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Aug. 3, 1943.

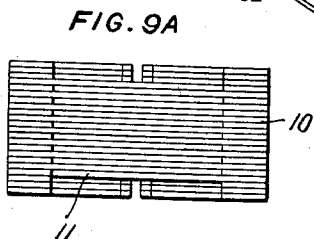
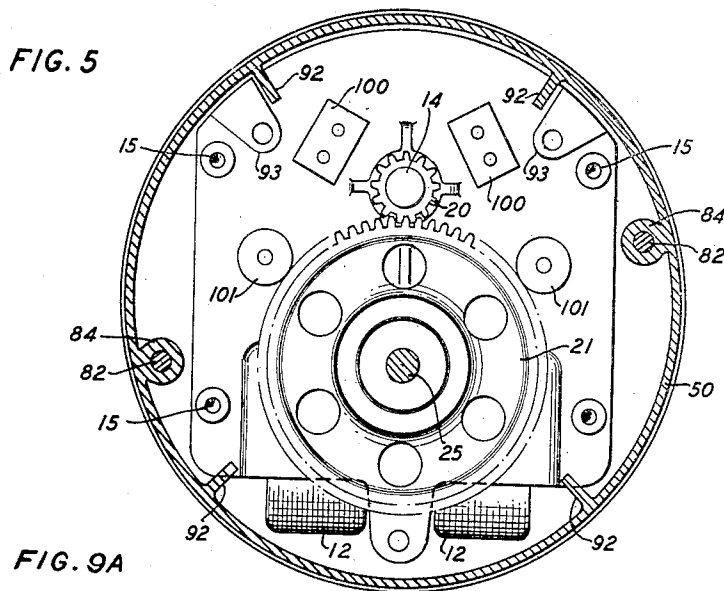
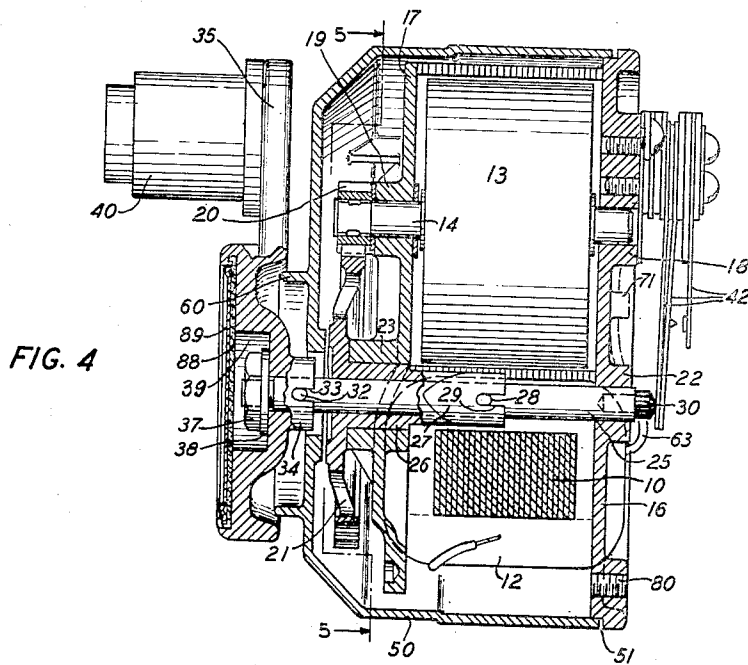
L. N. HAMPTON ET AL

2,325,952

SIGNALING DEVICE

Filed Dec. 11, 1941

4 Sheets-Sheet 2



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Aug. 3, 1943.

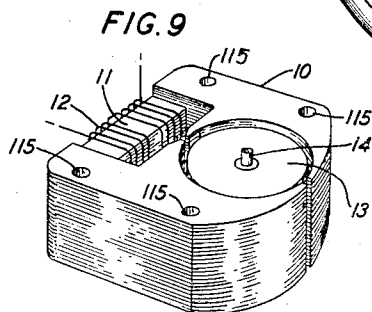
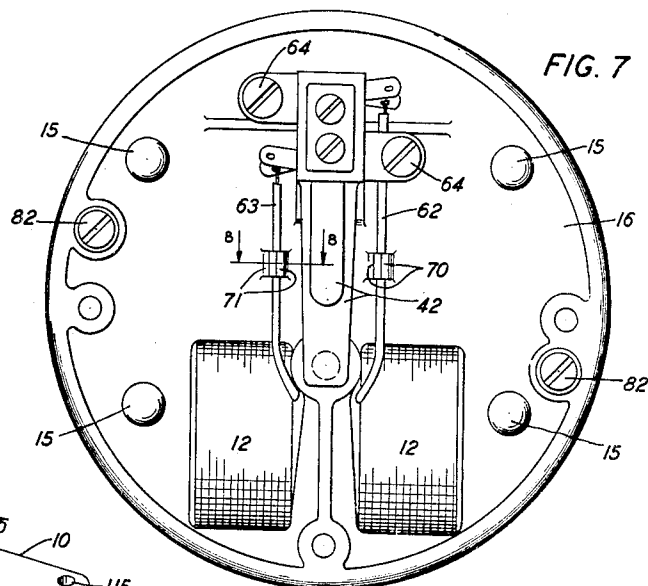
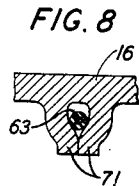
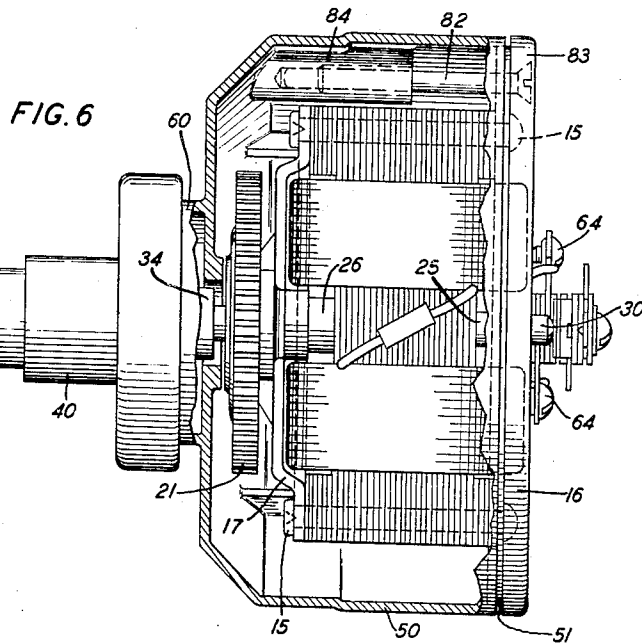
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SIGNALING DEVICE

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4 Sheets-Sheet 3



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SIGNALING DEVICE

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FIG. 10

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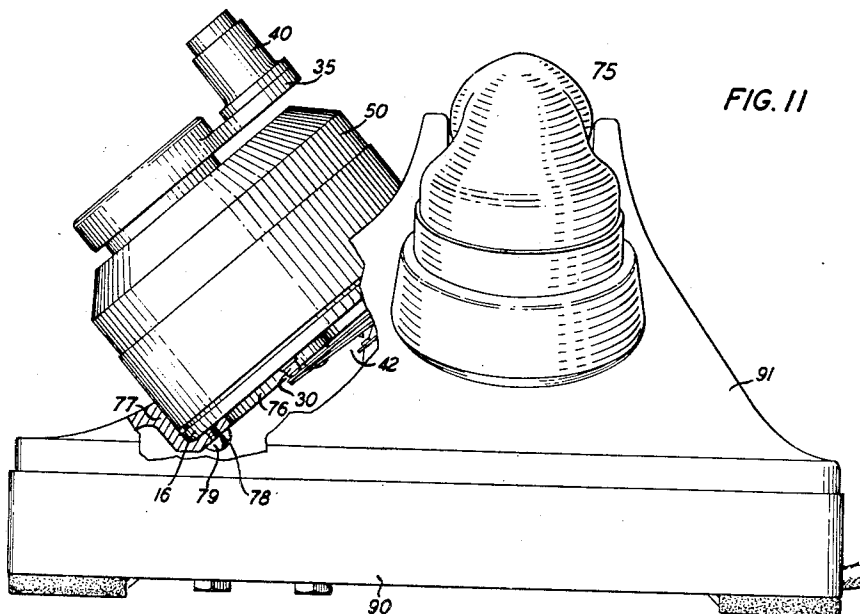
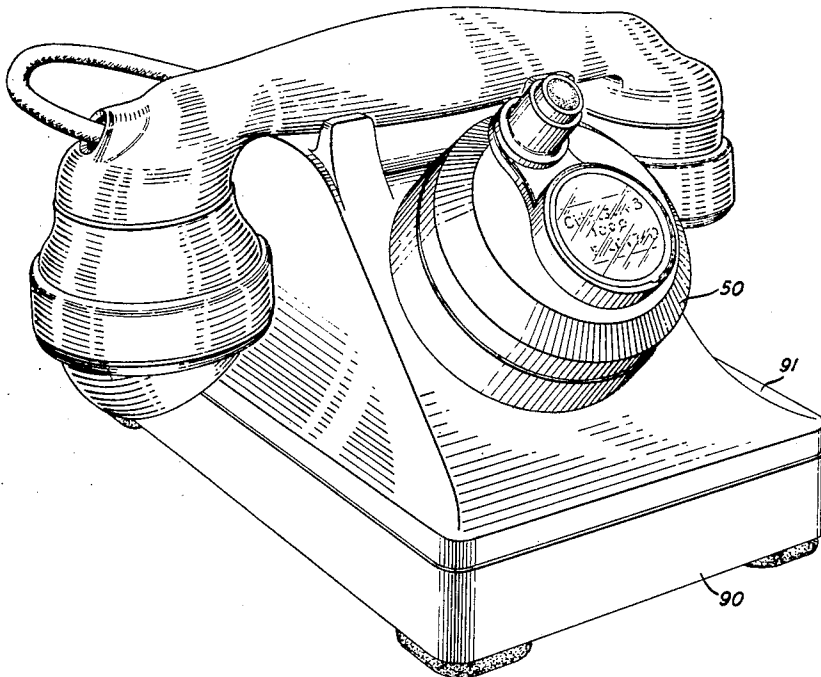


FIG. 11

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UNITED STATES PATENT OFFICE

2,325,952

SIGNALING DEVICE

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Application December 11, 1941, Serial No. 422,508

8 Claims. (Cl. 171-76)

This invention relates to ringing generators and particularly to the design of a single generator which is adaptable for substantially every use to which a ringing generator is put in the telephone field.

It is the object of this invention to simplify and otherwise improve the design of telephone ringing generators, and particularly to provide a generator which is suitable for use with various instrumentalities used in telephone signaling, such as combined telephone sets, telephone linemen's test sets, and the like.

This object is attained by the provision of design features which effect a compact and highly efficient structure of reduced weight and size, and which readily lends itself for mounting in the receptacle or cavity generally occupied by the telephone dial of a subscriber's set, or for association with other telephone apparatus such, for example, as a lineman's test set.

A feature of the invention resides in the design of a front mounting plate which serves to accommodate one or more interrupters of the type commonly used with ringing generators, in such a position, or positions, that the interrupters are capable of being driven directly by the crankshaft gear which functions to drive the rotor element of the generator. In prior generators of this type the interrupters have been independently mounted. This built-in interrupter feature tends to reduce the cost of the equipment and results in the embodiment, in a single unit, of those essential generator and interrupter elements which heretofore were designed for independent mountings. This feature which finds particular use in what are known as linemen's test sets, is equally applicable to the generators employed for other purposes, as for example, the ringing current generator of a magneto type telephone set.

Another feature of the invention resides in the use of anchoring, or fastening means for the leads which extend from the generator coils to the terminals of the spring pile-up associated with the generator. This anchoring means comprises pairs of lugs, or projections, integrally formed on the rear mounting plate between which the coil leads are inserted or confined, and which, after the insertion of the leads, are crimped or otherwise pressed together to hold the leads neatly and flush with the face of the rear mounting plate.

A further feature of the invention resides in the crank handle design which is such that the crank handle serves also to accommodate the

designation strip, or instruction card usually furnished with subscribers' telephone sets.

These and other features of the invention which cooperate in effecting a simple, compact generator structure having a minimum number of parts, will be set forth in greater detail in the following description which is made with reference to the accompanying drawings.

In the drawings,

Fig. 1 is a side sectional view of a ringing generator of the type particularly suitable for use with a lineman's test set and which embodies features of the invention;

Fig. 2 is a front view of the generator of Fig. 1 with a portion of the cover removed, showing the position of the interrupters relative to the crankshaft gear which drives the generator rotor;

Fig. 3 is a section taken along the line 3-3 of Fig. 2 and shows a side view of the interrupter mechanism;

Fig. 3A is a view of the interrupter assembly, partly in section, showing the integral flange or hub-like projection of the pinion and the relative disposition of the insulating and contact elements of which the interrupter is made;

Fig. 4 is a side sectional view of a hand generator similar in design to that shown in Fig. 2, but which is arranged for mounting in the dial cavity of a subscriber's telephone set;

Fig. 5 is a sectional view of the ringer shown in Fig. 4, taken along the line 5-5 of Fig. 4 and looking in the direction of the arrows;

Fig. 6 is a view of the interior of the generator unit of Fig. 5 with a portion of the cover removed;

Fig. 7 is a rear view of the generator illustrated in Fig. 5 showing the rear mounting plate and the method of anchoring the generator coil leads thereto;

Fig. 8 is an enlarged section taken along the line 8-8 of Fig. 7 showing more clearly the method employed in anchoring the generator coil leads;

Fig. 9 is a perspective view (reduced in size) of the electromagnetic structure of the generators shown in the preceding figures;

Fig. 9A is an end view of the stator structure shown in Fig. 9 and illustrates the interleaved lap joint employed in the assembly of the laminations of which the stator is made up;

Fig. 10 is a perspective view of a combined telephone set showing the hand generator mounted in the position usually occupied by the telephone dial; and

Fig. 11 is a side view of the telephone set shown in Fig. 10 with a section of the pedestal portion broken away to disclose the manner in which the generator is mounted on, and secured to the set.

The electromagnetic structure of the generators illustrated in the drawings comprises a stator 10 made of silicon steel laminations with an interleaved lap joint. The interleaved portions of the laminations constitute the magnetic leg 11 on which the output coils 12 are carried. The coils 12 are preferably form wound. The stator leg 11, in effect constitutes a magnetic shunt which, by virtue of the interleaved arrangement of the laminae, is magnetically continuous, thus constituting an improvement over similar structures which resort to a butt joint. The laminae of the stator 10 are so formed that when assembled, they effect a structure having a pole arc substantially equal to the pole pitch, that is, in the case of the bi-polar machine disclosed, substantially 180 degrees. The wider arc increases the internal reactance of the generator in that it provides a return magnetic path when the rotor poles are in line with the stator pole centers. In other words, the permanent magnet flux has an augmented leakage path principally through iron even when the flux does not interlock with the coil.

The rotor 13 is a cylindrical permanent magnet of an alloy having high coercive force and work factor. The permanent magnet is cast directly on the shaft 14 which is made of non-magnetic steel. The external surface of the magnet is ground to secure accurate mechanical dimensions. The use of a complete cylinder for the field magnet, instead of physical salient poles, eliminates the voltage peaks which would occur with the latter type of rotor, when the edges of the poles line up with the stator pole tips. It also minimizes variations in the mechanical torque required to drive the generator.

The construction illustrated permits the rotor to be magnetized in place, thereby increasing the flux output of the permanent magnet and therefore, the power delivered by the generator. The poles of a powerful electromagnet may be placed on the sides of the generator in line with the stator pole centers, and sufficient flux passed through the structure to fully saturate the core through the coils, so that flux is forced through the permanent magnet and magnetizes it in place.

The laminations of the stator 10 are held in position by means of four screws or rivets 15, or their equivalents, located at the four corners of the structure.

Since the structures illustrated in the several figures of the drawings are substantially identical, like numerals will be used to identify similar elements throughout the various figures.

The electromagnetic structure described above and shown particularly in Fig. 9 is held between a rear mounting plate 16 and a front plate 17. The above-mentioned rivets 15, which serve to mount, or secure the stator laminations, extend through the front and rear plates 17 and 16, respectively, so as to hold the plates together with the laminations clamped therebetween. These rivets are indicated by the numeral 15 in Figs. 2, 5, 6 and 7 whereas the holes which receive these rivets are indicated by the numeral 115 in Fig. 9.

On the vertical center line of each plate 16 and 17, and located near the top (viewing Figs. 75

1 and 4), there are provided two bearings effected by the apertured circular bosses 18 and 19, into which extensions of the rotor shaft 14 extend, and in which the shaft is permitted to rotate freely. On the front end of the shaft 14 there is tightly fitted a pinion gear 20 of relatively small diameter which, as will appear more fully from a later description, meshes with the large drive gear 21.

On the same center lines on which the bosses 18 and 19 are located, and spaced from these bosses are two other cylindrical apertures effected by the cylindrical bosses 22 and 23 in the plates 16 and 17, respectively, the former of which constitutes a bearing in which one end of the crankshaft 25 is adapted to rotate freely. Interposed between the inner face of the bearing effected by the boss 23 on the front plate 17 and the forward portion of the crankshaft 25 is a collar 26 which is formed integral with the large drive gear 21. The rear edge of collar 26 is so formed as to present two helical camming surfaces which normally mesh with correspondingly shaped camming surfaces of the cam follower 27. The cam follower 27 is pinned to the shaft 25 by means of pins 28, whose ends are fitted into oppositely disposed slots 29 in the cam follower. The rear end of the shaft 25 is bored so as to accommodate the stud 30 which serves a purpose to be indicated hereinafter. The rear end of shaft 25 is adapted to rotate freely in the bearing effected by the cylindrical boss 22.

The forward end of shaft 25 is provided with a pair of oppositely disposed pins 32, or integral projections which fit loosely into oppositely disposed slots 33 in a boss 34 formed integral with the crank 35. The boss 34 is apertured to allow the crank 35 to be slipped over the forward end of the shaft 25. The extreme front end of the shaft 25 is threaded to accommodate the nut 37, which, with the washer 38, fits into a depression 39 in the outer face of the crank 35. After the crank 35 is slipped over the end of shaft 25 in such a manner that the slots 33 receive the pins 32 of the shaft, the nut 37 is screwed up on the shaft end, thus firmly securing the crank to the shaft.

The apparatus thus far described functions in the following manner:

When the handle 40 (Fig. 4) or 40' (Fig. 1) of the crank 35 is rotated, the shaft 25 experiences a similar movement due to the engagement of the shaft pins 32 with the crank slots 33. The large drive gear 21, with its integral collar 26, is freely mounted on the shaft 25 and does not immediately rotate. The sleeve 27, being pinned to shaft 25, does rotate, however, so that a camming action takes place between the helical camming surfaces of the sleeve 27 and of the inner edge of the gear collar 26, with the result that, as the shaft continues to rotate, it is moved longitudinally to the right (viewing Figs. 1 and 4) causing the stud 30 to experience a similar movement which results in the operation of contact springs 42 (Fig. 4) or 42' (Fig. 1). These contact springs, which are mounted on the outer face of the rear plate 16, as shown, perform functions well known to those skilled in the art.

The extent to which shaft 25 moves to the right (Figs. 1 and 6) is limited by the boss, or flange 34 on crank 35 which abuts gear 21, and is of such magnitude that the longitudinal movement of the shaft is insufficient to cause sleeve 27 to disengage from collar 26, and also insuffi-

cient to cause boss 60 (Fig. 4) to contact crank 35. Thus the shaft 25 and the drive gear 21 become locked, and the latter is then driven by the shaft by virtue of the engagement of the camming spirals of sleeve 27 and gear collar 26 which can no longer rotate relative to one another. The drive gear 21 accordingly rotates and, through the pinion gear 20, drives the permanent magnet rotor 13 as long as the crank 35 is rotated. Rotation of the permanent magnet 13 between the poles of stator 10 causes a current of substantially pure sinusoidal wave form to be generated in the output coils 21.

As clearly shown in Fig. 7, the leads 62 and 63 of the output coils 12 are connected to terminals of the spring pile-ups mounted on the rear plate 16. The leads 62 and 63 are held neatly, in close proximity to the outer face of the rear plate 16 by means of integrally formed lugs 70 and 71 on the outer face of the rear plate. These lugs are cast integrally with the rear plate. They may be formed by slotting the mold in which the plate 16 is cast, the metal which occupies the slots during the molding process constituting the lugs 70 and 71 when the plate is removed from the mold. The leads 62 and 63 are inserted between the pairs of lugs 70 and 71, respectively, and the lugs are then crimped, or otherwise pressed together over the leads as clearly shown in Fig. 8. In this manner the generator coil leads are neatly and securely fastened to the rear face of the plate 16 and held in close proximity thereto.

When the crank handle is released, the springs of the spring pile-ups 42 or 42' exert sufficient pressure on the stud 32 to drive the shaft 25 back to its normal position. The camming spirals of sleeve 27 and collar 26 assume their original condition of mesh during the return longitudinal movement of the shaft 25.

The generator shown in Fig. 1 is equipped with a folding handle which distinguishes from the handle furnished on the generator of Fig. 4. These handles obviously are interchangeable though the former type is preferred with generators to be used in conjunction with telephone linemen's test sets, whereas the rigid type is preferred with generators used with subscribers' sets.

The following description is directed principally to the design of crank handle shown in Fig. 4. The crank 35 may be molded or otherwise formed so as to consist of a main body portion and a handle supporting portion extending therefrom. The main body portion is circular in contour and has its outer face recessed to provide a seat for the circular designation, or instruction card 86. The upper edge of the main body portion of the crank which defines the recess, or card-holding compartment is slightly curved over to provide a lip which serves to retain a circular window 83 of transparent material in position over the card 86. Thus, the generator crank, besides serving as a medium for actuating the generator rotor, also serves as a designation card-holder, thus obviating the need for a separate card-holder and associated means for mounting it on the subset.

The generator equipped with the rigid type crank handle and shown in Fig. 4 is illustrated in Figs. 10 and 11 mounted on a telephone subset. As illustrated in Fig. 11, the front face of the pedestal portion of the set 75 is provided with a circular cavity or cup-shaped depression which is defined by the base 76 and the circular rim 77. The base 76 is provided with three holes

78, only one of which is shown in Fig. 11, which accommodate screws 79. The screws 79 pass through the base 76 and engage the threaded holes 80 in the generator base plate 16. The diameter of the circular depression in the front of the telephone subset is such as to conveniently accommodate the plate 16. The generator unit is set in the circular cavity in such a manner that the holes 80 in the generator plate 16 are aligned with the holes 78 in the base 76. The screws 79 are then made up tight. In this manner, the generator is securely held in position on the telephone set in the location usually occupied by the telephone dial. The numeral 90 identifies the apparatus supporting base of the combined set while the pedestal portion is indicated by the numeral 91.

A cover 50 for the generator unit is provided, whose circular rim fits into the offset at 51 in the rear plate 16. Four bosses 92 on the cover locate the cover longitudinally with respect to the generator unit, and the proximity of two of the bosses 92 to the bosses 93 on the front plate 17 locates the cover radially. The cover is held in position on the rear plate 16 by means of two screws 82 which fit into recesses 83 in the plate 16 and are screwed into tapped holes in the bosses 84.

As previously mentioned, the ringing generator of this invention may be furnished with one or more interrupters whose functions are well known to those skilled in the art. Heretofore, such interrupters were mounted independently of the generator as a separate unit. In accordance with a particular feature of this invention the front plate 17 of the generator unit is provided with two sets of integrally formed bosses, each set including a rectangular boss 100 and a circular boss 101. The rectangular bosses provide mountings for the spring pile-up of an interrupter assembly, while the circular bosses provide mountings for the interrupter unit per se. These two sets of bosses are clearly shown in Figs. 2 and 5, the former figure showing one of the interrupter assemblies in position on its respective set of mounting bosses.

The interrupter assembly consists primarily of a pinion gear 120 having a cylindrical flange or hub-like projection 150 of lesser diameter extending therefrom and integrally formed therewith. The flange and gear, preferably of steel, are provided with a centrally located axial bore which accommodates the stud 121 which is fitted tightly in a suitable hole in the front plate 17. The stud constitutes a bearing upon which the pinion is adapted to rotate freely. The flange or shank of the pinion 120 serves to mount a ring-shaped slotted contact element 122 of hard copper, and a similarly formed insulator element 123. The outer end of the pinion flange is formed over or set in such a manner as to securely hold the contact 122 and insulator 123 in position on the flange. An insulating ring-shaped washer 124 is interposed between the shoulder of the pinion and the contact element. By virtue of this construction the pinion and its associated contact and insulator elements rotate as a unit.

A spring pile-up, mounted on the rectangular boss 100, consists of a plurality of phenol fibre spacers 125 and a steel spacer 127 which are securely fixed to the boss 100 by means of two machine screws 128 which pass through aligned holes in the several elements 125 and 127 and are screwed into tapped holes in the boss 100. A con-

tact spring 147 is provided with an offset rectangular lug which is located between two upper insulating spacers 125 and is provided with two holes placed similarly to those in the spacers which permit the shanks of the screws 123 to pass therethrough. Thus the rectangular lug of the contact spring 147 becomes, in effect, an element of the spring pile-up. The spring 147 is provided with a contact at its free end which is adapted to ride over the periphery of the insulator 123. A second contact spring 133, mounted in the spring pile-up, is arcuate in form, having a substantially semi-circular portion which is located immediately above the contact element 122 and is provided with an irregularly formed contact end which rides on the upper face of the contact 122 near its outer edge when the interrupter is rotated. Each machine screw 123 is provided with a cylindrical bushing or sleeve, not shown. Each of the springs 147 and 133, preferably of phosphor bronze, is equipped with a terminal tab to which suitable conductors are affixed.

The rectangular and circular bosses 100 and 101 are so positioned on the forward face of the generator front plate 17 that when the interrupter assembly and associated spring pile-up are mounted thereon, the pinion of the former meshes with the large drive gear 21 as clearly shown in Fig. 2. Thus, any rotational movement of the drive gear 21 is imparted to the interrupter which functions to interrupt the current generated by the generator at a frequency determined by the number of slots in the contact element 122 and its associated insulator 123. This arrangement provides a positive drive for the interrupter and results in a self-contained generator and interrupter assembly.

In the general disclosures, Figs. 4, 5, and 6, the interrupter mechanism is not shown, though the rectangular and circular bosses 100 and 101 upon which the interrupter assembly is mounted are illustrated in Fig. 5. In Fig. 2 only one interrupter is shown in position on the generator front plate 17, it being understood that the right-hand rectangular and circular bosses 100 and 101 may be used to mount a second interrupter mechanism, if required.

As hereinbefore indicated the generator of this invention is suitable for use in numerous instances in the telephone field requiring such a device. In Figs. 1 and 2 the generator is mounted on an angle bracket 140 which is secured thereto by means of screws. Across the upper end of this bracket there is mounted a terminal strip 141 which accommodates a plurality of terminals 142 to which the leads extending from the generator coils and from the springs of the spring pile-up 42' are secured. The leads are bunched at the center of the strip 141 by means of a strap, not shown, from which the leads are fanned out to their respective terminals 142 from which connections to a test set may be made.

As previously indicated, the operating crank handles illustrated in Figs. 1 and 4, while differing in design, may be interchanged if required. The crank handle shown in Fig. 1 is particularly desirable when the generator is to be used in connection with a lineman's test set, whereas the one shown in Fig. 4 is suitable for use in cases where the generator is to be used in connection with a combined telephone handset, as shown in Figs. 10 and 11. In the former case the designation card, illustrated in Fig. 4, is not required. As shown in Fig. 1, the handle assembly com-

prises a crank 35', a handle 40', a circular insulating washer 9 and a metal piece 8. The last element is generally circular in shape and is provided with an integral cylindrical projection 34' which corresponds to the integral projection 34 of Fig. 4. This projection 34' is slotted at 33' in the same manner that the projection 34 of Fig. 4 is slotted, so as to enable it to fit over the shaft 25 with the pins 32 engaging the slots 33'. The elements, 8, 9, and 35' are held together as a unit by means of rivets, one of which is shown at 7.

The crank portion 35' is provided with two integral, spaced, right-angular projections 6, between which one end of the handle 40' is mounted for rotation on a pin 5. The pin 5 may carry a coil spring which functions to normally hold the handle 40' in the full-line position indicated in Fig. 1, that is, folded down. When the generator is to be actuated, the handle 40' is moved to the position indicated by the horizontal outline shown in Fig. 1, and the crank assembly rotated.

What is claimed is:

1. In combination, an electric current generator comprising a rotor, a coil bearing stator, a front and rear mounting plate and means for mounting said rotor and coil bearing stator between said plates, and an interrupter mounted directly on one of said mounting plates, driving means for said rotor comprising a shaft and a gear carried thereby, and a gear fixed to said interrupter permanently meshing with the gear of said driving means whereby said interrupter and said rotor are separately driven by said shaft through the medium of the gear associated therewith.

2. In combination, an electric current generator comprising a rotor, a drive shaft therefor, a coil bearing stator, a front mounting plate, a rear mounting plate, means for securing said rotor and said coil bearing stator between said plates, and an interrupter assembly comprising an interrupting contact device, contact springs therefor, means for mounting said interrupter assembly directly on one of said mounting plates comprising integrally formed bosses on said plate, and means for securing said interrupting contact device and said contact springs to separate ones of said bosses, and means for coupling said interrupting contact device to said drive shaft comprising a pinion fixed to said interrupting contact and a gear associated with said drive shaft, said pinion and said gear being directly and permanently in mesh.

3. In combination, a ringing current generator comprising a rotor, a stator, a pair of output coils on said stator, a pair of mounting plates between which said rotor and stator are mounted, a drive shaft having a gear carried thereby, a rotor shaft having a pinion gear thereon normally meshing with the said drive shaft gear, manually operable means for driving said shaft to cause said rotor to rotate relative to said stator whereby signaling current is generated in the output coils of said stator, and means for interrupting the current output of said stator coils comprising an interrupter mounted directly on one of said mounting plates and having a pinion gear in permanent mesh with said drive shaft gear.

4. In combination, a current generator comprising a rotor, a stator, a pair of output coils on said stator, a front mounting plate, a rear mounting plate, means for clamping said rotor and stator between said front and rear mounting plates, a shaft on which said rotor is mounted, a drive shaft, cylindrical bosses cast integrally with

said front and rear plates which constitute bearings for said shafts, a gear carried by said drive shaft, a pinion gear fixed to said rotor shaft and normally meshing with said drive gear, manually operable means associated with said drive shaft for rotating said rotor relative to said stator whereby current is generated in said stator output coils, and means for interrupting the output current of said coils comprising a rotatable interrupter, contact springs engaging said interrupter having circuit connections with said output coils, independent means for mounting said interrupter and said contact springs directly on said rear mounting plate in close proximity to said drive shaft gear, and means comprising a pinion gear associated with said interrupter permanently meshing with the drive shaft gear for imparting the rotational movement of said drive shaft to said interrupter.

5. In combination, a current generator comprising a rotor, a stator, a pair of output coils mounted on said stator, a drive shaft, a shaft for said rotor, end plates, means for clamping said rotor and stator between said end plates, bearings for said drive and rotor shafts comprising hollow cylindrical bosses formed integrally with said plates, a pinion gear on said rotor, an interrupter assembly comprising interrupter contacts and contact springs operatively associated therewith, a pinion gear associated with said interrupter contacts, means comprising bosses formed integrally with one of said plates for supporting said interrupter assembly, manually operable means for rotating said drive shaft, and means for coupling said drive shaft to said rotor and to said interrupter assembly comprising a gear carried by said drive shaft and permanently meshing with the pinion gears associated with said interrupter contacts and with said rotor shaft, whereby said rotor and said interrupter contacts rotate coincidentally upon the operation of said manually operable means, the former to generate current in said output coils and the latter to interrupt the generated current.

6. In an electric current generator, a rotor, a stator, output coils mounted on said stator, a front mounting plate, a rear mounting plate, means for clamping said stator and said rotor between said plates, contact springs mounted on said rear mounting plate, conductors extending from said output coils to said contact springs, and means for fastening said conductors to said rear plate comprising pairs of complementary lugs formed integrally with said rear plate and projecting outwardly therefrom, the lugs of each pair being so disposed relative to one another as to permit the insertion of one of said conductors therebetween and adapted to be thereafter crimped so as to enclose said conductor and hold it in place against the face of said rear mounting plate.

7. In combination, an electric current generator comprising a rotor having a gear fixedly associated therewith, a coil bearing stator, front and rear mounting plates, means for mounting said rotor and coil bearing stator between said plates, a rotatable interrupter mounted directly on one of said plates and having a gear fixedly associated therewith, and means for driving said interrupter and said rotor simultaneously comprising a manually operable drive shaft having a single drive gear associated therewith and in permanent mesh with the gears associated with said rotor and with said interrupter.

8. In combination, an electric current generator comprising a geared rotor, a coil bearing stator, a front and rear mounting plate, means for mounting said rotor and coil bearing stator between said plates, and a geared interrupter mounted directly on one of said mounting plates, and common driving means for said rotor and said interrupter comprising a rotatable shaft and having a single gear associated therewith in permanent mesh with the gears of said rotor and interrupter at different points on its periphery.

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