March 6, 1956 O. W. HENRIKSON 2,737,651

RINGER SOUND CONTROL

Filed Oct. 5, 1954 2 Sheets-Sheet 1

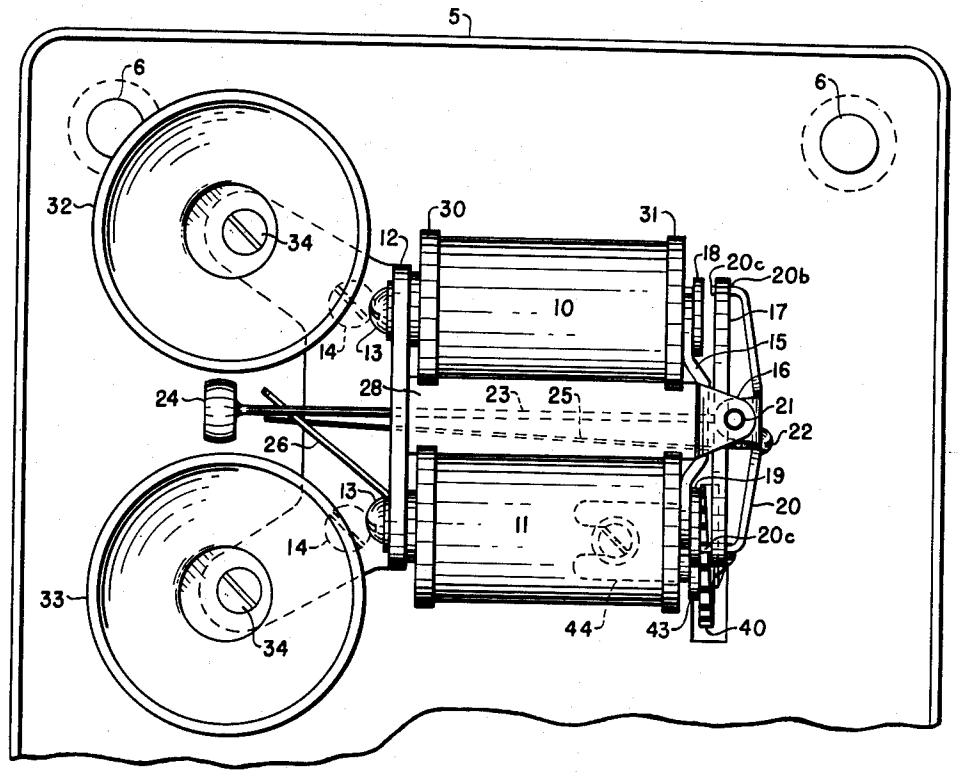


FIG. 1

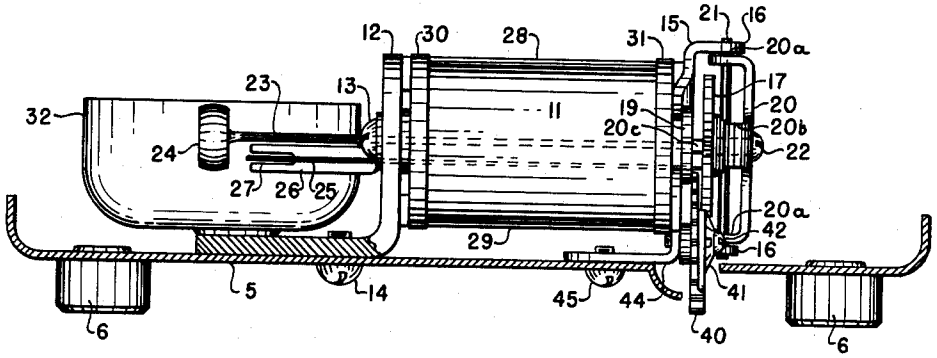


FIG. 2

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2 Sheets-Sheet 2

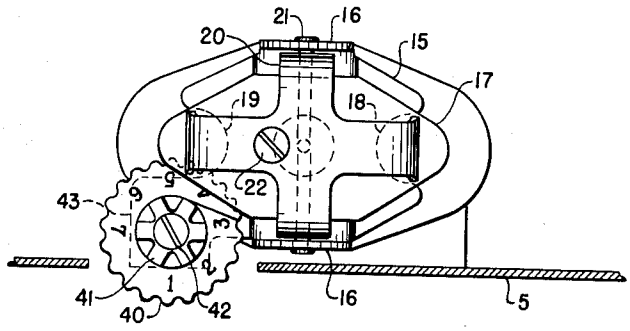


FIG. 3

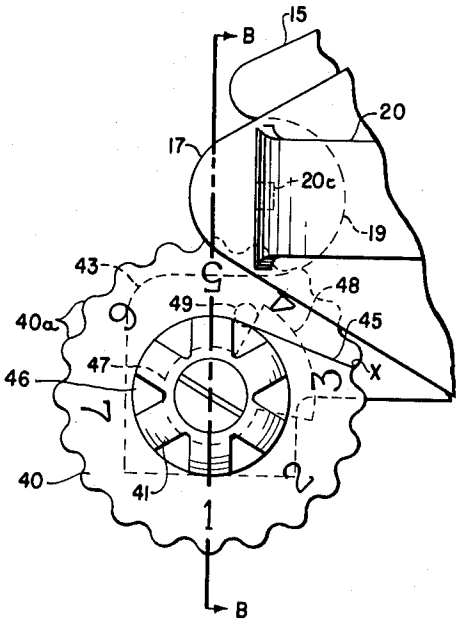


FIG. 4a

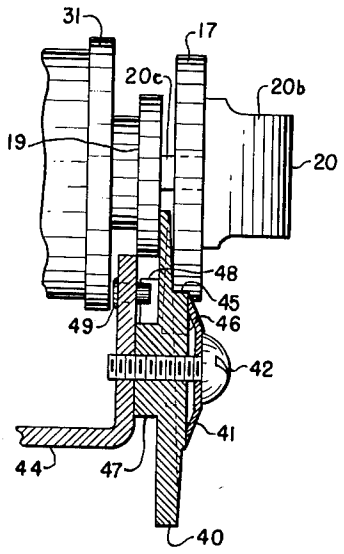


FIG. 4b

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2,737,651

RINGER SOUND CONTROL

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Application October 5, 1954, Serial No. 460,359

7 Claims. (Cl. 340—401)

This invention relates to electromagnetically operated ringing devices and particularly to improvements in volume controls for telephone subscriber substation ringers. This invention finds its chief application to ringers of the type generally known as "polarized" and then especially to ringers where it is found desirable to provide means for adjusting the travel of the armature of the electromagnet with respect to its pole-piece.

My invention is particularly applicable to ringers of the type substantially described in my copending application Serial No. 229,623 filed June 2, 1951, and which employ a pair of electromagnets the pole-pieces of which alternatively operate upon the arms of an armature pivoted between the magnets. A clapper rod staked into the armature to the opposite end of which a clapper is secured is thus caused to vibrate thereby causing the clapper to alternately strike each of a pair of gongs. The intensity level of the sound produced by the contact of clapper and gong is determined partly by the amplitude of movement of the clapper rod which in turn is determined by the degree which the armature is permitted to move about its pivot. Thus if a means is provided whereby the armature travel can be adjusted an adjustment in intensity level of the ringer sound is also achieved.

Generally stated then, it is the primary object of my invention to provide a means for controlling the sound level of a telephone subscriber station ringer to any desired intensity through a new and novel means for adjusting the movement of the ringer armature with respect to its pole-piece.

It is another object of my invention to provide such adjusting means of a simplicity and ease of operation that the adjustment can readily be made by the telephone subscriber to suit individual requirements.

An important feature of my invention is a novel finger wheel which may be rotated to a number of positions corresponding to any number of sound intensity levels available, the finger wheel at the same time serving as the means whereby the movement of the armature is limited.

Another feature of my invention is the fact that an adjustment in the armature gap accomplishes a corresponding adjustment in the striking force of the clapper.

This invention will become clear from a reading of the detailed description which follows taken in connection with the accompanying drawings of which:

Fig. 1 shows a plan view of the ringer in which the relative position of the armature and clapper rod and the pole-piece and finger wheel are clearly presented,

Fig. 2 is a side elevation of the ringer in which is shown the finger wheel in its position between a pole-piece and the armature and extending through the base-plate of a mounting in a subscriber substation. The Figs. 2–4 are shown partly broken to more clearly show the relation of the parts.

Fig. 3 is an end view of the ringer in which the position of the finger wheel is further illustrated, and

Fig. 4*a* and *b* show the details of the finger wheel, its

mounting and its cooperating elements, Fig. 4*b* being a section view taken along the line *b*—*b* of Fig. 4*a*.

A substation ringer embodying the sound level control constructed according to the present invention comprises a pair of electromagnets **10** and **11** rigidly secured to a bracket **12** by means of the screws **13** as may be seen in Figs. 1 and 2. The bracket **12** in turn constitutes the means whereby the ringer assembly may be installed on a base **5** of a subscriber substation as by the screws **14**. Composition or rubber feet **6** may be secured to the base **5** in any convenient manner. An armature yoke **15** having a pair of parallel lugs **16** turned at right angles provides a means for pivoting the armature **17**. The armature **17** is secured in a proper relationship with the pole-pieces **18** and **19** of the coils **10** and **11** respectively by means of a four member non-magnetic clamping spring **20**. The clamping spring **20** is provided at the extremities of the four members with a pair of lugs **20***a* and a pair of lugs **20***b*. The lugs **20***a* are turned at right angles to the main portion of the spring **20** and are drilled to receive a pivot pin **21** which also passes through suitable holes provided in the lugs **16** of the armature yoke **15**. The lugs **20***b* are also turned at right angles with the main portion of the spring **20** and terminate in the armature stops **20***c*. The armature stops **20***c* are adapted to pass through suitable apertures provided in the extremities of the armature **17**. The armature **17** is secured to the clamping spring **20** by means of a screw **22**. Thus the armature **17** and the spring **20** are enabled to pivot together about the pivot pin **21**.

Staked to the armature **17** or secured in any convenient manner is a clapper rod **23** to which at the other extremity is floatingly mounted a clapper **24**. A wire spring **25** is also staked in the armature **17** and is designed to bias the armature **17** and its stop **20***c* toward the pole-piece **19** of the electromagnet **11**. The spring **25** is held in a stressed position by means of a spring clip **26** which may be mounted to the bracket **12** by one of the screw means **13**, the spring **25** passing through and resting in a slot **27** of the clip **26**. A pair of permanent magnets **28** and **29** are held in place by slots provided in the spool heads **30** and **31** and the clamping action of the bracket **12** and the armature yoke **15**. The magnets **28** and **29** serve to provide polarization for the armature **17**.

A pair of gongs **32** and **33** mounted on extensions of the bracket **12** by the screws **34** completes the ringer assembly proper. As is evident from Fig. 1, as the electromagnets **10** and **11** are alternately energized, the pole-pieces **18** and **19** will be similarly magnetized causing the armature **17** to be alternately attracted to the pole-pieces **18** and **19** and thus pivoted about the pivot pin **21**. The clapper rod **23** will also thereby be vibrated, in one instance against the bias of the spring **25** and in the other with the bias. The clapper **24** as a result will alternately strike the gongs **32** and **33**. It is evident that the clapper **24** will strike the gongs **32** and **33** with the greatest force and thereby produce the loudest ringing when the vibration of the clapper rod **23** reaches its greatest amplitude and when the electromagnet exerts its greatest attraction on the armature **17**. This point of greatest amplitude is reached, obviously, when the armature **17** is permitted its maximum pivoting motion, that is, when the distance between the armature stops **20***c* and the pole-pieces **18** and **19** is at a maximum. The electromagnet exerts its greatest attraction when the magnetic flux path is substantially unbroken and this condition in part is accomplished by maintaining at a minimum the distance constituting the residual gap.

The present invention accomplishes simultaneously the adjustment of the aforementioned conditions, namely, the adjustment of the residual gap thus limiting the power of the armature **17** motion and the adjustment of the

limits of the travel of the armature **17** itself. This is accomplished by means of a finger controlled non-magnetic wheel **40** rotatably mounted on an extension **43** of the armature yoke **15**, most clearly shown in Fig. 4*a*. A lug **44** of the yoke **15** and turned at right angles to it provides additional means for securing the ringer assembly in the required installation as by the screw means **45**. The finger wheel **40** is mounted by means of a suitable shoulder screw **42** which is locked in position by means of a spider compression spring **41** and is provided on its periphery with the knurling **40***a* to facilitate finger rotation. The finger wheel **40** is so positioned with respect to the ringer installation that a sector of the wheel **40** is permitted to extend beyond the base or casing as is clearly represented in Figs. 2 and 3. Thus any rotation of the wheel **40** can be accomplished from the outside of the installation.

The finger wheel **40** to achieve its function is essentially a barrel cam having, in the preferred embodiment of this invention, its base in a plane perpendicular with its axis and its operating surface generated by rotating a portion of a radial section of the wheel about its axis at the same time linearly increasing the altitude of the radial section. If such a radial section is rotated for substantially a complete revolution an operating surface will result which gradually increases its distance from the base from a minimum at a point to a maximum when that point is again reached. Thus the peripheral surface of the barrel cam will present a substantially wedge shaped area. Referring to Figs. 4*a* and 4*b* of the drawings it is seen that the point X on the periphery of the wheel **40** may be the starting point of the rotation of the radial section. As the section is rotated in a counterclockwise direction as viewed in Fig. 4*a* the section will achieve its maximum distance from the base of the wheel **40** in one revolution when it again returns to the point X. The maximum and minimum differential is clearly shown by the formation of a ridge **45**. Since the cam surface is generated by rotating only an outer radial section, a concentric surface perpendicular to the axis of the wheel **40** remains which provides a flat surface for the seating of the compression spring **41**.

A shoulder **47** is provided on the wheel **40** on the opposite side from its operating surface to maintain the proper distance from the armature yoke **15** and to insure proper alignment with its cooperating elements. Also on the side of the wheel **40** opposite from the operating surface is a cam lobe **48** adapted to contact a stud pin **49** rigidly mounted in the yoke extension **43**. The cam lobe **48** is so designed and positioned with respect to the stud pin **49** that the wheel **40** can be rotated only between two extreme positions. As is clearly shown in Fig. 4*a* a sector of the wheel **40** is always interposed between the armature **17** and the pole-piece **19**. Thus, assuming the normal position of the finger wheel **40** to be as shown in Fig. 4*a*, that is, with the cam lobe **48** in contact with the stud pin **40** then, as indicated by the position of the point X, the sector of the barrel cam or finger wheel **40** having the minimum peripheral thickness will be in position between the armature **17** and the pole-piece **19**. This is most clearly shown in Fig. 4*b*. At this position of the wheel **40** the residual gap will be at a minimum and the armature stop **20***c* is permitted to contact the pole-piece **19**, that is, the minimum peripheral thickness of the wheel **40** at this position permits an unimpeded movement of the armature upon the energization of the electromagnets **10** and **11**. As a result, at this position the magnetic attractive force is greatest and the armature **17** and clapper rod **23** is permitted the greatest swing and the ringing will be the loudest.

If the finger wheel **40** is now rotated in a clockwise direction as viewed in Fig. 4*a*, its other extreme position will be determined by the other side of the cam lobe **48** contacting the stud pin **49** and a sector of the wheel **40** with the maximum peripheral thickness will be interposed between the armature **17** and the pole-piece **19**.

At this extreme position the cam wheel **40** effectively prevents any movement of the armature **17** and at this position also with the armature **17** held in its extreme position the residual gap will be at a maximum. The clapper **24** will thus be prevented from striking the gongs and the ringer will remain silent during any energization of the electromagnets **10** and **11**.

As will be evident from the above description there will be an unlimited number of intermediate positions to which the finger wheel **40** may be rotated, each position as described above, corresponding to a certain level of ringing loudness. To aid the subscriber in selecting the degree of loudness desired, however, indicia have been provided on the finger wheel **40** representing seven positions of ringing loudness. The number "1," for example, represents the extreme position of the wheel **40** and at which position the ringing will be the loudest. At this position the number "1" will be readable on the sector of the wheel **40** projecting outside of the casing. On the other extreme, the number "7" represents the silent position of the wheel and represents the position at which the sector of maximum peripheral thickness is interposed between the pole-piece **19** and the armature **17**. Similarly, the numbers "2" through "6" represent intermediate positions to which the wheel **40** may be rotated.

While what has been described is considered to be the preferred embodiment of my invention it is to be understood that various modifications may be made in the structure and arrangement of the component parts without departing from the scope of the following claims.

What is claimed is:

1. In a ringer, in combination, electromagnet means having a pole-piece, an armature pivotally mounted on said ringer and adapted to travel between predetermined limits as said electromagnet means is energized, a bracket mounted on said ringer adjacent the space between the armature and said pole-piece, an adjusting means rotatably mounted on said bracket and freely rotatable by hand, said means having a portion extending into said space between said pole-piece and said armature, said adjusting means adapted to progressively limit said armature travel as said adjusting means is rotated.

2. In a ringer, in combination, electromagnet means having a pole-piece, an armature pivotally connected on said ring and adapted to travel between predetermined limits as said electromagnet means is energized, a bracket mounted on said ringer adjacent the space between the armature and said pole-piece, an adjusting means rotatably mounted on said bracket and freely rotatable between said pole-piece and said armature, said adjusting means adapted to present a cross section of progressively increasing dimension between said pole-piece and said armature as said adjusting means is rotated to thereby progressively limit said armature travel.

3. In combination in a telephone substation ringer, electromagnet means having a pole-piece, an armature pivotally mounted in said ringer, and adapted to pivot between predetermined limits as said electromagnet is periodically energized, a clapper rod secured to said armature and having a clapper mounted on the extremity thereof, a pair of gongs associated with said clapper, said clapper adapted to alternately strike each of said gongs as said armature is pivoted, the sound intensity level of said gongs being a function of said predetermined limits, a rotatable wheel mounted in said ringer, a sector of said wheel passing between said pole-piece and said armature, the periphery of said wheel progressing from a minimum to a maximum thickness, the said sector of said wheel passing between said pole-piece and said armature varying in thickness as said wheel is rotated to thereby vary said predetermined limits whereby said sound intensity level is correspondingly varied.

4. The combination as claimed in claim 3, said ringer mounted in the casing of said substation, said rotatable wheel having a second sector projecting outside of said

casing and having means provided on the periphery thereof to facilitate rotation by means of a finger.

5. In an electromagnetically operated ringer for use in telephone substations, said ringer having an armature operated clapper and gongs associated therewith and in which the sound intensity level of said ringer is a function of the limits of the armature travel, a sound level control comprising a wheel mounted in said ringer, an annular portion of said wheel having a cross-section of progressively varying thickness such that as said wheel is rotated said limits of said armature travel will be correspondingly progressively limited to thereby progressively limit said sound intensity level, said annular portion of said wheel also projecting externally of said substation and said wheel provided with means on the periphery thereof to facilitate finger rotation of said wheel.

6. In a sound level control as described in claim 5, said annular portion of said wheel provided with indicia thereon, each of said indicia corresponding to representative levels of sound intensity, said indicia so positioned that as said wheel is rotated said indicia are successively visible externally of said substation.

7. In combination in a telephone substation ringer, electromagnet means having a pole-piece, an armature pivotally mounted in said ringer and separated from said pole-piece by a predetermined gap, said armature adapted

to pivot between predetermined limits as said electromagnet is periodically energized, a clapper rod connected to said armature and adapted to vibrate as said armature is pivoted between said limits, said clapper rod having a clapper mounted on the extremity thereof, a pair of gongs associated with said clapper, said clapper adapted to alternately strike each of said gongs as said armature is pivoted, the sound intensity level of said gongs determined by the striking force of said clapper, said striking force being a function of said predetermined gap and said predetermined limits, a rotatable non-magnetic wheel mounted in said ringer, a sector of said wheel passing between said pole-piece and said armature, a peripheral portion of said wheel progressing from a minimum to a maximum thickness, the said sector of said wheel thereby interposing a cross-section between said pole-piece and said armature of varying thickness as said wheel is rotated to thereby simultaneously vary said predetermined gap and said predetermined limits whereby said sound intensity level is correspondingly varied.

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