M. S. CONNER.

HARMONIC RINGER.

APPLICATION FILED AUG. 13, 1906.

915,334.

Patented Mar. 16, 1909.

Fig. 1.

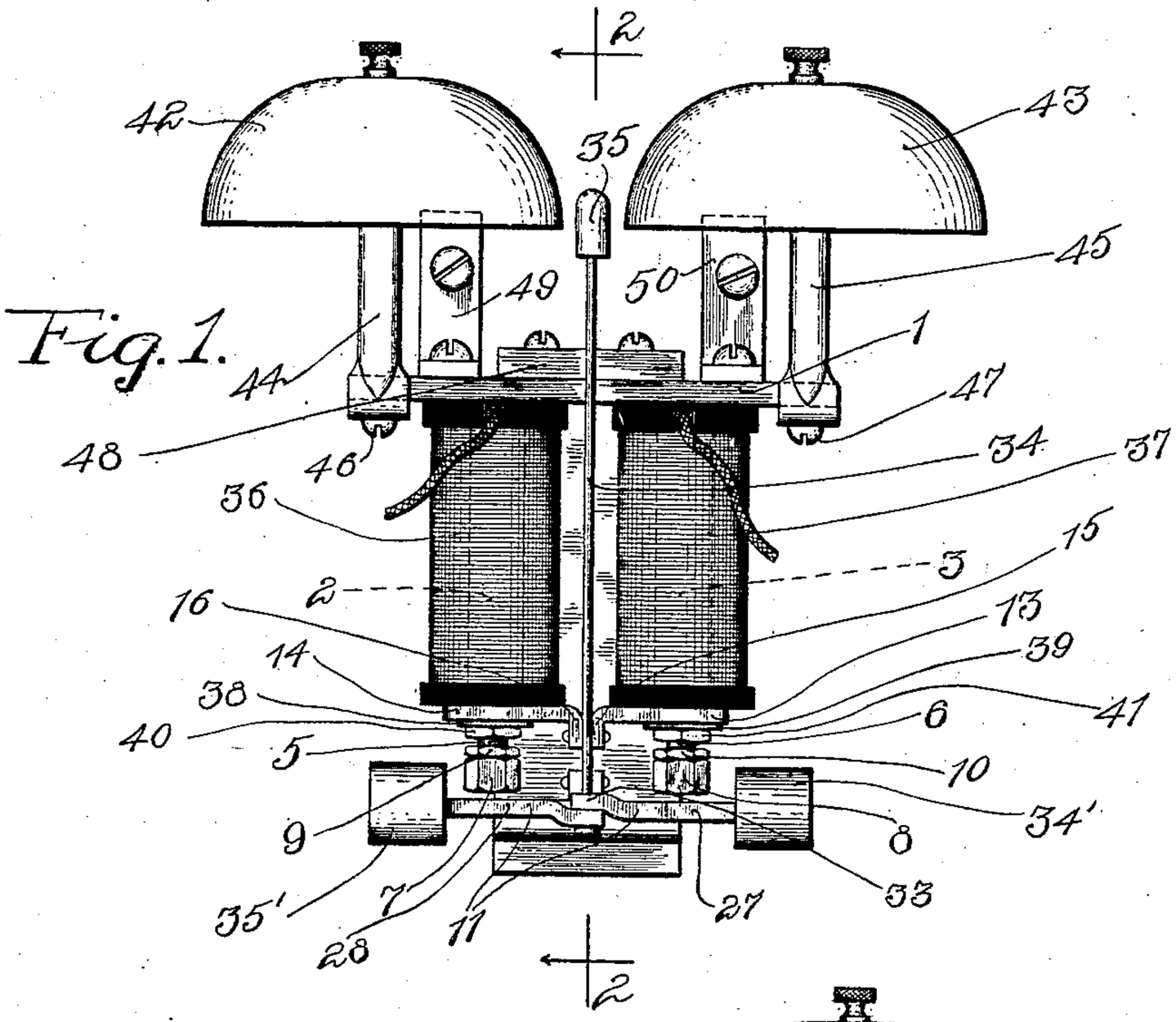


Fig. 2.

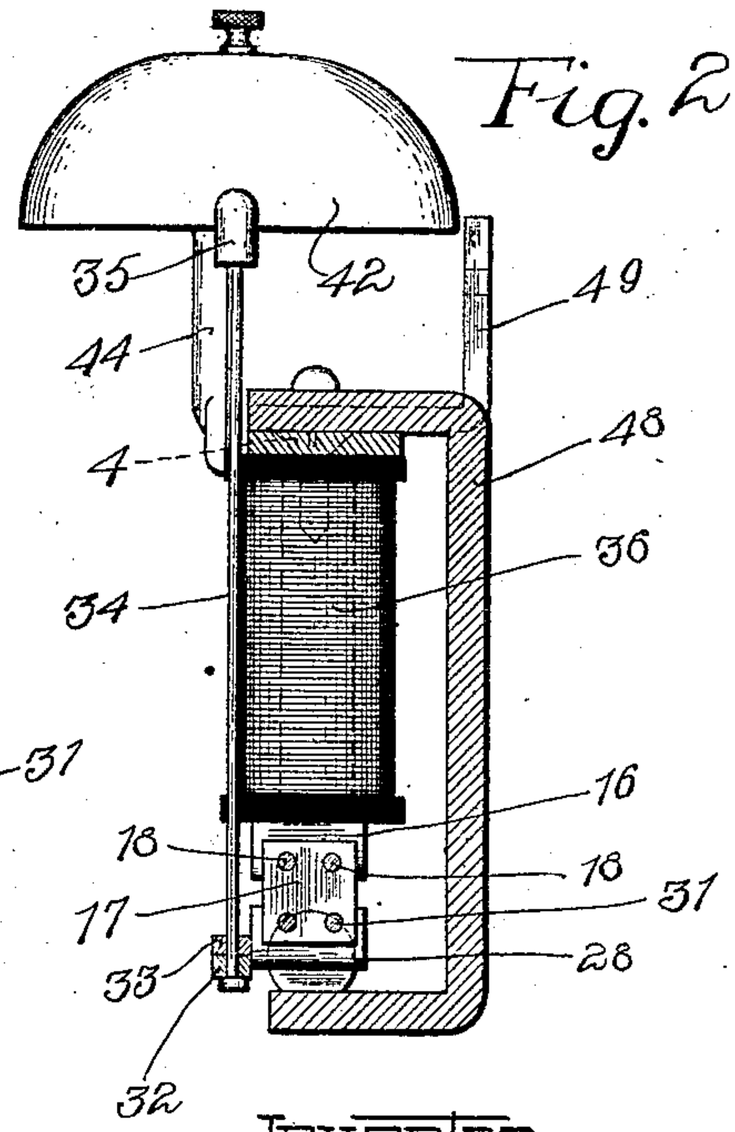
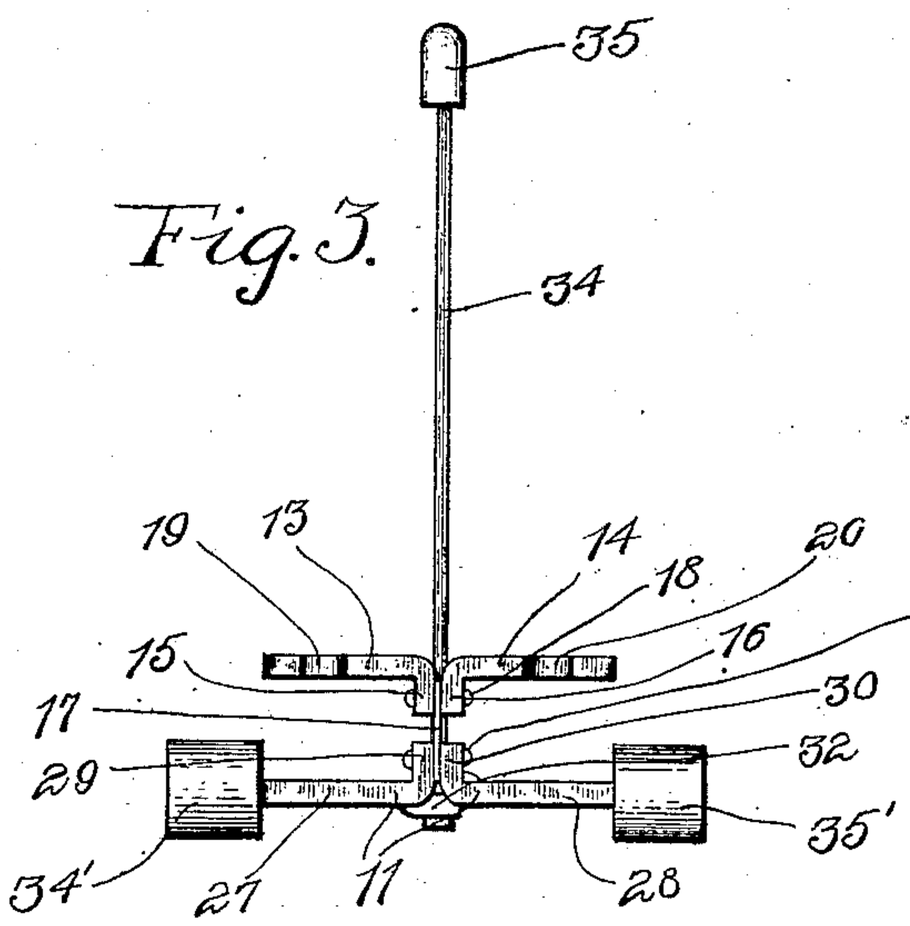


Fig. 3.



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UNITED STATES PATENT OFFICE.

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HARMONIC RINGER.

No. 915,334. Specification of Letters Patent. Patented March 16, 1909.

Application filed August 13, 1906. Serial No. 330,427.

To all whom it may concern:

Be it known that I, MERRITT S. CONNER, citizen of the United States, residing at Rochester, in the county of Monroe and State of New York, have invented a certain new and useful Improvement in Harmonic Ringers, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to selective apparatus for use in telephone systems and its object is to produce a selective, party line, tuned ringer of such a construction that stronger ringing can be effected with less operating energy than has been done heretofore in apparatus of this class and also that the ringer, while tuned to respond to certain characteristics of current adapted to operate it, will also respond to variations in these characteristics within certain predetermined limits, as well as to wide variations in current strength without danger of being operable by a current of different characteristics and subject to fluctuations similar to those just mentioned and adapted to operate a second and differently tuned ringer.

The invention consists of a tuned polarized ringer, responsive to its construction and adjustment to an alternating current of definite frequency, several such ringers being used on the same line, each ringer being tuned to a frequency enough different from any other so its range of flexibility of operation will lie wholly without the similar range of any other ringer.

Devices of this kind have been made in the past in which the armatures and attached gong hammers have been so supported by suitable springs as to have rates of vibration, as modified by the gong reactions, that synchronized with the frequencies of the alternating currents to which the ringers were designed to respectively respond. Experiments have conclusively demonstrated that much better results are obtained by so proportioning the parts that the natural rate of vibration of the moving parts of a ringer is in synchronism with the frequency of the operating alternating current without the modification of the gong reaction on the hammers for the following reason. In practice it is found advisable to adjust the gongs for a comparatively large hammer throw and since the action of the ringer is harmonic a considerable motion of the hammer is required before it touches the gong, and in the event of a smaller actuating current than the normal for which the ringer was designed, if the moving parts were tuned to the resultant period of the system including gong reaction, the interference or "discord" present before the amplitude of vibration reached the amount necessary to strike the gongs would probably be sufficient to prevent the harmonic building up of the vibration altogether and thus render the operation very uncertain. Experiments have shown that the gong reaction modifies the natural rate of vibration of the moving parts, as a result of which, if the resultant rate of the ringer is tuned to the frequency of the current, there must necessarily be a proportionate interference before the gongs are struck which means that a proportionately larger current must be used to operate a ringer under these disadvantageous conditions.

In the ringer which is the subject of this invention, in order to minimize the results of the gong reaction upon the natural rate of the ringer, since the effect of such gong reaction is always detrimental and necessarily introduces complicated vibration characteristics, the gong hammers and their supports are made as light as consistent with satisfactory ringing and most of the mass needed to produce the necessary moment of inertia is rigidly and directly attached to the armature itself.

It is an object of this invention, therefore, to produce by the construction above indicated a ringer of superior sensitiveness and reliability to that type of ringer in which the bulk of the moving mass is concentrated in the gong hammers themselves.

Another feature which is believed to be new consists in means for adjusting the range of flexibility of any ringer although it remains tuned to the same frequency for all such ranges.

The greatest advantage of a system in which the natural rate of vibration of the moving parts as unmodified by gong reactions, harmonizes or synchronizes with the rate or period of the actuating magnetic force, in contradistinction to a system in which this relation does not hold, is that the current required to operate a harmonic ringer, or one that is tuned as above indicated is much less than the current required to op-

erate a ringer that is not thus tuned. In the present harmonic system, the gongs of the ringer are so adjusted that the hammer must travel a considerable distance before striking the gongs and also so the blow imparted to the gongs is as light as can be used and still get strong, positive ringing. This is done in order to permit the natural harmonic vibration of the moving system to predominate and to cut down to a minimum the detrimental effects of gong reaction, which in all cases opposes the actuating force and prevents its most efficient operation. Harmonic vibration and accurate tuning are much more satisfactorily accomplished when the bulk of the moving mass is rigidly associated with that part of the mechanism upon which the harmonic force is directly exerted, namely, the armature, since any spring connection however slight to such mass permits local vibrations to be set up, which oppose the harmonic operation of the apparatus.

In the accompanying drawing I have shown a ringer constructed in accordance with and to carry out the principles of my invention.

In this drawing, Figure 1 is a front view of the ringer; Fig. 2 is a sectional view thereof taken on line 2—2, Fig. 1, and Fig. 3 is a rear view of a structure comprising the armature supporting bridge, the armature and the hammer rod and hammer.

The electromagnet frame comprises the yoke plate 1 from which extend the cores 2 and 3 secured thereto by countersunk screws 4. These cores have threaded extensions 5 and 6 respectively, engaged at their ends by cap nuts 7 and 8 which are locked in any adjusted position by the lock nuts 9 and 10, these cap nuts presenting pole faces for the armature 11. The supporting bridge may be integral or as here shown may be composed of the two members 13 and 14. The inner ends 15 and 16 of these members are turned at right angles as shown and receive between them one end of a spring plate 17 which is securely clamped between these ends by means of rivets 18, the members 13 and 14 being then held rigidly together to form the bridge member 12. The members 13 and 14 are also provided with the openings 19 and 20, placed to pass over the threaded extensions 5 and 6 on the cores 2 and 3 repectively. The armature 11 may be integral, but as here shown is formed of the two members 27 and 28. These members have part of their inner ends 29 and 30 turned upwardly at right angles for receiving between them the lower end of the spring plate 17 which is rigidly clamped therein by rivets 31. The other parts 32 and 33 of the ends of these members are slightly offset, as shown, and overlap, the lower end of the hammer rod 34 passing through these overlapped ends and secured therein as shown, the upper end of the hammer rod terminating in a hammer 35. Weights 34′ and 35′ are secured to the other ends of the members 27 and 28 respectively, and these weights may be of any size or shape. The armature frame and the bridge frame thus form a unitary structure, and after the energizing coils 36 and 37 are slipped on the cores, the bridge member 12 is applied, the threaded extensions passing through the openings 19 and 20. Washers 38 and 39 and nuts 40 and 41 are then applied to the threaded extensions, and the coils and bridge member securely clamped to the core ends. The cap nuts 7 and 8 are then applied and locked into an adjusted position at the ends of the extensions, the pole faces being opposed to the armature members 27 and 28, the hammer rod extending upwardly as shown with the hammer disposed between the gongs 42 and 43, supported on uprights 44 and 45 which are secured to the ends of the yoke plate 1 by means of screws 46 and 47 respectively. Also screwed to the yoke plate 1 is a polarizing magnet 48 which extends downwardly with its other end opposite the armature members, thus polarizing the armature. Angle members 49 and 50 also extend from the yoke plate by means of which the ringer may be suspended from a support.

From this construction it will be seen that the gong hammers and hammer rods are made very light and that all the mass for producing the necessary moment of inertia is rigidly and directly attached to the armature itself. The hammer is also adjusted so that it must travel a considerable distance before striking the gongs and so that the blow imparted to the gongs is as light as possible, being merely enough to produce a strong, positive ring. The harmonic vibrations of the weighted armature, therefore, predominate, and detrimental effects of gong reaction are eliminated. The armature and the mass thereon are rigidly associated, and there will, therefore, be no disturbing local vibrations which will tend to oppose the harmonic operation of the apparatus, but the harmonic force is directly exerted on the unitary weighted armature.

By changing the strength of the spring 17 and the weights on the armature, the ringer may be turned to respond to any frequency, and the amplitude of vibration can be adjusted by means of the cap nuts 7 and 8. It has been found that for any given strength of spring, a certain mass is necessary to coöperate therewith to produce a tune to a certain frequency. If the range of flexibility of the ringer, that is, the range of frequency to which it will respond is too great for a first relation of spring and moving mass, by increasing the strength of the spring and correspondingly increasing the moving mass, the range of flexibility is decreased without changing the tuning of the ringer. Similarly,

if the range of flexibility is too small, a lighter spring and a correspondingly smaller moving mass will increase the range of flexibility without changing the tuning of the ringer.

The ringer of my arrangement and construction, therefore, is of great adaptability in telephonic selective signaling systems, and each ringer may be readily tuned to respond to certain characteristics of current adapted to operate it and can also be independently adjusted to respond to variations in these characteristics within certain predetermined limits, as well as to wide variations in current strength without danger of being operable by currents of different characteristics and subject to fluctuations similar to those adapted to operate a second and different tuned ringer. Changes in the exact construction and arrangement, however, may be readily made by those skilled in the art which would still come within the scope of the following claims hereto appended and which I desire to secure by Letters Patent.

1. In a telephonic selective ringer, the combination with a suitable electromagnet frame and windings therefor, of an armature subjected to the changes of magnetism in said frame, a suitable support, a spring extending from said support and mounting the armature, a hammer rod extending from the armature and terminating in a hammer, gongs suitably supported to be struck by the hammer, said armature being of relatively great mass and the hammer rod and hammer being made comparatively light, the mass of weight of the armature being suitably disposed and adjusted to produce the desired moment of inertia, such adjustment together with adjustment of the strength of the spring causing the ringer to be responsive only to current flow of certain frequency.

2. In a ringer, the combination with a suitable electromagnet, of a spring rigidly mounted at one end to a support, an armature secured at its middle part to the other end of the spring and subjected to the influence of said electromagnet, a hammer rod extending from the armature and terminating in a hammer, said armature having tuning weights rigidly secured at its ends and said hammer rod and hammer being comparatively light, whereby such armature and the parts carried thereby are adapted to have a characteristic rate of vibration.

3. The combination with a ringer of a U-shaped electromagnet frame, a bridge member secured to the pole ends of the magnet frame, a spring rigidly secured to said bridge member between the pole ends, an armature secured at a middle point to the other end of the spring with its ends opposite the pole ends of the magnet frame, a hammer rod extending from the armature, a hammer at the end of the rod, and gongs or other sound producing means adapted to be engaged by the hammer upon actuation of the armature, said armature having tuning weights rigidly secured thereto and the hammer rod and hammer being comparatively light, whereby such armature and the parts carried thereby are adapted to have a characteristic rate of vibration.

4. The combination with a ringer, of a U-shaped electromagnet frame, a bridge member secured to the pole ends of the magnet frame, a spring rigidly secured to said bridge member between the pole ends, an armature secured at a middle point to the other end of the spring with its ends opposite the pole ends of the magnet frame, a hammer rod extending from the armature, a hammer at the end of the rod, gongs or other sound-producing means adapted to be engaged by the hammer upon actuation of the armature, tuning weights rigidly associated with the armature the hammer rod and hammer being comparatively light, whereby such armature and the parts carried thereby are adapted to have a characteristic rate of vibration, and means for adjusting the air gap of such ringer without changing the adjustment of the remaining portions of the ringer.

5. The combination with a ringer, of a magnet frame, a bridge member rigidly secured to the effective poles of the magnet frame, a spring rigidly secured to said bridge member between its ends, said bridge member consisting of two parts riveted together with the end of such spring between them, an armature consisting of two parts secured together and to the other end of such spring, such armature located opposite the pole ends of the magnet frame, a hammer rod extending from the armature, a hammer at the end of the rod, and gongs adapted to be engaged by the hammer upon actuation of the armature.

In witness whereof, I hereunto subscribe my name this 10th day of August A. D., 1906.

MERRITT S. CONNER.

Witnesses:
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