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UNIVERSAL TELEPHONE RINGER HAVING BIASED STRIKER

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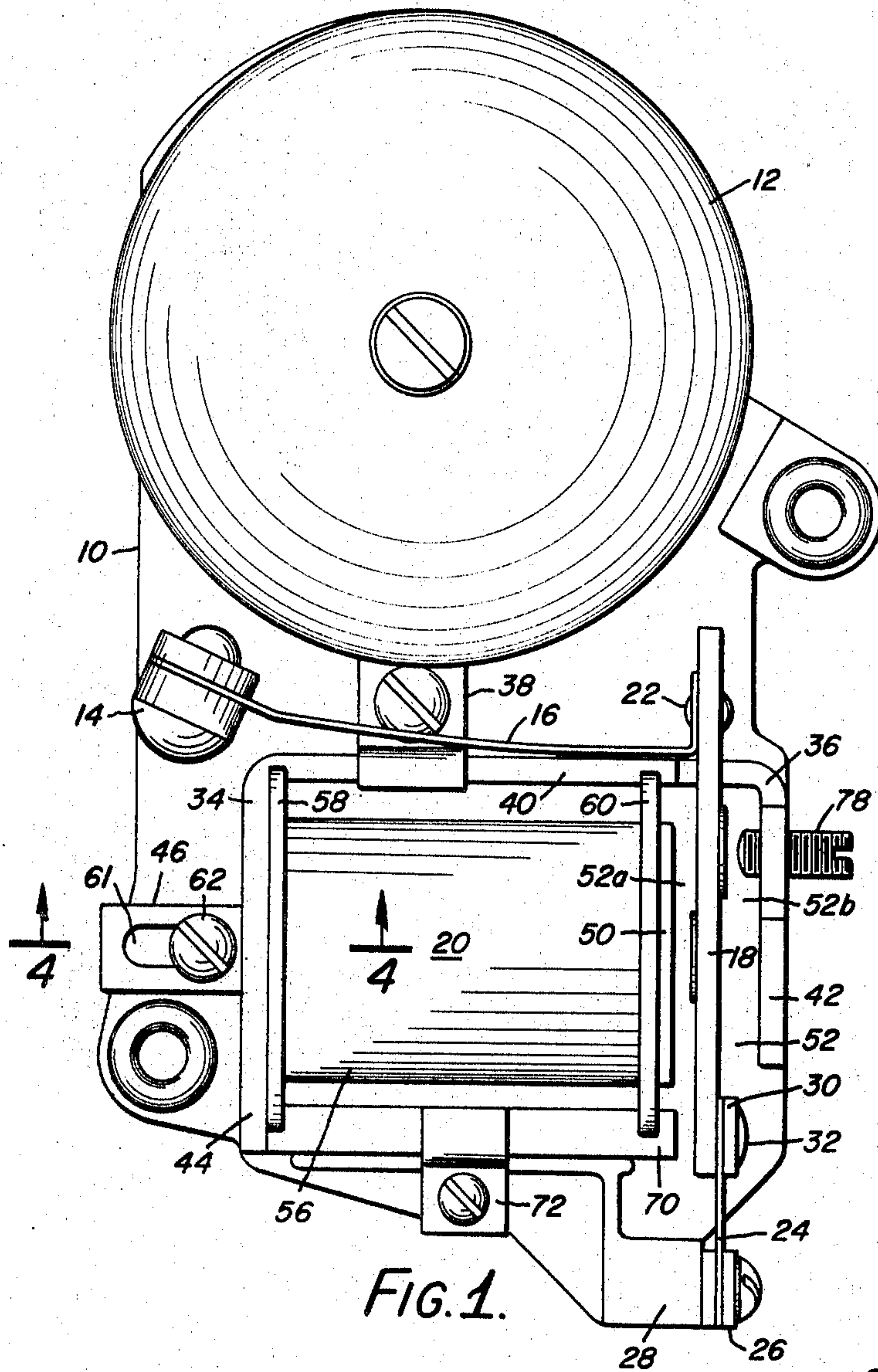


FIG. 1.

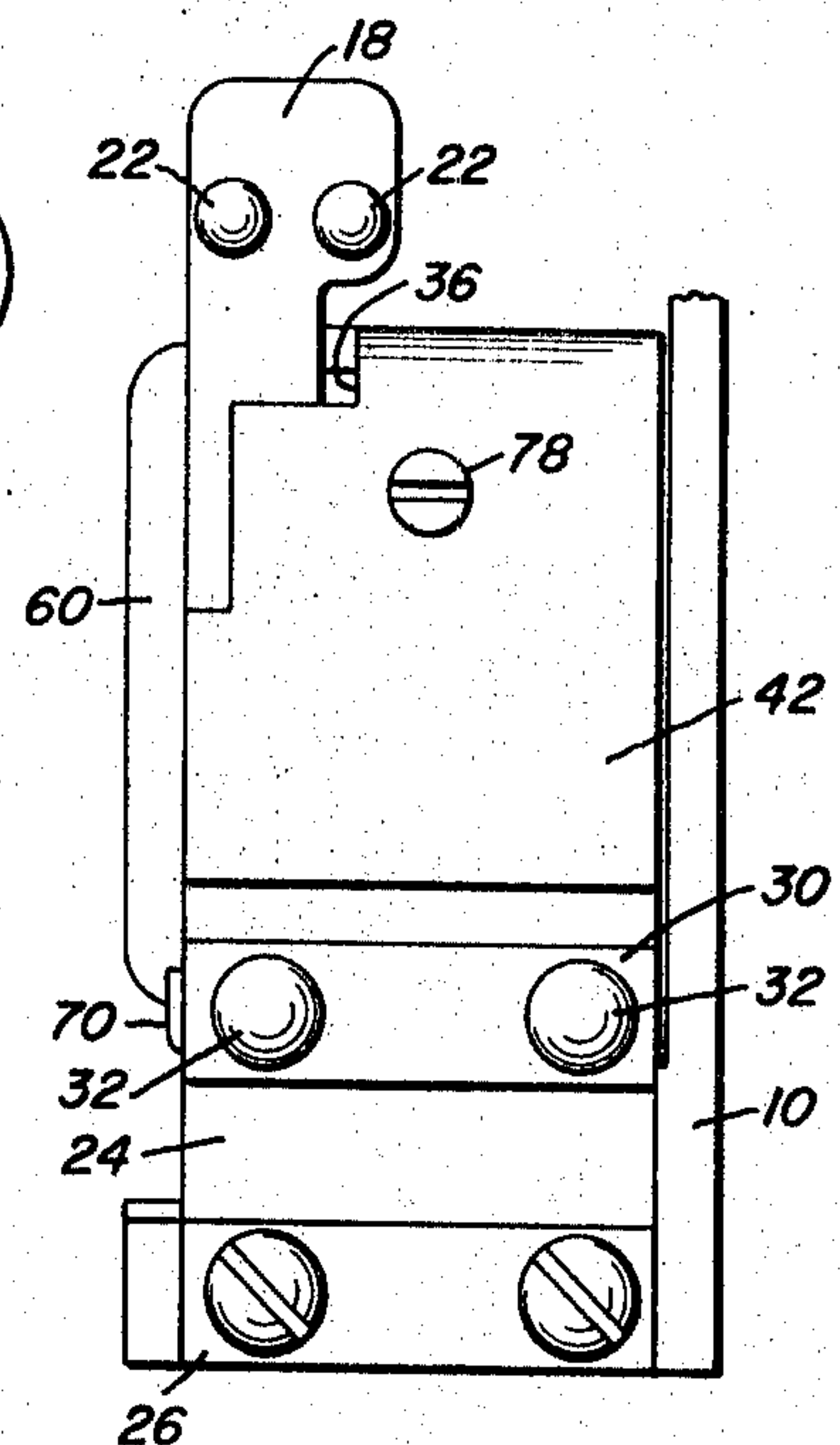


FIG. 3.

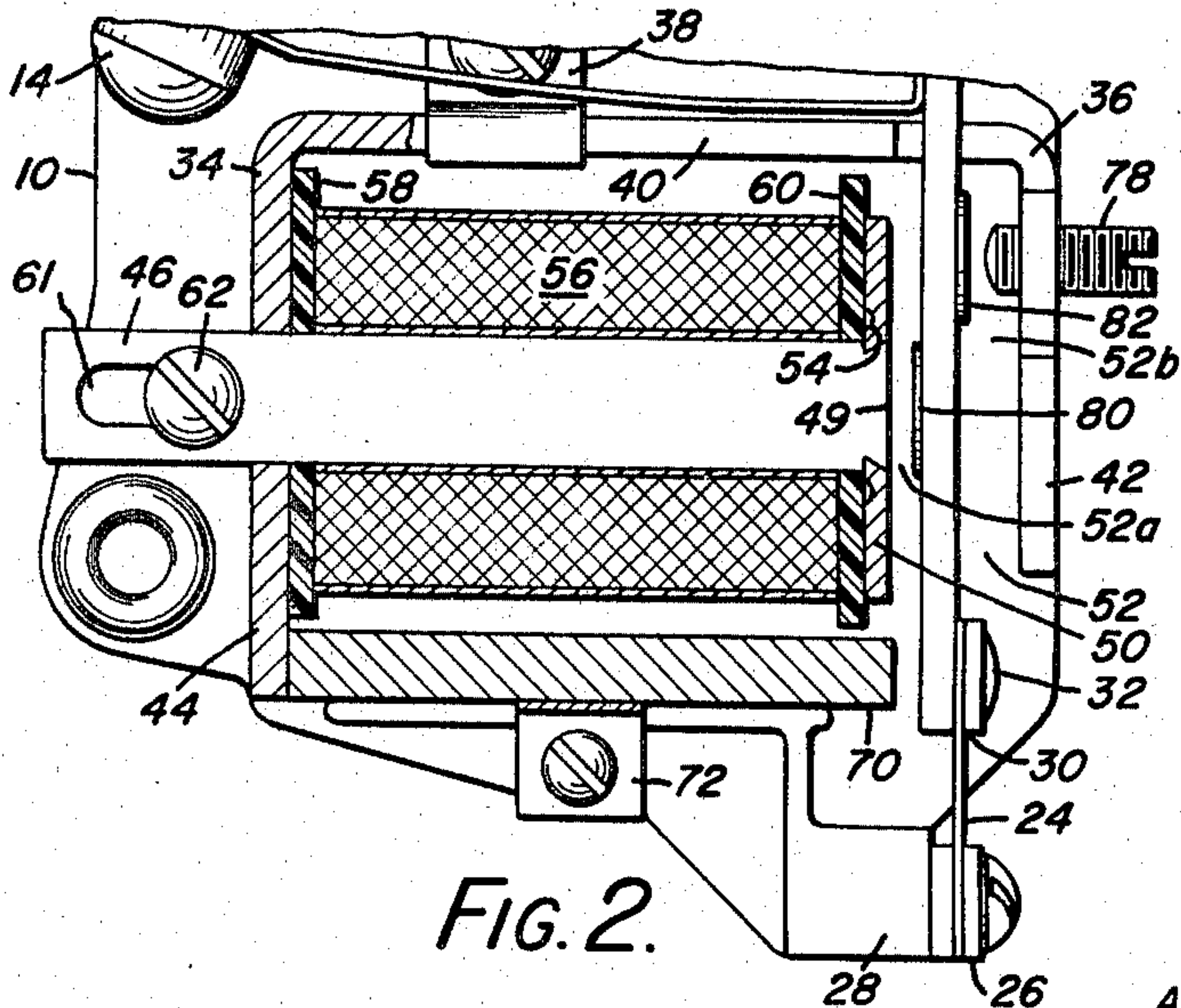


FIG. 2.

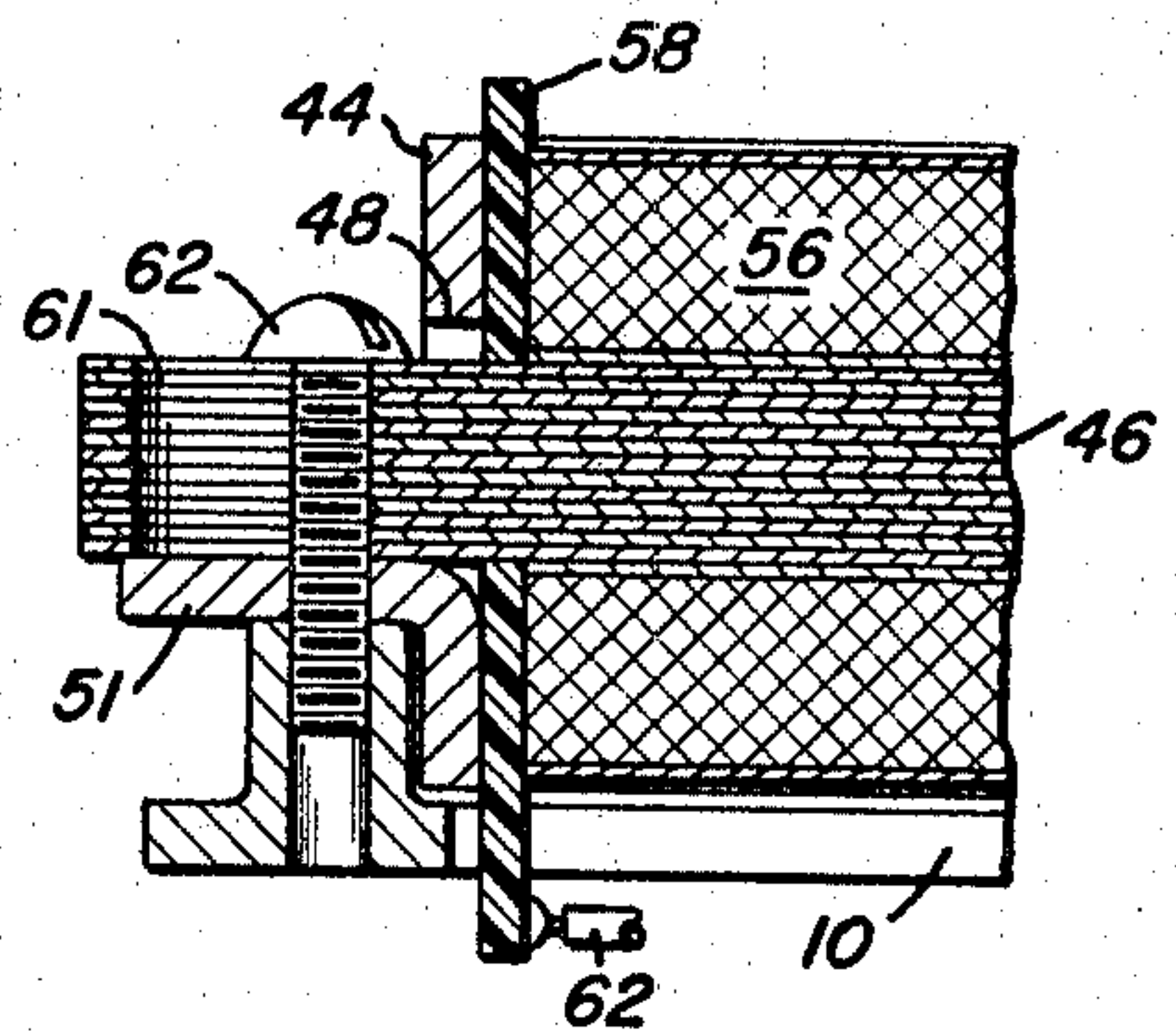


FIG. 4.

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14 Claims

ABSTRACT OF THE DISCLOSURE

A telephone ringer which is adaptable for use as a frequency selector ringer over a wide range of audible frequencies is described. The ringer has a gong, a tapper for striking the gong and an electromechanical actuator for driving the tapper into contact with the gong. The magnetic structure of the actuator includes a core having a flanged pole tip and a U-shaped pole piece which cooperates with the core to define an air gap with the proper flux distribution to permit ringing currents at various frequencies to properly actuate the ringer. An adjustable nylon stop screw in the pole piece also limits and controls the motion of the tapper to provide efficient ringing action.

The resent invention relates to telephone ringers, and particularly to ringers operable with ringing currents having various different frequencies.

The invention is especially suitable for use in ringers which must be relatively small in size so as to be capable of installation in telephone sets of the type which the presently coming into more frequent use. The features of the invention will, however, be generally applicable in providing improved telephone ringers.

Among the problems which existed in prior telephone ringers is the difficulty of obtaining the necessary efficiency in the electro-magnetic actuator to drive the tapper with sufficient force to provide the necessary amplitude and quality of ringing tones. In order to overcome this problem, complex pole piece and magnet structures were sometimes used. Different pole piece and magnet structures combinations were required for ringers which operated at different frequencies. Thus, commonality of parts was lacking and the cost of producing ringers ran high. Attempts to provide the requisite ringing efficiency also increased the amount of magnetic material (iron) needed for the pole piece and therefore increased the weight and sometimes the size of the ringer over and above that which was desired.

Accordingly, it is an object of the present invention to provide improved telephone ringers wherein the foregoing difficulties and disadvantages of prior ringers have been significantly reduced.

It is a principal object of the invention to provide a telephone ringer having an electro-mechanical actuator which is small in size and may be used substantially without modification in ringers which operate over many different ringing frequencies.

It is a further object of the present invention to provide an improved telephone ringer which provides a tone of high amplitude and long duration without imposing unnecessary wear on the tapper.

Briefly described, an improved telephone ringer embodying the invention contains an efficient electro-magnetic actuator which drives a tapper against a gong in accordance with ringing current which is applied to the operating winding or coil thereof. A U-shaped pole piece is used in the magnetic structure of the actuator through which a core extends so that the tip of the core and one end leg of the pole piece defines an air gap through which an armature may extend. A flange is provided on the pole

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tip region of the core which may be magnetic (e.g., iron) or non-magnetic (e.g., brass) material which distributes the flux in the air gap so as to provide efficient ringing action, either at higher frequencies (above 25 Hz.) or at lower frequencies (those below 25 Hz.). An adjustable stop may be provided in the pole end which provides the pole piece for restricting the motion of the armature to the end that the tapper strikes the gong at the point where the gong reaction is most favorable. Wiping action is reduced so that the tone produced by the gong is of long duration and is not damped. The ringer may be of the balanced armature type wherein a biasing flux is established which is balanced in the portions of the air gap on opposite sides of the armature. The flange on the pole tip end of the core assists in distributing this biasing flux in the air gap so that the actuator efficiency is enhanced.

The invention itself, both as to its organization and method of operation, as well as additional objects and advantages thereof will become more readily apparent from a reading of the following description in connection with the accompanying drawings in which:

FIG. 1 is a plan view of a ringer embodying the invention;

FIG. 2 is a fragmentary side view, taken from the right, of the ringer shown in FIG. 1;

FIG. 3 is a fragmentary plan view similar to FIG. 1, but partially in section to show the magnetic structure of the ringer in greater detail; and

FIG. 4 is a fragmentary sectional view taken along the line 4—4 of FIG. 1.

Referring more particularly to the drawings, the ringer is assembled on a base 10 of non-magnetic material, such as aluminum. A gong 12 is mounted on the base. A tapper 14 is positioned to strike the gong and is carried by an arm 16. The arm 16 may be made of spring material. For lower frequency ringers (viz., those operative below 25 Hz.) the flexibility of the arm 16 should be greater than for higher frequency ringers. A volume adjusting mechanism (not shown) may be disposed to engage the arm and the gong in order to adjust the intensity of the generated tones.

The arm is connected to an armature 18 of an electro-magnetic actuator 20 as by way of rivets 22. Adjusting springs or tuning arms (not shown) may be attached to the armature in order that the mechanical system may be tuned in the region of the tuning of the electro-magnetic system of the actuator 20. A portion of this system is, of course, the armature spring 24 which is connected by way of a clamping plate 26 through an upstanding projection 28 from the base 10. Another clamping plate 30 clamps the opposite end of the spring 24 to the armature and is secured to the armature as by means of rivets 32.

The magnetic structure of the actuator 20 includes a U-shaped pole piece 34 of magnetic material, such as iron, having a slot 36 through which extends the end of the armature 18 which is connected to the tapper arm 16. A clamping bracket 38 holds the pole piece 34 down on the base 10. The pole piece itself may be considered to have three parts. Specifically, a side leg 40 and a pair of end legs 42 and 44.

A core 46 of laminated magnetic material extends through an opening 48 in the end leg 44 and is in position with a lip 51 (see FIG. 4) which extends away from the pole end 44. The end 49 of the core 46 has a flange 50 of metallic material which may, depending upon the frequency range of the ringer, be either magnetic, such as iron, or non-magnetic, such as brass. The core end with its flange constitutes a pole tip of the magnetic structure. The flange 50 is also coextensive in size with the end leg 42 of the pole piece 34. The end leg 42 constitutes another pole tip of the magnetic structure; the

air gap 52 being defined between the core pole tip end 49 and the end leg 42 pole tip.

The flange 50 is attached to the laminations which constitute the core 46 by means of swaging (see FIG. 3). The flange 50 has a central square hole therein through which the end 49 extends. In the assembly of the flange 52 and the core 46, the flange is swaged by means of a swaging tool applied to the surface thereof which is opposite to the air gap so as to create a swaged region 54 which holds the flange securely to the laminations. In addition to its magnetic function, the pole tip flange 50 performs two other functions; namely, it prevents skewing of the laminations, thus simplifying their assembly and adjustments and it tightens the laminated assembly, thereby preventing vibration and the consequent generation of audio hum on side ringing or power line frequencies.

Means for establishing magnetic ringing flux in the air gap 52 is provided by means of the winding or coil 56. The coil may be wound on a coil form having end flanges 58 and 60. Connections to the coil are made at terminals 62 at the bottom of the end flange 58 (see FIG. 4).

The end of the core 46 which extends in a direction lengthwise thereof out of the hole 48 has a slot 60 therein. A screw 62 which extends through the lip 50 into a threaded hole 64 in the base 10 provides means for securing the core in different positions in a direction lengthwise thereof. This facilitates the adjustment of the width of the air gap 52 (viz. the pole tip spacing between the pole tips provided by the core end 49 and the end leg 42). The screw 62 also assists in fastening the pole piece 34 to the base 10.

The actuator magnetic structure is of the balanced armature type. To this end, a magnetic biasing flux is established which is balanced in the regions of the air gap 52a and 52b on opposite sides of the armature 18. This biasing flux is established by means of a permanent bar magnet 70 which is secured to the base by means of a clamping bracket 72.

Referring particularly to FIG. 3, it will be observed that the end leg 44 of the pole piece 34 is somewhat longer in a direction away from the side leg 40 of the pole piece than is the end leg 42 thereof. One pole end of the permanent magnet 70 is disposed in contact with the extended portion of the end leg 44. While the opposite end thereof is adjacent to but spaced from the armature 18. Magnetic flux therefore passes into the armature and divides in balanced relationship between the pole tip 49 and the pole tip provided by the end leg 42. Preferably, the magnet 70 is polarized so that its south pole is adjacent the armature 18.

It will be observed from the foregoing description that the pole piece 34, the core 46, magnet 70 and armature 52 comprises a magnetic circuit with a minimum of awkward complex configuration and also a minimum of iron. By complex configuration is meant such bends and steps as may be required in order to create flux densities of requisite magnitudes to drive the tapper with sufficient force to obtain good tonal amplitude and quality. Much of this improvement in the magnetic structure of the actuator 20 is attributable to the flange 50 on the pole tip of the core 46.

As mentioned above, for higher frequency ringers which are designed to operate, say above 25 Hz., the flange 50 is desirably of non-magnetic material. The increased reluctance in the air gap region 52a over and above that in the region 52b establishes a magnetic flux unbalance favoring the pole tip provided by the end leg 42. This permits the armature to move under the magnetic field established by the ringing current with more acceleration towards the pole tip provided by the leg 42. This increases the force developed by the actuator and applied by the tapper against the gong when the tapper comes into contact with the gong. This increased force also accommodates the increased stiffness of the spring 24 which is used for higher frequency ringers. The flange

50 also provides the advantages in facilitating the construction and improving the reliability and operational characteristics of the ringer which were mentioned above.

When the flange is made of magnetic material, such as iron, it has the additional advantage of distributing the flux between the air gap region 52a and 52b such that the armature may move readily in spite of low frequency actuating current.

It will be observed that when the armature 18 moves towards the end leg 42, the tapper 14 is brought into contact with the gong. Due to the location of the tapper 14, any tapper movement after striking the gong would result in a wiping action. This wiping action has two serious drawbacks. First, it causes wear of the tapper, such as would require its replacement more frequently than desired. Secondly, the gong reaction (viz. the tone produced) is reduced in quality if the gong does not strike the tapper only in that limited region where the tapper moves radially with respect to the gong. Continuing travel due to inertia of the tapper, when it moves in a radial direction, is translated efficiently into sound. Movement of the wiper in the wrong direction, as may be exhibited by the wiping action mentioned above, reduces tone quality and even causes damping of the generated tone, thereby shortening its duration. These difficulties are overcome by means of an adjustment member in the form of a nylon screw 78 which extends through a hole in the end leg 42 near the opening 36. This nylon screw by virtue of its material generates very little noise. The generation of noise is further inhibited by two disc shaped pads 80 and 82 which are disposed on opposite sides of the armature. One of these pads 82 engages the screw 78. The screw may be adjusted during testing of the ringer in the factory and then fastened in proper position by means of cement.

From the foregoing description it will be apparent that there has been provided an improved ringer which has many features of operation and construction, such as commonality of parts for ringers which are operative with ringing current of many different frequencies and an efficient magnetic structure which is of simple design and may be readily constructed and assembled at low cost. While an exemplary embodiment of the invention has been shown and described, it will be appreciated that variations and modifications thereof within the spirit and scope of the invention will undoubtedly suggest themselves to those skilled in the art. Accordingly, the foregoing description should be taken merely as illustrative and not in any limiting sense.

What is claimed is:

1. In a telephone ringer having a gong and a tapper for striking the gong an electro-mechanical actuator for driving said tapper comprising

- (a) A U-shaped pole piece having a side leg and a pair of end legs at opposite ends of said side legs,
- (b) a core disposed within said pole piece between said end legs and being spaced from one of said end legs to define an air gap, such that the end face of said core and the face of one of said pole piece ends which oppose each other across said air gap define pole tips,
- (c) means for establishing a magnetic flux which varies in accordance with ringing current across said air gap,
- (d) a flange attached to said pole tip end of said core for distributing the flux across said air gap,
- (e) an armature mounted in said air gap for movement between said pole tips,
- (f) means for establishing a magnetic biasing flux which is in substantially balancing relationship between said armature and each of said pole tips on opposite sides of said armature, and
- (g) means for connecting said tapper to said armature so that it strikes said gong at least when said arma-

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ture moves in a direction toward said pole tip end leg.

2. The invention as set forth in claim 1 wherein said flange is constituted of magnetic material so as to establish a predetermined balance of magnetic flux in said air gap.

3. The invention as set forth in claim 1 wherein said flange is constituted of non-magnetic material so as to establish a predetermined unbalance of magnetic flux in said air gap such that the flux between said armature and said pole tip end leg is greater than the flux between said armature and said core pole tip.

4. The invention as set forth in either claim 2 or 3 wherein the surface of said flange which faces said air gap is substantially co-planar with the surface of said core pole tip which faces said air gap.

5. The invention as set forth in either claim 2 or 3 wherein the leg of said flange and pole piece end leg pole tip are co-extensive with each other.

6. The invention as set forth in claim 4 wherein said flange has an opening therein through which said core pole tip extends, a swaged portion of said flange adjacent to said core pole tip attaching said flange thereto.

7. The invention as set forth in claim 6 wherein said core is comprised of a stack of laminations, said flange providing against skewing of said laminations.

8. The invention as set forth in claim 1 wherein the end leg of said pole piece opposite said pole tip end thereof has an opening therein and a lip extending outwardly of said pole piece therefrom along one side of said opening, and a second end of said core extending through said opening in juxtaposition with said lip.

9. The invention as set forth in claim 8 including a slot in said second end of said core extending lengthwise

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thereof, means in said slot for securing said core in different positions in a direction lengthwise thereof for adjusting the width of said air gap.

10. The invention as set forth in claim 1 including an adjustment member extendable through said pole piece end leg pole tip toward said armature for limiting the travel of said armature so as to enhance tapper to gong contact.

11. The invention as set forth in claim 10 wherein said adjustment member is a nylon screw.

12. The invention as set forth in claim 10 wherein a pair of pads are provided on opposite sides of said armature, one movable into contact with said adjustment member and the other movable into contact with said flange.

13. The invention as set forth in claim 1 wherein said pole tip end leg extends a lesser distance away from said side leg than the other of said pole piece end legs, and said biasing means provides magnetic potential between said other pole end and said armature.

14. The invention as set forth in claim 13 wherein said biasing means is a permanent magnet having one pole in contact with the position of said other pole end which extends beyond said pole tip pole end and its opposite pole adjacent to said armature.

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HAROLD I. PITTS, Primary Examiner

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