million.

JANUARY 15 — Transoceanic service opened to parts of Italy not previously covered. Further extensions in 1930:

February 1	Poland
March 10	Finland
April 3	Argentina, Chile, Uruguay—first countries in South America
July 16	Lithuania
October 27	Austria (via London)

APRIL 9 — Demonstration of two-way television over wires in cable between telephones at 195 Broadway and 463 West Street, New York City. An experimental service had been in operation for some time previous to this demonstration.

MAY 11 — Transatlantic telephone rates reduced. The New York-London charge was cut from \$45 to \$30 for the first three minutes, and charges from other points in the United States were reduced proportionately.

SUMMER — "Trademark service" made available in directories in 24,000 cities and towns in the United States and Canada.

1930 (Cont'd)

OCTOBER 1 — The Bell System purchased the Teletype Corporation, to be operated as a subsidiary of Western Electric Company.

OCTOBER 1 — First interstate connection for police teletypewriter systems was opened between New York City, New Jersey and Pennsylvania. Statewide police service was opened the same day in New Jersey.

A police teletype system was also installed in Connecticut during October, connecting both state and local police, that was connected to the other systems.

OCTOBER 14 — Beginning this day, ending November 12, the 8-story telephone building at Indianapolis was moved 52 feet south, turned to face a new direction, then moved 100 feet west without interruption of service or occupancy.

1931

GENERAL — Wave guide research began at Holmdel laboratories of Bell Telephone Laboratories this year.

JANUARY 4 — Completion of fourth deep-sea cable, Key West-Havana. Opened January 22.

JANUARY 15 — Oceangate, N. J., transmitting station opened for ship-shore telephone service.

APRIL 1 — Overseas telephone service opened to Indonesia and Latvia. Other openings:

August 15	Canary Islands
November 9	Roumania
November 12	Sumatra
December 18	Brazil
December 21	Bermuda
December 23	Hawaiian Islands

NOVEMBER 21 — Inauguration of teletypewriter exchange service, TWX, by A.T.&T. Company. Teletypewriters had been in use on private lines since 1915. The new service established central switching exchanges through which any subscriber could communicate by teletypewriter with any of the other subscribers to the service.

DECEMBER 25 — First radio broadcast of a complete opera, "Hansel and Gretel," NBC Blue network, coast-to-coast, from the stage of Metropolitan Opera House.

1932

MAY 14 — "Photo-finish" timing apparatus for sports, as developed in Bell Telephone Laboratories, first tried out at Columbia-Syracuse track meet at Baker Field, New York City.

OCTOBER 18 — Heavy sleet storm in North Dakota left 199 communities isolated from long distance communication. On open lines, some 12,000 poles had to be replaced.

Overseas telephone service extensions:

June 1	South Africa
July 15	Siam and Balearic Isles
August 8	Egypt
October 14	Peru
December 5	Lisbon
December 16	Bahama Islands
December 19	Venezuela
December 22	Colombia, S. Ameirca

1933

MARCH 10 — Earthquake at Los Angeles and San Diego. Telephone people gave striking demonstration of loyalty to the public service.

MARCH 12 — First Franklin D. Roosevelt "fireside chat" over WEAf.

APRIL 27 — Reproduction of symphonic music in auditory perspective transmitted from Philadelphia to Washington, over underground cable. Dr. Leopold Stokowski conducting; sponsored by National Academy of Sciences.

JULY 10 — Dr. Harold De Forest Arnold was born at Woodstock, Connecticut, Sept. 3, 1883. Died at Summit, N. J., July 10, 1933. Completing his doctorate in physics at Univ. of Chicago, Dr. Arnold became a research physicist in the Engineering Dept., Western Electric Company. Arnold specified modifications for the audion, the low vacuum tube of Lee De Forest, to make it a high vacuum tube, and added much to electronic theory by his recognition and calculation of the action of electrons in such a vacuum. His tube, used as a telephone repeater, made possible the successful transcontinental telephone conversations in 1914-1915, and in the 1915 transoceanic radiotelephone talk to Paris. (See Bell Laboratories Record, August, 1933, p. 351.)

JULY 15 — Initial period on TWX service shortened from 5 to 3 minutes.

Overseas service extensions:

February 24	Panama & Canal Zone
March 20	Costa Rica
March 30	Philippines
April 7	Palestine
April 17	Guatemala
May 9	India
June 7	Nicaragua
December 1	Yugoslavia

1934

GENERAL — Work on electromagnetic harmonic generators undertaken by E. Peterson, J. M. Manley, and L. R. Wrathall, of Bell Telephone Laboratories, during this year, resulted in improved transmission over carrier channels. The generators so developed were first used in the coaxial cable system between New York and Philadelphia, in 1936.

JANUARY 29 — Fire at Anderson, Indiana (5,500 telephones), wiped out central office. Service was completely restored on February 11, at 11:30 p.m., a few hours less than 14 days afterward.

1934 (Cont'd)

MARCH 10 — Fire in a nearby department store at Birmingham, Alabama, so damaged the downtown telephone building (Main) that service was interrupted on long distance and 8,000 local telephones. Essential toll service was restored March 12, and all local service within 10 days (March 20).

JULY 1 — First Bell System coastal-harbor shore station opened for commercial use at Marshfield, Mass., by the New England T.&T. Company.

JULY 1 — Communications Act became effective (approved by President Roosevelt, June 19). This brought interstate telephone business under regulation by the Federal Communications Commission instead of the Interstate Commerce Commission. (See Feb. 4, 1887.)

DECEMBER 1 — Overseas telephone service with Algeria, Fr. Morocco and Tunisia formally opened.

Other openings:

August 27 Syria
December 8 Japan

DECEMBER 13 — Thomas A. Watson, Bell's assistant in the invention of the telephone, died at Passagrille, Florida. (See biographical note under year 1854.)

1935

GENERAL — During 1935, the FBI installed teletypewriter service between its headquarters at Washington and 36 field offices.

In January of 1935, Bell System engineers installed two-way police radio service at Evansville, Indiana.

In the summer, great dust storms affected service in the west and midwest—chiefly in Kansas, Nebraska and Oklahoma.

JANUARY 1 — Private line channels for extensive photo transmission (telephotograph) network furnished to Associated Press. First transcontinental telephotograph network.

MARCH 12 — Michael I. Pupin, of Columbia University, died. He was the inventor of a method of using loading coils; the Bell System bought his patents for it. (See Dr. George A. Campbell below; also see Pupin's autobiography, *From Immigrant to Inventor*, Scribner's, New York, 1923.)

APRIL 25 — First round-the-world telephone call. Walter S. Gifford, president, A.T.&T. Company, talked with T. G. Miller, vice-president in charge of Long Lines Dept., in another room in the same building (32 Sixth Avenue) over a 23,000 mile circuit of wire and radio channels. The instrument used was presented to Smithsonian Institution.

JUNE 1 — Evening rate period discontinued; night rate period extended to start at 7 p.m.

AUGUST 7 — Transmission of pictures and similar material over message telephone service by the press was permitted for an experimental period of one year. (Note: filing was continued experimentally for a number of years, then changed to permanent offering which it is now.)

OCTOBER 11 — Telephone service to Iceland opened.

DECEMBER 1 — Dr. G. A. Campbell retired from Bell Telephone Laboratories after service from 1897, 38 years. Campbell, from Oliver Heaviside's suggestion, developed a complete theory of loading at about the same time as Dr. Michael I. Pupin, of Columbia University. A patent interference gave Dr. Pupin one month earlier date of conception. Campbell's analysis of the problem had led to the formulation of rules for the design of loading coils and their spacing along a circuit; these were from the beginning the only ones employed in the United States. Campbell also was responsible for deductions and discoveries that caused the invention (1903-1907) of a capacity unbalance test set which helped solve problems of noise and crosstalk in telephone circuits. He was originator of the "four-wire" circuit, used in long distance cables, and one of his early memoranda (1906) disclosed an anti-sidetone station circuit. He was born Nov. 27, 1870, was graduated from M.I.T., and devoted five years to advanced study at Harvard, Paris, Vienna and Gottingen. He died November 10, 1954.

Overseas service extensions:

April 23 Honduras
October 11 Paraguay
October 31 Dominican Republic

1936

JANUARY 15 — Long Lines night message rates made applicable all day Sunday.

MARCH — Exceptional floods in New England, the Atlantic coast states, and the valley of the Ohio River affected telephone service; plant forces, operators and Western Electric supply groups had to resort to emergency measures to maintain and restore telephone service.

JUNE 10 — First Bell System coaxial cable put in service for television use—1.5 miles long from NBC studio to transmitter on the Empire State Building, New York City.

JULY 1 — Overseas telephone rate reduced from \$30 to \$21 for three minutes between New York, Paris and London—elsewhere proportionately.

SEPTEMBER 1 — Long Distance rates reduced throughout the United States; the cut affected all calls over more than 234 miles and lowered the overtime charge on person-to-person calls to same as for station-to-station calls.

SEPTEMBER 4 — Bell Telephone Securities Company dissolved.

OCTOBER 5 — First coaxial cable installed between New York and Philadelphia; available for multi-channel telephone tests.

NOVEMBER 30 — Demonstration of coaxial cable system (see May 23, 1929). Frank B. Jewett, president of Bell Telephone Laboratories, talked with officials of the Federal Communications Commission at Washing-

1936 (Cont'd)

ton. Between New York and Philadelphia, the first experimental coaxial channels were looped to make a 3,800-mile circuit over the 95-mile system. Demonstrations for the press were held December 1.

Overseas service extensions:

February 20 Puerto Rico
 April 3 Jamaica
 June 10 El Salvador
 September 1 British East Africa

1937

GENERAL — The combined handset telephone was introduced commercially in 1937.

A patent on a method of cutting crystals for use in communication circuits, applied for in December, 1937, by W. P. Mason of Bell Telephone Laboratories, has resulted in getting crystals that do not change in sending or receiving at their given frequencies regardless of wide variations in temperature. Hence they have a "zero temperature coefficient."

JANUARY 15 — Intra-U.S. long distance rates reduced for hauls beyond 42 miles.

JANUARY 22 — Great floods in the Ohio and Mississippi valleys caused heavy losses and presented telephone people with many emergency situations.

MAY 12 — Seven-hour broadcast of coronation of King George VI and Queen Elizabeth of England.

JUNE 10 — First call from private yacht to liner (*Queen Mary*) at sea by H. B. Plant from Mascotte, off Florida. And on July 3, Walter May, Jr., Brookline, Mass., aboard yacht *Nepenthe*, called to the *Queen Mary*, also.

NOVEMBER 9 — Experimental showing of motion pictures transmitted over New York-Philadelphia coaxial cable system. TV image contained 240 lines.

NOVEMBER 11 — Dr. Clinton J. Davisson, of Bell Telephone Laboratories, became the first Bell System man to win the Nobel prize, when he shared the award for 1937 with Prof. George P. Thomson, of London. The award came to Dr. Davisson for his experimental discovery of the wave nature of the electron.

DECEMBER 8 — Opening of Fourth Transcontinental Line, through Southwest to Los Angeles.

Overseas service extensions:

May 19 Shanghai
 July 1 Bulgaria
 July 8 Juneau, Alaska
 September 29 Haiti
 December 15 Baghdad, Iraq

Ship-shore service to S.S. *Washington* opened Dec. 15.

1938

FEBRUARY 13 — First crossbar central office installation went into service at Troy Avenue, Brooklyn, after successful trial operation started in October, 1937.

APRIL 21 — Bancroft Gherardi, vice-president and chief engineer, A.T.&T. Company, retired after 43 years' service. He established the department of O. & E. He was graduated from Brooklyn Polytechnic; M.E. at Cornell, and M.M.E., Cornell. He joined the Bell System in 1895 at the age of 22.

SEPTEMBER 21 — Hurricane halted service on some 515,000 telephones in New York, New Jersey and the New England States; 240 communities were isolated from wire communication. A concentration of construction and repair crews from as far west as Southwestern Bell territory was mobilized to deal with the emergency. All told, more than 2,300 men and 615 vehicles were loaned by other Bell System companies to help in the work. Service was not permanently restored until November.

OCTOBER 8-9 — Bell Telephone Laboratories, Western Electric Company, and United Airlines shared in a demonstration of the terrain clearance indicator (altimeter). This was an application form of radar, developed from the experiments noted in the general topics for the year 1919.

OCTOBER 10-15 — The Southern Bell Telephone Company and 18 independent companies participated in a blackout and air raid operating test during a simulated attack on Fort Bragg, North Carolina.

OCTOBER 30 — Invasion from Mars radio program based on Wells' "War of the Worlds" caused telephone traffic peaks in nearly all cities and on long distance lines. Some calls were even placed to New Jersey where the invasion was supposed to be taking place, as listeners missed the repeated statement that this was a purely imaginative rendering from a novel.

DECEMBER 20 — Direct short-wave overseas channel, U. S.-Australia, opened.

1939

GENERAL — During 1939, development work for rural powerline carrier circuits was begun in Bell Telephone Laboratories.

JANUARY 10 — Radiotelephone service Montreal-Newfoundland opened.

APRIL 8 — New York weather forecast service inaugurated—WEather 6-1212. First such service in United States. Similar services opened in New Jersey, in November, and in Chicago, December 18.

APRIL 30 — New York World's Fair opened.

MAY 20 — Standard cable pairs used as local pick-up channel for television broadcast of bicycle race at Madison Square Garden, New York City.

AUGUST 22 — All broadcasting networks placed on 24-hour basis because of European crisis.

SEPTEMBER 3 — London and Paris overseas channels used only for program service when war was declared.

1939 (Cont'd)

DECEMBER 2 — Golden Gate International Exposition at San Francisco opened.

Overseas service extensions:

June 1	Singapore
September 11	Italy (direct circuits)
September 12	Netherlands (direct circuits)
November 1	Korea

1940

GENERAL — During 1940, broad band carrier systems—an improvement upon systems in use since World War I—provided a total of 96 circuits between New York and Boston. Carrier is in essence radio over wires or coaxials; for each space on the band of frequencies to be used to carry a message, a sending set puts one-half of the conversation on the wire, and a receiving set takes it off. In the case of a long distance call, the receiving set also places the conversation back on telephone wires in local service. Broad band systems in 1940 could provide for as many as 12 conversations simultaneously over a single pair of wires.

In June, 1940, A. W. Ziegler, of Bell Telephone Laboratories, applied for a patent on a method of mounting crystals with wire, which soon found its way into military tank radios, as well as into many non-military communication systems.

MARCH 3 — Last manual office in Manhattan cut over to dial.

APRIL 1 — Coastal-harbor service opened from Texas ports.

APRIL 29 — First broadcast *Telephone Hour*, from Studio A, World Broadcasting Company, 711 Fifth Avenue, New York; 8 to 8:30 p.m., Eastern Standard Time, NBC network.

MAY 1 — Intra-U.S. message rates reduced for hauls beyond 420 miles.

MAY 5-25 — War games in Gulf states test availability of Bell System and independent telephone services for anti-aircraft defense and other military communications.

MAY 20 — Automatic Tape Teletypewriter System (81 type) provided for General Electric Company.

MAY 21—441-line television with band of about 2,700,000 cycles transmitted over coaxial cable, New York to Philadelphia and return, nearly 200 miles.

JUNE 24 — Republican National Convention transmitted over coaxial cable from Philadelphia to New York for local TV broadcasts.

AUGUST 6 — W. H. Doherty, Bell Telephone Laboratories, was granted a patent on a high efficiency amplifier for radio transmission, which speedily came into wide use.

OCTOBER 28 — First sale at Boston of new stamp issue honoring Alexander Graham Bell — denomination 10 cents.

Overseas service extensions:

April 5 Bolivia
October 22 Spain (direct channel)

Weather forecast openings:

March	Baltimore
April 15	Michigan
November 17	New England

1941

GENERAL — During 1941, the Bell System and the Rural Electrification Administration began cooperative development of technical possibilities of power-line carrier systems.

Bell System Defense Activities: These were our main preoccupation during the year and the story cannot fairly be briefed in chronological form. See Bell Telephone Magazine throughout the year for details. Mr. Gifford's statement on defense appears in the May issue. The February issue contains a recapitulation by R. T. Barrett on the Bell System's "Pioneering in Radio Telephony."

JANUARY 4 — Telephone office to serve Camp Edwards, Mass., completed three months after breaking ground for the project.

JANUARY 26 — Administration building at Norfolk Naval Base, Va., destroyed by fire. Service to base fully restored with new 10-position switchboard, shipped on express car attached to a passenger train, 69 hours after fire.

FEBRUARY 14 — Radiotelephone service between Crisfield, Maryland, and Smith and Tangier Islands in Chesapeake Bay, opened.

MAY 12 — 441-line television transmitted with band extending to 2,700,000 cycles over 800-mile channel formed by looping coaxial conductors in cable between Stevens Point, Wisconsin, and Minneapolis.

JUNE 9 — The coaxial cable between Stevens Point and Minneapolis was put into commercial service. The previous, more or less experimental coaxial cables had contained one pair of coaxial conductors. This 195-mile installation was the first of two-pair coaxial conductors.

JULY 10 — Long distance rates reduced on medium hauls (145-1530 miles); rates beyond initial person-to-person period reduced to the station level; report charges generally eliminated.

SEPTEMBER 29 — The midnight re-broadcast of *Telephone Hour* for Pacific Coast cities was begun.

NOVEMBER 9 — The Bell System's first crossbar tandem unit was cut into service at New York City.

NOVEMBER 10 — *Telephone Hour* broadcast moved to NBC studios in Radio City; this was the beginning of the studio audiences.

1941 (Cont'd)

DECEMBER 7 — The Japanese attack on Pearl Harbor affected the telephone system of the United States by causing tremendous traffic peaks in all cities, and an increase from 100 to 400 percent in long distance telephoning — which already was at a record high of 3 million messages.

DECEMBER 8 — All radio stations carried the broadcast of the Declaration of War and speech by President Roosevelt.

Overseas service extensions:

January 12	Greece
June 25	Lisbon (direct)
July 11	Panama City (new system-direct)

1942

FEBRUARY 28 — Bell Telephone Laboratories, as a result of work in which many scientists shared, applied for a patent on an oscillator circuit which was widely adopted for teletypewriter systems and which almost at once proved of great value in radar systems used in the war.

APRIL 6 — *Telephone Hour* evening broadcast shifted from 8-8:30 p.m. to 9-9:30 p.m., EST, Mondays. The Pacific Coast re-broadcast continued at midnight.

APRIL 27 — Guest star series began on *Telephone Hour*, replacing James Melton and Francia White. Jascha Heifetz was the first guest artist to appear.

JUNE 26 — W. H. Harrison, vice-president and chief engineer, A.T.&T. Company, was made a brigadier-general in charge of production activities of Service of Supply, United States Army.

AUGUST 15-16 — Radio station WEAJ celebrated its 20th anniversary.

OCTOBER 18 — S.S. *Alexander Graham Bell* launched at Oregon Shipbuilding Corporation (Henry J. Kaiser) yards. This was the 50th anniversary of opening of New York-Chicago line.

OCTOBER 21 — John H. Ray elected vice-president and general counsel, A.T.&T. Company, succeeding the late C. M. Bracelen. Ray had been counsel of the company since 1936. During nearly 20 years with the Bell System he also served as vice-president and general counsel of the Western Electric Company, and before that as general solicitor, A.T.&T. Company. Prior to joining A.T.&T. in 1923, he practiced law in Minneapolis.

C. M. Bracelen died October 8, 1942. He joined A.T.&T. Company in 1918, after spending several years in practice in Minneapolis. He was graduated from the University of Nebraska, 1902; became general solicitor, A.T.&T., in 1921; vice-president, 1924; and general counsel, 1926. He was 64 years old.

DECEMBER 1 — First section of telephone line completed along the Alcan Highway, from Edmonton, Alberta, to Dawson Creek, B. C. (The Alcan Highway begins at Dawson Creek.)

DECEMBER 21 — Completion of Transcontinental Telephone Cable (underground quadded for carrier operation — *not coaxial*), and opening to regular service — a wartime feat.

Overseas service openings: May 4 — Paramaribo, Dutch Guiana.

1943

FEBRUARY 1 — Reduction in Long Lines private line rates; annual savings to customers about \$10 million.

FEBRUARY 15 — Long Lines message overtime rates reduced from one-third to one-fourth of initial period rate.

APRIL — Construction of telephone line, Calcutta to Kunming, China, along Stilwell Road, begun at Ledo, Assam. Many Bell System men in the U.S. Army Signal Corps assisted in this work which was completed 15 months later.

MAY 17 — Oliver E. Buckley, president, Bell Telephone Laboratories, discussed the work of the Laboratories on radar on *Telephone Hour* — the first mention of this subject since the beginning of the war.

AUGUST 21-22 — First No. 4 toll crossbar switching system in the world cut into service at Philadelphia, Pa. The first concrete move toward toll dialing.

NOVEMBER 9 — Electrical gun director demonstrated by Bell Telephone Laboratories at Murray Hill, N. J.

Overseas service:

September 22	To U.S.S.R., via New York
December 20	To Curacao, D.W.I., short wave

1944

GENERAL — During 1944 and 1945, in addition to devoting its facilities and personnel to military research, Bell Telephone Laboratories conducted the School for War Training, which prepared many men for technical services such as radar maintenance.

Overseas service: Feb 23 — Trinidad, B.W.I.

FEBRUARY 15 — Associated Companies of the Bell System filed tariffs to prevent hotels, apartment houses and clubs from making surcharges on service; agreed to pay 15 percent commissions on calls by guests of such establishments.

MARCH 1 — Reduction of overtime rates on most teletypewriter exchange service.

MARCH 1 — Night message toll rates became effective at 6 p.m. instead of 7 p.m.

APRIL — Distress warning system "Air Sea Rescue" established in New York area, as part of civilian cooperation with the Coast Guard. Extended to entire Atlantic coast by August.

1944 (Cont'd)

APRIL 20 — Bell System receives National Security Award for measures to protect its telephone plant during the war.

MAY 24 — Centennial of the telegraph.

JUNE 6 — D-Day — Allied forces landed in Normandy.

JULY 6 — Telephone people rendered exceptional emergency service when fire burned circus tent at Hartford, Connecticut.

AUGUST — Calcutta-Kunming telephone line completed by U. S. Signal Corps.

SEPTEMBER 20 — New Jersey Bell Telephone Company took title to Eastern T.&T. Company, and Camden and Atlantic Company, in southern New Jersey.

SEPTEMBER 21 — A.T.&T. Company announced establishment of trust fund to finance five post-doctorate fellowships in physical science, in honor of Dr. Frank B. Jewett of Bell Laboratories. (Fund expired in 1954.)

SEPTEMBER 30 — Dr. Frank B. Jewett retired as chairman of the board, Bell Telephone Laboratories, and vice-president, A.T.&T. Company. Dr. Jewett was born Sept. 5, 1879, at Pasadena, California; died Nov. 18, 1949. Graduated, Throop Polytechnic (now California Institute of Technology), 1898; Ph.D., U. of Chicago, 1902. After teaching and research at M.I.T., joined A.T.&T. Company as transmission engineer, 1904; vice-president, A.T.&T. Company, in charge of research, 1925; president, Bell Telephone Laboratories, Inc., 1925-1940, when he became chairman of the board of directors. (See *Bell Laboratories Record*, autumn, 1944.)

OCTOBER 18 — Leroy A. Wilson, assistant vice-president, A.T.&T. Company, commercial, O. & E. Dept., elected vice-president in charge of business research and studies of Bell System revenue requirements. Born Terre Haute, Feb. 21, 1901; B.S. in C.E., Rose Polytechnic Institute, 1921; joined Indiana Bell, June 1, 1922, traffic clerk; traffic superintendent, 1927; joined A.T.&T. Co., 1929; commercial engineer, A.T.&T., 1942.

1945

MARCH 13 — Last duplicate and competing telephone service in New Jersey eliminated in and near Camden and Cape May County.

MAY 8 — VE Day.

JULY 1 — Rates for message telephone service reduced on calls exceeding 790 miles.

JULY 16 — First atom bomb, experimental test, New Mexico.

AUGUST 5 — Hiroshima.

AUGUST 7 — Plowing in of coaxial cable, Washington, D.C.-Charlotte, N. C., begun.

AUGUST 9 — Nagasaki.

AUGUST 14 — VJ Day.

SEPTEMBER 17 — (See Sept. 20, 1944.) Cutover effecting consolidation of service of former Keystone Telephone Company of Philadelphia with Bell System. See *The Telephone News*, Nov., 1945, p. 4.

OCTOBER 31 — Up to then highly secret microwave relay AN/TRC-6 demonstrated at 140 West Street, and Neshanic, N. J. First and only American-built microwave radio relay to have seen actual combat use in both European and Pacific theaters of the war.

NOVEMBER 1 — Rates for overseas service to Hawaii, Puerto Rico and Alaska reduced.

NOVEMBER 8 — First public demonstration of the new Visible Speech by Bell Telephone Laboratories. Conceived by R. K. Potter, of the Laboratories, and developed in one form as a secret Army project during the war. Note: Do not confuse with Visible Speech of Alexander Melville Bell, father of Alexander Graham Bell. The Bell code was a list of symbols indicating the position of teeth, tongue and larynx in uttering various sounds. The new Visible Speech is an electric-electronic process that brings sound patterns on a screen. Both are used to teach the deaf.

DECEMBER 1 — First 525-line inter city TV broadcast of Army-Navy football game at Philadelphia brought to New York for broadcasting, over coaxial cable.

DECEMBER 10 — Michigan Bell Telephone Company began presenting its own radio program three times a week; called, "Number, Please," and featuring the Song Spinners.

DECEMBER 17 — First public use of rural power-line carrier, at Gordon Nelms' General Store, Brookland, Arkansas, near Jonesboro.

Overseas service restored after World War II:

March 2	Italy (Rome)
October 1	Netherlands
November 7	France

Service opened to:

June 4	Ecuador
October 25	New Zealand
December 20	Barbados

1946

FEBRUARY 1 — Rates reduced on message telephone service between 340-2140 miles.

FEBRUARY 12 — New coaxial link, Washington-New York, used for long distance television from Washington for first time, on occasion of Lincoln Memorial ceremonies.

FEBRUARY 16 — Walter S. Gifford, president, A.T.&T. Company, awarded Medal for Merit for exceptionally meritorious services to the United States. Presented by President Harry S. Truman.

APRIL 21 — Color television transmitted over coaxial channels, New York-Washington and return, 450 miles, in CBS tests.

1946 (Cont'd)

MAY 27 — First commercial multi-channel ultra high frequency microwave radiotelephone system in Bell System placed in service in southern California (S. C. Tel. Co.) for additional facilities between Santa Catalina Island and mainland. On *July 2*, a similar service was opened between Nantucket and the mainland.

JUNE 10 — New York-Washington television circuits opened for service on an experimental basis.

JUNE 17 — Mobile telephone service placed in commercial use at St. Louis, Mo.

JUNE 17 — *Telephone Hour* received award from "Musical America" as first among radio "orchestras with featured soloists."

JUNE 19 — First prize fight telecast (Billy Conn vs. Joe Louis) — New York to Washington, D. C.

JUNE 24 — *Telephone Hour* receives Phi Beta Annual Award for the program offering the best in music. Phi Beta is the national fraternity of music and speech.

JULY 15 — Theodore N. Vail gold medal and \$1,000 award (posthumously) to Mrs. Julia C. Berry who lost her life at switchboard in a Chicago hotel fire. (La Salle Hotel, June 5, 1946.)

AUGUST 20 — First rural radiotelephone service begun — connecting eight ranch houses in eastern Colorado with central office at Cheyenne Wells.

AUGUST 25 — Single link microwave radio used between the Los Angeles Coliseum and Mt. Wilson for pickup of rodeo.

OCTOBER 1 — The Cincinnati and Suburban Telephone Company became First Bell System company to clear backlog of orders for telephones received prior to 1946.

OCTOBER 5 — Two-link microwave radio used between West Point and New York for football pickup (Cornell-Army) and transmitted over the coaxial to Washington.

OCTOBER 10 — Four-link microwave radio looped back and forth between New York and Murray Hill, N. J., total 88 miles, for demonstration of television before T.B.A. convention.

OCTOBER 12 — First television pickup from Baltimore transmitted to Washington and New York over coaxial cable (Navy-Duke).

DECEMBER 14 — Historic River Grove, Ill., central office fire. All 5,161 lines (serving 9,585 phones) in immediate area and part of Chicago restored in 11 days.

DECEMBER — Beam traveling wave tube announced by Bell Telephone Laboratories. (See *Laboratories Record*, December, p. 439.)

Overseas service restorations:

January 1 Germany
January 7 Egypt
January 10 Japan

January 10 Frankfort, Munich
January 10 Berlin (and 7 cities
 American Zone)
January 28 Philippine Islands
February 20 Norway
April 18 Eire (rates reduced)
April 25 Sweden (via Oslo)
July 1 Denmark
July 8 Belgium (via London)
September 16 Austria
November 11 Palestine
December 16 South Africa
December 16 India

Openings:

October 14 Virgin Islands
December 1 Papua
December 1 New Britain

1947

JANUARY 1 — Appointment of first woman assistant to president in Bell System.

Miss Kathryn L. Davenport, asst. to pres. Carl Whitmore, New York Tel. Co. She retired April 30, 1948, and was succeeded by Mrs. Gertrude Frese, the second woman in Bell System holding that position and title.

(See *New York Telephone Review*, April-May, 1948, pages 8 and 37.)

JANUARY 7 — Celebration of 20th Anniversary of opening of New York-London telephone service.

JANUARY 15 — Dr. Vannevar Bush, president Carnegie Institution, and chairman of the Joint Research and Development Board of the War and Navy Department, elected a director of A.T.&T. Company.

JANUARY 24 — A.T.&T. Company filed application with Federal Communications Commission to install terminal stations for an experimental radio relay system between New York-Chicago.

EARLY IN YEAR — Initial use of "Mickey Mouse," largest tool ever (to date) developed by the Bell System and (to date) only one of its type. Officially called "C-60," first used in laying new coaxial telephone cable between Baltimore and Washington, supplementing existing coaxial facilities. Plows 60 inches deep — formerly 48 inches deep only. (See *195 Bulletin*, May 1947, p. 5.)

MARCH 3 — Centennial of birth of Alexander Graham Bell observed at Bell Telephone Laboratories, Murray Hill, N. J. Bust of Bell at age 29, by Paul Manship, unveiled by Mrs. Gilbert H. Grosvenor, Bell's eldest daughter.

As part of the Centennial Program, *Telephone Hour* was held in large studio and was broadcast one full hour, 9 to 10 p.m., and 12 to 1 a.m., EST. Guest stars were Jascha Heifetz, Helen Traubel and Raymond Massey. The last named acted as narrator in a dramatic sketch of Bell's life and achievements.

APRIL 7 — The first "nationwide" strike in telephone history began, lasted 44 days and involved at one time or another all but five operating companies and some 370,000 employees (including 60,000 from Western Electric).

1947 (Cont'd)

APRIL 30 — Radiotelephone link opened to resorts in Death Valley, California, through San Bernardino.

MAY 16 — Demonstration of mobile telephone equipment from United Airlines plane to ground stations.

JUNE 19 — Bell System and Rural Electrification Administration announced development of forms of agreement between telephone companies and REA cooperatives for power line carrier telephone service, and joint use of pole lines in rural areas.

JULY 16 — A.T.&T. directors voted to offer 2,800,000 shares of capital stock to Bell System employees.

AUGUST 15 — Opening of commercial telephone service for passengers on certain trains between New York and Washington, D. C.

AUGUST 15 — Inauguration (on an experimental basis) of telephone service from moving trains, to any other telephones. Tried out on five crack trains, two Congressional Limiteds and on the B. & O.'s Royal Blue; and a week later on the Pennsylvania's Potomac and Legislator — all five trains operating between New York and Washington via Philadelphia and Baltimore.

Prior to inauguration, try-out by railroad officials and journalists, former train-to-train; latter, train to home offices.

First call made by W. R. Triem, Gen. Supt. of Telegraph for Pennsylvania R.R., to A. S. Hunt, Chief Eng. of Communications for B. & O., from Penn. express emerging from New Jersey end of Hudson River tunnel to B. & O. train pulling out of Washington.

(See Tel. Co. magazines, notably 195 *Bulletin*, September, 1947, p. 3; New York *Times*, August 15, 1947. Also *Laboratories Record*, Jan., 1948, p. 9; May, 1949, p. 172.)

AUGUST 26 — Stockholders of A.T.&T. Company reach total of 712,300.

SEPTEMBER 3 — Construction of New York-Albany coaxial cable begun.

SEPTEMBER 17 — Hurricane crossed Florida peninsula and struck Alabama and Mississippi coasts (September 19), affecting about 80,000 telephones and many long distance lines. Second storm, September 23, brought total telephones affected to 105,000. Service was restored on 87,000 telephones and nearly all long lines by September 25. Portable radio was used to keep some Florida channels open during and after the storms.

SEPTEMBER 25 — Mobile telephone service opened along Boston-Washington highway.

SEPTEMBER 26 — New coaxial cable, New York-Philadelphia, opened.

SEPTEMBER 29 — World Series baseball games televised through coaxial cable, New York-Philadelphia-Baltimore-Washington.

OCTOBER 13 — *Telephone Hour* honored the inde-

pendent telephone industry of the United States by presenting its broadcast from the stage at Medinah Temple, Chicago, during the annual convention of the USITA, and upon the 50th anniversary of the founding of that organization.

OCTOBER 23 — Bar Harbor partly destroyed at climax of disastrous New England forest fires. Telephone men and women give notable demonstrations of loyalty to the public service in this period of emergency.

OCTOBER 31 — Bell System employee stock subscriptions closed; more than 25,000 participated in the offering.

NOVEMBER 13 — New York-Boston radio relay opened for experimental use.

NOVEMBER — Completion of a transcontinental coaxial cable from Atlanta to Los Angeles. With connections at Atlanta, this provides a second all-cable route to the West Coast, with an initial development of about 300 circuits, many of which extend across the continent.

Other large additions to the coaxial network include a link between Jacksonville and Miami which extends these facilities from Atlanta to Miami and one between Chicago and Terre Haute which establishes a coaxial link from Chicago to St. Louis.

(See Annual Report, A.T.&T. Co., for year 1947, p. 6.)

DECEMBER 8 — Development of Alpeth — cable with aluminum sheath covered with polyethylene plastic announced. Since lead-sheathed cable was at peak production, using all lead then available because of post-war scarcity, it was planned to use Alpeth cable in exchange areas, so that Western Electric cable plants could increase their output.

DECEMBER 23 — Transistor invented (See June 30, 1948).

Overseas service restorations:

January 13	Iceland
January 22	Austria (restricted)
February 12	Germany (restricted)
February 25	Roumania
March 1	Poland
March 20	Czechoslovakia
April 1	Germany (full use)
April 10	Finland
April 15	Hungary
July 1	Shanghai, Nanking
July 14	Java and N. I.
August 5	Yugoslavia
September 30	Korea (restricted)
October 8	Greece

Openings:

September 2	British Guiana
December 1	British So. Africa
December 15	Leeward and Windward Islands

1948

JANUARY 19 — A.T.&T. Company filed rates with FCC for intercity FM channels over a frequency band from 2,500 to 15,000 cycles. Some program channels

1948-1949

1948 (Cont'd)

2,500 to 8,000 cycles were already in use; this filing was to standardize procedure and charges.

FEBRUARY 18 — Walter S. Gifford was elected chairman of the board, A.T.&T. Company; Leroy A. Wilson was elected to succeed him as president of the company. Brief biography of Gifford, 1925; Wilson, 1944.

MAY 1 — Television: Following extended experimental operation of TV channels between Washington and New York (and later Boston), commercial charges were inaugurated on this date. Demand was immediate and during the summer additional facilities were provided on the East Coast network, and that network was extended to Richmond. A second network was opened in September of 1948 in the Midwest, interconnecting Buffalo, Cleveland, Toledo, Detroit, Chicago, Milwaukee and St. Louis.

MAY 30 — Columbia River flood destroyed Vanport, Ore. Eleven operators remained at switchboard warning residents to flee until power failed. A group Vail Medal award was made to Pacific company employees at Vanport.

JUNE 29 — Installation of 30,000,000th telephone in Bell System, Marshalltown, Iowa. (See *Northwestern Bell Magazine*, August, 1948.)

JUNE 30 — First public demonstration of the transistor by Bell Telephone Laboratories, which showed that this device, about the size of a metal pencil cap, could be used to do the work of some types of vacuum tubes in amplifiers and other communications devices.

JULY 11 — First installation of the No. 5 Crossbar System at Media, Pa., suburb of Philadelphia, and placing in service.

Having more extensive field of application than any previous switching system, this system meets the requirements of areas on the outskirts of large cities where calls to metropolitan office are handled manually because suitable equipment to permit direct dialing has not yet been available. (See *Bell Labs. Record*, March, 1949, p 85.)

OCTOBER 1 — License Contract payment by associated companies of the Bell System was reduced by A.T.&T. Company to one percent of annual revenues of the companies.

OCTOBER 1 — Opening of long distance coaxial telephone cable between the East and the Midwest, extending from Philadelphia, through Pittsburgh to Cleveland, adding many long distance telephone circuits along this route. Costing total of \$12,500,000, it was constructed as joint project of The Bell Tel. Co. of Pennsylvania, The Ohio Bell Tel. Co. and the Long Lines Dept. of A.T.&T. Co. (See *Bell Labs. Record*, Dec., 1948, p. 508.)

OCTOBER 1 — New plant for Western Electric Co. completed at Allentown, Pa. Begun in March, 1946, it was located on outskirts of city, on 50-acre hilltop site, and bordered by through Route U. S. 22; plant consists of 2 major buildings housing (1) offices and (2) plant and laboratory operations, and several small service

buildings, all of light-colored brick. (See *Bell Labs. Record*, Dec., 1948, p. 502.)

Overseas service:

March 3	Okinawa (new)
May 15	Sudan, Egypt (new)
June 8	Belgian Congo (new)

1949

GENERAL — The coaxial cable network was extended to a total of 7,600 miles during 1949. The television network was extended to 8,500 channel miles, with 25 cities and 50 television stations connected to it.

Some 600 new telephone sets were put in service during 1949 to check performance in actual use. The new set "is attractive in appearance, convenient and light in weight," says the *Annual Report* for 1949. Talking and hearing qualities were an improvement over previous sets, and the loudness of the set automatically is adjusted to compensate for its distance from the central office.

JANUARY 12 — Television: The eastern and mid-western coaxial and radio relay networks, described under date of May 1, 1948, were interconnected, making possible the broadcasting of the same TV program from the Atlantic to the Mississippi.

JANUARY 13 — A.T.&T. stockholders total announced: more than 800,000.

JANUARY 14 — The United States Attorney General filed suit in the Federal District Court in New Jersey against American Telephone & Telegraph Company and Western Electric Company, alleging violation of the Sherman Anti-Trust Act and asking that Western be separated from the Bell System. Answer filed as of Mar. 31. Suit was terminated by consent decree, January 24, 1956.

JANUARY 20 — Inauguration of President Harry S. Truman broadcast on radio and also over television channels within range of 32 stations linked with the Bell System's eastern and midwestern network. Job of setting up facilities for the extensive press, radio and telephone coverage was handled by the Ches. & Potomac Tel. Co. and the Long Lines Dept. of A.T.&T. Co. (See *Ohio Bell Tel. Magazine*, Feb.-March, 1949, p. 21.)

OCTOBER 17 — Toll dialing networks on East and West Coasts joined; coast-to-coast dialing of long distance calls begun — operator dialing. On the demonstration call, ringing signal of called telephone in New York began 30 seconds after the toll operator in Oakland, California, received the call.

NOVEMBER 1 — Western Electric Company took over operation of Sandia Laboratory, near Albuquerque, New Mexico, at the request of the United States Atomic Energy Commission. Request came because this laboratory "has an important function bridging the gap between research and manufacturing operations," and Western—in addition to other functions—fulfills exactly this one for the Bell System. The contract with the Atomic Commission was effective through 1953 and, at Western's suggestion, provides for no profit. The actual work was handled by a Western subsidiary, Sandia Corporation.

1949 (Cont'd)

NOVEMBER 16 — Employee pension minimum, \$100 a month.

DECEMBER 22 — System volume of calls is announced as 180 million a day.

DECEMBER 31 — Walter S. Gifford retired after 45 years' service; the directors elected him honorary chairman of the board.

Overseas service openings:

December 29 . . .	Formosa
March 1	Malta
June 7	Hong Kong
April 1	Tangiers
September 1 . . .	Bahrain Is.
November 17 . . .	Iran

GENERAL — Gain in 1949 was 2,028,000, unfilled orders at end of year, 788,000. About 70% of gross demand was connected. Rural area gain 298,000 as compared with 329,000 in 1948.

GENERAL — The sale of gift toll coupon books was tried during the Christmas season, 1949, at Peoria and Allentown. Six thousand contacts resulted in 288 sales.

1950

JANUARY 6 — Ice storm and floods affected service in the areas of the Cincinnati, Indiana, Southern and Southwestern companies. Snow on the West Coast a day later (Jan. 7) caused the northern transcontinental line to fail.

JANUARY 7 — The first No. 5 crossbar office which also provided switching facilities for toll calls to tributary offices was placed in service at Wheaton, Illinois (4200 stations).

JANUARY 20 — Completion of the first mobile Bell System television pickup unit was announced. It was built for the New York Telephone Company, and included a generator for spots where commercial power might not be available.

FEBRUARY 3 — Over 40% of the Bell mobile telephone base stations by this time had been authorized by the F.C.C. to operate under commercial licenses. Their status to begin with (1946) was experimental.

FEBRUARY 10 — F.C.C. granted permission to Zenith Radio Corporation to make a trial of Phonevision — a system of telecasting wherein the telephone companies would cooperate to provide clearer reception.

FEBRUARY 12 — Local service in the state of Delaware became 100 percent dial with the cutover of Georgetown (1500 main telephones) to dial operation.

FEBRUARY 14 — Automatic message accounting center at Newark began operation.

FEBRUARY 18 — First customer toll dialing from New Jersey to New York began when No. 5 crossbar with A.M.A. was cut over at Cranford, N. J.

MARCH 5 — Direct circuit to Tel Aviv replaced a tandem circuit through Tangier.

MARCH 15 — Step-by-step dial PBX 740E announced — primarily for less than a hundred extensions.

MARCH 17 — High-seas service to *Gripsholm* and the *Conte Biancamano* (Mar. 21) made the total passenger vessels equipped for it 16 in the Atlantic and 1 in the Pacific.

APRIL 21 — Plans for air-raid warning system in cooperation with the U. S. Air Force announced.

APRIL 22 — New York Telephone Company announced the sale of its stock in the Holmes Electric Protective Company (burglar alarm) some of which it had held since early days when E. T. Holmes founded Bell exchanges in New York. The purchaser was the Holmes Protective Company, a subsidiary of the Grinnell Corporation, of Providence, R. I.

APRIL 26 — Coin mobile service began on the Pennsylvania Railroad's Congressional Limited.

MAY 1 — Contract with Pennsylvania R.R. for two private mobile systems, Bell operated, but covering company railroad yards.

MAY 19 — Munitions explosion, South Amboy, N. J.; seven operators and the evening chief operator at the 10-position switchboard were shaken up and four cut by flying glass. All remained on duty and volunteers soon filled the board. Radio equipped cars helped to deal with the traffic overload which continued from the 19th (Friday) until the following Monday.

JUNE 2 — First supply of new 500-type handset telephones announced. About 180,000 were expected to come off production lines during the balance of the year.

JUNE 9 — Chicago Automatic Message Accounting (A.M.A.) center in service — fourth of its kind. Others were at Philadelphia, Detroit and Newark.

JUNE 15 — Operator dialing between San Francisco-Oakland and Hawaii went on trial.

JUNE 16 — California Department of Justice teletypewriter network, redesigned by the Pacific Company, O. & E., A.T.&T., using perforated tape relay equipment, became the most extensive state teletypewriter system used for law enforcement.

JULY 1 — First long-haul, under-ocean cables to be equipped with the built-in repeaters, in service between Key West and Havana; "through" rates established.

JULY 14 — Completion of revision of Toll Operating Practices, begun in 1945, announced.

JULY 21 — Initial planning for radar air warning network under way — 85 stations contemplated, including eight control centers.

JULY 21 — F.C.C. suggests field tests of telephone answering devices.

1950 (Cont'd)

JULY 21 — Radio circuit authorized for the New York Telephone Company television pickup facilities (where wire lines not available).

JULY 31 — Priorities set up on calls from Japan. (Korean War.)

AUGUST 4 — Letter from O. & E. to Bell companies outlined protective measures appropriate in view of the Korean War.

AUGUST 25 — First commercial installation of N1 Carrier, Harrisburg-Sunbury, Pa., 48 miles, under final tests. Service began August 31.

SEPTEMBER 1 — The New York-Chicago radio relay link went into commercial service, carrying network programs. Completion of the Los Angeles-San Francisco radio-relay system was announced, with commercial use planned for September 15.

SEPTEMBER 12 — Hurricane affected 20,000 telephones in New England, mostly on Cape Cod.

SEPTEMBER 18 — First cutover to prepay 10 cents coin telephones at Sioux Falls, S. D. Postpay rate had been ten cents; only change was in equipment.

SEPTEMBER 18 — Coin telephones in service on the New York, New Haven R.R.

SEPTEMBER 29 — Field trial of automatic answering service to 10 customers in New York and Cleveland announced as under way.

OCTOBER 10 — Overseas service to Seoul resumed after liberation.

OCTOBER 17 — Hurricane in Florida, greatest damage near Miami, 100,000 stations.

NOVEMBER — Bell System plant passed the \$10 billion mark this month.

NOVEMBER 4-5 — Bell companies participated in test maneuvers of the Ground Observers Corps.

NOVEMBER 9-19 — Telephone strike.

NOVEMBER 18 — Floods in California created emergency traffic.

NOVEMBER 25 — Windstorm affected 600,000 stations in New York and New England.

DECEMBER — Walter S. Gifford appointed Ambassador to Great Britain—served until January, 1953.

1951

JANUARY 1 — Zenith Phonevision trial began to 300 selected families in Chicago. Illinois Bell Company provided Zenith with a special PBX at a control center. Telephones connected to the PBX were for use in the trial only — for conversation or to transmit Zenith's

unlocking signal. First releases were at the rate of \$1 for each showing (\$1 per telephone or family). The trial ended March 31.

JANUARY 5 — Unfilled orders at the beginning of the year were 789,000. Regrade requests held, 1,718,000. Change-over to 10-cent coin operation on public telephones was scheduled in Illinois, Minnesota, New York and Iowa.

JANUARY 15 — Pennsylvania Railroad mobile yard system in service on a commercial basis.

JANUARY 23 — Civil Air Raid Warning System placed in service for the U. S. Air Force—seven networks including 11,000 miles of leased circuits.

JANUARY 25 — Long Lines channel rates for monochrome and alternate color video placed in effect.

FEBRUARY 15 — First 356A Community Dial Office, 75 lines, cut into service at Roberts, Idaho.

MARCH 1 — Tape-to-card converter in service at Newark A.M.A. centers.

APRIL 13 — F.C.C. approval announced for Bell acquisition of Western Union telephone business in Pacific company area, and sale to W. U. of Pacific company's telegram business.

MAY 1 — Overseas telephone service opened to British West Africa.

Other openings:

September 1 . . . Cyprus
November 21 . . . Guam

MAY 15 — Millionth stockholder celebration honored Brady Denton family of Saginaw, Mich.

JUNE 6 — Sixth Plenary Assembly of the International Radio Consultative Committee, at Geneva.

JUNE 8 — Group being organized to rewrite Bell System practices—8,000 sections to be studied and revised.

JUNE 15 — Intercity Theatre Television set-up for Louis-Savold prizefight. First large-scale theatre TV program.

JUNE 28 — Leroy A. Wilson, president A.T.&T. Company, died. He was succeeded by Cleo F. Craig. Mr. Craig was born in Rich Hill, Missouri, April 6, 1893. He studied electrical engineering at the University of Missouri, and after graduating in 1913, started work with the Bell System as equipment man at St. Louis, Mo., for the A.T.&T. Company. He became a vice-president in 1940, serving at various times in charge of the Long Lines department, personnel relations, operations and engineering, revenue requirements and finance. In 1914, he was married to Laura Heck of Rich Hill, Mo. (See September 19, 1956; May 31, 1957.)

JULY 9 — Omaha-Denver section of the transcontinental radio-relay system in commercial service.

1951 (Cont'd)

JULY 11 — Floods in Kansas and Missouri created severe emergency. Long Lines operators flown in to handle traffic load.

JULY 13 — Interdepartmental committee on customer toll dialing announced at A.T.&T.

AUGUST 17 — Transcontinental radio-relay system completed and in service (for telephone) from coast to coast.

SEPTEMBER 4 — First TV transmission over transcontinental radio-relay as President Truman opens Japanese peace conference in San Francisco.

SEPTEMBER 15 — First local and toll auxiliary desk in service at Harrisburg. One team of operators handles all auxiliary services—toll rate and route, toll information, intercepting and local information.

SEPTEMBER 29 — Regular coast-to-coast TV service began over transcontinental radio-relay system.

OCTOBER 6 — Dallas-Houston coaxial cable system in service.

NOVEMBER 10 — Trial of long distance customer dialing began at Englewood, N. J. Mayor Denning of Englewood dialed first call to Mayor Osborne at Alameda, California.

DECEMBER 7 — Color television of a heart operation sent by TV from Los Angeles to medical groups in Chicago and New York during American Medical Association meeting.

1952

JANUARY 11 — Trial of aluminum conductor cable announced when the National Production Authority granted requests to free aluminum for this purpose. Copper was on short allowance because of military needs. (The copper shortage cleared up during the year.)

JANUARY 12 — Winter storms caused trouble. Radio-relay station on Mount Rose, Nevada, failed because of loss of commercial power.

JANUARY 22 — Air crash at Elizabeth, N. J. Mobile telephone cars at the scene were of great help to police and officials. Same day: Floods at Los Angeles, such cars bridging gaps in local communication.

FEBRUARY 5 — First type "O" carrier, for short-haul use in open wire plant, placed in service in West Virginia.

FEBRUARY 6 — Overseas telephone service opened to Iraq.

Other Openings:

April 1 French West Africa
July 14 Azores

July 14 Madeira Is.
July 14 Cape Verde Is.
July 14 Angola
July 14 Mozambique
September 1 Lebanon
October 1 Madagascar
November 15 Aden

FEBRUARY 8 — Field trial of handset shoulder rests announced. Two designs supplied by Bell Laboratories.

MARCH 1 — Revised toll tariffs effective. The change, approved by the F.C.C., called for both increases and decreases in schedules, but the overall effect was to increase interstate revenues, while narrowing some differences between intra- and inter-state charges.

MARCH 17 — Aluminum cable trials began.

MARCH 21 — International toll dialing began shortly before this date between exchanges near Detroit and two exchanges in Ontario.

APRIL 1 — Reduced prices effective on some Western Electric equipment.

APRIL 27 — Mud slides in a small canyon 24 miles west of Salt Lake City interrupted service on the central transcontinental cable (K-Carrier with 750 message circuits).

GENERAL — During April, Western Electric began shipments of equipment for use of pre-lashed aerial cable.

MAY 16 — Limited deliveries of 1A answering set, developed by Bell Laboratories, started about this time.

MAY 23 — Increase of almost five percentage points in average of toll calls filed by number noted, after a year of interdepartmental effort to promote this practice.

JULY 11 — Extensive trials of pre-lashed cable method under way.

JULY 21 — Earthquake at Tehachapi, California.

AUGUST 1 — Reductions effective in prices of nearly all products of Western Electric's own manufacture.

AUGUST 22 — Earthquake at Bakersfield, Calif.

OCTOBER 1 — Service to Madagascar opened.

OCTOBER 3 — Decision to offer telephones with illuminated dials announced.

OCTOBER 4-5 — Pilot installation for anti-aircraft command tested.

OCTOBER 6 — National Safety Council Award of Honor to Bell System presented.

1952 (Cont'd)

OCTOBER 24 — Recorded announcement system for company managements with dial PBX's announced. Three units were then in service.

OCTOBER 24 — Alaska landline cut into service between Anchorage and TOK junction on the Alcan Highway. Western Electric, Long Lines and Bell Telephone Laboratories cooperated to build this line for the Army Signal Corps.

NOVEMBER 4 — Election returns on TV to 110 stations.

NOVEMBER 23 — The Cincinnati and Suburban Telephone Company reached goal of 100 per cent dial service.

DECEMBER — Year-end review found TV network service available to 114 stations in 71 cities.

DECEMBER 11 — "Carmen" telecast from Metropolitan Opera House stage to 31 theaters.

1953

JANUARY 1 — Overseas telephone service extended to New Caledonia. Other openings:

February 13 Syria (re-established)
February 16 Turkey (direct circuit)
July 23 Macao

JANUARY 2 — New testing procedures tried out in new No. 5 office at Hyattsville, Maryland, indicate possible reductions in Western installation time and amount of testing equipment required, as well as a reduction of telephone company cutover interval.

JANUARY 9 — Nearly 100,000 telephones in Maryland, Pennsylvania, New Jersey, New York, Connecticut, Ontario and westward to Northwestern Bell territory were out of service because of an ice storm.

JANUARY 19 — Bell System facilities extended to Toronto—establishing first regular video link between the two countries.

JANUARY 20 — First coast-to-coast telecast of Presidential inaugural ceremonies.

FEBRUARY 6 — Test desk observations plan announced to improve overtones of repair service.

FEBRUARY 20 — Study under way to develop improved facilities for air traffic control. Indianapolis to be the location of a "laboratory of the Air Navigation Development Board, for trying new ways of handling aircraft traffic control and operations. Pilot study of Bell suggestions to be made at Boston."

FEBRUARY 24 — L3 Coaxial Cable System placed in commercial service after a year or more of field trials. With L3, one pair of coaxials can provide up to 1800 telephone channels or 600 telephone channels plus two oppositely directed 4 mc TV channels. The older L1 system provides up to 600 telephone channels or two 2.7 mc TV channels.

MARCH 2-3 — Joint meeting of O. & E. Long Range Planning Committee and U.S.I.T.A. Subscriber and Operator Toll Dialing Committee. Plans discussed to integrate Bell and Independent company plant as required for nationwide dialing.

MARCH 30 — First commercial use of card translators in A4A toll office at Pittsburgh. The routing card has holes in it. Light rays pass through these to activate phototransistors which in turn operate the relays necessary to advance the call.

APRIL 15 — Television equipment at the A.T.&T. annual meeting made it possible for overflow crowds to witness what went on from adjoining rooms at 195 Broadway.

APRIL 24 — New practice on "leave-word" calls announced. Operator to supply called party with originating number if caller desires. Practice scheduled to be introduced in June and be in use everywhere by August.

APRIL 24 — Revision of practices begun in 1951 more than half complete. To continue on a reduced basis.

APRIL 29 — 3-D television broadcasting demonstrated by American Broadcasting Company over KECA-TV, Los Angeles.

MAY 17 — First 4A toll crossbar system cutover at Scranton. An important milestone in the development of nationwide toll dialing.

JUNE 1 — Radio-relay system placed in service for use by Illinois Power Company (right-of-way service) by Illinois Bell. Right-of-way sales now producing important revenue.

SEPTEMBER 25 — Improved telephone answering set announced.

OCTOBER 1 — Revised interstate telephone rates effective throughout U.S. New rates brought inter- and intra-state charges more nearly into line, and increased Long Lines revenue.

OCTOBER 30 — Experience with printing only 2-letter abbreviations of central office names in directories is found satisfactory. Saves printing costs, does not interfere with dialing.

NOVEMBER 8 — First installation of centralized automatic message accounting (CAMA) cut into service at Washington, D.C. Equipment placed at one point serves several central offices. At Washington, it permitted customers to dial toll calls over a more extended area.

NOVEMBER 13 — Bolted case with seals for closing cable splices under trial for splicing large cables. Based on a closure devised for polyethylene sheaths. It would save wiped solder joints.

NOVEMBER 18 — Installation of 50,000,000th U.S. telephone on desk of President Dwight D. Eisenhower. (See Public Relations releases for details of joint ceremony by Bell and Independent representatives.)

1953 (Cont'd)

NOVEMBER 20 — Birmingham, Mich., suburb of Detroit, able to dial "nationwide." This was the second community (Englewood, N. J., first) to have this service.

DECEMBER 1 — Plans for transatlantic telephone cable announced.

DECEMBER 3 — Valley office (East Pittsburgh) third to open for customer nationwide toll dialing.

DECEMBER 18 — F.C.C. approved color television standards, to begin January 1, 1954.

DECEMBER 18 — First installation Nike anti-aircraft missile station announced for Fort Meade "soon."

New, all-metal outdoor telephone booth was announced at the end of 1953.

1954

JANUARY 1 — First TV program in compatible color—the Tournament of Roses from Pasadena, Calif., received in 18 cities.

JANUARY 25 — Snow and sleet in Washington-Oregon interrupted 550 LD circuits, isolated 5 Independent, 14 Bell exchanges.

FEBRUARY 11 — Body belts and climber straps of nylon, impregnated with Neoprene, announced as standard for men who climb poles. Stronger, not subject to heat damage or leather deterioration.

FEBRUARY 28 — L3 carrier, Cleveland-Chicago, in commercial service.

MARCH 12 — Illuminated dial announced ready for offer in April.

MARCH 15 — Ice, wind and snow caused \$805 million damage in N. Dak. and S. Dak., Nebraska and Iowa.

MARCH 19 — No. 28 teletypewriter available to companies; Western's output previous to this had been absorbed by military orders. Has a new principle for moving type under a hammer that strikes always at one point. Quieter and easier to maintain than older models.

MARCH 25 — Fire destroyed Rugby, N.D., manual office, 1200 telephones. Emergency service from seven switchboard positions was operating within two hours.

APRIL 1 — World War II excise taxes on telephones reduced.

APRIL 2 — Central Record Plan that was started during World War II revised and extended. Western Electric is keeper of the records which provide a means whereby materials no longer needed by any particular Bell company are made available to other companies.

APRIL 12 — During this week, the first repeater was put in operation in trial of the transistorized rural car-

rier system at Americus, Georgia. The repeater includes transistor amplifiers made on printed wiring cards; first application of this technique on Bell lines. Amplifier elements, transistors, condensers, resistances are mounted on a plastic card and the connections between them are provided by lines of conducting material that are printed on the surface of the card. The original process for this was developed by the U. S. Bureau of Standards.

APRIL 25 — Bell Solar Battery announced by Bell Telephone Laboratories. Grew out of attempts to make a silicon transistor. (See Labs. releases this date and after. Also Labs. Record.)

MAY 2 — Dallas, Pittsburgh and Washington first full offices converted to 4A toll dialing operation.

MAY 10 — Overseas telephone service extended to Portuguese India. Other openings during the year:

June 1 British Malaya (direct circuit)
November 22 Thailand

MAY 21 — Broad band antenna announced that will make possible triple-decking of microwave transmission facilities; transmitting and receiving on 4,000, 6,000 and 11,000 megacycle bands.

JUNE 11 — Production of color telephones in eight shades under way. WE produced some 202 sets in color in 1927. In 1937 a few color 302 sets.

JUNE 17 — TV pictures of Marciano-Charles heavyweight fight carried to 61 theaters in 45 cities.

JUNE 18 — Handset with shoulder rest made standard offering. The shoulder support is removable and can be plugged onto the handset grip.

JUNE 29 — Record flood on Rio Grande cut 54 of 63 long distance lines between U. S. and Mexico.

JULY 2 — Hands-free Speakerphone in limited production.

Automatic alternate routing of toll calls well under way.

JULY 14 — Wind and rain in C. & P., New York, Pennsylvania, Ohio and New Jersey areas caused \$620,000 damage.

JULY 23 — Application on file with F.C.C. for submarine cable system between Port Angeles, Washington, and Ketchikan, Alaska; 36 circuits to connect with Alaska Communications System (branch of U. S. Signal Corps) with radio link from Port Angeles to U. S. telephone network at Seattle.

One-man cable splicing reported feasible.

AUGUST 6 — Sleeve and tool method of splicing cable conductors without removing insulation on trial. The tool causes the metal sleeve to puncture the insulating paper and make contact with the copper or aluminum conductor.

AUGUST 13 — Colored retractile cords offered.

AUGUST 31 — Hurricane "Carol." Damage, \$5½ million. (See O. & E. Notes, 9/3/54; Ann. Rept. 1954, etc.)

1954 (Cont'd)

SEPTEMBER 10 — Special direct dispatching for mobile units tried at Baltimore.

SEPTEMBER 11 — Hurricane "Edna" knocked out almost as many telephones and more long distance circuits than "Carol."

OCTOBER 1 — Long Lines channel rates for TV transmission, including audio and video, placed in effect. Prior to this, separate rates applied to audio and video.

OCTOBER 1 — Plans for an over-the-horizon radio transmission system between Florida and Cuba announced as filed with F.C.C.

OCTOBER 15 — Hurricane "Hazel." Total damage, all three hurricanes, \$17 million. (See 1954 Annual Report.)

OCTOBER 15 — Los Angeles-Amarillo TD-2 system (on 3 bands) on file with F.C.C.

OCTOBER 22 — Dictation recording trunks for PBX's offered after satisfactory trials.

NOVEMBER 5 — New wall telephone sets announced.

NOVEMBER 9 — Plaque in honor of Alexander Graham Bell unveiled in lobby at 195 Broadway, New York City, by Mrs. Gilbert Grosvenor and Mrs. David Fairchild. Sculptor: Paul Manship.

NOVEMBER 12 — Two miles of line wire laid on cross-arms of poles in California mountain country from a helicopter.

NOVEMBER 21 — White Plains 4A toll switching center cut into service.

DECEMBER 14 — I.D.P. service (Integrated Data Processing) began between Cincinnati, Ohio, and New York City. Data from punched cards in Ohio ultimately were fed into a computer in N. Y., but this service is constantly being refined and changed.

DECEMBER 21 — Earthquake at Eureka, Calif.

1955

STORMS — Ice storm, Kansas, February 3; 15 Bell, 38 Ind. towns isolated; high winds at Wheeling and Pittsburgh, about March 11; tornadoes Texas, Oklahoma, Kansas, May 25-26; hurricanes, "Connie" and "Diane," August 15-17; floods in Connecticut; rains and floods in Eastern States, October 15-16. Floods in California and Southern Oregon, December 18-27.

JANUARY 28 — Air Defense Nationwide Combat Alert network set up; 98% complete within 60 minutes. (See O. & E. Items for February 18.)

FEBRUARY 18 — New plan for handling tickets on delayed calls sent to companies. Traffic Letter No. 491.

FEBRUARY 25 — Brief of SAGE plan for semiautomatic air defense system appeared in O. & E. Items this date.

MARCH 15 — Overseas telephone service (direct circuit) extended to the Ascension Islands. Other openings during the year:

November 2 French Equatorial Africa

December 19 Oman (Muscat)

MARCH 18 — Initial trial installation of electronic switching announced for Morris, Illinois. Engineering letter on electronic switching sent to companies. (See November 17, 1960.)

APRIL 17 — Crossbar (4A) system at St. Louis cut into service. Other centers at Atlanta, Chicago, Dallas, Denver, Los Angeles, Pittsburgh, Sacramento and White Plains already in service.

APRIL 29 — Plan announced to increase terminal equipment in L1 (coaxial) and TD-2 (radio relay) lines to accommodate 720 instead of 600 circuits.

MAY 13 — Recorded announcements of disconnects and changed numbers to be used in some small dial offices.

MAY 17 — Mrs. Mary L. Kayes, Dutchess County housewife, was convicted of refusing to yield a party-line telephone to report a fire.

JUNE 17 — Trial of tone ringing (through telephone receiver instead of bell) begun at Americus, Georgia.

JUNE 24-25 — New emergency portable radio tried between Parmachenee Lake and Oquossoc, Maine, during a Presidential weekend fishing trip.

JULY 22 — Installers' supply truck being tested with low power radio communication for on-the-road dispatching.

JULY 29 — Bell System TV ("Telephone Time") program announced for future production.

AUGUST 10 — Plans for cable to Hawaii announced.

AUGUST 12 — Mobile community dial office installed in a trailer is proposed for relief use in rural areas, housing developments, etc.

AUGUST 19 — Entire cable system on Nantucket under gas pressure; lowers maintenance costs.

AUGUST 26 — Developments completed to convert 300-type handsets to give most of characteristics of 500-type.

SEPTEMBER 2 — New public emergency reporting system placed in service at Omaha. Permits either signal or conversation from public alarm boxes on streets and has valuable automatic features.

1955 (Cont'd)

SEPTEMBER 26 — First of twin transatlantic telephone cables completed between Clarendville, Newfoundland, and Oban, Scotland. Laying began June 22. The cable stretched 1940.8 nautical miles; 1850 route miles.

OCTOBER — Caribbean cable to provide wire communications to the 1000-mile guided missile range between Florida and Puerto Rico turned over to the Air Force by the Bell System.

OCTOBER 4 — First trial of Bell Solar Battery in actual service began on carrier system at Americus, Georgia.

OCTOBER 27 — Automation discussed before a Congressional subcommittee by Clifton W. Phalen.

NOVEMBER 1 — "A" Division, O. & E. Department, established to handle requirements of large industrial customers.

1956

GENERAL — The nation's telephones passed the 59 million mark in September. The total was made up of 48,546,000 Bell System telephones, 8,575,000 operated by independent companies, 1,532,000 by companies where A.T.&T. holds a minority stock, and 348,000 service stations.

The \$565 million raised by the A.T.&T. stock offer brought the total new capital added by the Bell System in the postwar period well past the \$10 billion mark. Capital added during this period was 2½ times the entire capital investment in the Bell System accumulated from the founding.

At the end of the year, the System had added 3,227,000 telephones—almost as many as the record gain in 1946. Some 11,000,000 customers could dial nearby cities directly and 2,700,000 could dial as many as 20,000,000 other telephones all over the nation. Eighty-nine per cent of all Bell System telephones were dial operated. Employees totaled 787,000. There were 1,492,000 share owners.

JANUARY 3 — Name of The Chesapeake and Potomac Telephone Company of Baltimore City changed to The Chesapeake and Potomac Telephone Company of Maryland.

JANUARY 20 — Bell Laboratories announced new type of transistor that could replace vacuum tube in many telephone and TV jobs. It is capable of amplifying 2500 conversations simultaneously on a telephone line—three times as many as the best previous transistor.

JANUARY 24 — A final judgment limiting the Bell System to common carrier communications and government projects, but preserving the long standing relationships between the manufacturing, research and operating arms of the System, was entered in the U.S. District Court in Newark, N. J., by consent. It brought to a close the Justice Department's seven-year-old antitrust suit against A.T.&T. and Western Electric which sought separation of the System's manufacturing from its operating and research functions. (See A.T.&T. bulletin *Current Information*, Jan. 31.)

FEBRUARY 1 — In largest single Direct Distance Dialing cutover to date, 350,000 telephones were switched in 53 New York company central offices.

MARCH 27 — Southern Bell installed its 5 millionth telephone in the office of Gov. Frank G. Clement at Nashville, Tenn. Gov. Clement accepted telephone as chairman of the Southern Governors' Conference on behalf of the entire region.

APRIL 8 — Bell System's first network television show, "Telephone Time," introduced over the CBS-TV network at 6 p.m. (EST). John Nesbitt narrated the weekly half-hour filmed dramatizations.

APRIL 15 — San Diego, Calif., became first large city where all customers could dial their own calls to millions of other telephones in metropolitan areas from coast to coast.

APRIL 18 — The 71st Annual Meeting of A.T.&T. Share Owners was held in new company quarters at 50 Varick St., New York City. A \$2 billion construction program for 1956 was announced by President Cleo F. Craig.

APRIL 27 — The use of transistors and solar batteries in a rural telephone system were proven successful at the end of a five-month field test in Americus, Ga. Bell Laboratories and the Southern Bell company cooperated in the test that included the use of the Bell solar battery to furnish electricity to power telephone calls for the first time.

MAY — Announcement made of increase in cash awards that accompany Vail Medals, effective January 1, 1956. Awards for Gold medal boosted from \$1,000 to \$2,500; Silver, from \$500 to \$1,000; Bronze from \$100 to \$250.

JULY 15 — First No. 5 Crossbar office in Canada cut over at Chatham, Ontario by Bell Canada.

AUGUST 14 — Actual laying of transatlantic telephone cable completed when cable ship *Monarch* arrived at Clarendville, Newfoundland, and last section was spliced to shore-end cable. (See September 25, 1956.)

AUGUST 18 — Alexander Graham Bell Museum opened at Baddeck, Nova Scotia. Canadian government officials and representatives of the telephone industry attended. Mrs. Gilbert Grosvenor and Mrs. David Fairchild, daughters of Dr. Bell, formally opened the museum.

AUGUST 20 — Editions of *New York Times* transmitted to delegates at Republican National Convention in San Francisco via video channel. New system permitted facsimile transmission at higher speed than was previously possible. Largest TV hook-ups to date were provided for this and the Democratic National Convention (Chicago, August 13).

AUGUST 23 — Bell Laboratories announced their experiment with "picture phone" transmission that sends pictures along with sound over regular telephone lines. Small screen (up to 2 by 3 inches) permits persons talking by telephone to see each other.

1956 (Cont'd)

SEPTEMBER 5 — At a special meeting, A.T.&T. share owners approved an increase in the authorized stock of the company from 60 million to 100 million shares for financing program designed to produce up to \$575 million in new capital through issuance of rights to existing share owners to buy common shares at \$100 par in the ratio of one new share for each ten held.

SEPTEMBER 19 — Frederick R. Kappel, president of Western Electric, elected the ninth president of A.T.&T. He succeeded Cleo F. Craig, who became chairman of the board.

Mr. Kappel was born January 14, 1902 in Albert Lea, Minnesota. He received a B.S.E. degree from the University of Minnesota and joined the Northwestern company as a groundman in 1924. He became vice president-operations in 1942, moved to A.T.&T. in New York as assistant vice president, O. & E. in 1949. Later he was vice president, Long Lines Department, then vice president, O. & E. In January, 1954, he became president of Western Electric. Mr. Kappel married Ruth Carolyn Ihm in 1927. They have two daughters.

Arthur B. Goetze, vice president-manufacturing, succeeded Mr. Kappel as president of Western Electric.

SEPTEMBER 25 — Transatlantic cable opened at 11 a.m. (EST) with a three-way call between A.T.&T. Board Chairman Cleo F. Craig and F.C.C. Chairman George C. McConnaughey in New York, British Postmaster General Charles Hill in London, and Minister of Transport George Carlyle Marler in Ottawa. The ceremony was viewed and heard by thousands who gathered at Bell System company and Long Lines area headquarters buildings. On the first full day of commercial service (Sept. 26), 588 completed US-UK calls passed over the cable—75 percent more traffic than the average for the ten previous business days. (See October, 1956, employee magazines.)

SEPTEMBER 30 — Toronto-Winnipeg portion of the trans-Canada TD-2 system placed in service by Bell of Canada. The system will provide both message and TV service when completed.

NOVEMBER 19 — First of a series of one-hour color television programs on science inaugurated by the Bell System over CBS network. First was titled "Our Mr. Sun."

DECEMBER 10 — The 1956 Nobel Prize in physics awarded to inventors of the transistor: Dr. Walter H. Brattain of Bell Laboratories, Dr. William Shockley and Dr. John Bardeen.

DECEMBER 11 — Alaska submarine cable formally opened with ceremonies in Washington, D.C., Seattle and four Alaska cities. The ceremony climaxed two years of work and an investment of \$21 million. The A.T.&T. cable, running from Port Angeles, Wash., to Ketchikan, Alaska, is 877 miles long. The Alaska Communication System's cable, joining at Ketchikan and running to Skagway, Alaska, covers an additional 400 miles through inland waterways along the Alaskan coast. (See *Long Lines* magazine, Jan., 1957.)

Overseas telephone service extended to the following countries during the year:

January 13	Kuwait
November 1	Saudi Arabia
November 1	Jordan

1957

MARCH 11 — Exhibit telling story of the development of the telephone opened at the Smithsonian Institution in Washington, D. C.

MARCH 13 — The 50 millionth Bell telephone installed in the home of C.&P. of Maryland employee James S. Russell at Salisbury, Md. Russell had longest service (53 years) among Bell System employees.

MARCH 20 — New television system that transmits images on broadcast quality telephone lines of 5 to 8 KC band width demonstrated at Philadelphia's Franklin Institute. Bell of Pennsylvania described system's main function as industrial.

APRIL 17 — Bell Laboratories announced development of magnetic tape machine capable of transmitting 1,000 words a minute—16 times faster than conventional teletypewriter systems.

MAY 31 — Cleo F. Craig resigned as chairman of the board, A.T.&T., but remained a director and member of the executive committee.

JUNE 12 — Western Electric Company broke ground for its \$50 million Columbus plant for manufacturing dial switching equipment.

JUNE 17 — Western Electric "universities" opened in New York, Chicago and Winston-Salem for graduate engineer employees.

JUNE — Bell Laboratories reported development, under an Air Force contract, of a high-speed digital computer about the size of a home TV set and requiring less power to operate. Named the "Leprechaun," more than half of its 9,000 electrical components are transistors.

JULY — Construction of the 3000-mile distant early warning (DEW) line was completed and trials were held through the summer on the \$400 million radar system stretching across the Far North. Western Electric was prime contractor for construction of the DEW line. Federal Electric Corp., a subsidiary of I.T.&T., was given the contract to maintain and operate the line.

JULY 15 — Bell of Pennsylvania began trial operation in Allentown-Bethlehem of a personal signaling service to pocket-size radio receivers worn or carried on the person.

JULY 15 — Cables ship *Monarch* started laying first undersea telephone cable to Hawaii (see Oct. 8).

AUGUST — A.T.&T. obtained registration of its familiar blue bell as a service mark. It had been in use in several forms since 1889.

1957 (Cont'd)

AUGUST 1 — Walter S. Sparling elected president of Ohio Bell Telephone Company to succeed John A. Green who was elected chairman of the board.

AUGUST 12 — "Over-the-horizon" communications link between the U. S. and Cuba completed. The facilities were planned to supplement submarine cables that provide telephone and radio program and marked first time live TV shows could be transmitted between the U. S. and Cuba. The system operates on a principle known as "tropospheric scatter propagation" that permits radio signals to be sent skyward, bounced off a layer of the atmosphere called troposphere, and deflected down to a receiver beyond the curvature of the earth.

SEPTEMBER 30 — Contracts signed between German and French agencies and A.T.&T. for a second underseas transatlantic telephone cable. The cable, scheduled for completion in 1959, will stretch from Clarendville, Newfoundland, to Penmarch, France. (See September 22, 1959.)

OCTOBER 8 — The submarine telephone cable system linking the U. S. mainland with Hawaii opened to public service. The twin cable system, reaching some 2,400 miles between cable terminal points, was built by Long Lines and the Hawaiian Telephone Company. The Pacific Company constructed a 125-mile radio relay link connecting the cable terminal with the nationwide telephone network at Oakland.

DECEMBER 6 — First public air-ground telephone call made from a commercial airliner. The call was from about 150 miles west of Chicago to 195 Broadway, New York City. The service was inaugurated on a trial basis in the Chicago-Detroit areas; some private and government planes started using the service Sept. 15.

Overseas service opened during 1957 included:

January 1	Libya (via London)
March 15	Ethiopia (via London)
April 8	Ceylon (via London)
May 6	Viet-Nam (via Tokyo)
May 29	Fiji Islands (via Sydney)
August 1	Bulgaria (via Austria)
August 28	Tortola Island (via St. Thomas, V. I.)
September 8	Netherlands New Guinea (via Amsterdam)
December 2	St. Helena (via Ascension Is.)

1958

JANUARY 15 — Special meeting of share owners authorized A.T.&T. to issue \$718 million in convertible debentures and to offer up to 7 million shares of stock to Bell System employees.

JANUARY — Bell System's Data-Phone service, which permits high-speed transmission of data over regular telephone circuits, announced. (Introduced throughout System in 1960.)

JANUARY 31 — Army's Explorer satellite, sent into space from Cape Canaveral, contained radio transmitters operated by Western Electric-manufactured transistors.

MARCH 17 — Solar cells of the type invented by Bell Laboratories powered radio transmitter in Navy's Vanguard I satellite.

MARCH 26 — "White Alice," the radio transmission web in Alaska, turned over to Air Force by Western Electric, whose technicians directed the building of the project. It uses an over-the-horizon method of transmission to link outposts of the Alaskan Air Command and the DEW Line.

MARCH — Costliest storm damage to date in Bell System history when 650,000 telephones were knocked out of service in a heavy, wet snowstorm which extended from Virginia to New England. Restoration work cost approximately \$11 million.

APRIL 30 — First offering under 1958 employee stock plan announced. The installment purchases were limited to one share per \$400 of annual salary.

MAY — Work began on Western Electric's office building across from A.T.&T. headquarters in New York City. (See April, 1961.)

JUNE 25 — The FCC directed A.T.&T. to cut its rates for privately leased telephone circuits by about 15 percent.

JUNE 30 — Last performance of the *Telephone Hour*—the eighteen-year-old radio program of semi-classical music.

JUNE 30 — Largest private industry group insurance program in existence became effective for entire Bell System. It covered more than 750,000 active and retired employees. The insurance was handled by eleven life insurance companies located in all parts of the country. Each Bell company selected its own insurance company to run its plan. The contribution of active employees to the plan amounted to 50 cents monthly for each \$1,000 of life insurance above the first \$1,000.

SEPTEMBER 24 — Westrex Corporation, subsidiary of Western Electric, was purchased by Litton Industries. Westrex is an international marketing organization which distributes and services abroad a line of communication products. Domestically, it distributes and services recording equipment.

OCTOBER 1 — Paul A. Gorman succeeded William A. Hughes as president of the New Jersey Bell Telephone Company.

OCTOBER 6 — "Continental Classroom," college classroom lectures televised on a nationwide basis, began. Bell system joined with several leading business concerns to support the programs.

1959

JANUARY 1 — Dr. James B. Fisk succeeded Dr. Marvin J. Kelly as president of the Bell Telephone Laboratories.

1959 (Cont'd)

JANUARY — Call Director telephone introduced in the Bell System.

FEBRUARY 28 — Five years substituted for ten as the salary base for employee pension plan.

MARCH 17 — H. I. Romnes, A.T.&T. vice president, elected president of the Western Electric Company to succeed Arthur B. Goetz who died March 9.

APRIL 1 — E. Hornsby Wasson, A.T.&T. vice president, became president of the New Jersey Bell Telephone Company, succeeding Paul A. Gorman who was elected executive vice president, A.T.&T.

APRIL 12 — Washington, D. C., became biggest metropolitan area to date to be fully equipped for Direct Distance Dialing.

APRIL 15 — Share owners at A.T.&T. annual meeting endorsed 3 to 1 stock split. Some 12,000 share owners attended the meeting in the Kingsbridge Armory in the Bronx. The stock split carried with it a dividend rate equivalent to \$9.90 per year, as contrasted to the traditional \$9 paid each year since 1922.

APRIL 15 — At A.T.&T. annual meeting, a major addition to the facilities of the Bell Laboratories was announced. The plan — a \$20 million laboratory at Holmdel, N. J. (See October 9, 1962, and December 5, 1966.)

APRIL 15 — Marketing Department established at A.T.&T.

APRIL 30 — Second offering under the Employees' Stock plan authorized in 1958 went into effect.

MAY 1 — Clifton W. Phalen became president of the New York Telephone Company, succeeding Keith S. McHugh.

JUNE 18 — First transmission of motion picture film over transatlantic cable was accomplished by slow-scan technique. One minute of newsfilm, transmitted a frame at a time, showed London departure of Queen Elizabeth II for Canada. Sequence was broadcast over Canadian Broadcasting Corp. and NBC TV networks.

JULY — Southern Bell Telephone and Telegraph Co. introduced two-way mobile radio dialing service on a limited basis in Chattanooga, Tenn.

JULY — Public Service Commission approved New York company's proposal for additional charge for unlisted telephone numbers.

AUGUST 20 — Bell Laboratories announced development of a self-contained electronic artificial larynx for persons who have lost their voices through surgical removal or paralysis of the vocal cords. The device, which provides a substitute voice, was described by Harold L. Barney in a talk at the Western Electronic Show and Convention in San Francisco. It was planned for distribution in 1960. (See September, 1960.)

SEPTEMBER — The Princess telephone, produced in white, beige, pink, blue and turquoise, introduced in selected areas in the Bell System.

SEPTEMBER 22 — Second transatlantic telephone cable system, first to link North America directly to Europe, placed in service. The Twin-cable system, jointly owned by A.T.&T. and French and German communications administrations, spanned 2,500 miles between Clarendville, Nfld., and Penmarch, France.

SEPTEMBER 23 — Western Electric announced plans to construct first permanent units of its Engineering Research Center in Hopewell Township, N. J.

DECEMBER 19 — New "over-the-horizon" system opened between Florida and the Bahamas.

GENERAL — Record net gain in telephones for year was 3,298,000, topping previous high in 1946, bringing the Bell System total to nearly 58 million — 96 percent dial-operated. Some 15 million customers were able to dial long distance calls.

Annual report was made available in Braille and on talking records for blind share owners.

1960

JANUARY 7 — Long Lines made filing with FCC to result in net decrease in interstate telephone revenues of \$3 million annually, effective February 7. A special feature of filing was a new system for measuring distances to determine rates. The new method — called VH — is based on use of vertical and horizontal coordinates. By making allowances for curvature of earth's surface, it permitted a more accurate calculation of distances than could be made from conventional flat map.

JANUARY 17 — Over-the-horizon radio system—Florida to Nassau, Bahama Islands — opened. The system, spanning 186 miles, initially carried 24 voice circuits.

JANUARY 20 — A.T.&T. directors voted to proceed with new employee stock offering, with allotment payments to begin in July.

JANUARY 25 — Details of work underway to create a globe-girdling communication data and tracking network for Project Mercury disclosed by National Aeronautics and Space Administration with the signing of a contract with Western Electric to head industrial team engaged in the project. Preliminary work began in mid-1959. (See September, 1961.)

JANUARY 26 — U. S.-Puerto Rico submarine telephone cable opened. The 1,250-mile twin-cable system was built by Long Lines and the Radio Corporation of Puerto Rico, a subsidiary of I.T.&T. System enabled U. S. operators to dial directly to all phones in San Juan. San Juan operators could dial direct on 90 percent of all calls to U. S. and Canada.

FEBRUARY 1 — Carl O. Lindeman became president of the Pacific company, succeeding Mark R. Sullivan who was elected chairman of the board.

FEBRUARY 1 — A new division of the Pacific company, known as Pacific Northwest Telephone, and headed by Walter W. Straley as president, went into operation. The unit consisted of the states of Oregon and Washington and the northern part of Idaho, with headquarters in Seattle. (See July 1, 1961.)

FEBRUARY 2 — First guided test flight of Air Force Titan ICBM. Second stage of missile was steered by Bell

1960 (Cont'd)

Labs Command Guidance System. BTL was teamed with Remington Rand-Univac, developer of the computer used in guidance system.

FEBRUARY 4 — Australian Government announced plans to complete a trans-Pacific submarine telephone cable linking Vancouver, B.C., with Australia and New Zealand by 1964.

MARCH 6 — First large All-Number Calling (ANC) conversion — Council Bluffs, Iowa (26,000 telephones) — since trial of this system in Wichita Falls, Texas. A number of smaller towns in Bell System and Independent Company territory were converted prior to this.

MARCH 21 — Long Lines announced first use of TASI (Time Assignment Speech Interpolation) to increase conversation capacity of first transatlantic telephone cable, opened in 1956 between North American mainland and Great Britain. Transmission system takes advantage of idle time during conversations to provide more talking paths. (See September 16.)

APRIL 1 — TIROS I, television-equipped meteorological satellite, placed in orbit. This first robot space weatherman was directed into orbit by the Bell Laboratories command guidance system.

APRIL 20 — Record \$2.6 billion construction program for 1960 announced by A.T.&T. President Kappel at Annual Meeting of Share Owners.

MAY 1 — Roy C. Echols became president of Indiana Bell Telephone Company.

JUNE 19 — New York metropolitan area became 100 percent dial with cutover of 7,200 manual telephones serving Oyster Bay and Bayville in Nassau County.

JUNE 21 — Long Lines filed plans with FCC for submarine telephone cable between New Jersey and Bermuda.

JULY 11 — Bell System outlined plan for space communications network in testimony filed with the FCC. Plan proposed system of about 50 satellites in random polar orbits to provide communications facilities between U. S. and all areas of the world.

JULY 21 — Agreement announced between A.T.&T. and British Post Office to construct a new transatlantic telephone system of single cable design — the first telephone cable direct from the U. S. to Great Britain.

AUGUST 3 — Bell Laboratories scientists carried on a coast-to-coast telephone conversation by "bouncing" their voices off the moon. Signals were beamed from Holmdel, N. J., via the moon, to the Jet Propulsion Laboratory in Goldstone, Calif.

AUGUST 12 — Project Echo experiment successful as 100-foot balloon satellite was placed in orbit. Taped message by President Eisenhower, sent from Jet Propulsion Laboratory in California, was bounced off the balloon and received by Bell Laboratories at Holmdel.

AUGUST 15 — Project Echo satellite communication system and conventional telephone circuits linked together to transmit a telephone call from California to New Jersey.

SEPTEMBER 16 — Long Lines announced capacity of ocean telephone cable between North American and European continents increased from 36 to 84 conversations by new type terminal equipment and a transmission system known as TASI (Time Assignment Speech Interpolation). (See March 21.)

SEPTEMBER — Bell companies began making available an electronic larynx to voiceless persons.

OCTOBER 5 — Bell Laboratories scientists demonstrated an experimental "optical maser," a device which generates light waves that eventually could be controlled and amplified like radio waves.

OCTOBER 21 — Long Lines filed application with the FCC seeking approval of a space communications experiment using "active" satellites. Company also asked for changes in Commission rules which would allow it to proceed, following tests, with the initial stages of commercial service.

OCTOBER 26 — A.T.&T. announced plans for deep-sea cable in the Caribbean — 322 miles between Puerto Rico and Antigua, via islands of Tortola, Dog and St. Kitts.

NOVEMBER 1 — Market trial of Touch-Tone calling undertaken in Findlay, Ohio.

NOVEMBER 3 — Overseas telephone service opened to Paraguay, South America, with terminal at Asuncion, reached via Rio de Janeiro (service originally opened October 11, 1935).

NOVEMBER 17 — World's first electronic telephone central office began undergoing a customer trial at Morris, Ill. (See March 18, 1955.)

NOVEMBER 17 — Long Lines Department announced plans for a specially designed ship to lay oceanic telephone cables.

NOVEMBER 23 — TIROS II, the National Aeronautics and Space Administration's weather satellite, launched at Cape Canaveral, was directed into orbit by Bell Laboratories Command Guidance System.

NOVEMBER 23 — Overseas telephone service opened to Cambodia via Tokyo, with terminal at Phnompenh.

DECEMBER 23 — Overseas telephone service opened by direct circuit to Tahiti, with terminal at Papeete.

DECEMBER 23 — A.T.&T. announced plans for a large-capacity undersea telephone cable between the United States and Jamaica, to be completed by late 1962.

DECEMBER — First telephone bills produced by Electronic Data Processing (EDP) were mailed to customers from Conshohocken, Pa. The heart of the system was an IBM 7070 computer. Trials in some other Bell companies began in 1961.

GENERAL — System extended DDD to half of System's customers; dial-operated telephones reached 97 per cent of total 60,700,000 telephones in use. Bell Chime introduced during first quarter.

1961

JANUARY 3 — New \$7 million Western Electric distribution center opened at Yonkers, N. Y.

JANUARY 15 — Wide Area Telephone Service (WATS) went into effect. This new service permitted customers to pay a flat, monthly rate for interstate long-distance service, and was designed for customers with large volumes of telephone communications over a wide area.

JANUARY 16 — Bell System proposed a new service, called TELPAK, which would create "electronic highways" between specified points, over which many types of communications could be transmitted.

JANUARY 18 — A.T.&T. directors voted to proceed with additional offering of company's stock under the Employees' Stock Plan; offering to be made on April 28.

JANUARY 19 — FCC authorized A.T.&T. to operate experimental radio stations for basic earth-satellite communications study ("Project Telstar"). (See January 27 and July 28.)

JANUARY 23 — Overseas telephone service opened to the island of Reunion, via Paris.

JANUARY 27 — NASA announced cooperative agreement with A.T.&T. to launch Telstar satellite during 1962.

JANUARY 31 — First continuously operating optical maser, a device potentially capable of carrying vast numbers of telephone calls and TV programs, demonstrated by Bell Laboratories at press conference.

APRIL 3 — First contingent of employees moved into new Western Electric building at 222 Broadway, New York City.

APRIL 19 — More than 18,000 share owners attended A.T.&T.'s Annual Meeting in Chicago — first meeting held outside New York City.

MAY 1 — In response to an FCC inquiry, A.T.&T. proposed that international communications common carriers in this country and abroad establish space communication system that would be jointly owned and operated.

MAY 17 — A.T.&T. directors approved increase in quarterly dividend to 90 cents a share. (Since July, 1959, a 82½ cents-a-share quarterly rate had been paid. Prior to that, the company had held to a \$9-a-share yearly rate since May 17, 1921.)

MAY 28 — Blasts destroyed three radio relay stations in Nevada and Utah (two men later convicted on charges of conspiracy and obstructing vital communications).

JUNE 20 — New Jersey Bell Telephone Company's 3 millionth telephone installed.

JULY 1 — Pacific Northwest Bell Telephone Company officially began operations to serve Washington, Oregon and Idaho. The new company had been an operating division of The Pacific Telephone and Telegraph Company since January, 1960.

JULY — Western Electric announced operation of the first fully automated process ever used for making

precision components. At their North Carolina works, a 110-foot production line, controlled by a single computer, made, inspected and packed deposited carbon resistors at a rate of one every three seconds.

JULY 25 — FCC named Ad Hoc Committee of U.S. international communications common carriers to draw up plan for establishment and operation of a communications satellite system.

JULY 26 — Mr. and Mrs. Hugh T. Polson of Wichita, Kansas, became 2 millionth A.T.&T. share owners. (See May 15, 1951 for the 1 millionth owners.)

JULY 28 — A.T.&T. and the National Aeronautics and Space Administration signed agreement to launch Telstar satellites in 1962.

AUGUST 16 — Frederick R. Kappel, A.T.&T. president since 1956, became chairman of the board. E. J. McNeely, executive vice president, was elected president.

SEPTEMBER 13 — Mercury spacecraft proved in NASA network with the successful flight of an unmanned Mercury craft, tracked by a world-wide network which Western Electric turned over to the National Aeronautics and Space Administration. The 18-station network was built around the globe to track, monitor and provide communications with manned orbiting spacecraft in the future.

SEPTEMBER 24 — Especially designed cable-laying and repair ship *C. S. Long Lines* launched at Hamburg, Germany. Mrs. Frederick R. Kappel christened the vessel, largest in the world of its kind.

SEPTEMBER 26 — Developmental line switched teletypewriter service—forerunner of wide areas service for teletypewriter and data — placed in operation for Delta Airlines.

SEPTEMBER 29-30 — The world's largest inflated earthbound structure, a nylon dome, was erected to serve as a temporary cover for the giant antenna at the Bell System's space communications center near Andover, Me. The dome was constructed to protect the Project Telstar's "eyes" and "ears" until a permanent dome assumed this role.

OCTOBER 12 — Ad Hoc Committee made its report to the FCC calling for creation of a corporation composed of authorized carriers to establish, own and run a satellite system of communications.

NOVEMBER 14 — Western Electric officially turned over to the U.S. Air Force two newly completed defense communication systems. One was the eastern segment of the DEW Line which extends from Canada across Greenland to Iceland. The other, a defense communications system linking Anchorage, Alaska with an Air Force installation at the western tip of the Aleutian Islands.

DECEMBER 7 — Long Lines filed tariff for the Bell System with the FCC on furnishing channels for educational television service. Service was developed for transmission of educational TV programs material to meet requirements of public and private schools, non-commercial educational organizations.

DECEMBER 19 — Transatlantic telephone cable, a link in the projected British Commonwealth overseas cable network, inaugurated by Queen Elizabeth II and Prime Minister John Diefenbaker of Canada. The eastern terminal: Oban, Scotland; western terminal: Grosse

1961 (Cont'd)

Roches, Newfoundland. Long Lines first leased 24 of the 80 circuits.

1962

JANUARY 1 — Two-month test of Bell System's magnetic dialer telephones begun in Buffalo, New York.

JANUARY 8 — Mediphone, a drug information center, opened in Washington, D.C. The center is capable of supplying detailed data on more than 8,000 drugs to doctors throughout the country by telephone. Data is arranged in manageable form with techniques and equipment supplied by Remington-Rand, IBM, and the Bell telephone companies.

FEBRUARY 1 — Revisions in Long Lines message toll and private line telephone service tariffs, to bring them in line with the FCC decision in the railroad interconnection case, became effective. Changes permit interconnection of customer-owned and telephone company facilities at both ends of a through circuit for emergency calls, and at either end—but not both—for calls related to the safety, continuity, or reliability of railroad service.

FEBRUARY 14 — Bids were accepted by A.T.&T. on a \$300 million bond issue, the largest ever offered to date on a bid basis by a corporation.

FEBRUARY 14 — A.T.&T., the Hawaiian Telephone Company and Kokusai Denshin Denwa Co., Ltd., of Japan signed an agreement for a transpacific telephone cable to be laid in 1964. The \$84 million project was scheduled to stretch some 6,300 statute miles between Hawaii and Japan, routed via the islands of Midway, Wake and Guam, with a capacity of 128 simultaneous conversations.

FEBRUARY 20 — Col. John Glenn made his historic three-orbital flight and conversed with earth over 140,000 miles of communications circuits. Communications network was built by team led by Western Electric.

FEBRUARY 27 — Charter and operating agreements signed by Transoceanic Cable Ship Co., and A.T.&T. subsidiary, and Isthmian Lines, Inc., for the cable ship *Long Lines*.

MARCH 1 — John D. deButts succeeded William V. Kahler as president, Illinois Bell Telephone Company.

MARCH — FCC approved "Bellboy" radio paging system on a developmental basis for use at the Century 21 World's Fair in Seattle. This marked the first commercial application of the paging system.

MARCH 21 — Bellcomm, the company founded by the Bell System to assist the National Aeronautics and Space Administration in its manned space flight programs, incorporated. Most of Bellcomm's technical personnel came from Bell Laboratories. Jointly owned by A.T.&T. and Western Electric, the company is located at Washington, D.C. At the outset, Bellcomm, Inc., performed systems engineering studies for NASA on Project Apollo—which will land men on the moon and bring them back.

APRIL 15 — Ellis C. Maxcy succeeded Lucius S. Rowe

as president, The Southern New England Telephone Company.

APRIL 18 — A record \$3 billion construction program for 1962 was announced by A.T.&T. Board Chairman Kappel at the company's Annual Meeting in New York City.

APRIL 19 — A thirteen-story radome replaced the temporary cover for the Bell System's satellite communication station at Andover, Me.

APRIL 21 — President Kennedy, in West Palm Beach, pressed a telegraph key that sent a signal over telephone lines to the Bell System's earth station at Andover, Me., to officially open the Seattle World's Fair. From Andover the giant horn antenna focused on Cassiopeia A and picked up energy emitted by the star that was relayed by earth lines to Seattle.

MAY 28 — The *Wall Street Journal* began publishing first regularly and commercially printed facsimile newspaper for readers in Southern California and Arizona. Printed at Riverside, Calif., the papers were exact duplicates of the Pacific Coast Edition prepared by conventional methods at San Francisco. Transmission was handled over coaxial cable and microwave circuits installed by the Pacific company.

JUNE 21 — Ground broken for Bell Telephone System pavilion at the New York 1964-65 World's Fair.

JUNE 22 — Officials of A.T.&T. and seven associated companies signed "Plans for Progress" statements in Washington to reaffirm their established policy of employment based on merit. Bell companies included the Laboratories, the C.&P. Company, Illinois Bell, Michigan Bell, New York Company, Ohio Bell and the Pacific Company.

JULY 10 — World's first international communications satellite, Telstar®, rocketed into orbit. The 170-pound satellite was launched at 4:35 a.m. aboard a three-stage Delta rocket. First transmission came during Telstar's sixth orbit of the earth when A.T.&T. Board Chairman Kappel made the first telephone call via the satellite from and to Andover, Me., and by land line to Vice President Lyndon Johnson in Washington. (See *Bell Telephone Magazine*, Autumn 1962, for Telstar historic "firsts.")

JULY 10 — Groundbreaking ceremonies held at Succasunna, N.J., for Bell System's first full-scale electronic central office. Office scheduled to begin service in mid-1965. (See May 30, 1965.)

JULY 20 — Nike Zeus defense missile successfully tested in the Pacific when it intercepted a target vehicle boosted by an Atlas intercontinental ballistic missile—the first time an ICBM-type target was intercepted by an antimissile missile. Nike Zeus was developed for the U. S. Army by Bell Laboratories and Western Electric.

JULY 25 — Bell System's "Skyphone" air-ground public telephone service opened for commercial airline use for the first time when TWA inaugurated the service on an experimental basis between St. Louis, Chicago and the East Coast.

1962 (Cont'd)

AUGUST 1 — Western Electric reorganization became effective. Functions of the telephone sales division and some duties of the manufacturing and finance divisions were transferred to the new service and administration divisions.

AUGUST 31 — Bell System's Teletypewriter Exchange Service cut from manual to dial operation on a nationwide basis.

SEPTEMBER 1 — President Kennedy signed bill authorizing the creation of a private corporation to develop an international communications system using satellites such as Telstar®. The corporation was to be financed by the issuance of stock—half for purchase by regular communications carriers and half by the general public.

OCTOBER 1 — The new Office of Satellite Communications, of the FCC, went into operation. Office is responsible for regulatory functions imposed on the FCC by the new satellite communications law.

OCTOBER 5 — Incorporators of company to own and operate space communications system, Communication Satellite Corporation, named by President Kennedy.

OCTOBER 9 — Community open house gave the public its first view of the recently opened Holmdel Laboratory of Bell Laboratories.

OCTOBER 17 — Storms with winds up to 100 miles an hour struck northern California, Oregon and Washington, knocking out 140,000 telephones.

NOVEMBER 26 — Bell Laboratories announced that communications satellite Telstar® had developed difficulties in its command circuit after the 1,242nd orbit on Nov. 23.

DECEMBER 1 — TWX service at speeds up to 100 words per minute introduced.

DECEMBER 1 — Frederick R. Eckley succeeded Walter S. Sparling as president, the Ohio Bell Telephone Company.

DECEMBER 13 — Relay, a communications satellite developed for the National Aeronautics and Space Administration by RCA, launched into space. The Bell System participated by providing launch vehicle guidance, a radiation measurement package in the satellite, and use of the Andover, Me., earth station.

1963

JANUARY 1 — U.S. telephones totaled 80,969,000; world's total reached 159,200,000.

JANUARY 3 — Bell Laboratories engineers succeeded in getting the transmitter and receiver of Telstar® I to operate on command from the ground. The command circuit had stopped working on November 23, 1962. (On February 21, 1963, radiation knocked the satellite out permanently.)

JANUARY 9 — Relay, a communications satellite developed for NASA by RCA, beamed its first full-scale TV program simultaneously to Europe and the U.S. It had been launched on December 13. Relay was tracked from the Bell System space station at Andover, Me.

JANUARY 16 — A.T.&T. directors voted to proceed with an additional offering of the company's stock under the Employees' Stock Plan. Basis of employee participation was to be one share for each \$133-1/3 of basic annual rate of pay.

JANUARY 31 — Announcement made that the Carlisle Chemical Works in New Brunswick, N. J., had been selected for the first commercial testing of the Bell System's 101 Electronic Switching System (see Nov.).

FEBRUARY 19 — New underseas telephone cable opened to link Jamaica to the United States dial network. The 850 nautical mile cable stretched between Florida City, Fla., and a point near Kingston, Jamaica.

MARCH 29 — Overseas operators in the U.S. and the United Kingdom began dialing direct to telephones across the Atlantic. West Germany was linked to the dial network the same day, France on July 10, Italy in the summer, and Switzerland in the fall.

APRIL 1 — Deep-sea telephone cable between Jamaica, W.I., and the Panama Canal Zone placed in service.

APRIL 4 — New "after nine" interstate long distance rates became effective. These reduced to \$1 or less the charges for a three-minute station-to-station call made from 9 p.m. to 4:30 a.m. between any two interstate points in the continental U.S.

APRIL 15 — Overseas telephone service opened to Rwanda.

APRIL 17 — A.T.&T. introduced the new Cable Ship *Long Lines* at Baltimore. The \$19 million vessel, first of her type to be built for operation under the U.S. flag, was designed to string and repair cables across the world's ocean floors.

MAY 7 — Telstar® II placed in orbit to learn further how to overcome the effects of radiation and extend the useful life of communications satellites in space.

MAY 20 — Five new Western Electric Service Division Regions were created, completing a coast-to-coast reorganization aimed at facilitating service to Bell System companies.

JUNE 10 — Overseas telephone service opened to American Samoa.

JULY 22 — Overseas telephone service opened to St. Maartens.

AUGUST 1 — NASA announced that the new *Syncom II* communications satellite had been used successfully to transmit voices live between the U.S. and Africa. At the time of the conversations, *Syncom II* hovered 22,000 miles above the Sahara. The satellite was world's first successful synchronous satellite. The Bell System space station was used for tracking.

1963 (Cont'd)

AUGUST 2 — The Bell System disclosed it was completing initial field tests of a telephone that has the dial in the handle between the ear and mouth pieces. The tests of the instrument, later to be named the Trimline® telephone, were conducted near Detroit.

AUGUST 28 — The new Cable Ship *Long Lines* completed its first assignment, the laying of a 1,300 nautical mile section of a transatlantic telephone cable (TAT3) to link the U.S. mainland directly with England (see October 16). The first section was laid by the British ship *Alert*.

SEPTEMBER 17 — The third and final segment of the Ballistic Missile Early Warning System was put into operation at Fylingdales, England. Western Electric provided the rearward communications network for BMEWS, which flashes information automatically from the three long-range detection sites to NORAD headquarters of Colorado Springs and SAC headquarters in Nebraska.

SEPTEMBER 27 — Overseas service opened to Western Samoa.

OCTOBER 1 — Allen G. Barry, vice president and secretary of A.T.&T., became president of the New England Telephone and Telegraph Company, succeeding Erskine N. White, who was named chairman of the board.

OCTOBER 1 — Harold B. Groh, vice president-operations of the Ohio Bell Telephone Company, became president of the Wisconsin Telephone Company, succeeding Charles E. Wampler, who was elected vice president and secretary, A.T.&T.

OCTOBER 10 — The 304 Conference Switching System, or SCAMA (Station Conferencing and Monitoring Arrangement) was first put into service by the Bell System for the National Aeronautics and Space Administration at Goddard Space Flight Center, Greenbelt, Md. SCAMA serves as the central communications control of NASA's satellite communications and tracking networks.

OCTOBER 16 — New transatlantic telephone cable, linking the U.S. mainland and England directly, placed in service. Construction of the \$47 million system was a joint undertaking of A.T.&T.'s Long Lines Department and the British Post Office. The cable stretches 3,500 nautical miles from Tuckerton, N. J., to Widemouth Bay in Cornwall, England, and has the capacity for transmitting 138 simultaneous conversations.

NOVEMBER — The first commercial all-electronic switching system (ESS #101) went into service at Cocoa Beach, Fla., for the Brown Engineering Co.

NOVEMBER 18 — Touch-Tone® service, featuring telephones with push-buttons instead of rotary dials, introduced in Carnegie and Greensburg, Pa., following marketing trials in Pennsylvania and Ohio. Service was offered on an optional basis at an extra charge.

NOVEMBER 20 — A.T.&T. directors announced plans to make a large new offering of stock to share owners of record on February 18, 1964; to increase the quarterly dividend to \$1 in April, 1964; and to split the stock 2-for-1 in June, 1964.

DECEMBER 4 — British Commonwealth underseas cable system opened between Australia and British Columbia via New Zealand, Fiji, and Hawaii. The Bell System invested in the new cable to assure availability of circuits for U.S.-Australia calls.

1964

JANUARY 1 — H. I. Romnes, president of Western Electric, became a director and vice chairman of the board of A.T.&T. He was succeeded by Paul A. Gorman, A.T.&T. executive vice president.

JANUARY — An old building in New Haven, Conn., which in 1878 housed the nation's first telephone exchange, was designated a national historic landmark by the Department of the Interior.

JANUARY — A continentwide military telephone network, providing long distance private line dial service between major command points, was installed and turned over by Western Electric to NORAD.

JANUARY 2 — Echo II balloon satellite was launched with the aid of Bell Labs-designed, W. E.-developed command guidance equipment at Cape Kennedy and Vandenberg AF Base, Calif.

FEBRUARY 13 — A.T.&T. and RCA submitted a joint proposal to the Communications Satellite Corporation in response to that organization's invitation for proposals for the design of an international commercial communications satellite system.

FEBRUARY 17 — Traffic Service Positions (TSP) cut into service in New York City. The new push-button consoles for long distance operators permit person-to-person and other special types of long distance calls to be dialed directly by customers.

MARCH 2 — The General Electric Company's "switched service" private line network linking 100,000 telephones throughout the country placed in service. GE was the first major customer network to use the Bell System's new Common Control Switching Arrangement (CCSA).

MARCH 25 — Bell Laboratories announced plans to build a new laboratory near Naperville, Ill., which would serve as headquarters for the Electronic Switching Division. The \$7.9 million installation was scheduled for completion in 1966.

APRIL 20 — First transcontinental Picturephone® call made between Bell System exhibit at World's Fair and Disneyland, California. Participating in the call were William L. Laurence, science consultant to the World's Fair, and Donald Shaffer, managing editor of the Anaheim, Calif., *Bulletin*.

1964 (Cont'd)

APRIL 20 — Telephone service opened to the islands of Midway and Wake via a section of the Pacific cable.

APRIL 22 — Bell System exhibit at the New York World's Fair opened by A.T.&T. Board Chairman F. R. Kappel and Clifton W. Phalen, president of the New York Telephone Company.

MAY 4 — The last Number Eight Common Battery Switchboard in the Bell System was replaced by a 990-line community dial office. Purchased from W. E. by the Missouri and Kansas Telephone Company (now part of Southwestern Bell) and installed at Caney, Kan., the manual type switchboard was in use 54 years.

JUNE 1 — AT&T effected a two-for-one stock split.

JUNE 1 — Claude M. Blair became president of the Ohio Bell Telephone Company, succeeding Frederick R. Eckley who was elected executive vice president, A.T.&T.

JUNE 9 — Western Electric announced that, beginning July 1, it would reduce prices of the products it makes for the Bell companies by some \$44 million a year at current sales levels.

JUNE 11 — A.T.&T. presented a check for \$57,915,000 to the Communications Satellite Corporation for the purchase of 2,895,750 shares of common stock.

JUNE 18 — A call between President Johnson and Premier Hayato Ikeda inaugurated telephone service on the first cable between America and Japan. The cable, stretching 5,300 nautical miles from Oahu, Hawaii, to Japan via Midway, Wake and Guam, joined existing cables at Hawaii to the U.S. mainland, Canada and Australia. Partners in the \$80 million cable project were A.T.&T., Kokusai Den shin Den wa Company, Ltd. (KDD) of Japan, the Hawaiian Telephone Company, and RCA Communications, Inc. The cable has a capacity of 138 voice channels.

JUNE 22 — Improved stock ticker (designed, developed and manufactured by the Teletype Corporation) was placed into service at the New York Stock Exchange. The ticker, which transmits stock prices to brokerage houses nearly twice as fast as the previous system, has a capacity of ten million shares a day without incurring delays.

JUNE 24 — Picturephone® service inaugurated in New York, Chicago and Washington, D.C., centers. First call was made by Mrs. Lyndon B. Johnson in Washington who spoke to Dr. Elizabeth A. Wood of Bell Laboratories in New York. Service for the general public opened June 25. Rates for calls were \$16 for the initial three-minute period between New York and Washington, \$21 between Chicago and Washington, and \$27 between Chicago and New York.

JUNE 26 — Western Electric announced that its new Eastern Regional headquarters would be located in the Baltimore, Md., area.

JULY 6 — The Federal Telecommunications System, the world's largest private line network, began operation. The system linked 750,000 U.S. government telephones in more than 400 cities throughout the country. It provided direct, desk-to-desk dialing between 8,000 Federal civil offices of the government.

JULY 16 — A new deep-sea telephone cable was placed in service between the U.S. mainland and Hawaii. Extending 2,400 nautical miles from San Luis Obispo, Calif., to Makaha, Oahu, this was the second cable linking the mainland with Hawaii. The \$34 million system was a joint project of Long Lines and the Hawaiian Telephone Company.

AUGUST — Western Electric began the manufacture of a twenty-tube coaxial cable capable of handling 18,740 simultaneous telephone conversations over existing carrier equipment.

AUGUST 15 — Western Electric announced plans to build a \$2.5 million Southern Service Division Regional headquarters building in the Sandy Springs area of Atlanta, Ga.

AUGUST 18 — A.T.&T. nominated three executives for election to the board of directors of the Communications Satellite Corporation: James E. Dingman, executive vice president, Horace P. Moulton, vice president and general counsel, and Harold M. Botkin, assistant vice president in charge of international services of the Long Lines Department.

OCTOBER 30 — The 1964 Nobel Prize in physics was awarded to Provost Charles H. Townes of Massachusetts Institute of Technology and Professors A. Prokhorov and N. Basov of Russia for "fundamental work in the field of quantum electronics which has led to the construction of oscillators and amplifiers based on the maser-laser principle." Dr. Townes was a former staff member and consultant to Bell Telephone Laboratories.

NOVEMBER 25 — Reductions in the cost of interstate long distance calls, totaling \$100 million annually, were announced by the FCC. Cuts amounting to \$75 million were to become effective Feb. 1 and the remainder about April 1.

DECEMBER 2 — An underground transcontinental cable route, blast-resistant and adding 9,000 telephone circuits to the 15,000 spanning the country, was opened for service. The \$200 million system had 11 manned communications centers and more than 900 intermediate repeater stations buried underground.

DECEMBER 15 — Telephone cable placed in service between Guam and the Philippines. The 138-circuit cable connects with cable linking U.S. mainland, Hawaii and Japan.

DECEMBER 22 — Telephone cable placed in service between Vero Beach, Fla., and St. Thomas, V.I.

1965

JANUARY 1 — H. I. Romnes became president, A.T.&T., and a member of its board of directors and executive committee, succeeding E. J. McNeely who retired.

JANUARY 1 — The number of independent telephone companies dropped to 2,535 from the 2,675 in existence at the start of 1964.

FEBRUARY 1 — Reduced long distance rates, announced in November, went into effect. New rates permit a three-minute, station-to-station interstate call anywhere in the continental U.S. for \$1 or less all day Sunday and after 8 p.m. on other days.

MARCH 1 — Western Electric effected a general revision of its prices for products manufactured for Bell companies. The revision was designed to lower prices by \$33 million a year.

MARCH 1 — The New York State law authorizing electronic eavesdropping was declared unconstitutional by Justice Nathan R. Sobel in Supreme Court in Brooklyn, N. Y.

MARCH 1 — Gov. Scranton inaugurated IMTS (Improved Mobile Telephone Service) mobile radiotelephone service at Harrisburg, Pa. The Bell Laboratories-developed system made using a car telephone much the same as using an office telephone. The first IMTS system was installed earlier at Charleston, W. Va., for trials.

MARCH 9 — The New York Stock Exchange placed its first talking computer into operation to provide an electronic stock quotation system for brokers. Subscribers were able to dial special telephones to a computer which responds with the latest sales data for any of 1,600 stocks listed on the exchange. Computer's voice was a prerecorded vocabulary of 126 words. Depending on the message length, the quotation service could handle up to 400,000 calls daily. The high-speed switching equipment was provided by the New York Telephone Company.

APRIL 6 — The first commercial communications satellite, Early Bird, was launched into orbit from Cape Kennedy. The 85-pound satellite was of the synchronous type, matching the earth's rotation to hover over the same spot all the time.

APRIL 20 — Radiotelephone service with Liberia opened, bringing the West African republic into telephone contact with the U.S. for the first time.

APRIL 20 — A.T.&T. Long Lines announced plans for a \$182 million underground cable between Miami and Boston. Completion was scheduled for 1968.

APRIL 21 — The 80th A.T.&T. Annual Meeting was held in Philadelphia's Convention Hall. It was the first time the meeting was held in Philadelphia, and only the second time outside New York City. The 1961 meeting was in Chicago.

APRIL 23 — The Soviet Union launched its first communications satellite and carried out transmission of television programs. Satellite was called "Molniya 1"—(Lightning 1).

MAY 16 — Telstar® II turned off its VHF beacon and telemetry transmitter as scheduled. A preset 2-year clock built into the satellite turned off the beacon on Telstar's 4,736th orbit around the earth. The reason for the turnoff was to release the 136-megacycle radio frequency for use by other satellites.

MAY 30 — The first commercial electronic central office—at Succasunna, N. J.—was cut into service. Initially, about 200 of the 4,300 subscribers participated in a customer trial of the memory services available. These included adding a third party to a conversation, shortened dialing for frequently called numbers and automatic transfer of incoming calls to another telephone. Other memory services were scheduled for later testing.

Attending the dedication ceremonies several days earlier were A.T.&T. Chairman Frederick R. Kappel, New Jersey Bell President E. Hornsby Wasson, Governor Richard Hughes of New Jersey, and Bell Laboratories President James B. Fisk.

JUNE 10 — Charges for Picturephone® service cut in half. Under the new schedule, a three-minute call from New York to Washington became \$8, and to Chicago, \$13.50. A Chicago-Washington call was reduced to \$10.50.

JUNE 14 — San Francisco was introduced to Expanded Direct Distance Dialing when the Bay Area cut 120 remote Traffic Service Positions into service. This was the first TSP remote operation in the Bell System.

JUNE 14 — Inward WATS became available within the State of Alabama for a trial period—the first Bell System offering of this service. The inward-only service was offered on both a full and measured time basis. Rate levels were the same as those charged for outward WATS.

JUNE 21 — President Johnson signed a bill repealing many Federal excise taxes. Under the bill, the 10 per cent tax on local and long distance service was to be reduced to three per cent on Jan. 1, 1966, and further reduced by one percentage point each Jan. 1 until completely removed by 1969. The 10 per cent tax on private communications services was to be dropped Jan. 1, 1966. The law repealed a telephone tax that had been on the books in some form since 1932 when long distance service was taxed to support government programs during the depression. In 1941, the tax on local service was enacted for wartime preparedness. Both taxes were on the 10 per cent level since 1954. (See April 1, 1966.)

JUNE 28 — Commercial telephone service via satellite was inaugurated between the U.S. and Europe with ceremonies in six countries. President Johnson was introduced by Joseph V. Charyk, president of Comsat which put the Early Bird satellite into operation. Greetings were exchanged with British Prime Minister Harold Wilson in London, German Chancellor Ludwig Erhard in Bonn, Swiss President Hans-Peter Tschudi in Berne, and French Minister of State Louis Jacquinot in Paris.

1965 (Cont'd)

Remarks of Italian Minister of Posts and Telecommunications, Carlo Russo, were read from Rome.

During the previous week, the FCC authorized the leasing of Early Bird channels to various international common carriers. Seventy-four channels were made available to A.T.&T. and the company initially used 61 to handle increased traffic.

JULY 1 — E. Hornsby Wasson, president of the New Jersey Bell Telephone Company, succeeded Carl O. Lindeman as president of the Pacific Telephone and Telegraph Company. Mr. Lindeman became chairman of the board. Robert D. Lilley, group vice president, Western Electric, succeeded Mr. Wasson as president of the New Jersey Bell Telephone Company.

JULY 1 — Clifton W. Phalen, president of the New York Telephone Company, became chairman of the board. He was succeeded by Cornelius W. Owens, formerly executive vice president, A.T.&T.

JULY 1 — James B. Morrison became chairman of the board, the Chesapeake and Potomac Telephone Companies. He was succeeded as president by William L. Lindholm, who had been vice president of Southwestern Bell in charge of its Texas operations.

JULY 1 — Richard A. Goodson, vice president-operations, succeeded Edwin M. Clark as president of Southwestern Bell Telephone Company; Mr. Clark retired, ending a 42-year Bell System career.

JULY 7 — A product trial of Picturephone® service began in the New York and Chicago headquarters of the Union Carbide Corporation. Some 35 Picturephone® sets were installed on employees' desks.

AUGUST 1 — Frank M. Malone, formerly vice president-operations, became president of Southern Bell, succeeding Ben S. Gilmer who was elected executive vice president, A.T.&T.

AUGUST 1 — Robert M. Wachob, A.T.&T. vice president, became president of the Bell Telephone Company of Pennsylvania and the Diamond State Telephone Company. He succeeded Wilfred D. Gillen, president since 1949, who retired.

AUGUST 2 — Michigan Bell became the first company to sell Trimline® phones on a companywide basis. Systemwide introduction on a gradual basis was expected to be completed by the end of 1966.

SEPTEMBER 15 — The fourth transatlantic cable—and the first linking the U.S. directly to Continental Europe—was placed in service. The 3,600 nautical mile span stretched from Tuckerton, N. J., to St. Hilaire-de-Riez, France, with the capacity for handling 128 simultaneous voice conversations. The \$50 million cable system is owned jointly by the Long Lines Department of A.T.&T. and the French and German Ministries of Posts and Telecommunications. A.T.&T. shared its ownership with three other international carriers: ITT World Communications, Inc.; RCA Communications, Inc.; and Western Union International, Inc.

SEPTEMBER — Hurricane Betsy became the most costly storm in telephone history with damage totaling about \$16 million in Louisiana, Mississippi, and Florida. The storm knocked out 377,000 telephones in southern Louisiana, 125,000 in Florida, and more than 22,000 in Mississippi.

OCTOBER 3 — The first step-by-step common control installations were placed in service at Kearns and Bountiful, Utah. These eliminate the need for directing codes in their extended area service calling plan. These installations became part of a "metro" calling plan for the Salt Lake City area covering approximately 450,000 stations.

OCTOBER 4 — First visit of a head of the Roman Catholic Church (Pope Paul VI) to the U.S. received more television, radio and telephone coverage than any event reported by American news media to date. Circuit and channel requirements far exceeded those needed for any other major news story, including the funeral of President Kennedy, the Republican and Democratic conventions, and the Gemini space launches.

OCTOBER 12 — Dedication ceremonies for Project LASA (Large Aperture Seismic Array) held in Billings, Mont. Project was developed by Lincoln Laboratories to permit detecting underground nuclear explosions anywhere in the world and consists of 21 underground sites scattered over a 600 square mile area. A Bell System-designed wideband data transmission system connects the sites to a central computer in Billings.

OCTOBER — A.T.&T. announced a new policy of installing the working parts of telephone instruments in antique or decorator-designed sets purchased by customers.

OCTOBER 17 — New York World's Fair closed. The Bell System Exhibit attracted 12,912,037 visitors—one out of every four who attended the Fair during the 1964 and 1965 seasons.

OCTOBER 25 — Common Carrier Bureau of the FCC issued report recommending creation of an integrated record message service under Western Union and sale of TWX to Western Union. Other recommendations included investigation of Bell System interstate and international rates.

OCTOBER 27 — The FCC issued a Memorandum Opinion and Order which instituted an investigation of charges for interstate and foreign communications services.

NOVEMBER 9 — More than 1,300 Bell System offices went to emergency power to continue telephone service during a massive blackout when power failed in the northeastern section of the U.S.

NOVEMBER 17 — A.T.&T.'s board of directors declared a regular quarterly dividend of 55 cents a share—up 5 cents from the previous quarter. The dividend was payable Jan. 3, 1966.

1965 (Cont'd)

DECEMBER 1 — B. L. Kilgour, Jr., president of The Cincinnati and Suburban Bell Telephone Company, became chairman of the board. He was succeeded by William J. Whittaker, assistant vice president of A.T.&T.

DECEMBER 16 — Alexander Graham Bell was named to the Aviation Hall of Fame in Dayton, Ohio. He was cited for research on principles of aerodynamic lift propulsion and control in the early nineteenth-hundreds.

1966

GENERAL — Nearly three-fourths of all telephones in the U.S. and Canada now have ANC numbers. The changeover to seven-digit phone listings began in 1960.

The Service Attitude Measurement (SAM) Plan, a program designed to help determine what customers think of their telephone service, was introduced in the Bell System on a gradual basis. The idea behind SAM was that telephone service can be considered good only if the customer thinks that it is good.

JANUARY 3 — A quarterly dividend of 55 cents per share was paid to A.T.&T. share owners. This was 10 per cent more than the previous rate of 50 cents which was established in the spring of 1964.

JANUARY 16 — The second No. 1 Electronic Switching System (ESS) in the Bell System was placed in service at the Chase, Md., office of C&P of Maryland. The system served some 2,900 stations.

FEBRUARY 7 — F. R. Kappel awarded the Pupin medal by Columbia University's School of Engineering for "service to the nation."

FEBRUARY 17 — A.T.&T. proposed transistorized high-capacity cable link between Florida and the Virgin Islands. (See June entry.)

FEBRUARY 28 — In a new regulation aimed at protecting the right to privacy, the FCC prohibited eavesdropping of private conversations by the direct or indirect use of radio-controlled devices.

MARCH 1 — Long Lines added a sixth major operating area. The new Western Area was headquartered in San Francisco serving territories of the Pacific, Pacific Northwest and Mountain States companies. The area with headquarters in Kansas City became the Midwestern Area, serving territories of the Northwestern and Southwestern companies.

MARCH 15 — President Johnson signed a tax bill that would increase to ten per cent from three per cent the Federal excise tax on all telephone and Teletype service. (See April 1.)

MARCH 21 — The Theodore N. Vail Gold Medal, the Bell System's highest award for outstanding public service, was awarded posthumously to Miss Lydia Haughwout. Miss Haughwout, a PBX operator, suffered fatal

injuries in the Military Park Hotel in Newark, N. J., the previous Christmas Eve when she remained at her switchboard to warn guests of the fire.

MARCH 24 — Bell System proposes domestic communications satellite system to Comsat.

APRIL — Illinois Bell introduced a new residential telephone set that provides two lines to use for making calls and a hold button for switching back and forth between calls while holding one on the line. Called the "two line/two hold" telephone, it was offered for less than the cost of two telephone lines.

APRIL 1 — New law reinstated the federal excise tax on local and long distance telephone and teletypewriter service to 10 per cent. Since Jan. 1, customers had paid a 3 per cent tax. The new law provided for the 10 per cent rate until April 1, 1968 when it would be reduced to 1 per cent, then completely eliminated at the end of that year.

APRIL 1 — A.T.&T. submitted initial testimony in FCC inquiry.

APRIL 1 — John D. deButts, president of Illinois Bell, became A.T.&T. executive vice president, succeeding Frederick R. Eckley, who became president of Ohio Bell. Mr. Eckley succeeded Claude M. Blair who became president of Pacific Northwest. At the same time Walter W. Straley moved from president of Pacific Northwest to public relations vice president, A.T.&T., succeeding James W. Cook who became president of Illinois Bell.

APRIL 1 — The Easy Move Plan introduced in the Bell System.

APRIL 12 — Voiceprints were first exhibited to a judge and jury in a perjury trial in White Plains, New York. Lawrence G. Kersta, a retired Bell Laboratories physicist who developed the technique, used the prints in testifying that the defendant's voices on three tapes were the same.

APRIL 20 — A.T.&T.'s annual meeting, with 4,016 share owners present, was held in Detroit's Cobo Arena.

MAY 1 — Telephones on Shelter Island and Greenport, L. I., were converted to dial—the final changeover in New York Telephone territory.

MAY 7 — Walter S. Gifford, president of A.T.&T. longer than any other man (1925-1948) died at age 81 in New York City.

MAY 16 — The first air-conditioned telephone booths in the Bell System were installed by New York Telephone in Grand Central Station.

JUNE — Bell Laboratories revealed details of the new high-capacity undersea cable proposed for serving the Caribbean and Central and South American areas. The new cable had nearly six times the capacity of any existing submarine cable system (720 two-way voice channels compared to 138 in the last previous system) and for the first time used transistors instead of vacuum tubes in the repeaters. (See February 17 entry.)

1966 (Cont'd)

JUNE 7 — A new optional service which enabled residence customers to call long distance to most points in the state for a flat monthly rate became a regular service offering to Wisconsin Telephone Company customers. Called "Tel-a-Visit," the service made it possible for customers to dial as many station-to-station intrastate calls as they wished during certain time periods. The flat rate for the service was \$15 a month in addition to the regular service and equipment charges.

JUNE 15 — Worldwide direct telephone dialing had its first public demonstration when Lowell F. Wingert of A.T.&T.'s Long Lines Department dialed 10 digits (200 233-1011) and called Geneva, Switzerland, from Philadelphia. He explained, at the demonstration experiment, that the company will begin in 1970 to gradually introduce overseas direct dialing.

JUNE 25-27 — The existing Air Defense Command SAGE voice point-to-point and interim PBX switching networks serving over 350 CONUS (Continental U.S.) Air Force sites were cut over to AUTOVON (Automatic Voice Network).

JULY — A.T.&T.'s quarterly report announced the number of A.T.&T. shareholders had climbed to more than 3 million.

JULY 1 — North American Air Defense (NORAD) facilities in Cheyenne Mountain, Colorado, placed in service by Bell System.

AUGUST — Southern New England began testing coin telephones which permit emergency calling without a coin. The user could hear dial tone and dial "Operator" without depositing a coin. Some 300 "dial tone first" outdoor pay telephones were involved in the trial at Hartford, Conn.

AUGUST 1 — A.T.&T. acquired telephone circuits in a new undersea telephone cable to Hong Kong, Singapore and Kuala Lumpur, Malaysia, when the Guam-Hong Kong Section of the British Commonwealth Seacom cable system opened. A.T.&T. obtained 12 cable circuits to Hong Kong, two to Singapore and one to Malaysia.

AUGUST 1 — The Ford Foundation filed a proposal with the FCC for a non-profit non-Governmental satellite system that would distribute commercial and non-commercial television, such as educational TV, to stations throughout the nation. The plan proposed using profits from the satellite distribution of commercial shows to underwrite network presentation of live non-commercial TV.

AUGUST 3 — A new telephone cable, which extended 550 nautical miles from St. Thomas, Virgin Islands, to Maiquetia, Venezuela, was placed, thus completing the first physical communications link between North and South America. (The initial segment from Florida to St. Thomas, was opened in late 1964.) President Johnson inaugurated the service with a call to President Leoni of Venezuela.

AUGUST 9 — Telephone engineers of the New England public utilities commissions recommended that the telephone company discontinue monitoring any part of telephone calls or conversations between customers. The report followed widespread publicity on the practice of service observing.

SEPTEMBER — Southern Bell became the largest operating company in the Bell System in terms of telephones when it passed the New York company. By the end of October, Southern Bell had a total of 10,091,601 telephones compared to New York's 10,011,459.

SEPTEMBER 8 — Ohio Bell began operation of an initial Business Information System for central storage of records that will become a pattern for the Bell System. The storage location was in Willoughby, Ohio, and was controlled by Ohio Bell's data-processing center in Cleveland. Under the plan, all records become instantaneously available via teletypewriter from any department in the company.

SEPTEMBER 13 — A.T.&T. announced plans to acquire the minority stockholder interest in the Western Electric Company, currently 99.85 per cent owned by A.T.&T. The approximately 650 minority share owners of WE, who owned 29,309 shares, would receive six A.T.&T. shares for each WE share held.

SEPTEMBER 14 — A.T.&T. stopped accepting collect calls from Cuba to the U.S. because of a \$2 million balance of payments problem. The Cubans would not permit either collect calls from the U.S. or calls paid for in Cuba.

SEPTEMBER 20 — The first direct telephone dialing link between the continental U.S. and an overseas point was inaugurated when U.S. and Virgin Island customers were able to dial each other.

SEPTEMBER 26 — A.T.&T. announced it would not appeal a U.S. Court of Appeals decision upholding a ruling that it is charging too little for its bulk communications service known as Telpak.

OCTOBER — Bell System recommended exhaust emission control units on all 1967 telephone vehicles.

OCTOBER 30 — Intelstat 2, Comsat's new commercial communications satellite, failed to go into designated orbit over the Pacific. However, transmission was later possible on a part-time basis.

NOVEMBER 1 — Clifton W. Phalen, chairman of the board, New York Telephone, retired. Overall responsibility was assumed by Cornelius W. Owens, president.

DECEMBER — New York Telephone's 1967 Staten Island telephone directory was the first ever set by a computerized phototypesetting process. This was the first step in a five-year program to convert all downstate white pages to this ultra high-speed printing method.

1966 (Cont'd)

DECEMBER 1 — Lowell Wingert, head of the Long Lines Department, succeeded Walter K. Koch (who retired) as president of the Mountain States Company. Mr. Wingert was succeeded by Richard R. Hough, vice president of engineering at AT&T.

DECEMBER 5 — A brief ceremony marked the official opening of the Bell Laboratory's new \$34 million Holmdel, N. J., Laboratory. Construction of the laboratory's first phase, two of the present four buildings, began in August, 1959, and ended in June, 1962. Construction of the remaining two buildings began in June, 1964. Employees began occupying the Eero Saarinen-designed building in October 1961. Technical work at Holmdel is in four major areas: systems engineering, development of customer products, transmission systems, and switching systems.

DECEMBER 7 — The FCC ruled that Comsat must share ownership of satellite ground stations with U.S.-owned international common carriers. The ruling specified that Comsat should own 50 per cent of each of the six ground stations eventually to be used in the global satellite communications system. The remaining 50 per cent ownership would be spread among the international carriers. The ruling was to apply through 1969.

DECEMBER 15 — AT&T filed proposals with the FCC for a domestic satellite communications system which could go into operation as early as 1969. The company asked that the satellites be integrated with conventional ground systems and that they provide a comprehensive multi-purpose range of communications services. The estimated investment would total \$339 million by 1980 and would cost about \$115 million to operate — considerably less than comparable ground facilities would cost.

1967

JANUARY 5 — The FCC authorized the purchase of the satellite ground station in Andover, Me., by Comsat from AT&T for \$4.9 million.

JANUARY 10 — RCA and Western Electric announced the joint development of a computerized typesetting system that automatically adjusts line spacing. The system, called Autoscript, uses an RCA Spectra 70/25 computer and a phototypesetter to produce a continuous flow of Bell System technical documents.

FEBRUARY 1 — H. I. Romnes succeeded Frederick R. Kappel as chairman of the board and chief executive officer, AT&T. Mr. Kappel retired but remained a board member. Ben S. Gilmer, executive vice president, succeeded Mr. Romnes as president.

FEBRUARY 15 — John A. Copeland of Bell Telephone Laboratories announced a new solid-state source of high frequency radio waves. His "LSA diodes" emit millimeter waves, a part of the radio frequency range that can carry about nine times more telephone calls

than all lower frequencies combined. An LSA diode and its power supply are about as large as a cigarette pack.

FEBRUARY 20 — A new kind of television camera tube for use in future models of the PICTUREPHONE® visual telephone was announced by Bell Telephone Laboratories. The new tube uses a solid-state silicon "target structure," and provides greater sensitivity to light, higher reliability, and potentially longer life than conventional camera tubes.

MARCH 5 — Telephone users began dialing their own calls to London and Paris from Manhattan in a four-month trial. Eighty Manhattan subscribers participated in the tests.

MARCH 30 — An alternate telephone communications route between the United States, Australia and other Pacific points was provided with the opening of Southeast Asia Commonwealth cable (SEACOM) between Guam and Cairns, Australia, by the way of New Guinea. Long Lines had rights to use one-half of the 160-circuit cable, a British Commonwealth facility.

APRIL — Service began in a field trial of aluminum conductor cable as a substitute for copper cable for exchange area use. The trial was in Iowa by Northwestern Bell Telephone Company. Other trials later in the year were in Mississippi, Illinois and California. Bell Labs, Western Electric, AT&T and the operating companies cooperated in the project.

APRIL 18 — After 76 days of hearings over a 10-month period, the FCC completed hearings in Phase 1-A of the interstate rate case.

APRIL 19 — The eighty-second AT&T Annual Meeting of share owners was held at the Baltimore Civic Center, Baltimore, Md.

APRIL 28 — Bell Laboratories announced development of a new "light knife," a device which allows surgeons to use the focused beam of a laser as easily as they would a scalpel.

MAY 11 — President Johnson received a gold Trimline® telephone with Touch-Tone® service. He used it to talk with governors, other state officials and telephone people across the country over a special communications network. The call went to 47 states, Puerto Rico and the Virgin Islands. H. I. Romnes, board chairman of AT&T, presented the President with the gold phone to commemorate installation of the 100-millionth phone in the U.S.

JUNE 30 — An experimental lineless extension telephone, a battery-operated portable unit that performs the major functions of a regular telephone set, was revealed by Bell Labs. The experimental set connects with the telephone network via a radio link to a fixed station, which is connected to a regular telephone line.

JULY 5 — The FCC announced its interim decision and order in Phase 1-A of the interstate rate case. The decision calls for Bell System interstate rate of return in the range of 7 to 7.5 per cent and a reduction in interstate revenues of \$120 million annually. The Commission order included revisions in separations procedures

1967 (Cont'd)

which would result in a net transfer of \$85 million in Bell System revenue requirements from intrastate to interstate.

JULY 20 — AT&T announced that it had buried the shore-end sections of two transatlantic undersea cables beneath the ocean floor to safeguard them against damage from fishing vessels. A specially designed plow, developed at Bell Laboratories, was used to bury more than 100 miles of cable off the New Jersey coast.

SEPTEMBER 14 — The FCC asserted that its July 5 interim order and decision in Phase I-A of the interstate rate case did not place an "arbitrary ceiling" on AT&T's rate of return. At the same time, the FCC restored \$544 million in plant under construction to the interstate rate base, deferred until May 1, 1968 a \$20 million portion of its ordered rate reduction of \$120 million, and remanded its decision on separations for further consideration.

OCTOBER 2 — The New Jersey Bell Telephone Company marked its 40th anniversary and the installation of its four millionth telephone.

OCTOBER 9 — The FCC opened hearings in Phase I-B of the interstate rate case. In this phase of the hearings, Bell System ratemaking principles were to be considered.

OCTOBER — A new mechanical concept, claimed to be as elementary as the wheel, was discovered by an engineer of Sandia Corp. The concept was named "rolamite," and its basic design consists of a long band made of any flexible material curled into the shape of "S" and a cylinder or roller inserted into each of the two curves. The rollers roll along the band with extremely little friction, much less than conventional roller or ball bearings.

NOVEMBER — The L-4 "hardened" coaxial cable system was inaugurated between Washington, D.C., and Miami, Florida.

NOVEMBER 1 — Telephone rates reduced between midnight and 7:00 a.m. to 75 cents in the continental U.S.

NOVEMBER 14 — Teletype Corporation announced the development of a new page printer that can print as many as 1,200 words a minute with electronically controlled jets of ink. The company calls its new device the Inktronic Page Printer.

NOVEMBER 15 — Directors of AT&T raised the company's quarterly dividend to 60 cents from 55 cents, payable January 2, 1968 to stock of record December 1.

DECEMBER 14 — The Bell System's Picturephone® see-while-you-talk set has been completely redesigned to incorporate additional features that earlier trials showed the public wants. The new set was shown at a press demonstration in New York City. The improved "Model II" set will be given trials at the Westinghouse Corp. locations in Pittsburgh and New York in early 1969.

DECEMBER 20 — Southern Bell announced that the nine-state company would form a new company, South Central Bell Telephone Company, to operate in five of the states. The new company, to operate in Alabama, Kentucky, Louisiana, Mississippi and Tennessee, was scheduled to begin operations on July 1, 1968.

1968

JANUARY — The Bell System's first "TD-3" radio relay system, capable of carrying 12,000 telephone conversations simultaneously, was placed in service between Alexandria, Ark., and Arkabutla, Miss. The solid state system used transistors and traveling wave tubes instead of the familiar vacuum tubes.

JANUARY — The Call-A-Matic® telephone was patented for Bell Laboratories by two engineers in its Indianapolis laboratory. The device had a plastic tape on which the user could write or type the names he might want to call. Users would be able to dial any of 500 numbers automatically. The telephone was made available to operating companies in October, 1968.

This repertory dialer was the first of a series of sets using a "modular concept" which provided sets as a basic chassis to which cords, handsets and housing are added in the field by the companies.

JANUARY 11 — A job program to provide work for more than 500 persons from central city areas was announced by New Jersey Bell, Western Electric, Bell Telephone Laboratories and Long Lines.

JANUARY 12 — Ben S. Gilmer, president of AT&T, announced the adoption by the Bell System of "911" as a nationwide emergency telephone number. The system, which will take several years to extend throughout the country, was in response to the expressed public need for a common easy-to-remember number for police, fire, ambulance and other emergency services.

FEBRUARY — The Bell System's new Center for Technical Education at Lisle, Illinois, opened. School facilities included six laboratories, computer facilities, a library, and "live-in" dormitory. The curriculum includes a 15-week basic engineering course for new engineers to give a broad understanding of Bell System services, systems and equipment; courses of shorter duration in applied engineering; and seminars for administrative levels of engineering departments.

MARCH — Name of The Bell Telephone Company of Canada changed to Bell Canada, Inc.

MARCH 1 — Huntington, Ind., became the first U.S. city served by the Bell System to receive the new universal emergency telephone number "911." By dialing that number, customers reached a central dispatch bureau serving both Police and Fire.

MARCH 11 — The FCC authorized the first commercial television service between the U.S. and Australia. It gave four carriers temporary authority to lease a satellite circuit to provide the service: AT&T, ITT World Communications Inc., RCA Communications Inc., and Western Union International Inc.

MARCH 23 — Jerome W. Hull, executive vice president, was elected president of Pacific Telephone and E. Hornsby Wasson, president, was elected chairman. Mr. Wasson remained chief executive officer.

APRIL — Final trial and appraisal of the Bell System's "Dial Tone First" service in Danville, Ill., was highly successful. (Trials were held earlier in Hartford, Conn., and New York City.) Coin telephones nationwide will be converted to the service over the next several years at a cost of more than \$100 million.

APRIL 1 — Data-Phone 50,[®] the Bell System's new high-speed switched message service, became available between the cities of Chicago, Los Angeles, New York and Washington. The service permitted the transmission of data and facsimile at speeds up to 50,000 bits per second with voice coordination.

1968 Telephone Strike Highlights

APRIL 15 — The 1968 strike started when IBEW-represented plant and engineering employees struck New Jersey Bell, and CWA-represented traffic employees honored their picket lines.

APRIL 18 — CWA struck 11 telephone companies operating in 14 states, and Western Electric manufacturing in Buffalo, and WE installation in 42 states.

APRIL 24 — The Federation of Telephone Workers struck Bell of Pennsylvania.

APRIL 26 — The International Brotherhood of Telephone Workers walked out in New England. Employees returned to work on September 2 — 129 days after the start of the strike.

MAY 8 — IBEW broke off negotiations with Illinois Bell and went on strike. On September 21, members ratified a wage and benefit offer, ending the longest single strike (137 days) in the history of the Bell System.

APRIL 17 — AT&T's Annual Meeting of Shareowners drew a standing room crowd of 6,329 at Boston's War Memorial Auditorium. Stockholders elected 19 board members, including Edward W. Carter, president of Broadway-Hale Stores, Inc., who was nominated to fill a vacancy.

APRIL 17 — AT&T unveiled an experimental model of a new telephone at its annual meeting in Boston. Smaller, lighter and largely electronic, it weighs less than half as much as today's phones, and owes its lightness to use of integrated circuits.

JUNE 26 — Carterphone decision by the FCC. The FCC struck down existing interstate telephone tariffs prohibiting attachment or connection to the public telephone system of any equipment or device that was not supplied by the telephone companies. The suit, which began October 20, 1966, centered on the desire of Carter Electronics of Dallas to interconnect private mobile radio systems with the nationwide exchange and message toll telephone network.

JUNE 30 — The Employees' Stock Plan suspended as the current offering was completed. Because AT&T was on an all-debt financing program, the Company had no immediate plans to raise money for construction through stock offerings to share owners in general or to employees.

SUMMER — Bell System operating companies began changing the designation of their "information" service to "directory assistance." New Jersey Bell completed the change in June, New York and Southern New England switched in July.

JULY 1 — Mayor John V. Lindsay opened the new police communications center designed to give 8 million New Yorkers instant police protection by dialing the new emergency number "911." (See January 12 and March 1, 1968.)

JULY 1 — South Central Bell Telephone Company, with headquarters in Birmingham, began operation. The company was formed to serve the states of Alabama, Kentucky, Louisiana, Mississippi and Tennessee. W. C. Bauer, formerly executive vice president of Southern Bell, became president and chief executive and a director of the new company. Frank M. Malone, president of Southern Bell, became chairman and a director. Mr. Malone continued as president of Southern Bell.

AUGUST — Western Electric's Phoenix Plant, largest communication cable-producing works in the world, opened officially for business. Ultimately, it is scheduled to produce more than 50 billion conductor feet of cable annually.

AUGUST 1 — Robert C. Scrivener succeeded Marcel Vincent as president of Bell Canada. Mr. Vincent, who was appointed chairman, remained chief executive officer. Mr. Vincent succeeded Thomas W. Eadie who continued as a director.

AUGUST 1 — AT&T began routing telephone calls to Chile via space satellite, and introduced station-to-station telephone rates between the two countries for the first time. AT&T used ten satellite circuits to Chile, marking the first satellite communications between North and South America.

AUGUST 29 — AT&T proposed new, liberalized tariff regulations to permit direct connection of a wider variety of customer-owned equipment to the Bell System's nationwide network. Included under the tariffs would be such customer terminal devices as business machines, data modulating and demodulating sets and voice transmitting and receiving equipment. Acoustic or inductive connection of private mobile radio-telephone systems (such as Carterfone) through customer-provided connecting devices also would be permitted. In all cases, the connection to the message network would be made at the terminals of a network control device (which may be that included in the telephone instrument) furnished by the telephone company. AT&T said that the new tariffs reflected changes in technology, particularly in the computer-communications field, and that it wanted

1968 (Cont'd)

to open the switched network to a greater variety of applications without impairing the quality of service to all users. The tariff changes would become effective November 1, if approved by the FCC. The Bell operating companies are filing similar tariff provisions with the state regulatory commissions. (See October 22 and December 24, 1968.)

OCTOBER 22 — Connection of customer-owned communications systems and channels to the Bell System nationwide network was proposed in new tariffs filed with the FCC. This was a further liberalization of the tariffs filed in September that would open up the network to customer-provided terminal devices. AT&T asked the FCC to make both the September and today's tariff changes effective January 1, 1969. It also asked that the earlier tariff proposal for the inductive or acoustic connection of private mobile radio systems be made effective November 1, 1968. The most recent tariff changes would provide for connection of customer-owned communications systems, such as switchboards and their extension telephones, and customer-owned communications channels, such as those derived from private microwave systems. The telephone companies would provide and maintain the interfaces or connecting devices. (See August 29 and December 24, 1968.)

NOVEMBER 1 — William M. Day, president of Michigan Bell, became chairman and chief executive officer of the company. Kenneth J. Whalen, vice president for operations of New York Telephone, succeeded Mr. Day as president.

NOVEMBER 26 — Fifteen Bell System companies are now cut over to the new Centralized Message Data System, and all companies will be using CMDS in early 1969. CMDS is a computerized communications systems that enables the companies to exchange billing information on collect and toll calls charged to credit cards or a third party. It employs a Data-Phone 50 network connecting the companies to a Long Lines computer center in Kansas City, Mo.

DECEMBER 2 — AT&T completed another major segment of its \$210 million Miami-to-Boston "hardened" underground communications system by opening 32,000 voice channels between Washington, D.C. and New York. The Miami-to-Washington section went into service in 1967; the New York-to-Boston was scheduled for completion in mid-1969.

DECEMBER 8 — New Jersey Bell opened a new \$6.35 million electronic central office in Trenton. The new center was the largest electronic switching system in the nation to date, equipped to serve more than 43,000 lines.

DECEMBER 24 — The FCC announced that new Bell System tariffs providing for interconnection with the network of customer-owned terminal devices and systems will take effect on January 1. The Commission said it will not investigate the tariffs but that "its permission for them to take effect does not constitute approval and they will be subject to any further action" of the FCC. (See August 29 and October 22, 1968.)

1969

GENERAL — An unprecedented and unexpected surge in telephone growth and usage brought about service difficulties in New York and some other large cities. To meet demand, the telephone companies undertook a massive service effort that included sizeable increases in construction dollars, additional hiring of plant craftsmen and accelerated training programs.

Faced with a climbing rise in costs due to inflation, higher wages, growth in telephone demand and higher cost of debt capital, many operating companies had requests for rate increases before their state regulatory commissions. In most states, it had been a dozen years or more since the last general rate increase.

Several Bell companies changed their names for simplification and ease of understanding. Mountain States Telephone & Telegraph Company became Mountain Bell; Bell Telephone Company of Nevada became Nevada Bell; the Cincinnati & Suburban Bell Telephone Company became Cincinnati Bell; and the four Chesapeake & Potomac Telephone Companies (each followed by the name of the state served) were changed to C&P Telephone. The old names were retained only for legal use.

Outdoor coin phone users throughout Manhattan and Washington, D.C., and in some locations in Maryland, Virginia and New Jersey began receiving Dial Tone First service.

New telephone equipment offered by Bell companies during the year included a doorless telephone kiosk, Apartment Door Answering Service (ADAS), Receive-only Dataspeed printer terminal, page key for manual or dial PBX service, and a vandal-resistant fingerwheel.

JANUARY 1 — New Bell System tariffs enabling interconnection with the network of customer-provided communications terminal devices and systems (for example, a business machine or a private microwave system) became effective. The FCC said that "its permission for them to take effect does not constitute approval and they will be subject to any further action" the FCC may take.

JANUARY 1 — Effective this date, those awarded the Bell System Bronze Vail Medal will receive a cash award of \$500 instead of \$250. Cash awards for silver and gold medals remained the same, \$1,000 and \$2,500 respectively.

JANUARY 15 — AT&T agreed to sell its teletypewriter exchange service to the Western Union Telegraph Company. The agreement was dependent on the FCC, Bell System operating companies, independent telephone carriers and certain state or local regulatory authorities. Under terms of the agreement, WU would be responsible for providing TWX service to customers. The sale would not affect AT&T's continuing private line teletypewriter service and wouldn't include the teletypewriter machines used by AT&T's Data-Phone customers.

JANUARY 15 — The first mobile Touch-Tone coin telephones made their debut along with high-speed train service between New York City, Philadelphia and Washington, as the Penn Central's Metroliner made its inaugural run.

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JANUARY 19 — The nation's first Traffic Service Position System (TSPS)—a high-speed, electronically controlled telephone service for operator-assisted calls—went into operation in Morristown, N.J. TSPS offers the same basic customer services as TSP, but is faster, more economical, more flexible for adding new features, and can be used with any toll switching system.

FEBRUARY 3 — Successful six-month trial of the Bell System's Picturephone service between the Pittsburgh and New York offices of Westinghouse Electric Corporation began. Forty Model II Picturephone sets were evaluated. Subsequently, AT&T announced that commercial service would be offered in mid-1970 in and between Pittsburgh and Manhattan on a limited basis.

FEBRUARY 28 — Bayard L. Kilgour, Jr., retired as chairman of the board, Cincinnati & Suburban Telephone Company. He continued as a director.

MARCH 3 — AT&T received the 1969 Alexander Graham Bell Award for distinguished service to the deaf.

MARCH 11 — Western Electric announced that its annual sales reached \$4 billion for the first time in 1968.

APRIL 16 — Some 3,500 share owners attended AT&T's 84th Annual Meeting in Atlanta, the sixth meeting held outside New York City. At the meeting, AT&T Board Chairman H. I. Romnes reported on the results of the 2½-year study of Western Electric Company by the firm of McKinsey & Company, Inc. The management consultant firm conducted one of the most thorough studies of an industrial enterprise ever made and rated Western Electric high in performance and very efficiently managed.

APRIL 25 — Illinois Bell named Charles L. Brown, operations vice president, as its new president, succeeding James W. Cook, who was elected chairman. Mr. Brown took over as chief executive officer when Mr. Cook retired on September 1.

MAY 2 — Improved radiotelephone service to ships at sea was initiated when the liner "Queen Elizabeth II" began her maiden transatlantic voyage. New equipment substantially eliminated fading and interference in circuits used for ship-to-shore communications.

JUNE — The Bell System's 90 millionth telephone was placed in service.

JUNE 10 — Western Electric's new Corporate Education Center near Princeton, N.J.—an "in-company college" believed to be the largest and most advanced of its kind in industry—was dedicated by WE President Paul A. Gorman. The center brought together major management and engineering training programs previously conducted at different locations.

JUNE 29 — Trial of a one-minute charging minimum for interstate direct distance dialed telephone calls inaugurated in the Charlotte, N.C., calling area. The test involved only two basic time periods for rate purposes instead of four, and a night charge for a customer-dialed, station-to-station call, coast-to-coast for 35 cents. It also

included generally higher rates for operator-handled calls.

JULY 1 — A Bell System Savings Plan for Salaried Employees became effective. Eligible employees could allocate 2, 4 or 6 per cent of their salaries, and the company contributes an amount equal to 50 per cent of the employee's allotment. The employee was given the option of having the money invested in AT&T stock, a diversified equity portfolio or government obligations or a combination of such.

JULY 29 — Hearings in Phase I-B of the interstate rate case concerned with ratemaking principles and factors ended after nearly two years when the FCC accepted pricing procedures proposed by AT&T and other parties to the case.

AUGUST 1 — AT&T established a Department of Environmental Affairs to help relate Bell System planning and operations to the environment in which it provides service. Walter W. Straley, who had been Information Department vice president, was named to head the new organization.

AUGUST 8 — Bell Laboratories announced it is experimenting with magnetic "bubbles," each smaller than the diameter of a human hair, that can be moved on magnetic plates in precise patterns to store enormous bits of information, do computation or switch signals.

SEPTEMBER 4 — Development of a new lead-acid battery with an anticipated life span of more than 30 years was reported by Bell Laboratories. Nassau Smelting and Refining Company was producing the battery in limited quantities to determine manufacturability and production economics. The Bell System maintains more than a million storage batteries in telephone buildings for standby power.

SEPTEMBER 15 — The final link in the Bell System's 1800-mile Boston-Miami underground "hardened" cable went into service between Cheshire, Conn., and Blackstone, Mass.

NOVEMBER 17 — AT&T announced its Data-Phone 50 service, a high-speed data and facsimile system, was now fully automatic and could be operated by direct dialing instead of going through an operator. The trial service operated between Chicago, Washington, D.C., Los Angeles and New York.

NOVEMBER 30 — Long Lines' new inland overseas operating center in Pittsburgh was opened and began handling calls to Great Britain. The center was scheduled to provide service to additional countries in 1970 and 1971.

DECEMBER 1 — Harvey G. Mehlhouse became president and chief executive officer of the Western Electric Company. He succeeded Paul A. Gorman who retired.

1970

JANUARY 21 — AT&T announced plans for an offering to its shareholders of approximately \$1,570,000,000 principal amount of 30-year debentures, together with warrants of approximately five-year life, to purchase an aggregate of some 31,400,000 additional shares of the company.

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JANUARY 26 — AT&T announced that it intended to apply to the FCC for permission to employ satellites as an integral part of its nationwide network.

MARCH 1 — International DDD was inaugurated from London to New York City and soon after to other points in the U.S.

MARCH 15 — About 24,000 customers in Manhattan were provided with direct distance dialing to the United Kingdom. On July 5 the service was extended to include a total of 50,000 customers in nine Manhattan exchanges.

MARCH 17 — Cincinnati and Suburban Bell Telephone Company name officially changed to Cincinnati Bell, Incorporated.

MARCH 20 — The New York Stock Exchange gave final approval to a plan to list long-term warrants for trading on the exchange.

MARCH 22 — The fifth transatlantic cable—the highest capacity undersea cable to date—was placed in service. The 3,500-mile cable was part of a \$100 million communications system. Included in the system were: the cable from Green Hill, R.I., to San Fernando, Spain; radio relay systems between San Fernando and Sesimbra, Portugal, and between San Fernando and Estepona, Spain, and a new 1,000-mile Mediterranean cable between Estepona and Rome, Italy. The new cable could handle more than 800 simultaneous telephone conversations, or a combination of telephone, teletypewriter, data and facsimile. The project was a joint undertaking by AT&T; ITT World Communications, Inc.; Western Union International, Inc.; RCA Global Communications, Inc.; Compania Telefonica Nacional de Espana; Companhia Portuguesa Radio Marconi and Intalcable Servizi Caslognatici Radiotelegrafici e Radioelettrici, S.p.A. (Italcable).

APRIL 1 — International DDD commenced from West Germany to the U.S.

APRIL 1 — H. I. Romnes, AT&T chairman and chief executive officer, took on the additional title of president upon the retirement of Ben S. Gilmer. William L. Lindholm, president of the Chesapeake and Potomac companies, became AT&T executive vice president in charge of operating and engineering activities. William M. Ellinghaus, vice president, marketing and rate plans, became executive vice president, rate planning and government. Robert D. Lilley, executive vice president, now headed human affairs activities which embraced the personnel, environmental affairs and information departments. Vice Chairman John D. de Butts supervised the company's financial activities. Angus S. Alston, AT&T executive vice president, became president of Southwestern Bell, succeeding Richard A. Goodson who will serve as Southwestern's chairman and chief executive officer. Thomas E. Bolger, president of Pacific Northwest Bell, became president of the Chesapeake and Potomac companies. Zane Barnes, operating vice

president of Pacific Northwest Bell, became president of Pacific Northwest Bell.

APRIL 13 — International DDD began from Belgium and Luxembourg to the U.S.

APRIL 13 — By presenting 35 rights and \$100, a share owner could subscribe to a \$100 AT&T debenture that carried 8¾ per cent interest. Two warrants come with each debenture. Each warrant entitled the holder to purchase for cash a common share at the \$52 exercise price. The warrants could not be exercised before November 15, 1970, and then could be exercised any time until May 15, 1975. Rights to purchase debentures with warrants expired May 18, 1970. Interest on the debentures will be paid semi-annually on May 15 and November 15.

APRIL 15 — AT&T's 85th Annual Meeting, the seventh held outside of New York City, was held in the Public Auditorium, Cleveland, Ohio. Robert D. Lilley and William L. Lindholm, executive vice presidents of AT&T, were elected to the board of directors. They succeeded Frederick R. Kappel, former AT&T chairman, and Dr. Henry T. Heald, chairman of Heald, Hobson and Associates, Inc., who did not stand for re-election. The meeting was attended by 2,362 share owners.

MAY 1 — Thomas S. Nurnberger became president of Northwestern Bell succeeding A. F. Jacobson, who retired. David K. Easlick, vice president—operations, Indiana Bell, succeeded Mr. Nurnberger as president of that company.

MAY 18 — Rights to purchase AT&T debentures expired. The record-setting AT&T offering of debentures with warrants was about 98 per cent subscribed.

MAY 20 — AT&T announced establishment of a new journal to provide a public forum for extending and deepening understanding of the economics of regulation and the management of regulated companies. It was to be published twice a year and was entitled *The Bell Journal of Economics and Management Science*. Dr. Paul W. MacAvoy, professor of economics at MIT, was named editor.

MAY 22 — AT&T announced it had taken options on 120 acres of land in Basking Ridge, New Jersey, and was negotiating for additional nearby parcels, to construct new offices for eventual relocation of many employees currently in New York City. The company did not plan to move its corporate headquarters to New Jersey.

JUNE 12 — The FCC ordered an inquiry aimed at establishing ground rules for proponents of satellites and cables in their quest for the international communications market. The basic aim was to develop a policy for deciding how telephone, data-processing and other communications services between the U.S. and foreign countries would be provided in the next decade.

JUNE 17 — The AT&T board of directors authorized the following title designations in the Long Lines Department: company vice president in charge of Long Lines became president; titles for director of operations and assistant vice presidents on the executive and operating staffs became vice presidents. In addition, the gen-

1970 (Cont'd)

eral managers in charge of the six operating areas became vice presidents and general managers. No changes in job responsibilities or organizational levels accompanied the new titles.

JUNE 26 — The FCC formally announced its plan for regulating the cable television industry. In the ownership area, the FCC barred the three major broadcasting networks from the cable TV field and prohibited the joint ownership of CATV operations and over-the-air TV stations within the same community. In the programming area, the commission proposed new rules aimed at allowing CATV systems to expand their operations in the nation's 100 largest cities while offering financial protection to educational and ultra-high-frequency TV stations in those markets.

JUNE 28 — Trial of special one-minute direct distance dialed calls ended in Charlotte, N.C.

JUNE 29 — Presidential Assistant Clay T. Whitehead was named director of the proposed Office of Telecommunications Policy.

JULY 1 — First commercial exchange offering of Picturephone service was introduced in downtown Pittsburgh, Pa. Mayor Peter F. Flaherty dialed the inaugural call from the Bell of Pennsylvania building to John D. Harper, chairman of the board of the Aluminum Company of America. New York Telephone Company postponed original plans to offer Picturephone service in lower Manhattan at this time to concentrate on its service improvement program.

JULY 1 — An 18-month trial of a new coaxial cable system began between Cedarbrook and Netcong, New Jersey. Called L-5, it was comprised of four units capable of carrying 18,000 two-way simultaneous conversations. The L-5 system was expected to carry a total of 90,000 two-way conversations when operated with a 22-tube coaxial cable. Alternatively, it will carry 420 Picturephone calls, or 30 color TV programs, or high speed digital data, or combinations of the services.

JULY 1 — First trial of a PhoneCenter in a high-rise building complex began in the Hollywood-Hallandale area of Florida. The service center offers customers the opportunity to go to a special telephone center, select telephones, take them home and plug them in for "instant" service.

JULY 28 — The FCC gave final approval to Western Union Corporation's acquisition of the TWX teleprinter exchange service operated by AT&T and several independent telephone companies. The TWX sale doesn't include AT&T's private line teletypewriter service or the teletypewriter machines used by AT&T's Data-Phone customers. The transfer was scheduled to take effect March 31, 1971.

AUGUST 14 — In a letter to the FCC, Long Lines indicated that a new carrier system, called L-5, would be used with a 22-tube coaxial cable to provide up to 90,000 simultaneous calls over a 622-mile route between Pittsburgh and St. Louis. It is planned for service in 1973. While its primary purpose was to transmit calls

and data, Picturephone service and television are possible alternate uses.

AUGUST 31 — AT&T filed a proposal with the FCC for a sixth transatlantic communications cable. The \$86 million cable would have 825 voice circuits, and extend from Green Hill, R.I., to Penmarch, France, where it would connect with direct land line facilities to Germany. It was planned for completion by late 1972.

SEPTEMBER 1 — Cornelius W. Owens, elected an executive vice president of AT&T, succeeding William M. Ellinghaus, who assumed Mr. Owens' position as president of New York Telephone Company.

SEPTEMBER 1 — L. E. Rast, executive vice president of Southern Bell, became president. He succeeded Frank M. Malone who retired.

SEPTEMBER 1 — President Nixon signed the executive order officially bringing the Office of Telecommunications Policy into being. It will assume and broaden the duties of an existing unit located in the office of Emergency Preparedness.

SEPTEMBER 20 — International DDD began from the U.S. mainland to Hawaii. The service from Hawaii was scheduled to begin in 1972.

OCTOBER 9 — For Manhattan customers now able to dial directly to the United Kingdom, International DDD was extended to Belgium, France and West Germany.

OCTOBER 19 — Details of a proposed communications satellite system to serve the U.S. were formally announced by AT&T and Comsat. AT&T and Comsat filed separate applications with the FCC, one covering the satellites (to be owned by Comsat) and one covering the earth station (to be owned by AT&T).

NOVEMBER 10 — AT&T announced the negotiated sale of \$500 million of debt securities—\$350 million 32-year debentures and \$150 million of seven-year notes. The Board of Directors had authorized the sale on October 21.

NOVEMBER 15 — First day on which warrants could be exercised. First payment of interest on debentures.

NOVEMBER 20 — AT&T filed for increases in interstate long distance telephone rates. The rate changes, to become effective January 19, 1971, were designed to produce an additional six per cent in total interstate revenues. It would be the first general increase in interstate long distance rates in 17 years. The planned rate changes would provide about \$385 million in additional revenues for the Bell System.

DECEMBER 10 — The Equal Employment Opportunity Commission requested the FCC to deny AT&T's pending interstate rate increase until the company ends its alleged discrimination in employment practices.

DECEMBER 11 — In a formal statement at a press conference, AT&T Board Chairman H. I. Romnes termed the charges of discriminatory practices by the EEOC "outrageous" and said "in the field of equal employment we have been leaders not followers."

1970 (Cont'd)

DECEMBER 14 — Comsat paid its first quarterly dividend of 12½ cents a share to stockholders of record November 13.

DECEMBER 18 — AT&T filed a formal rebuttal with the FCC to charges filed by the EEOC in connection with the interstate rate increase application.

DECEMBER 30 — International DDD was inaugurated from Greece to the U.S.

1971

JANUARY — Bell Canada and its 100 per cent-owned manufacturing associate, Northern Electric Company, formed a research and development organization known as Bell Canada-Northern Electric Research Limited, or, more briefly, Bell Northern Research. The new company is located in Ottawa.

JANUARY 14 — AT&T filed with the FCC new interstate long distance rates that would increase interstate revenues by about \$175 million.

JANUARY 22 — The FCC announced a comprehensive investigation of AT&T — rate of return first, then mounting costs, Western Electric, and service pricing.

JANUARY 26 — Increased rates for certain kinds of long distance calls went into effect on an interim basis should the FCC later order refunds. The interim rates were expected to increase interstate revenues 3 per cent. It was the first general rate hike since 1953.

FEBRUARY — NASA extended its contract with Bellcomm for 17 months to continue to provide systems analysis, study, planning and technical support to manned space flight program through May, 1972.

MARCH 8 — The FCC began the first phase of hearings on AT&T rates to establish a reasonable rate of return. AT&T said it should be allowed 9.5 per cent on interstate operations, up from the 7.5 per cent it earned in 1970.

MARCH 16 — Mrs. Frances Jones Poetker, owner of Jones the Florist, was elected a director of Cincinnati Bell and became the first woman director of a Bell affiliate.

MARCH 26 — The Intelsat IV communications satellite went into commercial operation following FCC approval to the Communications Satellite Corporation to participate in the use of the satellite. Initially, it had 830 circuits in service and linked ground stations in 15 countries.

APRIL 1 — Western Union Corporation's telegraph subsidiary company completed its previously-announced acquisition of TWX with AT&T and several independents. At the closing WU said it paid AT&T \$83.4 million and the independents \$5.5 million for about 41,000 teleprinters on subscribers' premises and some central office equipment.

MAY 10 — The FCC ruled that transatlantic satellites

and cables might be used only at the rate of five satellite circuits to one cable circuit. At the same time, it authorized AT&T to activate 446 more cable and satellite circuits during 1971.

MAY 19 — An offering of 27,500,000 convertible preferred shares, with an aggregate subscription price of \$1,275,000,000 was announced by the AT&T Board of Directors. Owners of record of common shares June 3 received one subscription right for each common share owned. Twenty subscription rights and payment of \$50 were required to purchase one convertible preferred share.

JUNE 11 — Interconnection of customer-furnished terminal equipment and systems to most voice grade private line services through protection supplied as part of the service terminal at "no additional charges for protection" was provided for under tariff changes filed by AT&T with the FCC, to be effective on 60 days notice, August 15.

JULY 1 — Preferential rates for private line telegraph and telephoto services, long afforded news wire services and other press organizations, were discontinued. The end to the preferential rates was affirmed by the U.S. Court of Appeals on May 12, upholding an FCC order of a year earlier.

JULY 14 — Nationwide telephone strike by the CWA began. New three-year contract ratified on August 14 with the exception of one local, New York Plant. (New York Plant ratified a new contract February 16, 1972, ending the longest strike in telephone history.)

SEPTEMBER 3 — Mainland China and the U.S. re-established telephone service on a temporary basis. The service, through a Japanese link, became available from 9 a.m. to 9 p.m.

OCTOBER 23 — AT&T Chairman H. I. Romnes announced a technological development which permitted data signals to "hitch-hike" on existing microwave radio systems by using the lower end of the frequency band not normally used by voice channels. It was called "DUV," Data Under Voice.

NOVEMBER 1 — Donald E. Procknow, executive vice president of Western Electric, became president. Harvey G. Mehlhouse was named board chairman and continued to serve as chief executive officer.

NOVEMBER 1 — First quarterly dividend paid on AT&T's new convertible preferred stock — \$1.21 per share — to more than 600,000 shareowners. It was expected that, thereafter, the quarterly dividend rate would be \$1.00 a share.

DECEMBER 1 — Allen G. Barry was elected chairman of New England Telephone and Telegraph Company and remained chief executive officer. William C. Mercer, vice president-personnel relations of AT&T, succeeded him as president. He was also named chief operations officer and a director.

DECEMBER — During the last week of this month, the number of Bell System telephones in service reached 100 million. Independent telephone companies serve 25 million phones in the United States, and 160 million are in use in some 200 other countries.

1973 (Cont'd)

had ever broken any law concerning non-discriminatory hiring or pay.

FEBRUARY 1—William O. Baker, vice president in charge of research and patents, succeeded James B. Fisk as president of Bell Laboratories, with the latter becoming chairman of the board.

FEBRUARY 1—A law enacted in Colorado nullified a state PUC order which prohibited discounts on utilities' bills to their employees.

MARCH—Bell Laboratories announced the development of a phone that could automatically dial a call to anywhere in the U.S. at the touch of a single button. Called Touch-a-Matic* telephone, its solid state memory allowed dialing up to 32 pre-coded telephone numbers.

MARCH—Bell Telephone of Nevada can install modern equipment in the Virginia City area, but the ancient, hand-crank telephone system must be preserved, the state PSC ruled. It suggested the magneto system, last of its kind in the Bell System, may be turned over to some "responsible" society or institution.

MARCH—Eliminating the possibility of a longer-range problem, AT&T announced it would sell its 29 per cent stock interest in Comsat. When it issued its domestic satellite decision, the FCC made divestiture of the stock, and departure from the Comsat board, conditions for future permission to AT&T to use Comsat facilities for non-message toll services.

MAY—Authority to build the first earth station for domestic satellite communications was given to Western Union by the FCC. Comsat, after agreeing to an amended application that others could join in providing a Navy/commercial maritime satellite service, was given a new go-ahead by the FCC to buy the necessary satellites.

JULY 1—Kenneth J. Whalen became vice-president-Market and Service Plans of AT&T and was succeeded by David K. Easlick, AT&T vice-president-Human Resources Development, as president of Michigan Bell.

JULY 10—The twenty-fifth anniversary of the transistor was honored with the issuance of a commemorative eight-cent stamp.

AUGUST—Cincinnati Bell became the first phone company in the U.S. to receive regulatory approval to charge for directory assistance calls. The company was

authorized a charge of 20 cents for local customer-dialed calls to directory assistance, in excess of a three-call allowance per billing period. The charge did not apply to handicapped individuals or calls from public telephones, hospitals or hotels.

SEPTEMBER—The FCC authorized AT&T to construct and operate five earth stations for a domestic satellite system ("domsat"). Comsat was given the go-ahead to build the satellites for the AT&T system. Other applications for domsat systems were also granted to GTE Satellite Corp., National Satellite Services, Inc., American Satellite Corp., RCA Globcom and RCA Alascom.

OCTOBER—Michigan Bell issued the first white directory produced by the new DIR/ECT (directory project) system, which uses a computer memory bank and photocomposers.

OCTOBER 1—International direct distance dialing (IDDD) was introduced to 100,000 North Jersey telephone subscribers, served by 10 ESS offices.

OCTOBER 16—Angus S. Alston, Southwestern Bell president, was named chairman and continued as chief executive officer. Succeeding him as president was Zane Barnes, who had headed Pacific Northwest Bell. The new PNB President was Wallace R. Bunn who had been operating vice president of South Central Bell.

NOVEMBER 19—H. I. Romnes, AT&T chairman for five years until his retirement in March 1972, died in Sarasota, Florida.

NOVEMBER 21—AT&T directors voted a 10 per cent increase in the regular dividend rate—to 77 cents a share quarterly from the 70 cents paid for more than a year. The increase in the annual rate to \$3.08 from \$2.80 began with the January 2, 1974, dividend checks.

DECEMBER—Alberta Government Telephones became the first telephone organization in the world to have buried cable throughout its rural operating territory, following completion of a 10-year program. About 63,000 miles of cable was laid to connect some 77,000 rural telephones.

DECEMBER—Construction of a new, high-capacity coaxial cable system, called L-5, was completed between Pittsburgh and St. Louis. It is capable of carrying 108,000 simultaneous telephone conversations, three times the capacity of any previous coaxial system. (See Bell Laboratories Record, November, 1973, for history of coaxial systems.)

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