

No. 831,848.

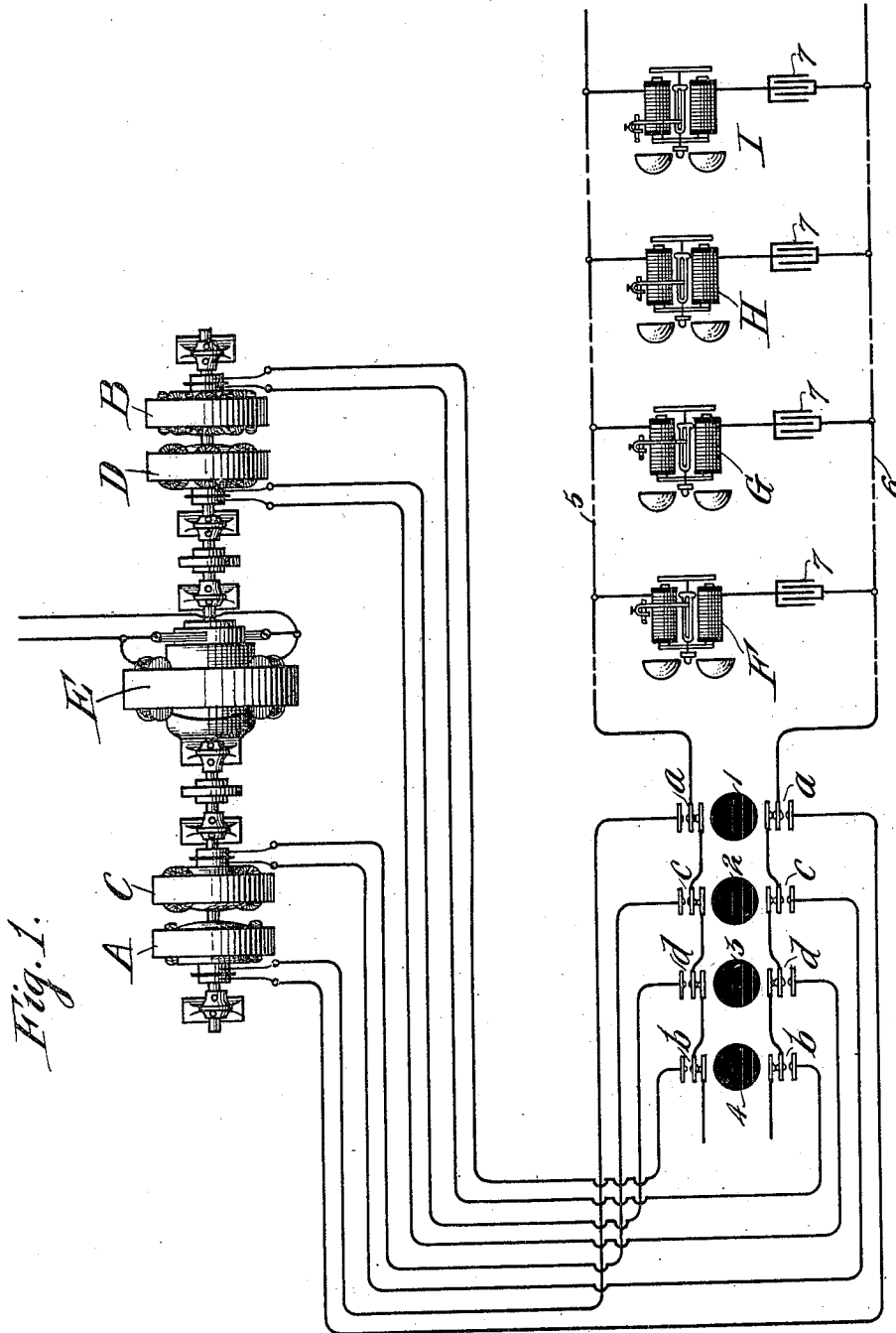
PATENTED SEPT. 25, 1906.

J. ERICKSON.

ADJUSTABLE HARMONIC RINGER FOR SELECTIVE SIGNALING SYSTEMS.

APPLICATION FILED SEPT. 18, 1905.

2 SHEETS—SHEET 1.



Witnesses.
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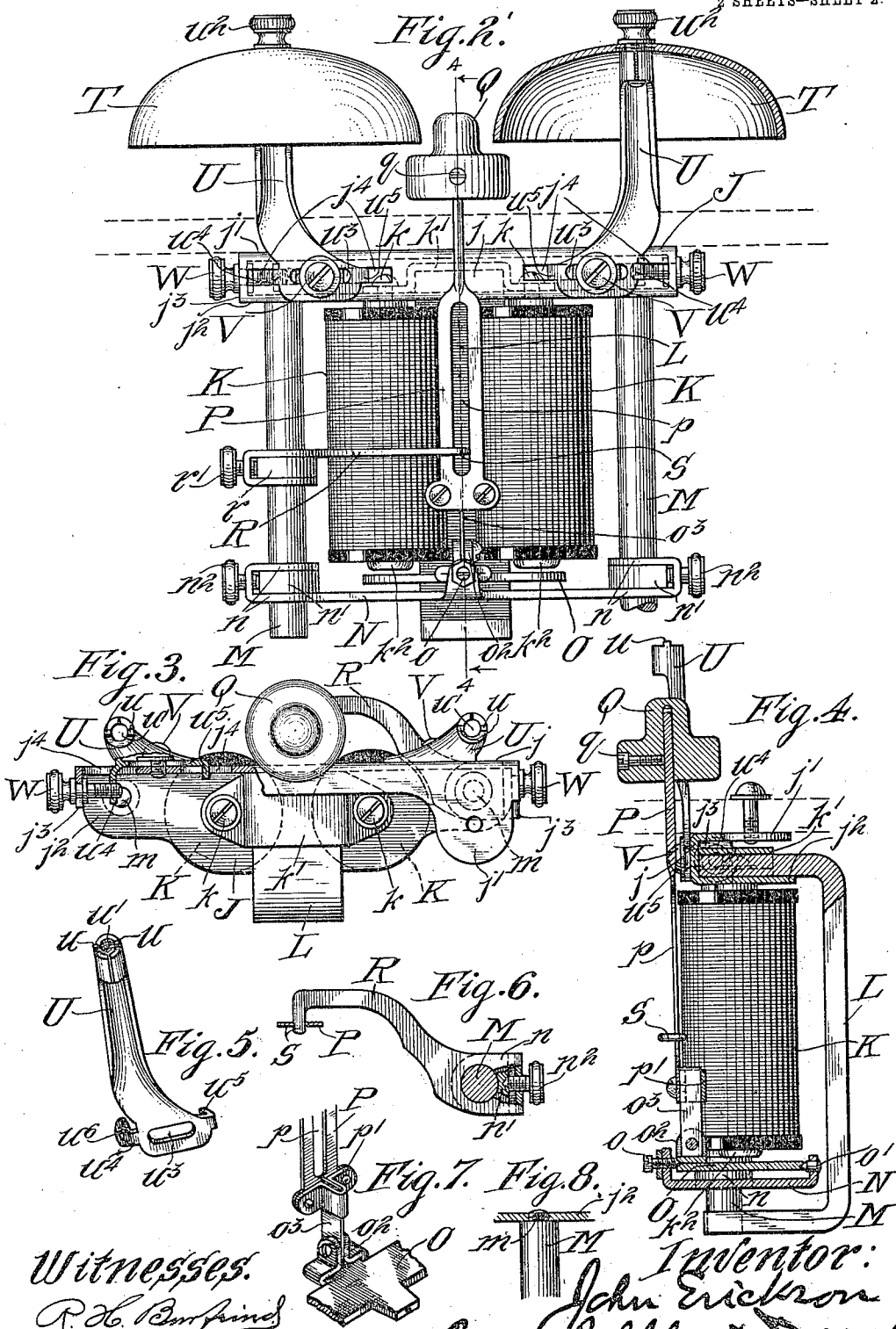
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UNITED STATES PATENT OFFICE.

JOHN ERICKSON, OF CHICAGO, ILLINOIS, ASSIGNOR TO AUTOMATIC ELECTRIC COMPANY, OF CHICAGO, ILLINOIS.

ADJUSTABLE HARMONIC RINGER FOR SELECTIVE SIGNALING SYSTEMS.

No. 831,848.

Specification of Letters Patent.

Patented Sept. 25, 1906.

Application filed September 18, 1905. Serial No. 278,902.

To all whom it may concern:

Be it known that I, JOHN ERICKSON, a citizen of the United States of America, and a resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Adjustable Harmonic Ringers for Selective Signaling Systems, of which the following is a specification.

My invention relates to ringers adapted for use in telephone systems in general, but adapted more particularly for use in party-line telephone systems, and more especially to ringers adapted for use in party-line systems operating on the tuned or harmonic principle. In party-line telephone systems it is desirable and of considerable advantage to have the apparatus so constructed that the operator at the exchange or central station can ring the bell at any particular subscriber's station on a line without ringing the bells at any of the other stations on the same line. Party-line systems operating in this manner are ordinarily known as "selective" systems, inasmuch as the operator can at will ring any one of the bells on a line to the exclusion of all the other bells on the same line, this being much more satisfactory to the subscribers than the old and well-known arrangement in which several subscribers use the same line, but in which all the bells ring each time any subscriber on the line is called, thus making it necessary to resort to the expedient of a different number of rings for each subscriber. In some of the selective party-line systems the signal-receiving means at each subscriber's station is of a tuned or harmonic character, while in other selective party-line systems the said means are of a non-tuned character, the tuned and non-tuned apparatus being dependent, of course, upon different principles for the selectivity of the ringing or signaling of the different subscribers.

My invention, as stated, relates to selective signaling systems of the tuned or harmonic character—that is to say, to selective signaling or ringing systems in which each ringer or signal-receiving means is so constructed or adjusted that it will only respond to a vibratory or alternating current of a certain period of vibration or frequency. In some cases the circuit itself is so constructed or adjusted that it has a certain definite electrical resonance or period of vibration, and is thus made capable of receiving a vibratory or al-

ternating current having the same period of vibration or frequency and excluding all others. Again, and in other cases, the ringer or signal-receiving means may itself be so constructed or adjusted that any vibratory or alternating current will pass through it readily, but in such manner that it will respond only to that current which has a similar period of vibration—that is to say, a period of vibration exactly or substantially the same as its own. In one case, therefore, the tuning is purely of an electrical character, a circuit being provided which will only respond electrically to currents having the same period of electrical vibration as its own, while in the other case the tuning is of a "mechanical" character, so to speak, the mechanical construction of the ringer itself being such that although all currents thrown on the line pass through its windings only that current which has exactly the right period of vibration or frequency will induce a corresponding vibration on the part of its striker. In any event, however, and regardless of the expedient employed it will be seen that a tuned or harmonic selective ringing system utilizes the fundamental principle of sympathetic vibration—i. e., the vibration sympathetically of one thing by another. Obviously any selective ringing or signaling system thus utilizing the principle of sympathetic vibration, or "harmonies," as it is commonly called, may have a comparatively wide range of selectivity and may involve a great many subscribers' stations on the same line, inasmuch as any desired number of different kinds of current may be employed, each having a more or less different period of vibration or frequency than the others for ringing as many different bells or ringers on the same line.

Generally stated, the object of my invention is, therefore, the provision of an improved and highly efficient selective ringing or signaling system adapted to operate on the tuned or harmonic principle.

Special objects of my invention are the provision of an improved and simplified selective ringing or signaling system of that character in which a plurality of ringers or electric bells are connected in parallel in the same circuit and in which all of the different currents employed for ringing the different bells or ringers pass through all of the bells or ringers with equal facility and in which each

bell or ringer only responds to its allotted character of current, the provision of an improved construction and arrangement whereby the gongs of the bell or ringer may be readily adjusted toward and away from each other; the provision of an improved construction and arrangement for holding the gongs firmly in place upon their mountings, the provision of an improved construction and arrangement whereby all of the different bells or ringers in a selective ringing or signaling system operating on the tuned or harmonic principle may be of the same construction, thus obviating the necessity of manufacturing several different kinds of bells or ringers and making it possible to supply all of the stations on a party-line with the same kind of a bell or ringer and to then insure the selectivity of operation of these bells or ringers by simply giving each one an adjustment slightly different from that given the others, the provision of a bell or ringer of such character that the natural period of vibration of its striker can be readily changed or adjusted in order to make it responsive to vibratory or alternating currents of different periods of vibration or frequency, the provision of a bell or ringer in which the natural vibration of its striker can be readily changed or varied by simply varying the fulcrum or pivotal point of the striker, and the provision of certain details and features of improvement tending to increase the general efficiency and serviceability of a polarized electric bell or ringer of this particular character.

To the foregoing and other useful ends my invention consists in matters hereinafter set forth and claimed.

In the accompanying drawings, Figure 1 is a conventional diagram illustrating a party-line or selective ringing system embodying the principles of my invention. Fig. 2 is a front elevation of a harmonic bell or ringer embodying the principles of my invention, one of the gongs of the same being shown in section. Fig. 3 is a top view of the bell or ringer shown in Fig. 2, showing the gongs removed and showing certain portions of the supporting structure in horizontal section. Fig. 4 is a vertical section on line 4-4 in Fig. 2. Fig. 5 is a perspective of one of the removable gong posts or mountings. Fig. 6 is a plan of the adjustable fulcrum or pivotal point for the striker, showing adjacent parts in section. Fig. 7 is a detail perspective view of the connection between the lower end of the gong-striker and the pivotally-mounted armature. Fig. 8 is a detail showing the connection between the top plate or body-frame and the upper end of one of the uprights or posts upon which the armature-yoke is mounted.

As thus illustrated, my invention comprises high and low frequency alternating-current generators A and B, together with a

couple of intermediate-frequency generators C and D, all driven by a suitable motor E. The switchboard-operator is provided with a selective ringing-key having four push-buttons 1, 2, 3, and 4. The push-button 1 is provided with switch-contacts *a*, by which the generator A can be connected with the line conductors 5 and 6, constituting the party-line. In a similar way the push-button 2 is provided with contacts *c*, by which the generator C can be connected with the said line. The push-button 3 has a set of switch-contacts *d*, by which the generator D can be connected with the said party-line, and, finally, the push-button 4 has a set of contacts *b*, by which the generator B can be connected with the said line. In each case the said contacts are normally open, whereby all of said generators are normally disconnected from the said line.

It will be readily understood that the switchboard-operator's equipment may also include suitable plugs and jacks or other switching devices by which the said switch-key can be connected with the said line when it is desired to connect any one of the said generators therewith. Across the said line are a number of polarized ringers or electric bells F, G, H, and I, the same corresponding in number to the number of push-buttons in the operator's selective ringing-key, and in each case the bell or ringer is bridged across the line-circuit by means of a condenser 7, there being as many condensers as there are bells or ringers. It will also be understood that these bells or ringers are located at different subscribers' stations located along the line and that in each case the subscriber's equipment may involve any suitable known or approved devices. With this arrangement the push-button 1 can be pressed for the purpose of connecting the generator A with the line and for thereby ringing the bell or ringer I, the latter being a high-frequency ringer. When the button 2 is pressed, the generator C is connected with the line, with the result that the bell or ringer H is rung, the latter being an intermediate-frequency ringer. If the operator desires to ring the bell or ringer G, the push-button 3 is pressed, thus connecting the generator D with the line. The low-frequency ringer F is rung by pressing the button 4, and thereby connecting the generator B with the line. When any generator is connected with the line, the current from such generator is distributed equally between all of the bell-bridges; but as these bells or ringers are tuned or harmonic in character it is evident that only one of them will ring when current from any particular generator is projected onto the line. In other words, each bell or ringer is mechanically tuned in such manner that its striker will vibrate sympathetically when a current having the required period of vibration or

frequency is projected onto the line. In this way the striker of each bell or ringer is capable of sympathetic vibration. In each case it will be seen that each current preferably and desirably passes through a condenser before passing through the bell or ringer, as the condenser has the desired and well-understood effect on the ringing-current. With this arrangement each bell or ringer is operated by a capacity charge—*i. e.*, an alternating current passed through a condenser. It will be seen, therefore, that the effect of any alternating current upon the armatures of the different bells or ringers may be compared to a succession of blows, the only difference, in effect, between the different currents being that in one case these blows are delivered in rapid succession, while in another case the blows are exerted less rapidly and with longer intervals of time between them. If, then, these different striker-arms are so adjusted or constructed that each has a different natural period of vibration, it is obvious that each can only vibrate in sympathy with a current having a corresponding period of vibration, for in no case is there ever a current impulse of sufficient duration to operatively tilt the striker-arm of a bell or ringer, and consequently there can be no forced vibration of such arm. Each striker-arm can thus vibrate sympathetically when subjected to the electromagnetic effects of an alternating current having just the right period of vibration or frequency. When the armatures or strikers of a plurality of bells or ringers are thus so adjusted or constructed and so employed in conjunction with certain kinds of current that they can only be given a sympathetic vibration, each bell or ringer may then properly be said to be of a tuned or harmonic character.

In Figs. 2 to 8, inclusive, I have illustrated my improved tuned or harmonic ringer for use in selective ringing or signaling systems of the character illustrated in Fig. 1. As shown, the said electric bell or ringer comprises a top plate or attaching bracket J. This plate is preferably constructed from a piece of sheet metal folded upon itself in such manner as to provide a vertical front wall j and upper and lower walls j' and j'' . The construction is also preferably such that the said plate or attaching member is provided with short end walls j^3 . As shown, the said vertical front wall j is provided with a couple of longitudinally-extending slots j^4 . The two electromagnets K have their cores secured to the lower wall j'' by means of screws k and are magnetically connected by a strap or clamping-piece k' , arranged between the upper wall j' and the said bottom wall j'' . The upper end portion of the permanent magnet L is firmly clamped upon the upper surface of the bottom wall j'' by the said strap or clamping-piece k' . The cylin-

dric uprights or suspending-rods M have their upper ends provided with small screw-threaded portions m , adapted to be screwed into small threaded sockets in the bottom wall j'' of the top plate J.

A yoke N is provided with end portions n , adapted to slide up and down upon the said uprights or suspending-rods M. In order that the said yoke may be clamped or held in any desired position on the said rods, each end portion of said yoke is provided between its upper and lower portions with a sliding block n' and with a clamping or binding screw n^2 . It will be seen that these screws extend through and are threaded in the vertical end portion of the yoke and are adapted to bear upon the said blocks n' . In this way the said screws when tightened tend to crowd the blocks in one direction and the end portions of the yoke in the opposite direction in each case, thus producing a sufficient clamping or binding action of the yoke upon the rods to hold the yoke in any desired position. The armature O is pivotally mounted at o and o' upon the central or middle portion of the said yoke and between the latter and the lower ends of the cores k^2 of the two electromagnets. At one side and at a point in line with its axis the said armature is provided with a clamping-piece o^2 , provided with a spring o^3 . The striker-arm P is disposed at the front of the ringer and is provided with a longitudinally and vertically extending slot p . At its lower end the said striker-arm is provided with a clamping-piece p' , which engages the upper end portion of the spring o^3 . At its upper end the said striker-arm is provided with a striker Q. One of the said rods M is provided with an arm R and a block r , together with a clamping or binding screw r' , and it will be seen that this arm and clamping block and screw are adapted to hold the same in any desired position on the said rod, as shown in Fig. 6 and as explained in connection with the screws and connections by which the yoke N is adjustably held in any position upon the said rods. In other words, the yoke for the armature is so mounted that the armature can be adjusted toward and away from the cores of the electromagnets, and the arm R is so mounted that it can be adjusted toward and away from the axis of the armature or toward and away from the striker Q. This arm R is provided at its end with a projection S, which engages the slot p and which serves as a fulcrum or axis about which the striker-arm P can vibrate for the purpose of producing the desired signal. It will be seen that when the armature O vibrates the spring o^3 is thereby flexed and the striker-arm swung or vibrated about the projection S as an axis. The gongs T are disposed at opposite sides of the striker Q and are preferably mounted upon gong posts or mountings U. Each gong-post has its upper

end portion provided with small projections u and with a socket u' , it being observed that each gong-post is preferably made of sheet metal stamped and bent into the desired shape. The gongs are provided on their under surfaces with small notches adapted to be engaged by the projections u and are held in place by clamping-screws u^2 , screwed into the sockets u' . At their lower ends each gong-post is provided with a slot u^3 and a couple of projections u^4 and u^5 , the projection u^4 being provided with a threaded opening or socket u^6 . Suitable screws V are employed for securing the gong-posts in place upon the top plate J , each screw extending through the slot in the post and engaging the support. (See Fig. 3.) When the same are adjusted in place, it will be seen that the projections u^4 and u^5 slide in the slots j^4 and that the screws V extend through both the gong-posts and the vertical wall j —that is to say, through the slots u^3 and j^4 and slide in the latter. The adjusting-screws W extend through openings in the short end wall j^3 and have threaded portions adapted to engage the threaded openings or sockets u^6 in the lower end portions of the gong-posts. With this arrangement the screws V can be sufficiently tightened to firmly hold the gong-posts in place without interfering with the adjustment of the gong-posts in the slots j^4 . When the screws W are rotated one way or the other, the sliding or mounted portions of the said gong-posts are caused to move toward and away from each other, according to requirements. It will be understood, of course, that only one gong may be employed and that the ringer is adapted to operate with either one or two gongs, according to requirements. I find that my improved ringer works admirably with one gong.

Referring again to Fig. 1, it will be seen that the high-frequency bell I has its striker-arm fulcrum or axis some distance away from the armature, while the low-frequency bell F has its striker-arm fulcrum or axis quite close to its armature. The intermediate-frequency bell or ringer G has its striker-arm fulcrum or axis adjusted somewhat farther away from its armature, while the fulcrum or axis of the bell or ringer H is still farther away from its armature, though not quite as far away as is the fulcrum or axis of the ringer I . It will thus be seen that the higher the frequency of the current the farther away from the armature must the fulcrum or axis of the striker-arm be adjusted and the lower the frequency the nearer the fulcrum or axis must be adjusted to the armature. The adjustment of the striker-arm fulcrum or axis away from the armature in effect decreases the length of the striker-arm and increases the leverage through which it is operated by the armature. Each armature has a yielding or spring connection with its allotted

striker-arm, the tension of the spring connection being practically the same in each case, regardless of the adjustment of the fulcrum or axis. It is evident, however, that if the vibration of the armature is communicated by its spring to a long leverage the striker-arm is made just that much more responsive, or "sensitive," so to speak, and more susceptible to a rapid degree of vibration on the part of the armature, while, on the other hand, if the spring be connected with a comparatively short leverage then the striker-arm can only vibrate in sympathy with a comparatively slow rate of vibration. When any particular current is projected onto the line, all of the armatures may perhaps vibrate, but without producing false signaling, as only that striker-arm will vibrate which is so adjusted as to be in tune with the particular rate of vibration. When another current is projected onto the line, all the armatures may perhaps again vibrate; but this time another striker-arm will vibrate—namely, the one having its fulcrum or axis so adjusted that its natural period of vibration corresponds to the rate of vibration given the armatures. When a low-frequency current is projected onto the line, the armature of the high-frequency ringer is, if affected at all, attracted and then released so quickly and these vibrations are so far apart that the striker-arm does not respond. Also when the high-frequency current is projected onto the line the armature of the low-frequency ringer is, if disturbed at all, attracted and released so quickly and the vibrations follow each other so closely that the striker-arm of the low-frequency ringer does not respond, for the reason that the leverage through which its spring works is much shorter than that of the high-frequency ringer. The intermediate-frequency ringers operate in a similar way, and their selectivity is brought about in the same way, it being evident that between the highest-frequency and the lowest-frequency ringers there may be any suitable or desired number of intermediate-frequency ringers or as many as the range and delicacy of the adjustment will permit. It will be seen that the adjustment of the fulcrum or axis of the striker-arm one way or the other in effect simply increases or decreases the length of the striker-arm and changes the leverage through which the spring acts or communicates the vibrations of the armature.

With my improved construction it is evident that it is only necessary to manufacture one kind of bell or ringer and that all substations on the same line will be supplied with the same kind of ringer. After this all that is necessary in order to make the system selective in character is to give the different bells or ringers a different adjustment and to thus in effect give them different lengths

of striker-arms. As previously stated, the gongs can be nicely adjusted with respect to the striker Q, and the armature can be accurately and delicately adjusted relatively to the lower ends of the magnet-cores.

By means of a screw *q* the striker Q is adjustably mounted upon the end portion of the striker-arm P. In this way the striker can be adjusted toward and away from the axis about which the striker-arm swings.

It will be seen that my invention is based, in part at least, upon the fundamental principle exemplified by the familiar illustration of pendulums which are of different lengths and which are thus adapted to vibrate sympathetically in response to vibrations of different rates or frequency. It will be understood, of course, that each bell when properly adjusted has a striker which could swing slowly from side to side and for the full amplitude of the movement of its armature without striking either gong; but as soon as the striker vibrates in response to a current having a rate or frequency of vibration corresponding to its own natural period of vibration the weight of the striker is then sufficient, and the spring is adapted to flex or bend and yield just enough to bring the striker into engagement with the gongs. In other words, it would be possible to tilt the armature slowly from side to side without causing the striker to touch the gongs, inasmuch as the adjustment is preferably of this character; but in each case the striker must engage the gongs when the striker-arm is given its natural period of vibration. In this way nothing but a harmonic or sympathetic vibration on the part of the different striker-arms can bring the strikers into contact with the gongs.

What I claim as my invention is—

1. The combination of a gong, a striker-arm, a striker on said arm, an electromagnet, an armature for said magnet, a fulcrum or axis for the said striker-arm, and means whereby the said fulcrum or axis is adjustable longitudinally of the said arm, and a spring connecting the said armature with the end of said arm.

2. The combination of one or more gongs, a striker and striker-arm, said striker-arm being provided with a readily-adjustable axis, and electromagnetic means for operating said striker-arm, together with means for effecting a lateral or sidewise adjustment of said axis to vary the same relatively to the striker.

3. The combination of one or more gongs, a striker and striker-arm, a pair of electromagnets, a permanent magnet having one pole magnetically connected with the cores of said electromagnets, a fulcrum or axis which is adjustable longitudinally of said striker-arm, a pivoted armature, means for adjusting the said armature toward and away from the

cores of said electromagnets; and a flexible connection between the said armature and the end of said striker-arm.

4. The combination of a gong, a striker and striker-arm, means for adjusting the gong toward and away from the striker, means whereby the axis about which the striker-arm swings is adjustable longitudinally of the arm, an electromagnet, an armature for the electromagnet, and a spring for connecting the armature with the end of the striker-arm.

5. The combination of a gong, a gong-post on which the gong is mounted, a support on which the gong-post is adjustably mounted, a screw for adjusting the gong-post on the said support, and means whereby the gong is actuated toward and away from the striker by the rotation of said screw, an electromagnet, and an armature for operating the said striker-arm.

6. The combination of a pair of gongs, gong-posts on which the gongs are mounted, a top plate on which the gong-posts are adjustably mounted, screws for delicately adjusting the gongs toward and away from each other, means whereby the gongs are actuated toward and away from each other by the rotation of the said screws, a striker disposed between the gongs, a striker-arm on which the striker is mounted, a pair of electromagnets secured to said support, a permanent magnet secured to said support and magnetically connected with the cores of said electromagnet, an armature for the said electromagnets, and a suitable connection between the armature and the striker-arm.

7. The combination of a gong, a striker, means for adjusting the gong toward and away from the striker, a striker-arm upon which the striker is adjustably mounted, a fulcrum or axis for the striker-arm, means whereby said fulcrum or axis is adjustable longitudinally of the said arm, an electromagnet, an armature for said magnet, means whereby the armature is adjustable toward and away from the electromagnet, and a spring connection between the armature and the striker-arm.

8. The combination of a gong, a sheet-metal gong-post provided with a socket and a pair of projections, a screw engaging the said socket and holding the gong on the said post, said gong having notches adapted to be engaged by said projections, and a support provided with a slot, said gong-post being also provided with a slot and having a pair of projections engaging the slot in the support, a clamping-screw passing through said slot in the post and engaging said support, and an adjusting-screw mounted in the support and having a threaded engagement with one of the last-mentioned projections on the gong-post, whereby the said gong-post can be adjusted back and forth in the slot in the sup-

port, a striker for the gong, and electromagnetically-operated means for operating said striker.

9. The combination of one or more gongs, a support on which the gongs are mounted, rods depending from said support, electromagnets depending from said support, a yoke slidingly mounted on said rods, an armature mounted on said yoke, a striker operated by the armature, blocks slidingly mounted on the rods and carried by the end portions of the yoke, and clamping-screws having threaded engagement with the end portions of the yoke, the ends of said screws bearing against said clamping-blocks.
10. The combination of a gong, an electromagnet, an armature for said magnet, a flexible standard on said armature, a striker mounted on said standard, and a fulcrum or axis intermediate the flexible standard and the striker, and means whereby the said fulcrum or axis is adjustable toward and away from the armature.
11. The combination of a gong, a striker and striker-arm, said arm being adapted to swing about an axis intermediate of its ends, an electromagnet, an armature for said magnet, and a springy or resilient connection between said armature and the adjacent end of said striker-arm.
12. The combination of a gong, a striker-arm provided with a longitudinal slot, a striker mounted on one end of said striker-arm, a fulcrum or axis engaging said slot and adjustable along the length thereof, whereby the striker-arm swings about an axis intermediate of its ends, an electromagnet, an armature, and a flexible connection between the armature and the other end of said striker-arm.
13. The combination of a gong, a striker-arm provided with a longitudinal slot, a striker mounted on one end of said striker-arm, a fulcrum or axis engaging said slot and adjustable along the length thereof, whereby the striker-arm swings about an axis intermediate of its ends, an electromagnet, an armature, and a springy or resilient connection between the armature and the other end of said striker-arm.
14. The combination of a plurality of polarized ringers or electric bells connected in

parallel and each provided with an armature and a striker and a striker-arm having means for in effect varying or changing its length, without disturbing the armature and striker thereof, each bell provided with means for holding its striker and armature against displacement while the length of its striker-arm is being changed or varied, and means for supplying alternating currents of different frequency, one for each bell.

15. The combination of means for supplying alternating currents of different frequency, and a polarized ringer or electric bell provided with an armature and a striker and adjusting means for making it responsive to any frequency without disturbing the armature and striker thereof, each bell provided with means for holding its striker and armature against displacement while the ringer is being adjusted for any given frequency of alternation.

16. The combination of means for supplying alternating currents of different frequency, a line-circuit, and a plurality of polarized ringers or electric bells all connected with said circuit and each provided with an armature and a striker and adjustable to respond to any frequency without disturbing the armature and striker thereof, each bell provided with means for holding its striker and armature against displacement while the ringer is being adjusted for any given frequency of alternation.

17. In a selective party-line telephone system, the combination of a telephone-line, a plurality of substations on said line, dynamos for supplying alternating currents of different frequency, a ringer at each substation, each ringer provided with a striker and armature, means in each ringer for adjusting it to different frequencies, means for preventing displacement of the striker and armature while any ringer is being adjusted for any given frequency of alternation, and an operator's ringing-key switch provided with a push-button for each adjustable ringer.

Signed by me at Chicago, Cook county, Illinois, this 13th day of September, 1905.

JOHN ERICKSON.

Witnesses:

EDW. D. FALES,
M. A. EDSON.