No. 841,640. PATENTED JAN. 15, 1907.

W. W. DEAN.

METHOD OF HARMONIC SELECTIVE SIGNALING.

APPLICATION FILED AUG. 9, 1905.

3 SHEETS—SHEET 1.

Fig. 2.

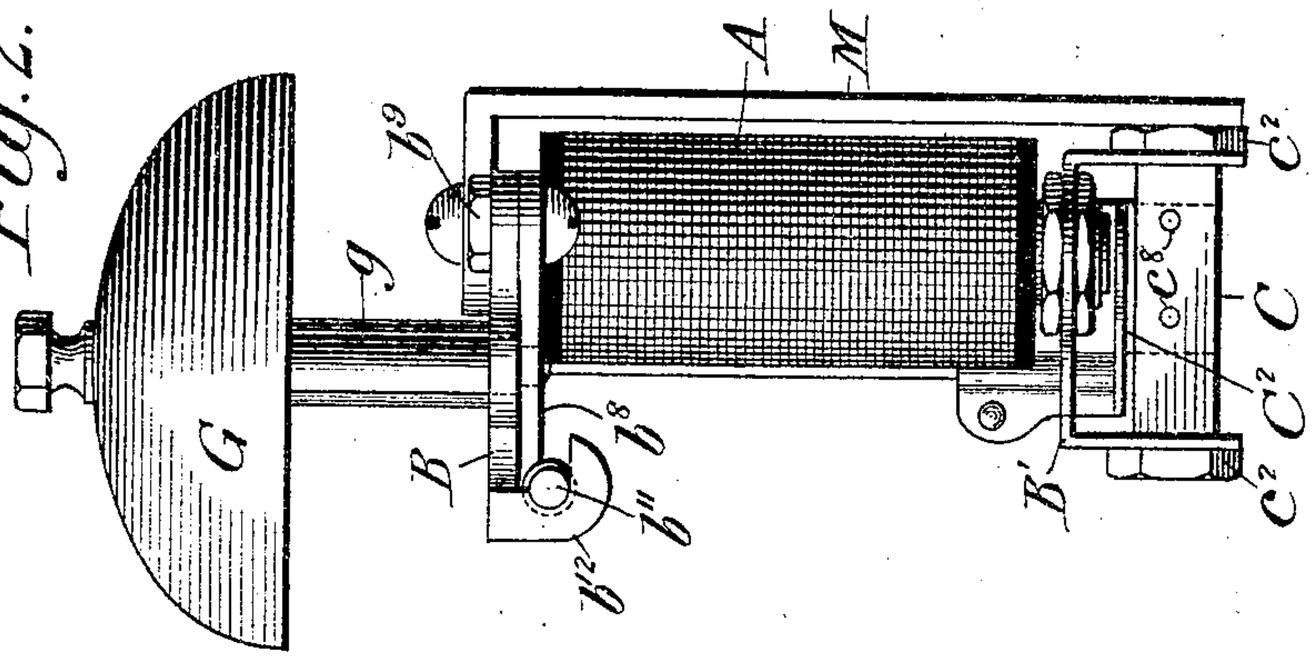
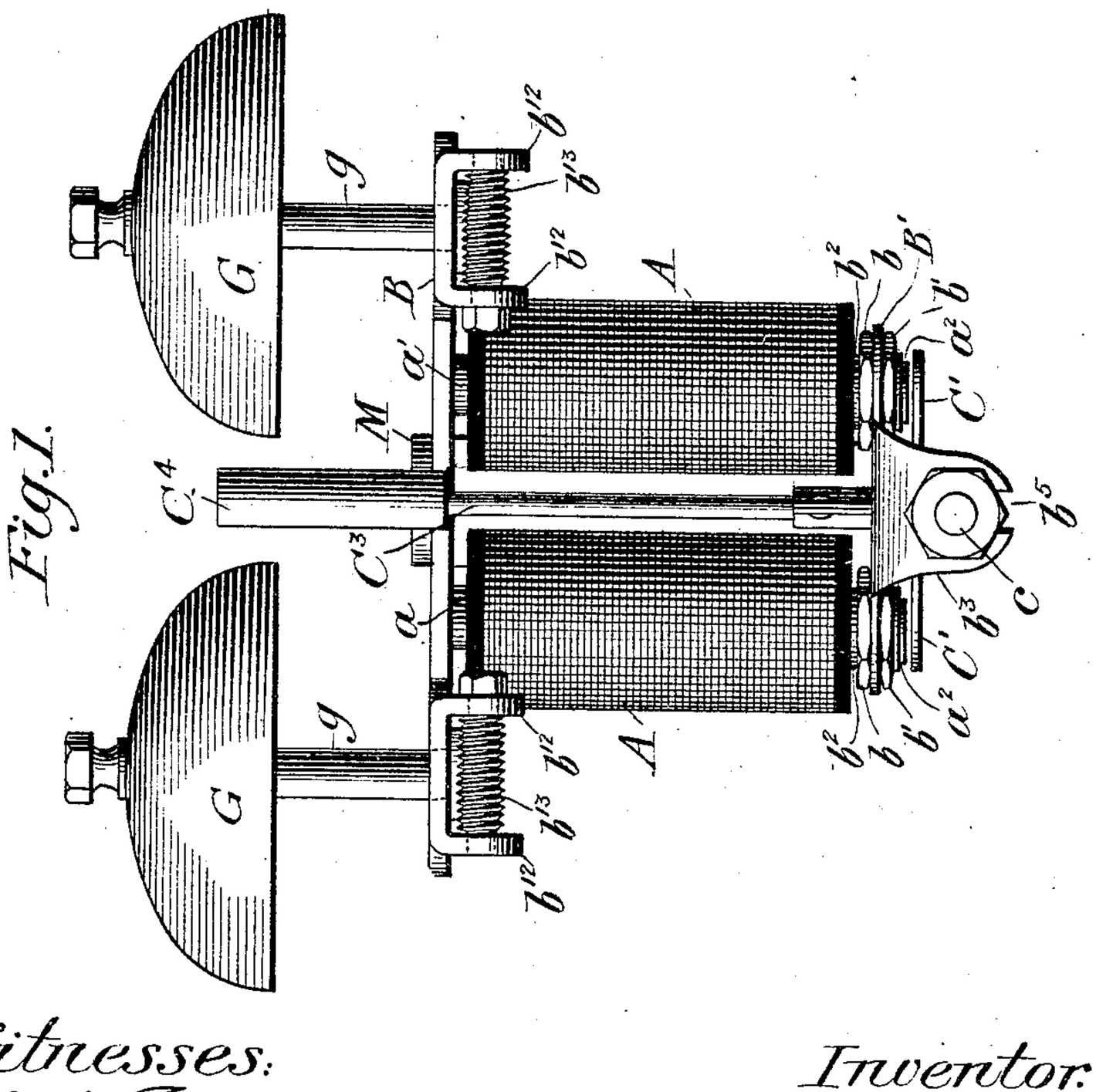


Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 3.

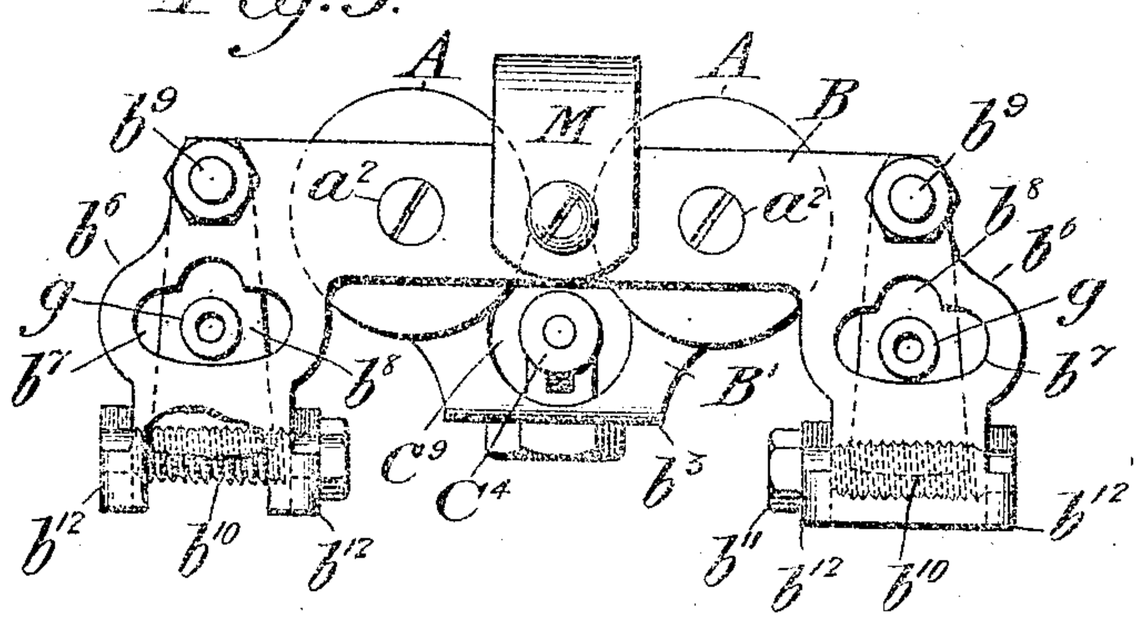


Fig. 4.

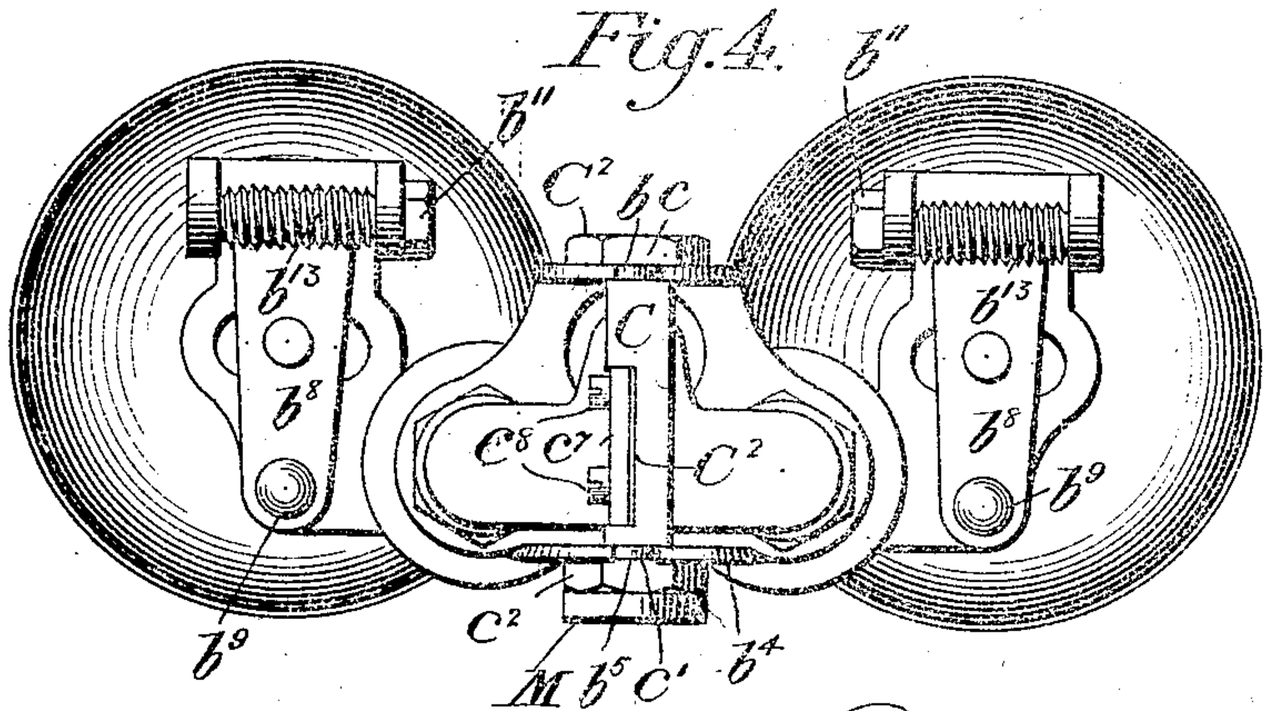
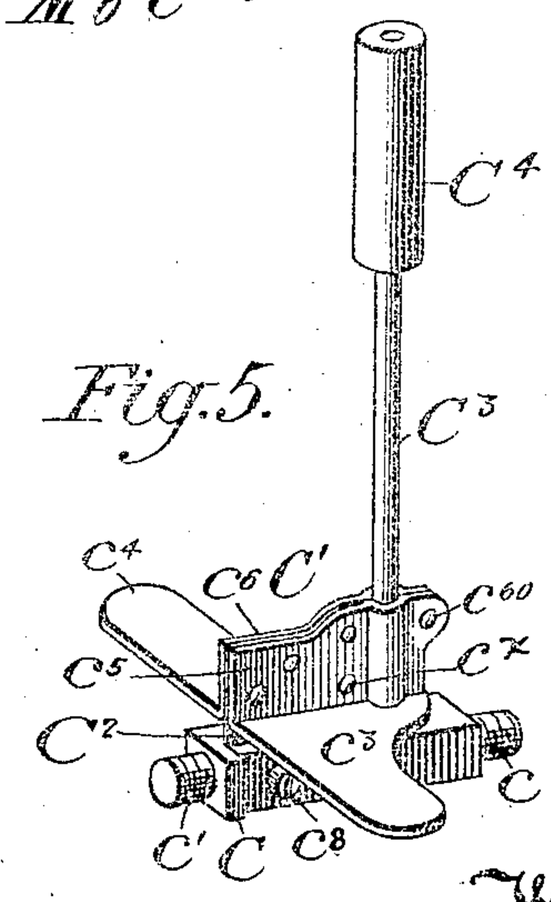


Fig. 5.



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APPLICATION FILED AUG. 9, 1905.

3 SHEETS—SHEET 3.

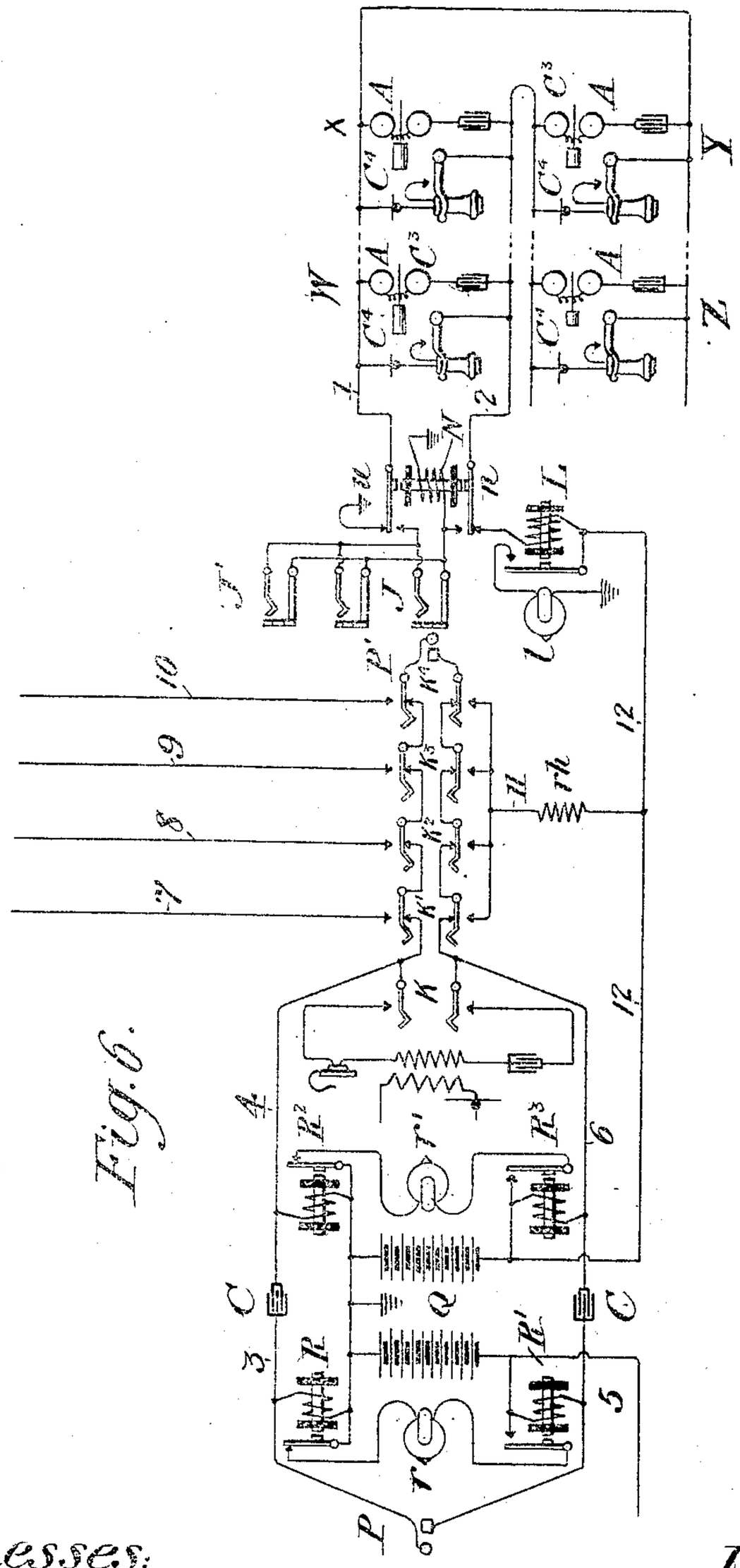

Fig. 6.

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UNITED STATES PATENT OFFICE.

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METHOD OF HARMONIC SELECTIVE SIGNALING.

No. 841,640. Specification of Letters Patent. Patented Jan. 15, 1907.

Original application filed April 17, 1905, Serial No. 255,961. Divided and this application filed August 9, 1905. Serial No. 273,461.

To all whom it may concern:

Be it known that I, WILLIAM W. DEAN, a citizen of the United States, residing at Elyria, in the county of Lorain and State of Ohio, have invented certain new and useful Improvements in Methods of Harmonic Selective Signaling, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to improvements in party-line telephone systems, and has for its object, generally speaking, the provision of an improved harmonic system for selective signaling and an improved method of operation therefor.

My invention, as I shall present it, comprises both the method and one form of apparatus or apparatus embodied in one form by which the method may be practiced. The method alone will be claimed herein, however, the apparatus being claimed in a separate application, filed April 17, 1905, Serial No. 255,961, of which the present case is a division.

In harmonic selective-signaling systems heretofore designed two methods have been employed. By one a reed tuned to exact pitch was relied upon to close a circuit, and by the other a mechanical signal included directly in the harmonic circuit was overtuned or undertuned to allow for losses or acceleration in operation. A third method, that of exact tuning of the mechanical elements, has been attemped at divers times, but has never succeeded to my knowledge prior to my present invention. The first and second methods need not be considered here, my present invention relating particularly to the third method. Systems of this type have heretofore been unsuccessful and uncommercial for several reasons. It was found difficult if not impossible to operate a bell having a tongue constituting a tuned reed by means of the ordinary pulsating or alternating current of a frequency or a pitch corresponding to that of the bell-reed. The weight of the hammer or clapper, the manner of applying the attractive force of the magnet, and the reactive effect of the vibrating gong have always proved sources of trouble in attempting to reach a perfect tune. I have discovered, however, that it is possible by properly applying the energy of the ringing-current to positively overcome and render neglible the disturbing forces to which I have referred. In other words, without unduly increasing either the voltage or the ampere-turns in the ringer-magnets I apply the energy cumulatively in such manner as to reach an effective totality of sufficient magnitude to render small losses and disturbing elements negligible.

Expressed in a few words my system employs a polarized ringer having its armature mounted in a neutral position upon a strong spring, so strong that ordinary ringing-current momentarily applied produces no effect. Only when current of the proper frequency has passed through the ringer-coils for a long enough period to start up the armature and the tuned clapper do the gongs receive any stroke. I tune the clapper rods or reeds by fastening thereon clappers formed in cylindrical shape and of different lengths and weights.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a front view of a ringer with gongs mounted complete. Fig. 2 is an end view of the same. Fig. 3 is a top plan view with the gongs removed. Fig. 4 is a bottom plan view. Fig. 5 is a perspective view of the clapper-rod and connected parts removed, and Fig. 6 is a diagram of a subscriber's line having four stations equipped with my invention and the coöperating central office apparatus.

I will first describe the mechanical structure of my ringer and then point out the method of its employment.

Referring to Figs. 1 to 5, A designates a pair of magnet-spools with cores a a', secured by screws a^2 upon the yoke B. At the lower ends of these cores is carried a secondary yoke B′, the same being secured by the nuts b b' upon the sleeves b^2, secured to the magnet-heads or in any other suitable manner. The yoke B′ has front and rear drop portions b^3 b^4, each slotted, as indicated at b^5, for the reception of the ends c c' of the armature block or bolt C. On each of these is fitted a lock-nut c^2. This block and its connected parts are best shown in Figs. 4 and 5. The block C is preferably squared throughout that portion of its length which lies between the parts b^3 b^4, its ends being reduced and threaded at c c'. The squared portion is milled out on one side to receive the short

leaf-spring C^2. To hold this in position on the block, a short bar c^7 is clamped upon it by means of screws c^8. Secured upon the spring above the block is the armature C′ This is made of pressed metal in two halves c^3 c^4, each having an upstanding flange c^5 or c^6. These two flanges are set upon opposite sides of the spring and secured together through the latter by means of rivets $c^\times$. Each flange is formed with a semicylindrical channel to one side of the spring and an outside rivet c^{60}, the channels when put together receiving the clapper-rod C^3, which is thus secured rigidly to the armature structure by the common bridging means. At its upper end the clapper-rod is fitted with the clapper C^4, composed of a length of tubing solidly driven on the rod. The length of this tube varies according to the tune desired. In assembling the device the ends of the block C are inserted from beneath into the slots b^5, the clapper-rod at the same time passing up through an opening c^9 in the yoke B′ and lying in front of the upper yoke B between the gongs G. The armature having been adjusted with regard to the poles a^2 of the ringer-magnet the nuts c^2 are set up tightly, and thereafter the only movement of the armature possible to make is that permitted by bending the spring C^2. Secured upon the upper yoke and passing down behind the magnets into contact with the rear nut c^2 is the permanent magnet M, and as the upper yoke B and the block C, with its parts, are of iron it follows that a very efficient magnetic circuit is thus obtained, the only breaks in which are the air-gaps between the poles a^2 and the armature C′. The gongs G are mounted upon the posts g, the latter being carried upon metal segments b^8, each pivoted at b^9 upon a suitable bolt passing through the yoke B. At its front edge b^{10} each segment is provided with gear-teeth meshing with the worm b^{13}, cut on the stem of the bolt b^{11}. This bolt b^{11} has its ends supported in drop-bearings formed in hook shape on the yoke B, as shown at b^{12}, Figs. 1, 2, and 3. In order to get the best results with this ringer, an accurate adjustment of the gongs is necessary, and this adjustment, moreover, must be solid, so that when the parts are once set they will remain undisturbed by the forcible action which I contemplate. The gong-posts pass up from the segments through lateral enlarged openings b^7 in extensions b^6 on the yoke B. By means of a suitable wrench applied to the head of either bolt b^{11} the same may be turned, and the worm thereon will move the segment one way or the other and with it the gong-post and gong.

It will be observed that the construction of my ringer throughout is such as to make it very solid and substantial. Its depreciation through a long period of time is intended to be neglible and its operation uniformly efficient throughout its life. It is so designed that it may be substituted for an ordinary bridging-ringer or, in fact, for any ringer at any station having parts of standard type. The sizes and general arrangement of parts are such that no special features are required in the rest of the telephone set to permit the use of this ringer.

Referring now to Fig. 6, I have shown a pair of plugs P P′, connected by a cord-circuit 3 4 5 6 and provided with a listening-key K and ringing-keys K′, K^2, K^3, and K^4. A subscriber's line 1 2 terminates at contact n of the cut-off relay N, by which the line is adapted normally to be connected to a signal-relay L, controlling a lamp l, and when a plug is in one of the jacks J or J′ to be connected thereto and disconnected from the relay. The cord-circuit contains the four relays R, R′, R^2, and R^3, bridged in pairs across the two ends of the circuit, each pair jointly controlling one of the supervisory lamps r r'. Current is furnished by central batteries Q. From one of these the wire 12 extends as a common return for the line-relays, and also connected through resistance $r\,h$ by branch 11 as a common return for the selective ringing-keys, battery-current being thus supplied to the sleeve side of line for the cut-off relay N while ringing. Each of the selective keys K′, K^2, K^3, and K^4 is connected on one side by wire 7, 8, 9, or 10 to a generator giving a particular frequency, so that by using the proper key any one of the four frequencies may be thrown upon the line.

At the four subscribers' stations W, X, Y, and Z the four ringers are all tuned to respond to different frequencies. At station W the tubular clapper C^4 is long and heavy, this station being called by the lowest frequency-current. At stations X and Y the length and weight of the clapper is successively reduced, and at station Z it is shortest and lowest of all, this station being called by the current of highest frequency.

It is to be understood that momentary current of right or wrong frequency will not effectively move any of the four armatures. If the current continues to flow for a brief period, however, the armature at that station which is tuned to respond to the selected frequency gradually gets into motion. As it is pulled over the strength of the magnetic pole strongly increases, and in order to get a powerful effect, and, in fact, relying as I do upon what might be termed "sheer brute force," I discard all delicate adjustments and safeguards and strip the magnet-pole, so that the armature may come into direct contact with it. I thus get a maximum pull and a maximum effect on the clapper just when I need it the most—that is, at the instant of possible interference due to reactive vibration from the gong. Thus I start my selective ringer by tuning it exactly, so that it will

respond before striking the gong, and after it has once started to vibrating I provide a strong enough action to positively overcome any interference. Those ringers, however, which have not started into good vibration, owing to their being out of tune, are of course unaffected, and I may add that the strength of the springs C^2 is such that it takes almost a perfect resonance to overcome their stiffness.

The method I set forth without regard to the specific apparatus employed will now be plain. It consists in providing a number of positively-tuned elements normally held inactive and requiring considerable energy to actuate them, then by means of suitable current starting the action of a selected unit and having started it thereafter by supplying sufficient energy forcing it into full operation.

It will be noted that I have shown condensers in the bell branches at my substations. I employ these condensers in some cases in conjunction with the windings of the magnets for the purpose of electrically tuning the branches. While my system is preferably operative without this, it is particularly adapted for use in common battery systems, the small leakage through the branches not tuned to receive a particular ringing-current being negligible on account of the stiffness of the springs C^2. Thus the ringer at the desired station only will get current enough to start its armature into vibration irrespective of its mechanical tune, and, as I have stated in the foregoing, this initial vibration is essential to full actuation, as the normal position of the armature is too far from the poles of the magnet for instantaneous pulls to be effected against the stiffness of the springs.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The method of selectively operating electrical apparatus which consists in the following steps: first, tuning the movable parts of an electromagnet so that they will absorb energy when imparted at intervals of the proper frequency; second, initially moving said parts by means of their resonant response to the accumulative energy impulses received by said magnet; and lastly, exposing the parts when so moving to the strong and progressively-increasing magnetic forces of said magnet during their motion, substantially as described..

2. The method of selectively ringing telephone-bells, which comprises the following steps: first, tuning the mechanical parts of each bell to respond to a given frequency, and rendering them all inoperative for momentary current impulses through the magnet; second, by means of current of suitable frequency imparting initial motion to the parts of any desired ringer; and third, exposing the parts when so moving to the maximum magnetic effect of the magnet so as to insure proper actuation of the parts and to render reactive interferences negligible, substantially as described.

3. The method of selective signaling, which consists in tuning the movable parts of an electromagnet to respond to a given frequency, feeding a current of constant strength and proper frequency to said magnet to initially move said parts, and exposing said parts when so moving to the maximum magnetic effect of said magnet so as to insure proper actuation and to render reactive interference negligible.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM W. DEAN.

Witnesses:
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