New ringer for 500-type telephone set

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Throughout the centuries of civilization, bells have been the conveyors of information affecting the gamut of human emotions. In the telephone, too, the ringing of a bell continues to be the most practical way of announcing the arrival of messages. But comparison of the new C-type ringer with its predecessors, reveals many physical differences.

Just to run through the course of ringer history, there was the Watson ringer of 1878 (Figure 1), followed by the No. 8 type of Figure 2. This continued to be the basic design* until the advent of the combined telephone set in 1937. When that set was being designed, a flatter structure† was required by the limited space available. Like previous ringers, the B-type used in combined set has two coils with the armature pivoted in the center so as to vibrate outside the pole pieces. By contrast, the new C-type ringer (Figure 3) has a single coil, a short cylindrical permanent magnet and the armature vibrates between the pole pieces.

In laying down the design objectives for the C-type ringer, consideration was given to the functional characteristic of interest to subscribers as well as to the Bell System. It will be convenient to describe the features of interest to each of these categories of viewpoint: the subscribers', the Operating Companies' and Western Electric's.

One design objective, the reduction of maintenance visits to adjust the loudness of the bell, has proved an important item of subscriber convenience. He need no longer bury his telephone set under a pillow, stuff paper in the gongs or call in the telephone man. Available through a slot in the base of the 500-type telephone set is the edge of a plate, rotation of which will give control of the sound output. Mechanically, this accomplishes a variation in the energy input to the gongs by means of simultaneous changes in gong spacing and allowable clapper-ball motion. This plate, the heart of the sound control mechanism, is cast with a serrated surface at the lower edge for finger control and, as shown on Figure 4, rotates on a shaft that extends through the ringer frame. The end of the shaft is attached to a spring catch that engages slots in the ringer frame to position the plate for four steps of sound volume. Gong spacing varies with rotation since the gong mounted on the plate is eccentrically located with respect to the shaft. The

* RECORD, *July* 1932, *page* 385.
† RECORD, *May* 1942, *page* 222.

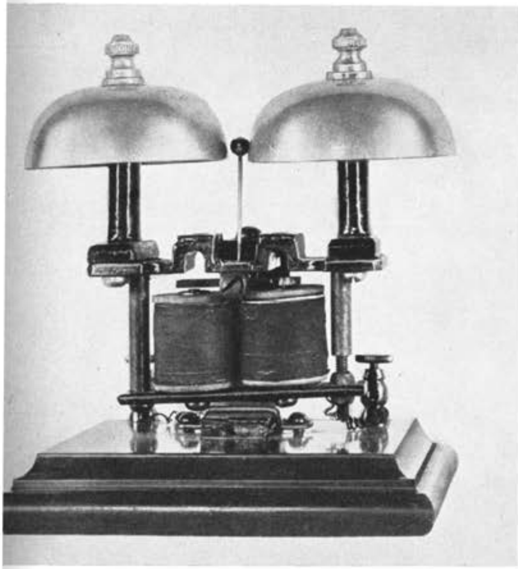

Fig. 1—This specimen of Watson's 1879 ringer is in the Bell System Historical Museum.

edge of the plate adjacent to the stop rod is a cam surface having discrete steps of rise. These sections of the cam surface are the contact points of the stop rod, and limit armature and clapper ball motion in accordance with the gong spacing at a particular sound control position.

The highest sound level is about 2 db above that of the combined telephone sets in current use and equal to it at the next lower position. Successive decreases of 5 db are obtained at the remaining two positions. Mechanical damping is avoided by maintaining proper clearance between the gongs and the clapper in the static positions. This contributes to clearness of ring and with harmonic spacing of the fundamental tones makes the sound more agreeable. The fundamentals of the gongs are spaced at a musical interval of a major third and resonated by air chambers under the gongs, which raise the output of the fundamentals above that of the overtones, pleasantly emphasizing the harmonic relationship. These resonators cause more than a 15 db gain in the fundamental gong frequencies, thereby effectively increasing the attention attracting quality of the gongs considerably more than is indicated by over-all sound output comparisons. This large low frequency gain helps those having some hearing loss in the higher frequency range as in the case of many older people.

System requirements for the C-type ringer include the possible addition of an extra extension telephone bringing the total permissible to five on a line. Consequently, the impedances of the new ringer at ringing and voice frequencies have been designed to meet this requirement. Normally, the ringer is installed with maximum bias-

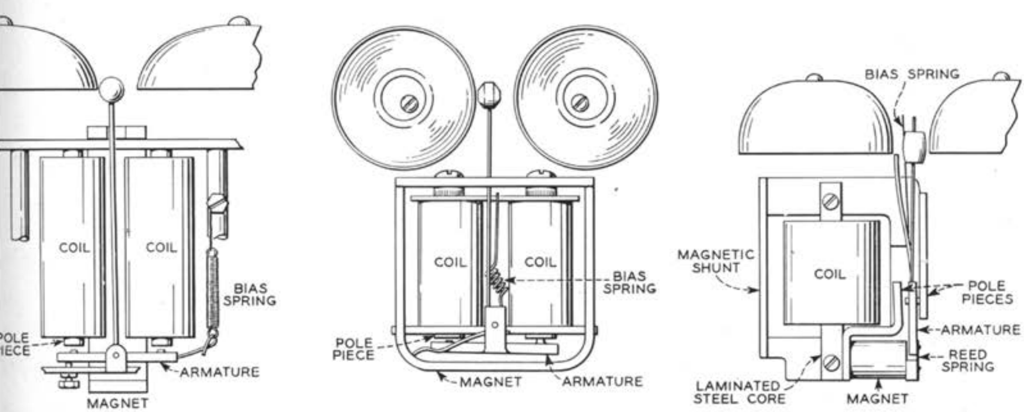

Fig. 2—The 8-type ringer is shown on the left, the B-type in the center, and the C-type on the right.

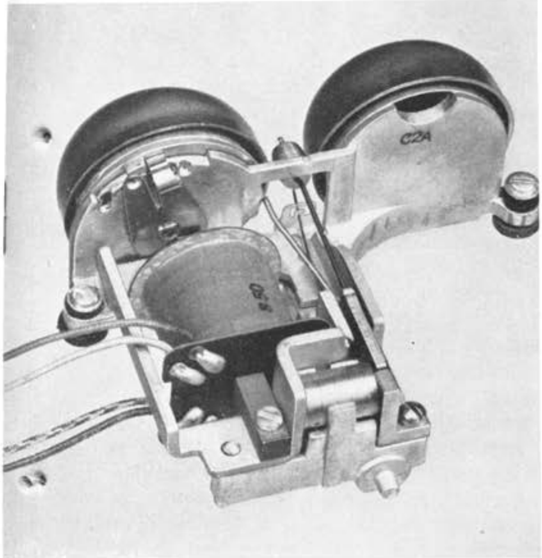

Fig. 3—The C2A ringer.

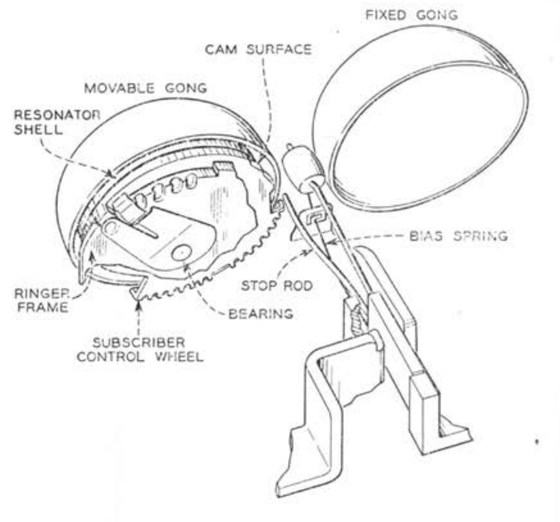

Fig. 4—Mechanism for sound level control.

ing load on the armature, however, in case of a line having the maximum number of extensions, a long loop and other adverse circuit conditions, the installer can use a lower biasing spring tension, as two notches are provided in the biasing spring bracket. This will provide increased ringer sensitivity that will be sufficient to meet limiting field conditions.

Another feature of interest from a system standpoint is that, unlike other ringers, the C-type up to the point of the winding being burnt out will not suffer demagnetization in service from surges on the line due to lightning or accidental contact with power lines. The magnetic paths of the electromagnet are so proportioned that saturation occurs long before the field strength becomes great enough to appreciably affect the permanent magnet. Also of interest to the field is the fact that the new ringer has eliminated the need of coding and handling several special combined telephone sets. The coil has a divided winding so that the sets can be used not only in individual and two-party but also in two-party message rate service. Only four-party full selective service requires a different code of ringer. Some extension stations are arranged so that the subscriber, on occasion, can cut off the ringer electrically by a switch. This type of special set is no longer

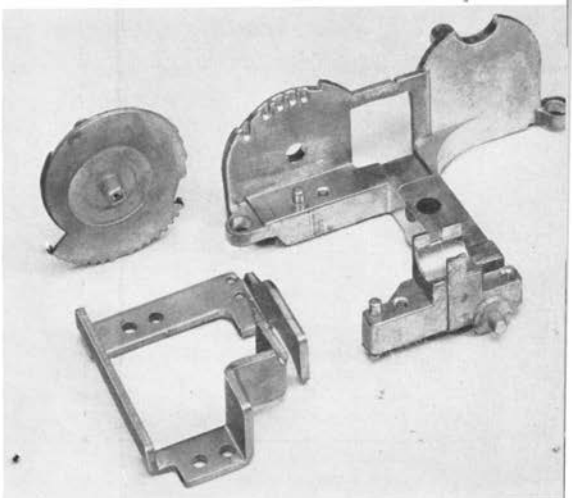

Fig. 5—Lower left, the punched and formed pole piece for the C-type ringer; upper right, the die cast frame; upper left, the finger wheel for sound level control.

required since the installer, by bending a tab on the spring catch can provide the subscriber with an additional step on the volume control where the ringer is completely silent.

Special features so far described, along with available space in the 500 type set, have primarily influenced the structural design of the C-type ringer. However, considerable thought has gone into producing a piece of apparatus that would be adaptable to modern manufacturing techniques pertaining to accurate, high rate production. From this standpoint, we have as usual worked closely with Western Electric engineers, incorporating into the design their ideas to facilitate production and reduce costs. The ringer structure is built around a single coil providing obvious manufacturing economies in materials and fabrication. As the inductances of the coil have to be boosted to approach that of two coils, a magnetic shunt is placed across the ends of the core of the coil. Mechanically, this joins the two pole pieces thereby forming a single unit of what would otherwise consist of three details (Figure 5). This simplification not only reduces the handling of extra piece parts but forms a more rigid structure requiring fewer fastening points. Incidentally, the armature is punched out of the scrap from the center of the pole piece blank. Assurance of a rigid, accurate mounting for the sound control features is secured by the use of a die cast frame. This type of design reduces to a minimum the number of fixtures and jigs that would otherwise be required for manufacture of a ringer composed solely of punched and formed parts.

Part of the manufacturing process involves adjustment of the ringer by an automatic machine that will be described in a subsequent article. Machine adjustment of the permanent magnet flux and the biasing spring tensions for suitable operating characteristics eliminates the need of a manual trial and error procedure during ringer manufacture. Experience to date indicates that automatic adjustment aids greatly in producing ringers with uniform operating characteristics.

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