

O. L. HARRISON.
ELECTRICAL SIGNALING APPARATUS.
APPLICATION FILED OCT. 2, 1908.

933,557.

Patented Sept. 7, 1909.

2 SHEETS—SHEET 1.

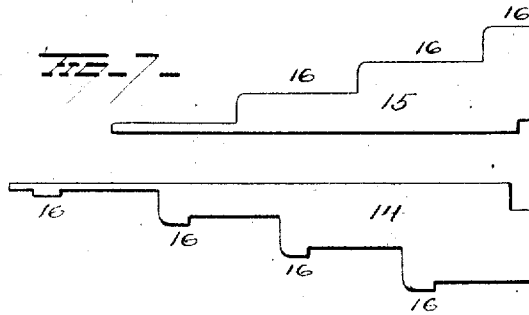
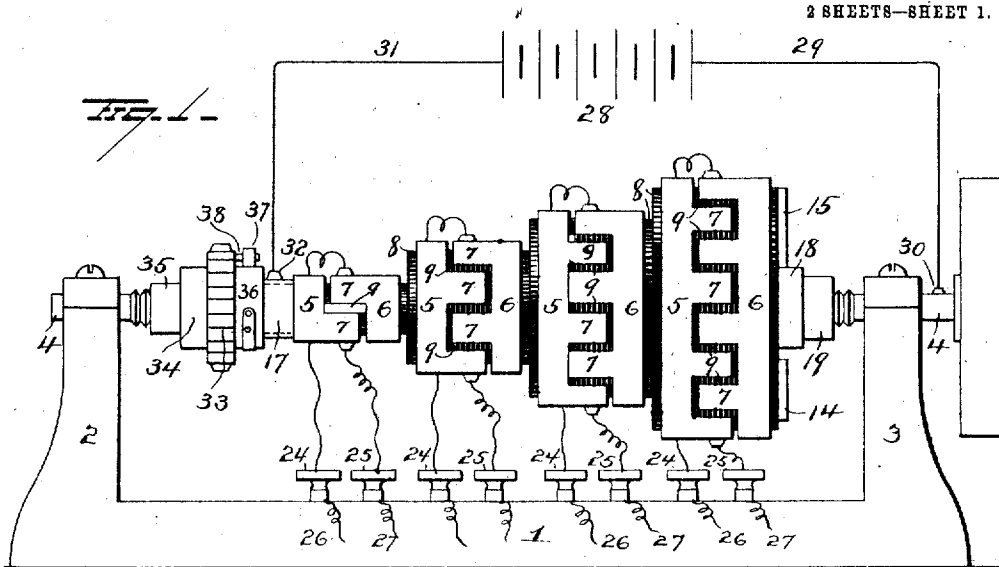


Fig. 3.

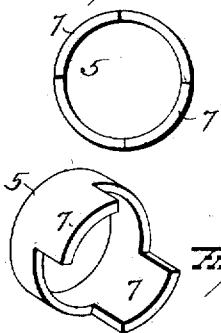


Fig. 2.

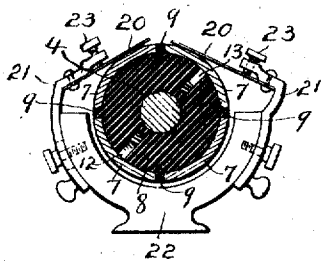


Fig. 5.

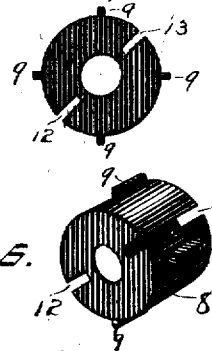
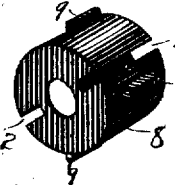


Fig. 6.



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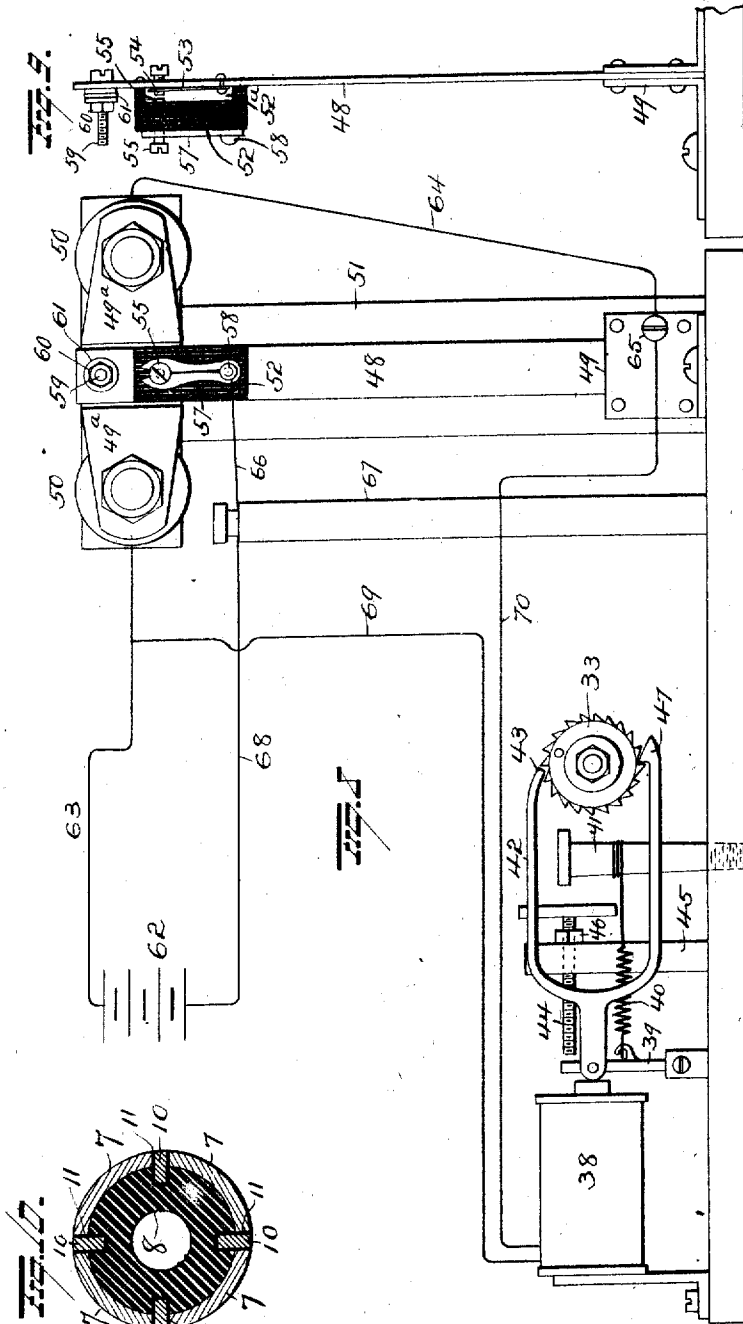
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UNITED STATES PATENT OFFICE.

OWEN L. HARRISON, OF COLETA, ILLINOIS.

ELECTRICAL SIGNALING APPARATUS.

933,557.

Specification of Letters Patent.

Patented Sept. 7, 1909.

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To all whom it may concern:

Be it known that I, OWEN L. HARRISON, of Coleta, in the county of Whiteside and State of Illinois, have invented certain new and useful Improvements in Electrical Signaling Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in electrical signaling mechanism and more particularly to such as are adapted for use on telephone lines for operating synchronized or harmonic call bells,—one object of the invention being to so construct and arrange an apparatus of the character specified, that various rates of frequency of current can be effected on a line or external circuit or so that several external circuits can be supplied simultaneously with currents of different frequencies, and thus enable several central office operators to use the apparatus at the same time for operating signal bells on various lines.

A further object is to provide a pole changer capable of supplying to a number of lines currents of different frequencies, with means for operating said pole changer at a constant or uniform speed.

A further object is to provide a rotary pole changer capable of supplying current of different frequencies to a number of lines, with simple and efficient means for driving the rotary member at a constant or uniform rate of speed regardless of changes of voltage of the current which operates and controls said driving means.

With these objects in view, the invention consists in certain novel features of construction and combinations of parts as hereinafter set forth and pointed out in the claims.

In the accompanying drawings; Figure 1 is a view in elevation of a pole changer embodying my invention. Fig. 2 is a transverse sectional view; Figs. 3, 4, 5, 6 and 7 are detail views illustrating various parts of the pole changer; Fig. 8 is a view illustrating the motor and means for controlling the same to drive the pole changer at a constant speed; Fig. 9 is an edge view showing a portion of the motor controlling means; Fig. 10 is a view of a slight modification.

1 represents a suitable base on which standards 2, 3 are located, and upon said standards, the shaft 4 of the pole changer is

mounted in suitable bearings. The shaft 4 carries a series of commutators, (four being shown in the drawing) which are so connected in circuits and cooperate with brushes in such manner as to supply various lines or external circuits with currents of different frequencies for operating harmonic bells on said lines or external circuits. Each commutator may consist of two rings 5—6 having intermeshing contact teeth or fingers 7, the rings of each commutator having a different number of such teeth or fingers so that currents of different frequencies will be supplied to the various lines with which the brushes cooperating with these commutators are connected.

The pairs of rings composing the various commutators are located upon hubs 8 of insulating material secured to the shaft 4. These hubs are made of such length as to project slightly beyond the edges of the commutators and contact with each other so as to prevent electrical interference of commutator with its neighbors. The rings 5—6 of each commutator are so placed on their hubs 8 as to be out of electrical contact with each other, and the spaces between the intermeshing contact teeth or fingers 7 of the respective rings are occupied by teeth or spacers 9 of insulating material projecting from the hub 8. Instead of making the spacing teeth 9 as projections from the hubs 8, said spacers may be made of metal as shown at 10 Fig. 10, and driven into the hub, with insulating material 11 at each side of each spacer.

Each of the several insulating hubs 8 is provided with two grooves 12 and 13, the grooves of the various hubs being made to align with each other. Into these grooves, keys 14—15 are inserted, the key 14 having a series of projecting portions 16 in electrical contact with one ring of each commutator, and the key 15 having similar projections in electrical contact with the other rings of the several commutators. One end of the key 14 is in electrical contact with a ring 17 carried by but insulated from the shaft 4, while one end of the key 15 is electrically connected with a washer 18 and a nut 19 located on the shaft 4 and having electrical connection therewith.

Two brushes 20—20 are provided for each commutator as shown in Fig. 2, and these brushes are secured to holders 21 adjustably connected with an insulated semicircular

support 22 disposed concentric with and suitably spaced from the commutators.

An adjustable screw 23 is provided for each brush 20 for regulating the tension of the same against its commutator. The brushes of each pair are connected by means of suitable conductors, with a pair of binding posts 24—25, and the latter are connected by conductors 26—27 (representing a telephone line or external circuit) with a suitable switch board, not shown.

One terminal of an electric battery 28 is connected, by a conductor 29 with a brush 30 making electrical contact with the shaft 4, while the other terminal of said battery is connected, by means of a conductor 31 with a brush 32 with the insulated ring 17.

With the construction and arrangement above described, a circuit may be traced from one terminal of the battery by conductor 29 to the shaft 4; thence by nut 19 and washer 18 to the key 15; thence to one member of a commutator, thence to one of the commutator brushes, thence to one limb of the external circuit; thence by way of the other limb of the external circuit to the other commutator brush, to the other member of the commutator, through the key 14 to the insulated ring 17, thence to brush 32 and from the latter, by the conductor 31 to the other terminal of the battery. As one member of each commutator is connected with one terminal of the battery by means of the key 14 and as the other member of the same commutator is connected with the other terminal of the battery by means of the key 15, it is apparent that when the commutator is rotated, in contact with the brushes 20, an alternating current will flow over the external circuit. It is also apparent that if one commutator brush be moved laterally so as to contact with the continuous or plain portion of a commutator member while the other brush is permitted to make contact with the teeth or fingers of the other commutator member, a pulsating current will be sent over the external circuit. The alternations of the current in the external circuit will be equal to the sum of the teeth of two rings or members composing a commutator. Thus, if a pair of rings or commutator members have six teeth each, the line or external circuit will receive twelve alternations of current with each complete rotation of the shaft 4, and any proportions may be obtained by varying the number of teeth of the commutator members. In the drawings I have shown the machine provided with four commutators, which will cause, respectively, 4, 8, 12 and 16 alternations on the lines connected with them, with each complete rotation of the shaft, when said external circuits are closed. Each pair of commutator members may be connected with a different line at the same time, and each line will re-

ceive alternations proportional to the number of teeth in the commutator members with which it is connected.

Several lines may be connected with any or each pair of binding posts or commutator brushes, and the various lines will receive the desired alternations. The machine will, therefore, serve any number of operators. It may be found desirable to make the rings or commutator members having the greatest number of teeth, larger in diameter than the rings or commutator members having a smaller number of teeth. To construct a revolving harmonic pole-changer when the frequencies are to have fractional ratios instead of multiple ratios, as in the drawing, the highest frequency should always be less than twice the lowest frequency. Suppose it is desired to produce five different frequencies. Then, the lowest number of teeth per ring will be five; the numbers of teeth in succession would then be, 5, 6, 7, 8, 9. The frequencies would be 10, 12, 14, 16, 18 per revolution of the shaft. By giving the shaft two revolutions per second, the frequencies produced would be 20, 24, 28, 32, 36. This would be a very practical set of frequencies for ringing harmonic bells made to respond to said frequencies. The object should be to leave the greatest interval possible between frequencies. This can always be readily done by making the number of teeth per ring for the lowest frequency equal to the number of frequencies desired, and giving each ring of each successive pair of rings, one more tooth than its predecessor. This rule will always divide the octave into equal parts, and will avoid multiple ratios.

In order that the machine shall operate effectually for ringing harmonic bells, it is important that the rotary pole changer shall be driven at a substantially constant, uniform speed. To accomplish this, the devices now to be described may be employed.

A ratchet wheel 33 is mounted loosely on the shaft 4 and prevented from lateral displacement in one direction by a washer 34 and a nut 35 on the shaft. A collar 36 is secured to the shaft at the other side of the ratchet wheel and to this collar, a spring 37 is secured. The projecting end of this spring is engaged by a pin 38 which projects laterally from the ratchet wheel. In this manner, the ratchet wheel has a yielding connection with the shaft, so that the speed of the latter will be constant, regardless of changes of voltage in the circuit which includes the magnet which controls the operation of the devices which propel the ratchet wheel,—whereas, if the ratchet wheel were rigidly secured to the shaft, a sudden increase of voltage in the circuit of the motor magnet would tend to accelerate the speed of the shaft. The motor magnet above referred to is indicated at 38 and actuates a

pivoted armature 39,—the latter being moved in one direction by means of a spring 40 attached at one end to said armature and at the other end to an adjusting screw 41. A yoke 42 is pivotally connected at one end with the armature 39 and one arm of this yoke terminates in a tooth 43 over the ratchet so as to engage the teeth of the latter when the yoke moves in a direction away from the magnet, the yoke being limited in its movement in this direction by means of a stop screw 44 adjustably mounted in a post 45 and held in adjusted position by a jam nut 46. The other arm of the yoke terminates under the ratchet wheel in a hook 47 to engage the teeth of the same. It is apparent that when the yoke is reciprocated by the combined action of the motor magnet 38 and the spring 40 (or by the alternate action of two motor magnets) the ratchet wheel, and consequently the shaft 4 and the commutators will be rotated constantly in the same direction.

In order that the circuit of the motor magnet shall be opened and closed at a uniform rate of speed and thus cause a constant, uniform speed of the commutators of the pole changer, the devices now to be described may be employed.

A reed 48 (preferably of hard spring steel) is secured at one end to a suitable support 49 and at its free end is adapted to play between the poles 49^a of a magnet 50 supported by a suitable standard 51. Near its free end, the reed carries a block 52 of insulating material and the side of this block next to the reed is cut away or recessed as shown at 52^a. A contact finger 53 of thin pliable spring metal is secured at one end to the reed 48 within the recess of the block 52 and the free end of this finger carries a contact point 54. A contact screw 55 passes through the block 52 and terminates in a contact point 56 close to the contact point 54 of the finger 53. The screw 55 is engaged by a clip 57 which prevents said screw from turning, and said clip is secured to the block 52 by means of a screw 58.

A screw 59 is secured to the free end of the reed, and on this screw, a nut 60 and thin washers 61 are located. These devices serve as simple means for tuning the reed. That is, by varying the load. Such devices are not apt to get out of proper adjustment.

One pole of a battery 62 is connected by a conductor 63 with one terminal of a helix of magnet 50 and the other helix of this magnet is connected by a conductor 64 with a binding post 65 electrically connected with the reed 48 through the reed support 49. The clip 57 and consequently the contact screw 55, is connected by a conductor 66 with a binding post 67 and the latter is connected, by a conductor 68 with the other

pole of the battery 62. The conductor 63 is connected by a wire 69 with one terminal of the helix of the motor magnet 38, and the other terminal of the helix of the motor magnet is connected by means of a wire 70 with the binding post 65. Thus it will be seen that the magnets 38 and 50 are arranged in parallel with each other and that these circuits are controlled by the circuit breaker afforded by the contacts 54 and 56 carried by the reed 48. The play of the contact point 54 is adjusted by means of the screw 55. The platinum contact 56 may be soldered to the inner end of screw 55.

When the reed 48 is at rest, and the circuit of battery 62 is open, the contact point 54 will rest lightly against the contact point 56. When the circuit is closed by means of a suitable key (not shown) the reed will be actuated by the magnet 50 and as the circuit breaking contacts 54—56 are in series with the coils of magnet 50, the circuit will be broken by the separation of the contacts 54—56 and cause the magnet 50 to release the reed. Making and breaking of the circuit at the contacts 54—56 will continue and the reed will thus be caused to vibrate with a definite and uniform frequency and the making and breaking of the circuit will correspond in frequency with that of the reed. In consequence of the above operation of the reed, the circuit of the motor magnet helix will be opened and closed with a uniform frequency corresponding with the frequency of vibration of the reed, and hence the speed of reciprocation of the yoke 42 and hence the speed of rotation of the commutators of the pole changer will be constant and uniform. The said pole changer is therefore capable of effectually controlling the operation of harmonic bells on the several lines or external circuits with which the pole changer is connected, as previously explained.

Various changes might be made in the details of construction of the various parts of my invention without departing from the spirit of the latter or limiting its scope, and hence I do not wish to restrict myself to the precise details herein set forth.

Having fully described my invention what I claim as new and desire to secure by Letters-Patent, is:—

1. In apparatus of the character described, the combination with a series of rotary commutators, each adapted to interrupt an electric circuit at a different frequency from the others, means for including each of said commutators in a different external circuit an electro-magnetic device for operating said commutators simultaneously and means for operating said electro-magnetic device at a substantially constantly uniform speed.

2. In an apparatus of the character de-

scribed, the combination of a shaft, a series of commutators carried by said shaft and each adapted to interrupt an external electric circuit with a frequency different from the others, means for including each commutator in a different external circuit, an electro-magnetic device for propelling said commutators simultaneously, a yielding connection between said electro-magnetic device and the shaft which carries the commutators, and means for operating the electro-magnetic device at a substantially constant uniform speed.

3. In an apparatus of the character described, the combination of a shaft, a series of commutators located thereon and each adapted to interrupt an external circuit at a different frequency from the others, means for including each commutator in a different external circuit, a ratchet wheel loose on the shaft, a pin and spring connection between the ratchet wheel and shaft, electrically-actuated means for rotating said ratchet wheel, and means for operating said electrically actuated means at a substantially constant uniform speed.

4. In apparatus of the character described, the combination of a series of commutators, each adapted to interrupt an external circuit at a different rate of frequency from the others, means for including each commutator in a different external circuit, an electro-magnetic device for propelling said commutators simultaneously at a substantially constant uniform speed, and a reed carrying a circuit making and breaking device for controlling the operation of the electro-magnetic device.

5. In apparatus of the character described, the combination with a rotary pole changer comprising a commutator and brushes cooperating therewith and adapted to be included in an external circuit, of an electro-magnetic device for propelling said commutator, a reed, a circuit interrupter carried by said reed, a magnet for operating the reed, and an electric circuit including said reed, the circuit interrupter, said magnet and the magnet of said electro-magnetic device.

6. The combination with a source of electrical energy, of a shaft, means for rotating the shaft at a substantially uniform rate of

speed, contacting elements mounted on said shaft, said contacting elements arranged in pairs, one positive and the other negative, means for including each pair of contacting devices in an external or working circuit, and each pair of said contacts adapted to produce a different number of changes or interruptions of the external or working circuit at each rotation of the shaft, and means for connecting each contacting element with the proper pole of the source of electric energy.

7. In an apparatus of the character described, the combination with a shaft, of a series of commutators mounted thereon, each commutator comprising two members and adapted to interrupt a current at a different frequency from the others, brushes cooperating with each commutator and included in an external or working circuit, a key electrically connected with one member of each commutator, another key electrically connected with the other member of each commutator, insulating hubs supporting said commutators and keys, a source of electrical energy having its terminals connected respectively with said keys, and means for rotating said commutators at a substantially constant uniform speed.

8. The combination with a source of electrical energy, of a shaft, means for rotating the shaft at a substantially constant uniform speed, pairs of insulated rings mounted on said shaft, both members of each pair of rings having an equal number of longitudinal intermeshing teeth and each pair of rings having a different number of teeth from any other pair, means for including each pair of rings in one or more external working circuits so that each pair of rings will produce a different number of interruptions or alternations in said circuit or circuits per revolution of the shaft, and means for connecting each ring with the proper pole of the source of electrical energy.

In testimony whereof, I have signed this specification in the presence of two subscribing witnesses.

OWEN L. HARRISON.

Witnesses:

A. X. HARRISON,
ADDIE C. HARRISON.