March 10, 1931. H. S. MARSH 1,795,341

TRANSMITTER

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Fig. 1

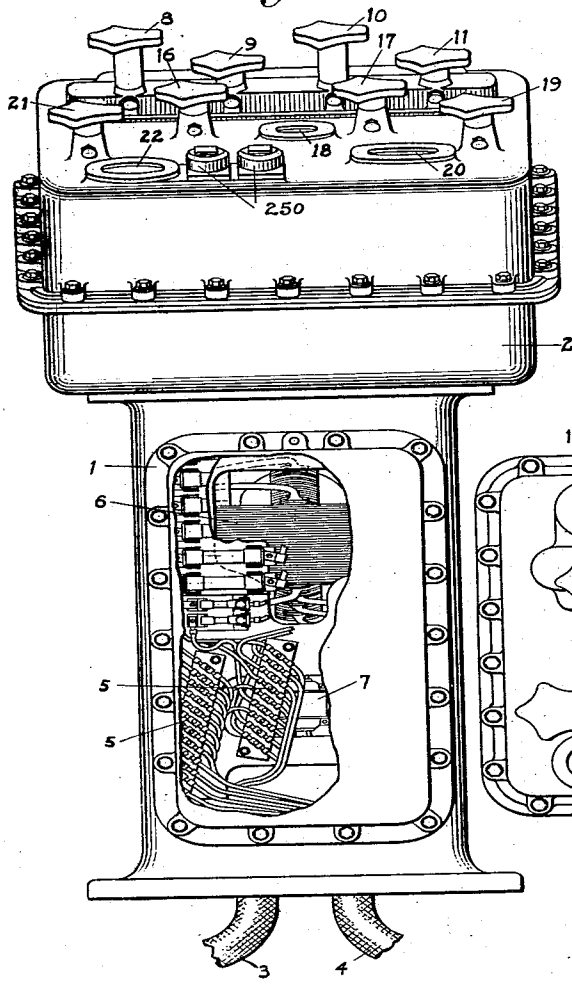
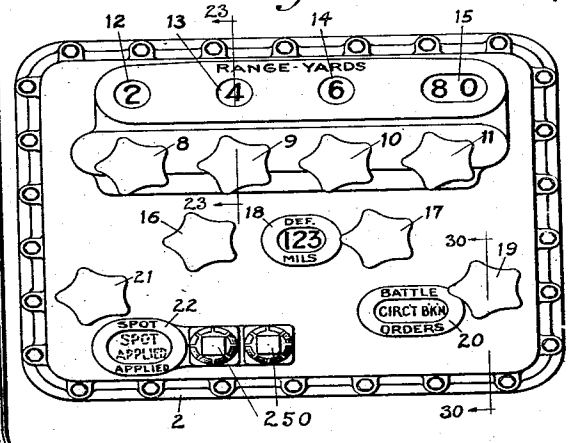


Fig. 2



INVENTOR.
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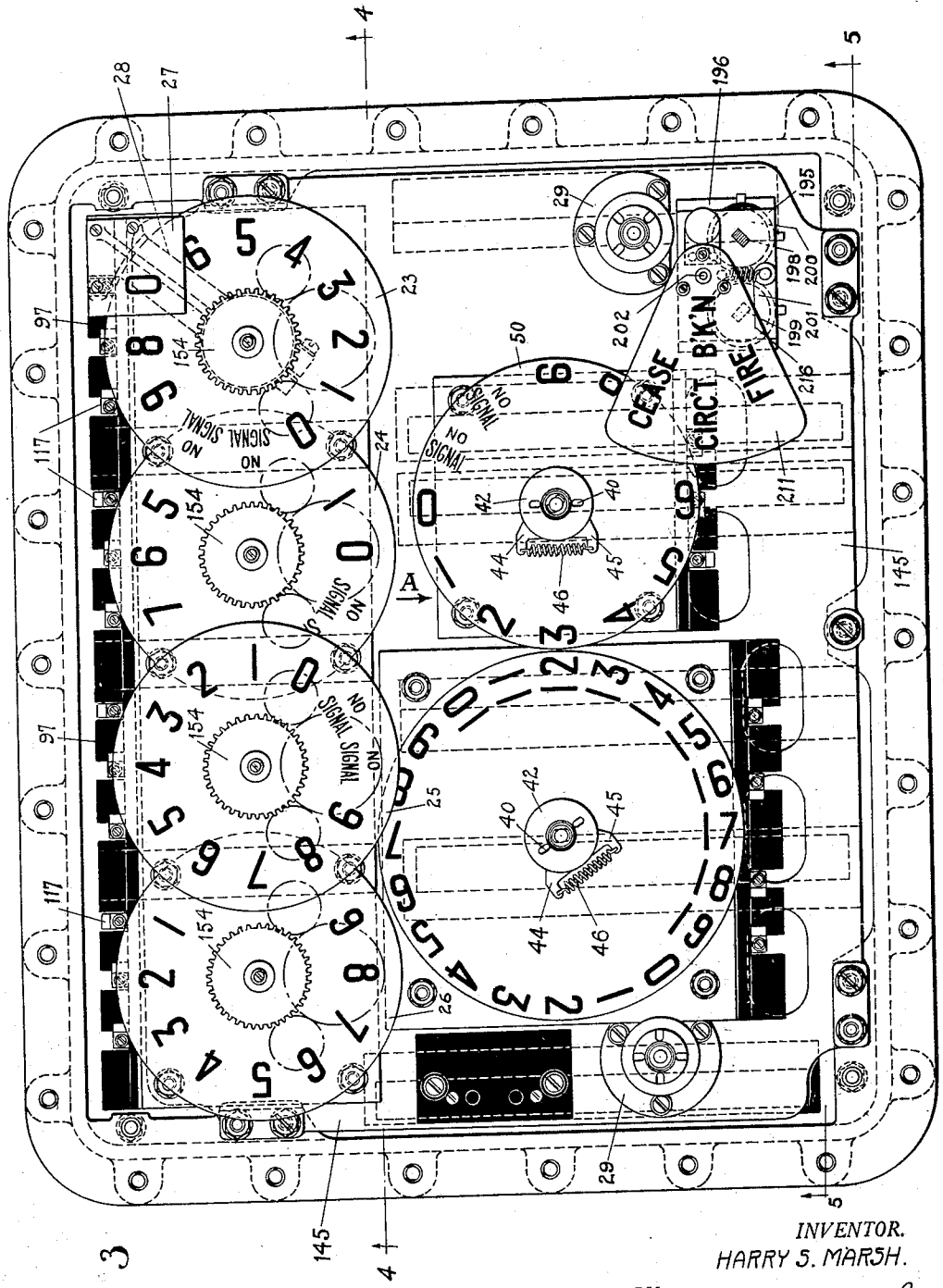


Fig. 3

INVENTOR.
HARRY S. MARSH.

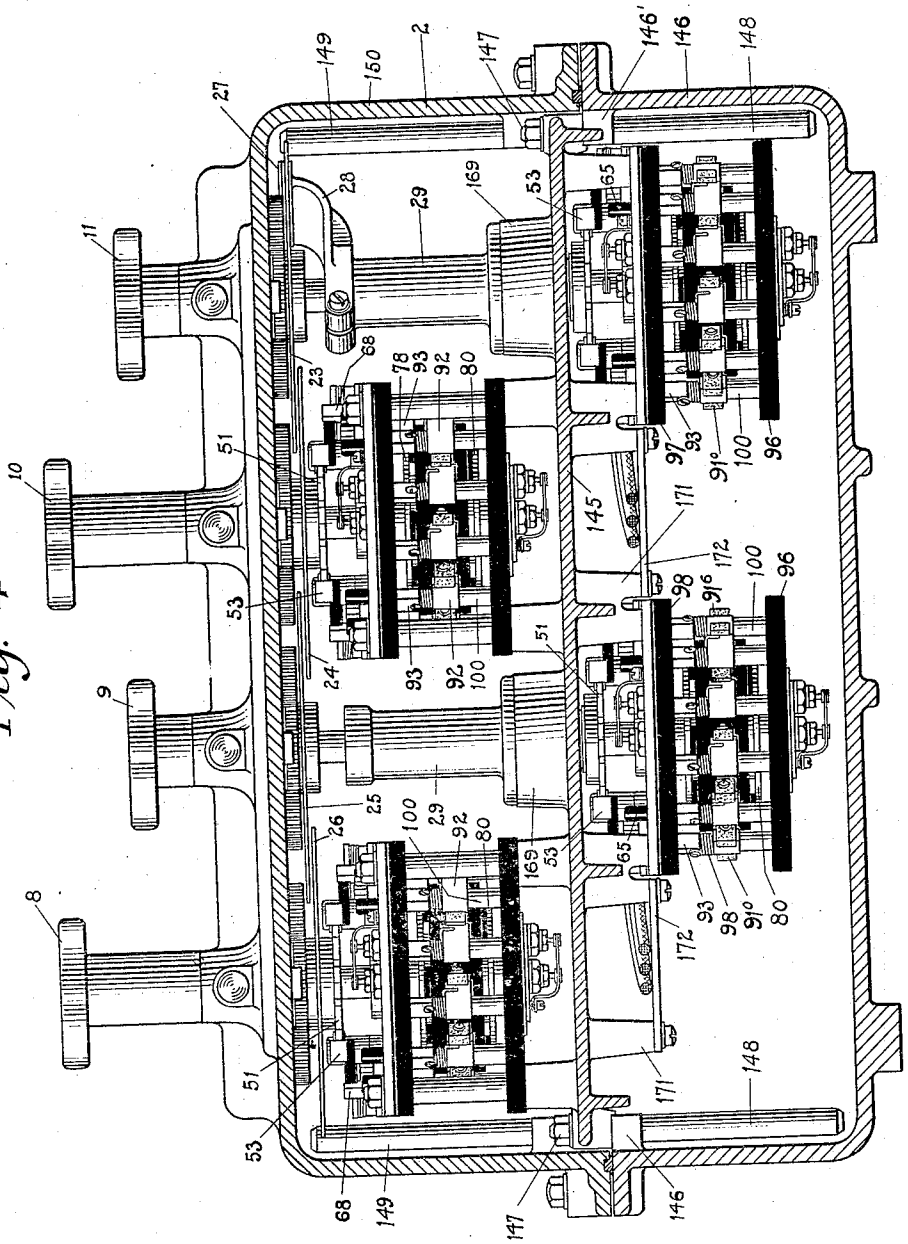
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March 10, 1931. H. S. MARSH 1,795,341

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Fig. 4



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BY Moakley and Gill
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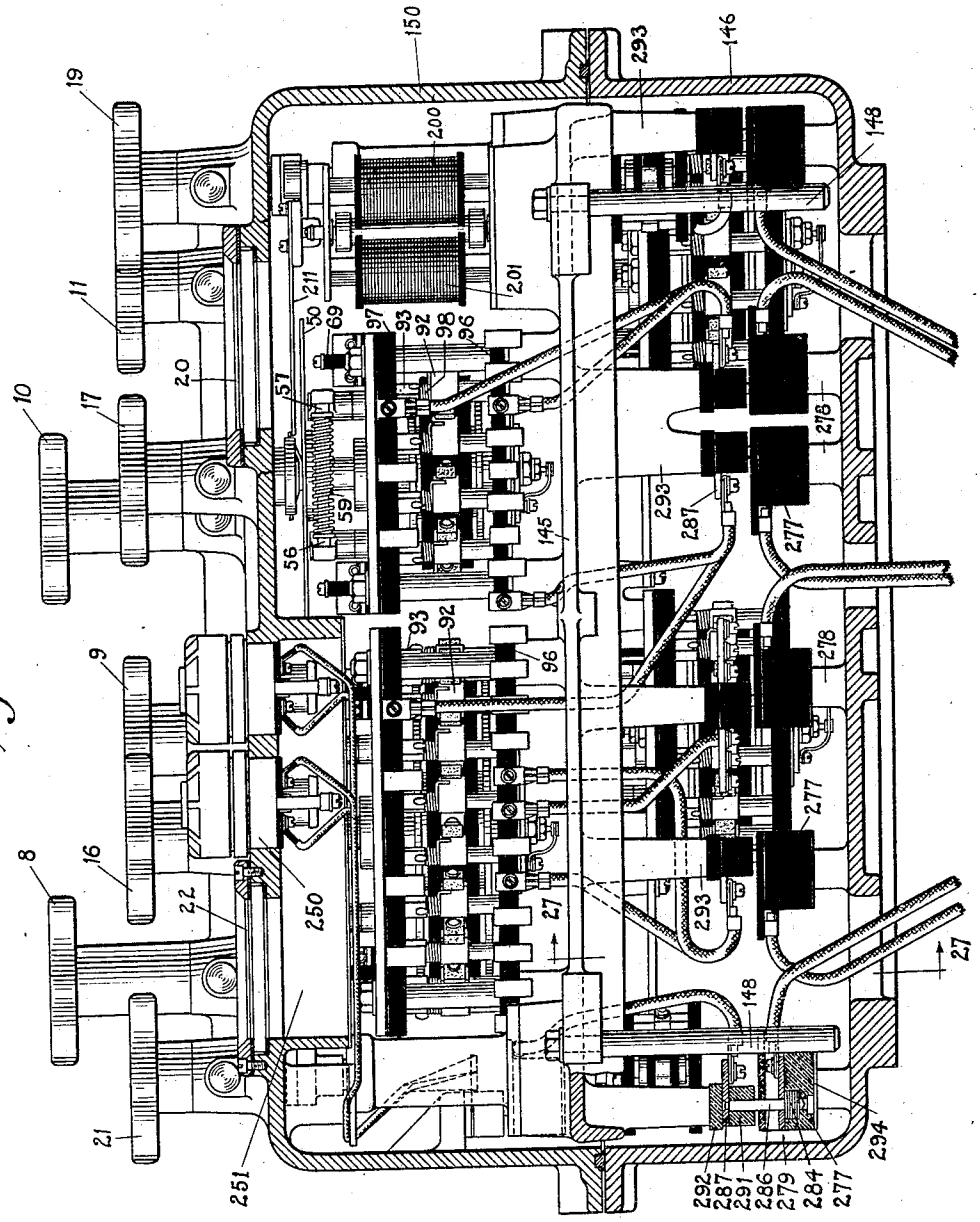


Fig. 5

INVENTOR.
HARRY S. MARSH
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Fig. 6

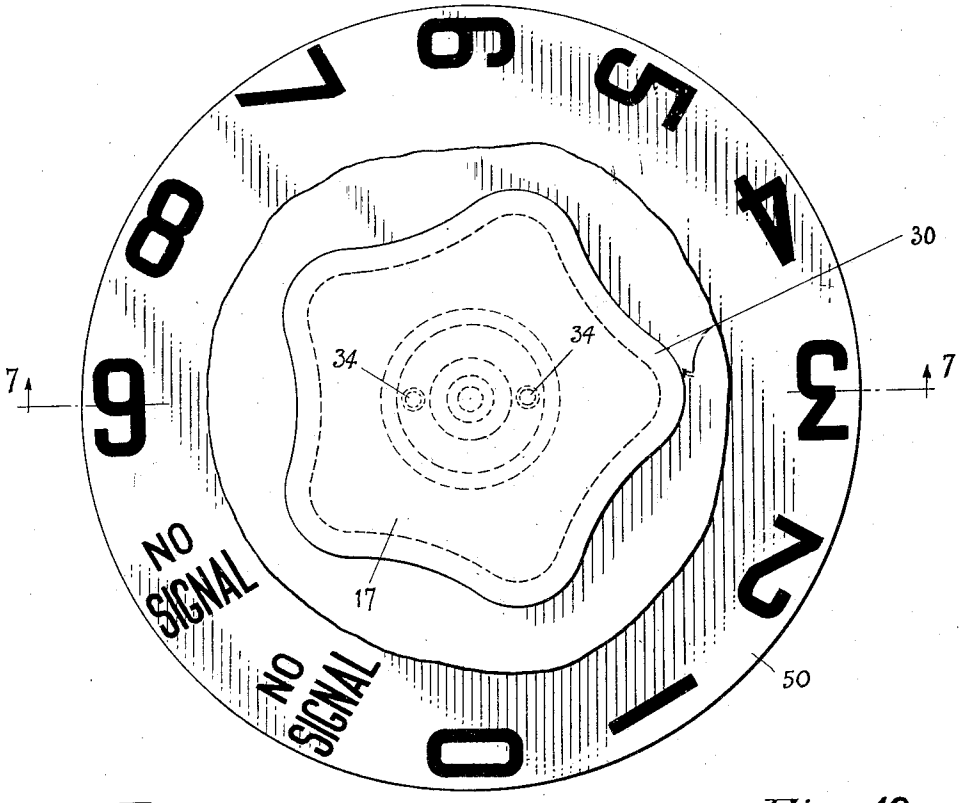


Fig. 8

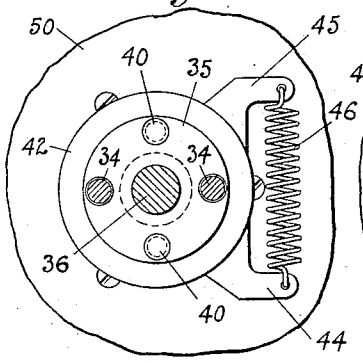


Fig. 9

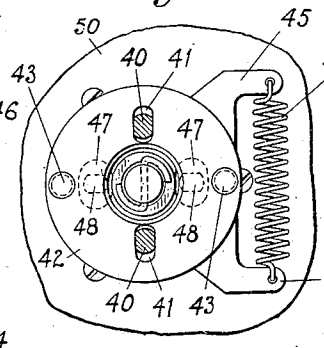
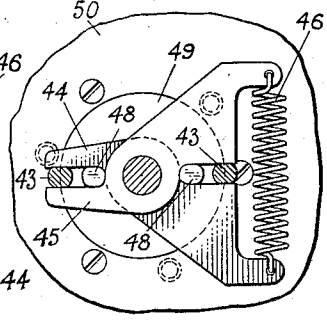


Fig. 10



INVENTOR.
HARRY S. MARSH.

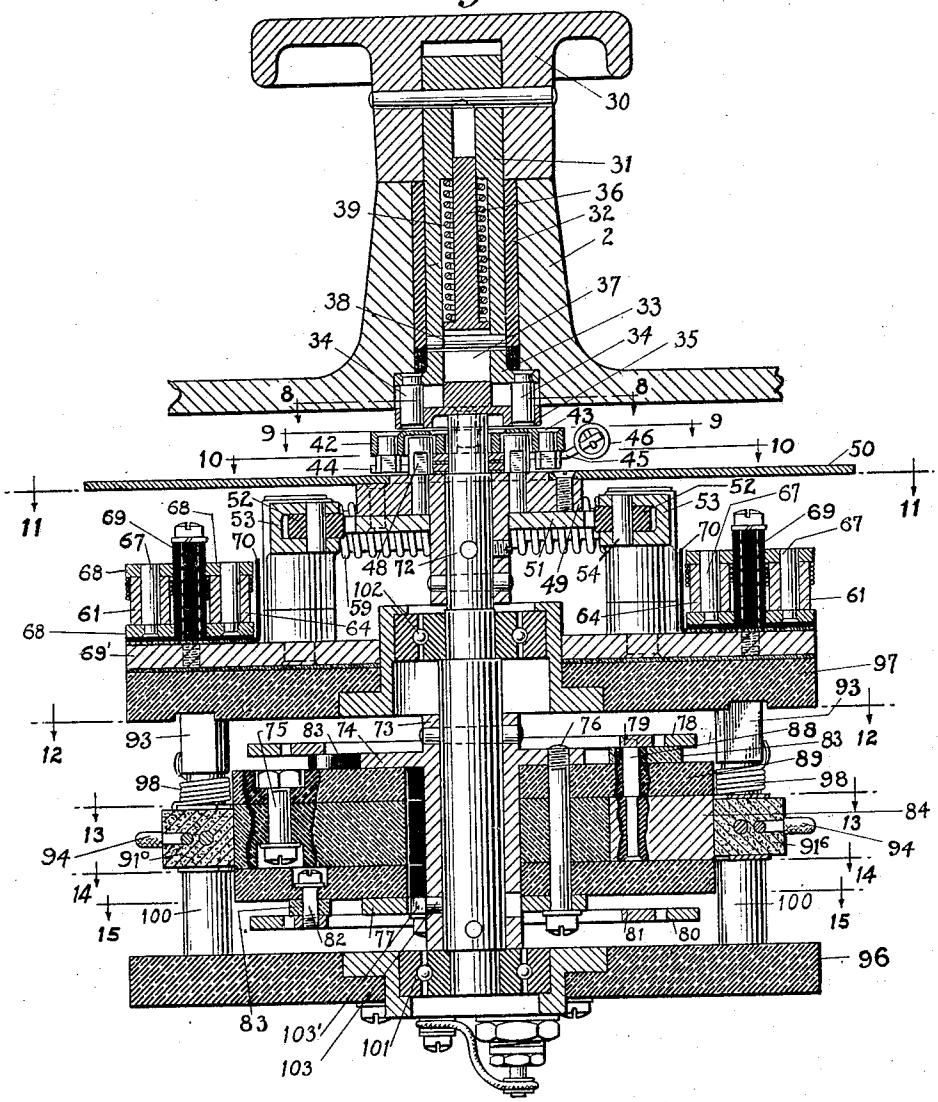
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March 10, 1931. H. S. MARSH 1,795,341

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Fig. 7



INVENTOR
HARRY S. MARSH.

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Fig. 11

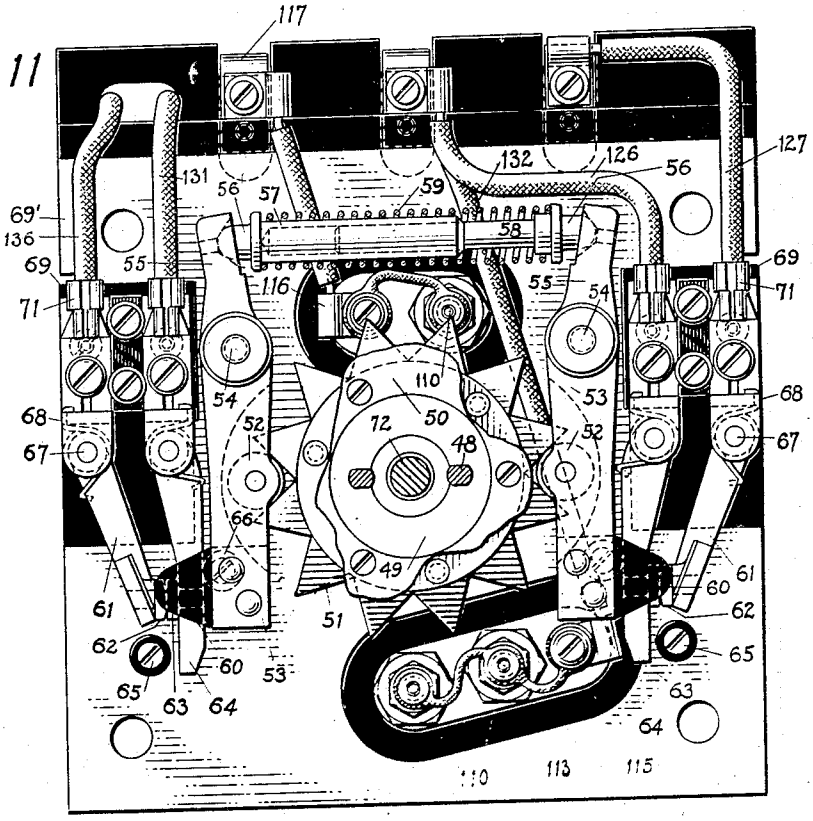


Fig. 13

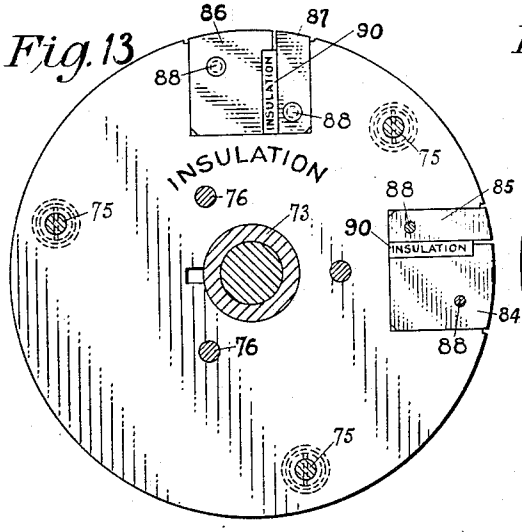
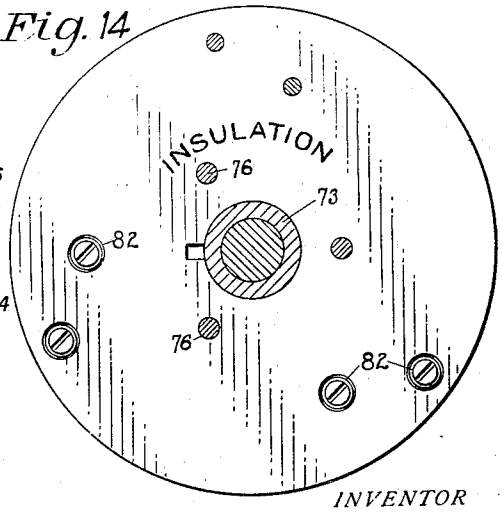


Fig. 14



INVENTOR
HARRY S. MARSH.

BY Moakley and Gill
ATTORNEYS

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Fig. 12

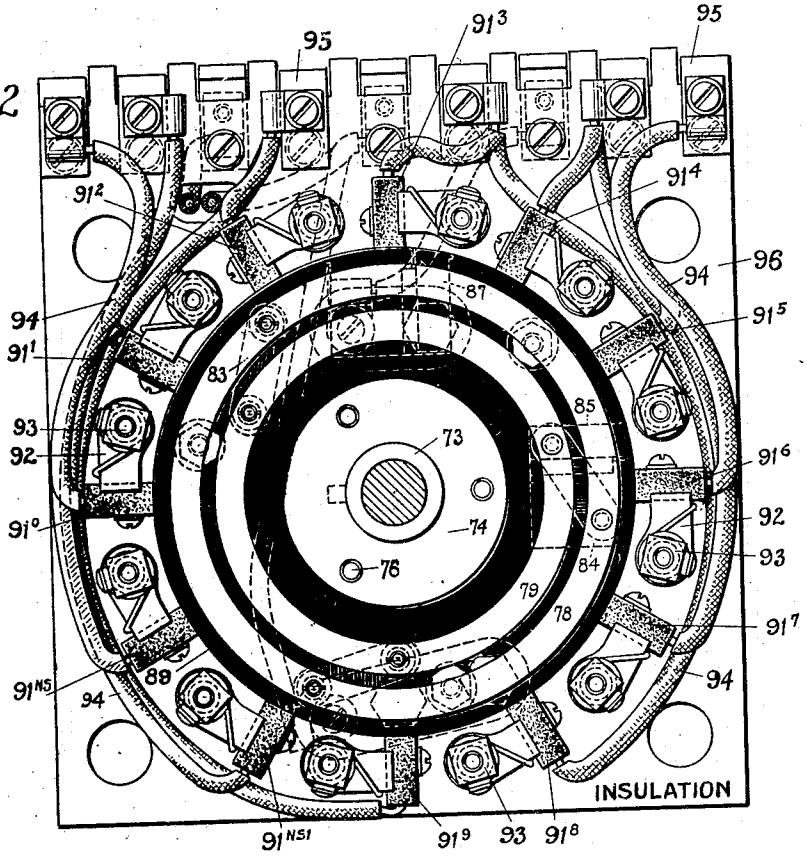


Fig. 15

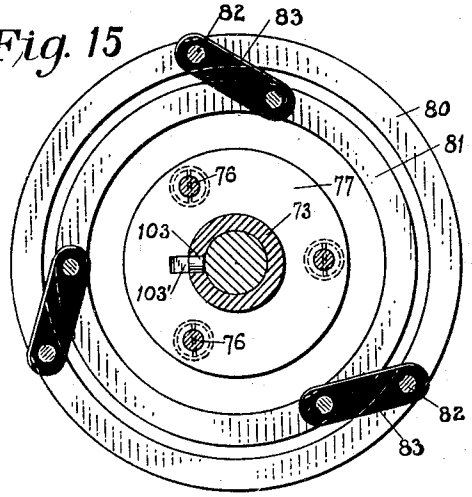
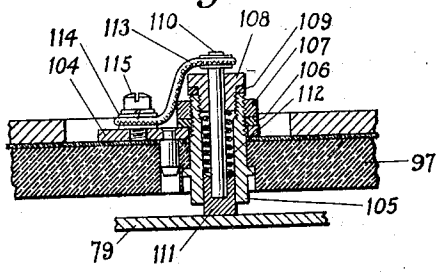


Fig. 16



INVENTOR
HARRY S. MARSH.

BY Mosley and Gill
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Fig. 17

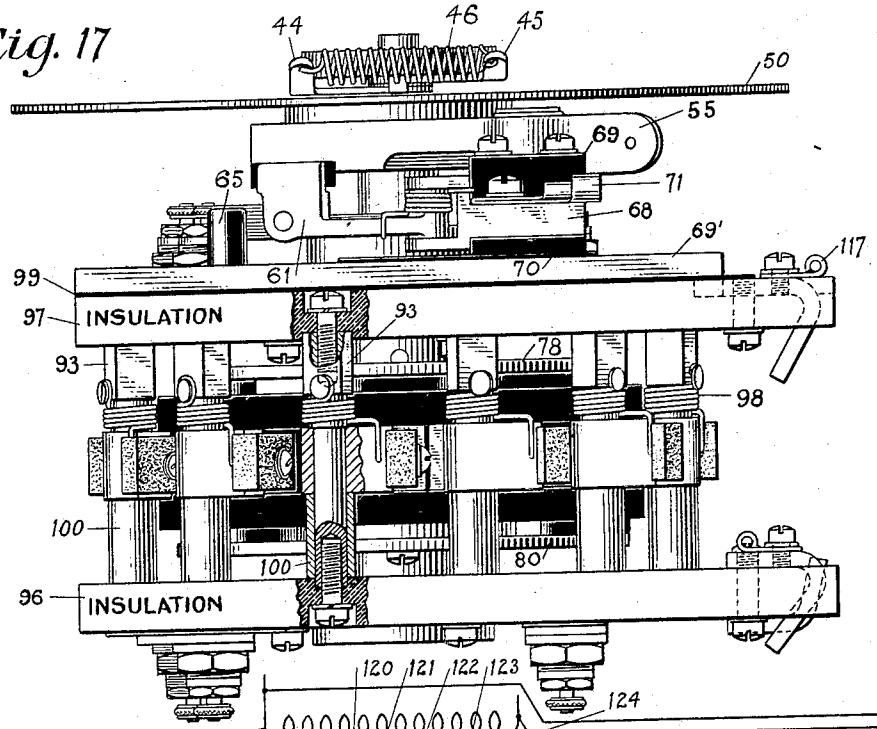
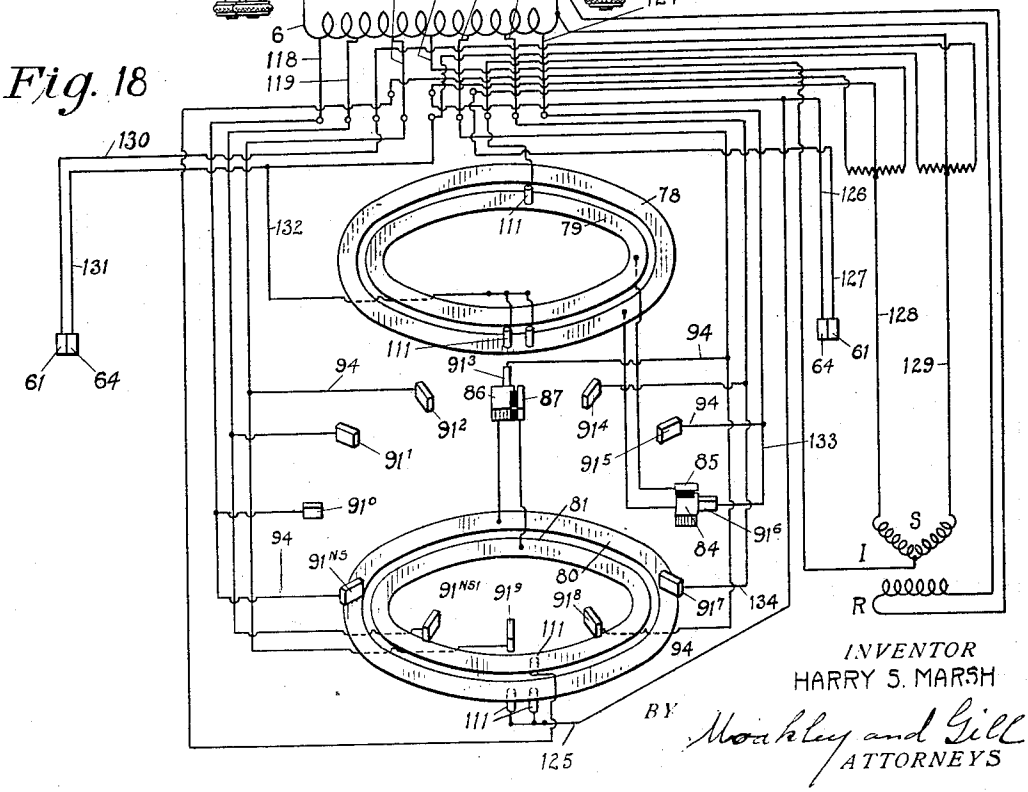


Fig. 18



INVENTOR
HARRY S. MARSH

BY Markley and Gill
ATTORNEYS

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Fig. 19

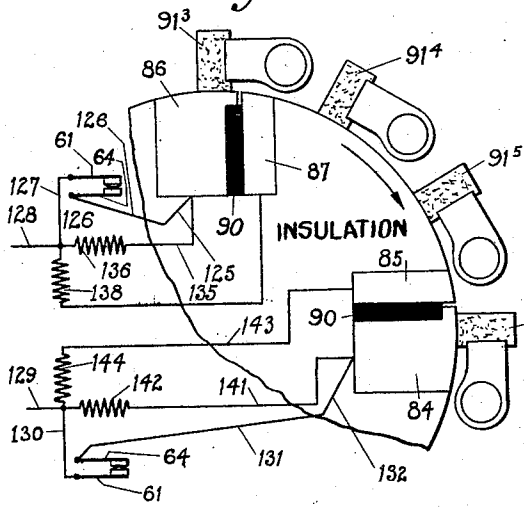


Fig. 20

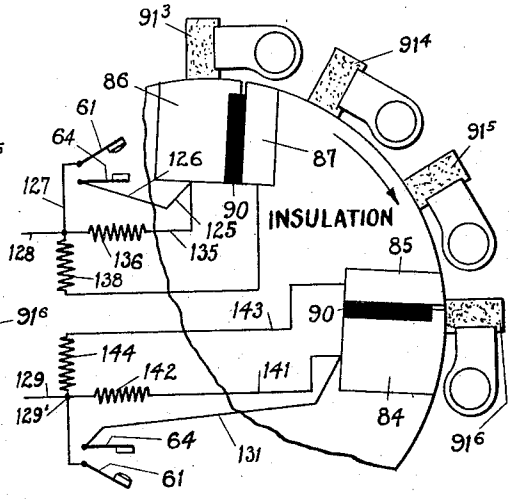


Fig. 21

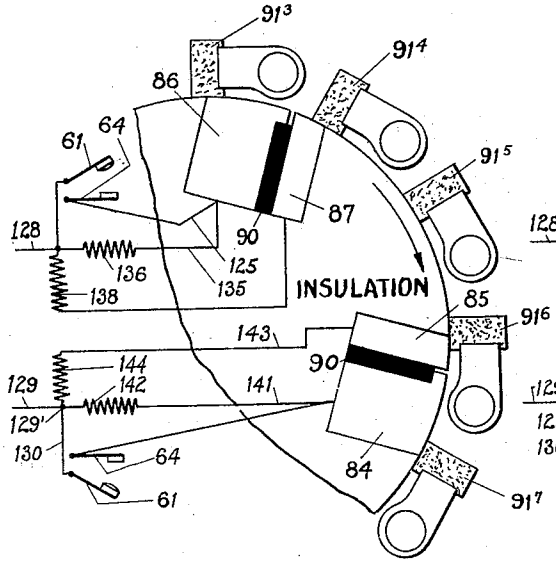
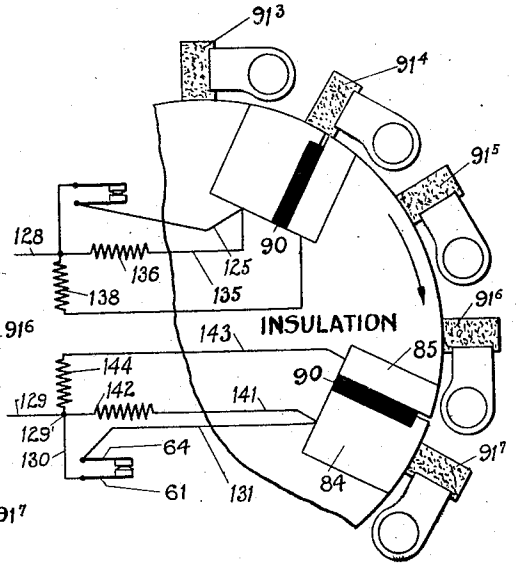


Fig. 22



INVENTOR.
HARRY S. MARSH.

BY Moakley and Gill
ATTORNEYS.

March 10, 1931. H. S. MARSH 1,795,341

TRANSMITTER

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Fig. 24

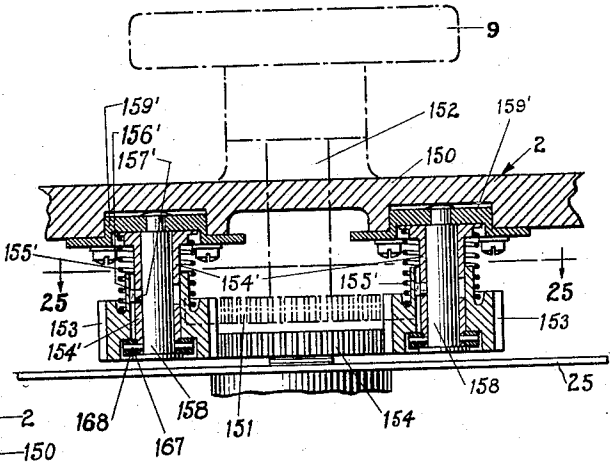


Fig. 23

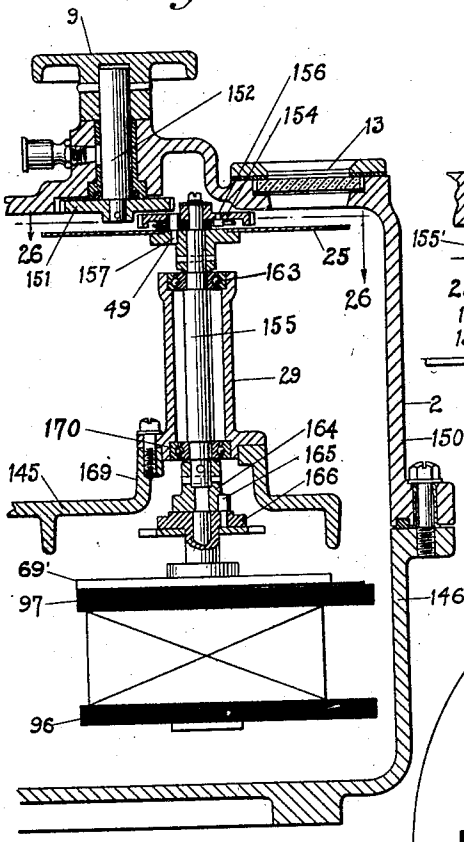


Fig. 25

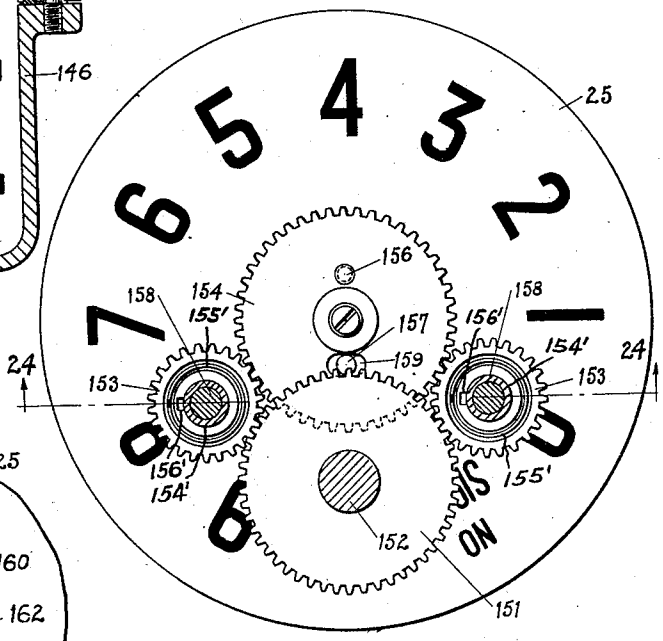
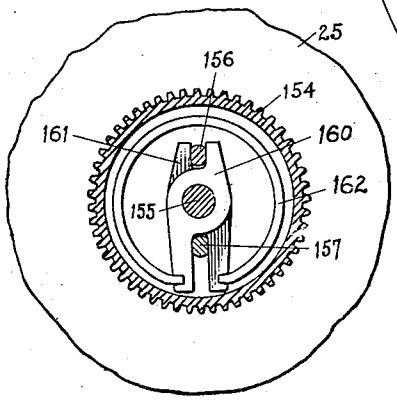


Fig. 26



INVENTOR.
HARRY S. MARSH.
BY Markley and Gill
ATTORNEYS.

Patented Mar. 10, 1931

1,795,341

UNITED STATES PATENT OFFICE

HARRY S. MARSH, OF BROOKLYN, NEW YORK, ASSIGNOR TO FORD INSTRUMENT COMPANY, INC., OF LONG ISLAND CITY, NEW YORK, A CORPORATION OF NEW YORK

TRANSMITTER

Application filed May 24, 1924. Serial No. 715,767.

This invention relates to transmitters of a type suited for installation at a source of information, and adapted to be set selectively so that information and instructions may be accurately and expeditiously furnished to those conducting operations at relatively remote points and dependent upon such imparted knowledge for efficient action. A transmitter of this character may, be installed in the plotting room of a warship, and have electrical circuits running from it to various locations aboard ship, such as to different guns.

Officers in the plotting room, controlling a naval action, are thus enabled to set up in the instrument and thereby transmit, for example, the range in yards and the deflection in mils, and also commands in connection with the transmitted information. Assurance of the accuracy of important transmitted information is thus provided, so that the receiver may encounter no doubt as to the values upon which he is to depend.

The particular nature of the invention as well as other objects and advantages thereof will appear more clearly from a description of a preferred embodiment as shown in the accompanying drawings in which,

Fig. 1 is a front elevation of a transmitter embodying the present invention;

Fig. 2 is a plan view thereof;

Fig. 3 is a plan view with the cover removed, showing the arrangement of the dials and co-operating units;

Fig. 4 is a sectional view normal to the top face of the transmitter, being taken on the line 4—4 of Fig. 3 and showing the range switch units;

Fig. 5 is a similar view, but is taken on line 5—5 of Fig. 3 and shows the deflection switch units;

Fig. 6 is a plan view of one of the switch units;

Fig. 7 is a vertical section therethrough, taken on the line 7—7 of Fig. 6;

Figs. 8, 9 and 10 are horizontal sections through the switch shown in Fig. 7, respectively taken on the successively lower lines 8—8, 9—9 and 10—10 of the last mentioned figure;

Fig. 11 is another horizontal section below the dial, being taken on line 11—11 of Fig. 7;

Fig. 12 is a similar view taken on the line 12—12 of Fig. 7, illustrating the disposition of the commutator drum and the co-acting brushes and electrical connections;

Fig. 13 is a horizontal section through the commutator drum, on the line 13—13 of Fig. 7;

Fig. 14 is another such section through the drum, taken along the line 14—14 of Fig. 7;

Fig. 15 is a horizontal section, on the line 15—15 of Fig. 7, showing an associated pair of slip rings;

Fig. 16 is a vertical section through one of the brushes adapted to co-operate with one of the slip rings carried by the commutator drum;

Fig. 17 is a side elevation of the switch unit shown in Fig. 7, the operating handle and parts immediately associated therewith being omitted;

Fig. 18 is a wiring diagram, showing one of the switch units in circuit with an electrical energizing means and with a device under the control of the switch;

Figs. 19, 20, 21, and 22 are diagrammatic views at successive stages of the rotation of the drum of one of the switch units through its passage from one transmitting position to the next;

Fig. 23 is a fragmentary vertical section taken on the line 23—23 of Fig. 2 showing the means for operating the lower level range switches;

Fig. 24 is a section taken on the line 24—24, of Fig. 25 normal to the dial of the latter figure, and showing the yielding gear train;

Fig. 25 is a section taken on line 25—25 of Fig. 24, being viewed at a right angle to the sectional plane of the latter Figure; and

Fig. 26 is a section on the line 26—26 of Fig. 23 and shows the centralizing device associated with switch there illustrated.

Referring now to the drawings, and particularly to Figs. 1 and 2, 1 represents a hollow pedestal upon which is mounted a range and deflection transmitter having an outer casing 2 inclined at an angle to present its

upper face for easy reading by an observer. Entering and leaving the pedestal 1 through its base are incoming and return cables 3 and 4, respectively, from which the conductors run to various connection members, indicated as mounted upon the terminal blocks 5.

Also within the pedestal 1 are mounted fuses which protect the electrical apparatus. An auto transformer 6 is supported in the upper portion of the pedestal. Leads from the auto transformer are carried to switch unit devices hereinafter fully referred to.

As shown in Fig. 1, and somewhat better in Fig. 2, provision is made of a plurality of range setting handles 8, 9, 10 and 11, each of which is operated to set up a desired numeral in a window individual thereto. Such windows are shown in Fig. 2 at 12, 13, 14, and 15. In Fig. 2, these windows respectively contain the numerals 2, 4, 6, and 80, thereby denoting a range of 24,680 yards.

Fig. 2 also shows operating handles 16 and 17 by which the deflection, in mils, is set up for observation through window 18.

The means for setting up the desired range in yards and deflection in mils may be readily comprehended by reference to Figs. 3, 4, 5 and 23 to 26 inclusive. As seen in Fig. 3, there is a series of dials 23 to 26 inclusive located in a straight line at the back of the instrument. Comparing Figs. 2 and 3 it will be noted that the numerals 2, 4, 6 and 8 are to be found at the rear-most portions of the referred to dials, the cipher representing the unit column of the range designation being engraved upon a permanently mounted plate 27. Plate 27, as shown in Fig. 4, is carried by an arm 28 mounted on a stem 29 of a hollow casing associated with the end switch unit.

Similar switch units are employed to give the deflection reading through the window 18 in the top of the instrument. As seen in Fig. 3 the numerals that appear in the tens and hundreds columns, however, are to be found on the dial of a large switch unit, the construction of which is similar to all the other switch units, but which has a greater number of steps, to wit, 0 to 19 inclusive. A smaller companion switch unit, bears numerals running from 0 to 9 for the units column inclusive. As shown in Fig. 3, where the dials of the deflection switch units become approximately tangent, the numerals on both dials co-operate to give a reading of 123, which accordingly appears at the window 18 in Fig. 2.

Since, as has been stated, all of the switch units are similar in character, it will suffice to describe one of them. Therefore, looking at the right hand switch unit in Fig. 3 of the deflection switches, and observing the same in the direction of the arrow A, a plan of the same will be found in Fig. 6. A head 30 of an operating handle, also seen in Fig. 7, is pinned to a shaft 31 which projects downwardly through a sleeve or bushing 32 and has at its bottom a flange portion 33 from which depend a pair of driving pins 34. These pins are shown in dotted lines in Fig. 6 and in section in Fig. 8. As shown in the latter figure and in Fig. 7, the pins 34 enter apertures in the disc-like portion 35 of a plunger 36, which plunger has a vertically arranged slot 37 through which passes a pin 38 that is anchored in the side walls of the shaft 31. A spring 39 is seated in a cavity in shaft 31, bearing against an internal shoulder of the latter and a shoulder on the plunger 36. Consequently, the disc-like portion 35 of the plunger is normally forced downwardly, and downwardly projecting driving pins 40 riveted thereto enter elongated slots 41 in an intermediate driving disc 42, well shown in Figs. 7 and 9.

Intermediate disc 42 is similarly provided with downwardly projecting pins 43 that extend between jaw members 44 and 45 of a centralizing device, best shown in Fig. 10, as considered in connection with Fig. 7. Jaws are provided on opposite sides of the pivotal point of the jaw members 44 and 45, each pair of bars bearing against one of the pins 43 with pressure derived from the centralizing spring 46. When operated, the head 30 under normal circumstances will, through the various discs and pins, exert a turning effort on the sides of the jaws, the spring 46 ordinarily tending to make the movement a definite one. Referring again to Figs. 7 and 9, it will be seen that there are elliptical cavities 47 in the underside of the intermediate disc member 42, into which project upwardly extending pins 48, the lower ends of pins 48 being driven into a hub 49 to which is secured, as by screws, the dial 50.

Riveted or otherwise secured to the underside of hub 49 is a detent wheel 51, which as best seen in Fig. 11, has teeth providing suitable notches for rollers 52 carried by oscillatory levers 53, pivotally mounted upon studs 54 and having rearwardly extending short arms 55 between which extends a spring device normally spreading the short arms 55 apart.

It will be observed in Fig. 6 that there are twelve steps designated on the dial 50, two of which are marked "No signal", and that Fig. 11 shows the detent 51 to be provided with a corresponding number of notches for the reception of the rollers 52. When the rollers 52 are seated in the notches of the detent 51, a numeral or "No signal" designation on the dial 50 contributes to the reading through the window associated with the dial, and also signifies that there is an establishment of a circuit between the unit switch in question and a remote device responding to the control of such switch.

Without the construction illustrated in Figs. 8 to 10 inclusive, there is liable to be a tendency for imperfect transmission, which

however is entirely avoided by the mechanism shown in these figures. Such danger is due to the possible tendency of the roller to stick at the apex of the tooth over which it is riding, when the switch is being turned from one designation to another. As shown in Figs. 7 and 8, when handle 30 is turned, there is a consequent movement of shaft 31, pins 34 and the downwardly projecting pins 40 which results in the turning of the intermediate disc member 42. Pins 43 secured to disc 42 consequently turn and cause one of the jaw members, 44 for example, to accompany them, but the inertia of the switch mechanism causes the pins 48 that project into the ellpitical cavities 47 to remain stationary for the time being. Thus, additional energy is stored in the spring 46 until such time as the walls of the elliptical cavities engage the pins 48 whereupon there is a positive drive of the pins, and consequently of the hub 49 and its dial 50. The additional energy so stored in the spring 46 causes the rollers 52, seen in Fig. 11, to snap past the apices of the teeth of the detent 51, whereupon the spring 46 immediately restores the driving mechanism to the position shown in Fig. 10, which is its normal arrangement.

The spring device, which, as shown in Fig. 11, presses apart the short arms 55 of the levers 53, causes the rollers 52 to immediately set themselves into the successive notches presented upon actuation of the head 30 of the switch unit. As shown in Fig. 11, the spring device has semi-spherical ends 56, which are seated in tangential bearing seats near the ends of the short arms 55 of the levers. The device comprises telescopic members 57 and 58 normally spread apart by a spring 59 bearing against shoulders on these members near the spherical ends thereof.

At their outer ends, the levers 53 are provided with insulating blocks 60 which extend toward and bear against spring pressed auxiliary switch arms 61, which arms are provided with contact members 62 adapted to bear against other contact members 63, which in turn are carried by other spring influenced switch arms 64. The spring pressure on the arms 61 and 64 of each auxiliary switch is such as to urge them toward each other, each spring arm 64 being, however, limited to slight movement by insulating posts 65 and 66 on opposite sides thereof. When the detent disc is turned through the agency of head 30, the rollers 52 are moved outwardly to the apices of the respective teeth over which they are traveling, the insulating blocks 60 thereupon pressing the switch arms 61 away from switch arms 64, thereby effecting the separation of the contacts 62 and 63 of both auxiliary switches, and opening of the circuit in which the switches are located, and making circuit changes later set forth. The rollers 52 having passed the apices of the teeth which force them outwardly are swung inwardly, whereupon the switch arms 61 and 64 resume their positions wherein the contacts 62 and 63 re-establish closures in their respective circuits.

The switch arms 61 and 64 are pivotally mounted on pins 67, which are each riveted, or otherwise secured, to the lower leg of a bifurcated terminal lug 68, as shown in Figs. 7, 11 and 17. The upper end of pivot pins 67 project into the upper leg of bifurcated terminal member, but are not necessarily secured thereto. The terminal lugs 68 are mounted in pairs at each side of the switch unit upon an inverted T-shaped insulating member 69, which in turn is fastened or in any other suitable way, by means of screws to a metallic plate 69′ on the upper side of the commutator drum frame of the switch unit. Insulating sheets 70 underlie the T-shaped members and extend between the metallic portions of the auxiliary switches comprising the arms 61 and 64 and the adjacent levers 53, whereby compactness of the unit is rendered possible. Terminal clips 71 are fastened to the terminal lugs 68 and conductors lead therefrom to appropriate places in the electrical circuits.

The hub 49, with its dial 50, as best seen in Fig. 7, is secured to the driving shaft 72 of the commutator drum of the switch unit. The driving shaft 72 extends through a metallic sleeve 73 of the drum structure, sleeve 73 being provided with an annular flange 74 in its upper portion. To this flange is secured the drum structure proper, the latter being built up of annular sections, the central and uppermost insulation sections being secured together as by bolts 75, shown in Fig. 7. Underneath the central section is a bottom insulating section, through which pass tap screws 76 that also pass through an underlying metallic annular plate 77, screws 76 binding the drum structure as a whole to the flange 74 of the sleeve 73. Mounted upon the insulating drum are current-carrying slip rings 78 and 79 at the upper side of the commutator drum, and 80 and 81 on the lower side of such drum. The slip rings may be secured, as shown in Figs. 7 and 15, by screws 82 that pass through tie blocks 83 of insulating material, except at those points where the slip rings are connected to the drum contact segments 84, 85, 86 and 87. At these places, the connection is such as is shown in Fig. 7, where a pin 88 is seen to be riveted into a slip ring 79 and to pass through the tie blocks 83, the upper insulating drum section 89 and through the metallic drum segment contact 84, to which the opposite end of the pin is riveted. As seen in Fig. 13, the drum segment contacts 84 and 85, and also 86 and 87, are maintained in peculiar relation, being separated by an air gap and an insulating block 90 in each contact assembly. The rea-

son for such construction will be plain hereinafter.

It has been made clear that the dial 50 has twelve positions, as shown in Fig. 6, and that the detent 51 has a corresponding number of positions, and reference to Fig. 12 will disclose that there are a similar number of brushes 91, 91^1, 91^2, etc., carried by brush holders 92 mounted on posts 93 annularly arranged around the commutator drum, the brushes being spring pressed to bear against the periphery of such drum. Leading from the brushes 91 are electrical conductors 94, which extend to suitable clips screwed to terminal lugs 95 mounted on an insulating plate 96 which forms the bottom member of the commutator drum supporting frame. These conductors 94 are diagrammatically shown in Fig. 18 and will be later referred to in the description of the circuits.

In Fig. 17 one of the brush posts 93 is in broken-away form to show the manner of supporting. It will be seen that the upper end of the post 93 projects into a recess in the upper insulating plate of the drum-supporting frame and that the post for a short distance below the upper plate is of square cross-section. The post is cylindrical where it passes through the brush spring 98 and is reduced in diameter where it passes through the brush, its lower end being seated in a recess in the bottom insulating plate 96. Screws pass through the upper and lower commutator drum frame insulating plates 97 and 96, respectively, and are threaded into the opposite ends of brush posts 93, the heads of the screws being imbedded in the plates. An insulating layer or sheet 99 is interposed between the upper insulating plate 97 and the metallic plate 69′ thereabove to insulate the screw heads from such metallic plate. Each brush 91, 91^1, etc., has its upper surface underlying the shoulder formed by the diameter reduction in the cylindrical portion of its post 93, and surrounding the lower end of such post is a sleeve 100 which acts as a spacer between the bottom insulating plate 96 and the brush and forms a seat for the latter.

Secured in the bottom insulating plate 96 of the commutator drum frame, and also in the upper insulating plate 97, and so as to project through the superposed metallic plate 69′, are lower and upper ball bearings 101 and 102, respectively, for the mounting of the shaft 72 of the commutator switch drum. As shown in Fig. 7, the central metallic sleeve 73 of the drum is provided in its lower portion with a pin 103 having a cylindrical portion seated in the sleeve and a squared portion 103′ that projects into a notch in the annular member 77 located on the bottom of the switch drum, whereby in conjunciton with the clamping screws 76 and the flange 74 a well established drive between the switch shaft and the drum proper is formed.

To be seen in Fig. 11 in full lines and in dotted lines in Fig. 12, are resilient brushes positioned to bear upon the current-carrying slip rings 78, 79, 80 and 81. Some of these brush assemblies are double and others are single, but all possess the same characteristics and it will therefore be sufficient to describe the brush illustrated in Fig. 16 as indicative of the form of these brushes generally. In that figure, is shown a plate 104 apertured for the passage of a metallic sleeve 105 having a flange to bear against an internal shoulder of the upper insulating plate 97 of the switch drum frame. The upper end of sleeve 105 is threaded both externally and internally, the external thread receiving a washer 106 and nut 107, which, when screwed home, cooperates with the flange on sleeve 105 to clamp such sleeve in position. Screwed into the upper end of sleeve 105 is a plug 108, under the head of which is a suitable washer 109, and extending through a central aperture in the plug is a plunger rod 110. Carried on the lower end of rod 110 is a brush 111 which bears upon one of the slip rings, such as ring 79. Interposed between the brush 111 and the underside of the plug 108 is a spring 112, which presses the brush firmly against the slip ring, assuring good electrical connection at all times. Fastened to the upper end of rod 110 externally of the plug 108 is an electrical conductor 113 which extends to a terminal washer 114 held in place by a screw 115 and a lock washer under the head thereof. In Fig. 11, it is seen that a suitable wire clip 116 is also held in place by the screw 115, and that an electrical conductor runs therefrom to another clip secured to a terminal lug 117.

In Fig. 18, the wiring is characteristic not only of the just described switch unit, but also of the other switch units that from part of the instrument as a whole. Therefore, the description of this figure may be regarded as applicable to any of the switch units of this type incorporated in the instrument. This applies to the larger switch unit which is used to give the numerals for the tens and hundreds columns of the deflection reading, the larger switch simply having a greater number of steps, and consequent electrical connections.

Now considering Fig. 18, the total voltage of the entire winding of the auto-transformer 6 will be compatible with that of the line. A plurality of taps 118 to 124 inclusive subdivide the transformer winding and are connected with the brushes 91 of the switch unit, whereby the turning of the dial of the switch unit by its handle to different positions will result in the inclusion in the circuit con-

trolled by such switch unit of different lengths of the auto-transformer winding.

Accordingly, voltages of various values suited to harmonize with the individual numerals of the switch unit dial are carried from the utilized portion of the winding of the auto-transformer 6, through the switch unit, to the stator winding S of an indicator I located at a more or less remote point, as at a gun. Hence, as the dial is turned so that one number replaces another under the window, as, say, at 18 in Fig. 2, a voltage of different value is set up in the circuit that includes the stator winding S of the indicator I. This indicator is of a type well known in the art, and it is sufficient to say that as the voltage is changed in its stator winding, there is a consequent response and adjustment of the rotor R, with a resultant angular displacement of the rotor. No difficulty will be experienced in understanding that this angular displacement may be communicated to a dial corresponding to dial 50 of the switch unit in the transmitter, so that the reading in that instrument and that given by the indicator I will be the same.

In Fig. 18, a circuit is shown established for one position of the dial of one of the switch units of the transmitter, such circuit being extended to the stator and rotor windings of the indicator I associated with that switch unit. This circuit goes from the winding of transformer 6 by lead 122 and one of the conductors 94 to the brush 91^3 and drum segment 86, continuing through a current-conductor to the outer lower slip ring 80. The circuit then goes by brushes 111, which bear on the ring 80, and by conductors 125 and 126 to the now closed right hand switch members 64 and 61, proceeding therefrom by conductors 127 and 128 to the stator winding S of the indicator I. From the winding S the circuit goes by conductors 129 and 130, through the at present closed left hand switch members 61 and 64, and by conductors 131 and 132 to the brushes 111 which bear upon the outer upper slip ring 78. From hence the circuit extends by a current-conductor to drum segment 84, then passing by brush 91^6 and conductor 133 and tap lead 124 to another part of the winding of the auto-transformer 6.

It is, therefore, apparent that the stator winding S is energized by current from a portion of the auto-transformer winding, and that the rotor winding R of the indicator I responds accordingly. If, now, the drum of the switch unit be rotated clockwise, so that the drum contact segments 86 and 84 engage brushes 91^4 and 91^7, respectively, the circuit will extend from the winding of the auto-transformer 6 by lead 123 and one of the conductors 94 to the brush 91^4, then by drum segment 86 to the lower slip ring 80, by brushes 111 and conductors 125 and 126 to the right hand switch members 64 and 61. As before, the circuit continues by conductors 127 and 128, through the stator winding S of the indicator I, and by conductors 129 and 130 to the left hand switch members 61 and 64. Thence the circuit goes by conductors 131 and 132, upper brushes 111, upper slip ring 78 and by a current-conductor to drum contact segment 84. From here the circuit runs by brush 91^7, conductor 134 and lead 123 to the auto-transformer winding. A zero position is thus set up, when no part of the auto-transformer is in circuit.

In each instance the rotor of the indicator I is excited by the alternating current which passes from the auto-transformer through the switch unit to it. The rotor so excited induces in the stator windings alternating currents, whose strength and phase relations to each other depend upon the setting of the unit switch, which selectively includes various portions of the auto-transformer winding in circuit, both for the two settings traced and the remaining possible settings.

Figs. 19 to 22 inclusive, in conjunction with Fig. 18, show diagrammatically the action of the commutator drum of the switch unit resulting from turning the dial 50 of that unit from one circuit-making and indicating position to the next. The arrangement is such as to avoid injurious sparking as the drum contacts 84—85 and 86—87 engage and leave the brushes 91, 91^1, 91^2, 91^3, etc.

Fig. 19 shows a circuit-establishing condition, such as is illustrated in Fig. 18, wherein the resistance 136 diverts the current to direct it from drum contact 86 to conductor 126, to the right hand auxiliary switch members 64 and 61 and by conductor 127 to conductor 128 that leads to the stator winding S of the indicator I. Similarly, resistance 142 causes the current path extending by conductor 129 from the stator winding S to be deflected through the conductor 130 and the left hand auxiliary switch members 61 and 64, and to continue by conductors 131 and 132 to the drum contact 84.

It has been shown that, when the dial 50 of the switch unit is turned from one position to the next, the notched detent wheel 51, illustrated in Fig. 11, forces the rollers 52 outwardly and also the levers 53 which carry them. The blocks 60 of insulation affixed to the levers 53 thereupon separate the arms 61 of both auxiliary switches from their associate arms 64, as diagrammatically indicated in Fig. 20. Brush 91^3 is still engaged with contact 86, but the current from the latter passes by conductor 135 through the resistance 136 to conductor 128, which runs to the indicator stator winding S. From winding S the circuit extends by conductor 129 to a junction point 129'. With the parts in the positions shown in Fig. 20, the current-path divides, one branch passing through resist-

ance 142 and by conductor 141 to the drum contact 84. The other branch goes by way of resistance 144 and conductor 143 to the drum contact 85. Brush 91^6 effects a junction of the two branches just traced, and the inclusion of the resistance in the circuit prevents injurious sparking as contact 85 moves into engagement with brush 91^6, which in Fig. 20 is shown to engage both contact segments 84 and 85, and to span the gap between them.

Referring to Fig. 21, the continued turning of the switch unit drum has placed its contact segments in such relation to the brushes that brushes 91^4 and 91^7 have just been engaged by contacts 87 and 84, respectively, and contacts 86 and 85 are nearly ready to separate from brushes 91^3 and 91^6, respectively. These engagements and disengagements ordinarily would effect sparking which would be apt to burn the insulation of the drum adjacent to the drum contact segments, but the inclusion of the resistances 136, 138, 142 and 144 in circuit, combined with the opened auxiliary switches comprising members 61 and 64, removes the danger of deleterious sparking.

In Fig. 22, contacts 86 and 85 have entirely disengaged brushes 91^3 and 91^6, respectively, and contacts 86 and 84 are in engagement with brushes 91^4 and 91^7, which effects a new connection of the indicator winding S with the winding of the auto-transformer 6, whereby the winding S of the indicator I is affected by an altered electro-motive-force, in consequence of which the indicator corresponds to that readable upon the dial 50 of the switch unit. The switch unit drum, however, to be properly positioned for this is turned slightly more than is shown in Fig. 22, until contacts 86 and 84 occupy the same relative position to brushes 91^4 and 91^7, respectively, that they did to brushes 91^3 and 91^6, respectively in Fig. 19. The auxiliary switch members 61 and 64 are now in closed positions, and the resistances 136, 138, 142 and 144 are not in circuit.

The range and deflection transmitter hereinbefore described is located at a central station, as say, in the plotting room of a war vessel. By means of the cables 3 and 4 this instrument is placed in circuit with a plurality of information-receiving instruments, such as the indicators I previously referred to. These indicators are positioned at stations remote to the central station or plotting room, as has been explained, being placed at the guns, stations of observation and where the information furnished by the range and deflection transmitter is needed.

Fig. 2 shows that the handles 8, 9, 10 and 11 have been manipulated to operate the range switch units, whereby their dials 23 to 26 inclusive are positioned, as shown in Fig 3, to give the range reading observed in Fig. 2, which reading shows the range to be 24680 yards. Each of the range switch units being similar to that illustrated in Figs. 6 to 22 inclusive, it will be readily comprehended that its commutator drum has been rotated to place the contacts 84 and 86 of the drum into engagement with such of the annularly disposed brushes 91, 91^1, 91^2, 91^3, etc., as will correspond to a circuit establishment. The value of this circuit is electrically synonymous to the numerical value on the dial which is readable through the window. From Fig. 18, it is apparent that the circuit so set up includes another instrument—the indicator I—the stator and rotor windings S and R, respectively, of which are electrified in accordance with amount of the winding of the auto-transformer 6 which the switch unit has included in the circuit. The indicator dial (not shown) movable in response to and in proportion to the movement of the rotor R of the indicator accordingly shows at the latter instrument a reading corresponding to that of the unit switch of the transmitter with which it is in circuit.

Therefore, when the range switch units of the transmitter are set so that their dials cooperate, as in Fig. 3, to give the range reading shown in Fig. 2, the indicator I, or any plurality of such indicators as are in circuit, will show the same range reading as does the transmitter.

Thus, the sight-setter at any gun, for example, which is furnished with an indicator, is enabled to set the gun sight in the usual manner for a gun elevation in conformity with the range in yards as disclosed by the indicator.

This step in aiming the gun being taken care of, as explained, it becomes necessary to provide for the proper gun-train to render the gun fire effective. The gun-train, in addition to the major training of the gun, includes gun-train for deflection, which is due to a number of factors, such as the relative speed of own ship and the target, windage, and the time of flight and drift of the projectile. From information readily obtainable in the plotting room, the handles 16 and 17, seen in Fig. 2, are operated to actuate, respectively, the larger and smaller deflection switch units, whereby the dials thereof co-act to give a deflection reading of 123 mils. This information is transmitted to the indicator or indicators I in the manner just set forth with respect to the range, and, therefore, requires no repetitional description.

Upon receipt of the deflection at his indicator, the sight setter sets the gun-sight in accordance with the primary gun-train combined with the gun train for the deflection angle. The gun being now set for both gun elevation and gun-train, including the deflection, it is aimed at the target and is ready to be fired. Any alterations in the range and deflection due to altering conditions are

immediately transmitted from the transmitter in the plotting room to the indicator at the gun, and the latter is constantly maintained aimed for hitting the target.

From the foregoing, it is evident that I have made an invention, wherein the various steps of setting and controlling one or a plurality of guns are subject to centralized control under the direction of those highly skilled in the art of warfare, yet simultaneously furnishing information in familiar terms to those remotely located and to whom the physical translation of the orders from the central command station is intrusted. Furthermore, it is plain that, with the use of the invention, the controlling officers and the men carrying out their orders, both, suitably and highly trained for their respective duties, have their activities linked through electro-mechanical means which serve in the interest of efficiency to unify the work of the officers and men.

I claim:

1. In a device of the character described, a brush, a contact member to cooperate therewith comprising two conductors separated by insulating material, and means connected with said separated conductors to allow full current to flow when the brush is in complete engagement and to reduce the current when the brush is in partial engagement.

2. In a device of the character described, a plurality of brushes arranged at regular intervals and a member having two contacts for selective engagement with pairs of said brushes, each of said contacts comprising two parts separated by insulating material.

3. In a device of the character described, a plurality of brushes arranged at regular intervals and a member having two contacts for selective engagement with pairs of said brushes, each of said contacts comprising a narrow part and a broad part separated by insulating material.

4. In a device of the character described, a plurality of brushes arranged at regular intervals and a member having two contacts for selective engagement with pairs of said brushes, each of said contacts comprising a narrow part and a broad part separated by insulating material, said parts being arranged in opposite order in the two contacts.

5. In a device of the character described, a plurality of brushes arranged at regular intervals and a member having two contacts for selective engagement with pairs of said brushes, each of said contacts comprising two parts separated by insulating material and having an air-gap between the ends with which the brushes contact.

6. In a device of the character described, a plurality of brushes arranged at regular intervals, a menber having two contacts for selective engagement with pairs of said brushes, each of said contacts comprising two parts separated by insulating material and means connected with both parts of each contact to control the current at times of circuit making and breaking.

7. The combination with a brush, of a current conducting contact device to engage said brush in moving past the same and comprising two contact portions separated by insulating material, and means to allow full current to flow when the brush is in complete engagement and to reduce the current when the brush is in partial engagement.

8. The combination with a brush, of a current conducting contact device to engage said brush in moving past the same and comprising two contact portions separated by insulating material and having an air gap between them adjacent their brush-engaging surfaces, and means to allow full current to flow only when the brush is in complete contact with the contact device.

9. In a signal transmitter, a plurality of stationary brushes, a rotatable element coacting with said brushes to form a switch and having two contacts for selective engagement with pairs of said brushes, a detent device to position the switch in circuit closing positions, and resistance devices controlled by said detent device to prevent sparking at the brushes.

10. In a signal transmitter, two relatively rotatable elements, one of said elements having a plurality of brushes arranged in an arc of a circle and the other having a pair of contact devices for selective engagement with pairs of said brushes, and resistance devices controlled by the relative rotation of said elements to prevent sparking at the brushes.

11. In a signal transmitter, means adapted to connect the transmitter to an external circuit, a stationary element comprising a brush, a rotatable member having a contact device to engage said brush in moving past the same, said contact device comprising two insulated parts for successive engagement by said brush, a resistance connection between one part of said contact device and said circuit, a resistance and a switch in parallel connecting the second part of the contact device with the circuit, and means effective after the brush has completed the circuit through the resistance connected to the first part and then through the resistance connected to the second part to close said switch and then to open the switch before the contact between the brush and the second element is broken.

12. In a device of the character described, a plurality of brushes arranged in an arc of a circle, a rotatable member having two contacts to engage pairs of said brushes, and means for positioning and detaining said rotatable member in operative position with respect to any pair of brushes, comprising a

toothed wheel connected with said rotatable element and spring pressed detent members to engage said wheel.

13. In a device of the character described, a plurality of brushes arranged in an arc of a circle, a rotatable member having two contacts to engage pairs of said brushes, means for positioning and detaining said rotatable member in operative position with respect to any pair of brushes, comprising a toothed wheel connected with said rotatable element and spring pressed detent members to engage said wheel, and anti-sparking device, one for each contact, operated by said detent members.

14. In a device of the character described, a plurality of brushes arranged in an arc of a circle, a rotatable member having two contacts to engage pairs of said brushes, means for positioning and detaining said rotatable member in operative position with respect to any pair of brushes, comprising a toothed wheel connected with said rotatable element and spring pressed detent members to engage said wheel, and anti-sparking devices, one for each contact, operated by said detent members, each of said anti-sparking devices comprising two pivoted contact members spring pressed toward each other and means operated by the corresponding detent member to move one of said contacts away from the other.

15. In a device of the character described, a plurality of brushes arranged in an arc of a circle, a rotatable member having two contacts to engage pairs of said brushes, means for positioning and detaining said rotatable member in operative position with respect to any pair of brushes, comprising a toothed wheel connected with said rotatable element and spring pressed detent members to engage said wheel, and anti-sparking devices, one for each contact, operated by said detent members, each of said anti-sparking devices comprising two pivoted contact members spring pressed toward each other, means operated by the corresponding detent member to move one of said contacts away from the other and a stop to limit the movement of the other and thereby permit such separation.

16. In a signal transmitter, a plurality of stationary brushes, a rotatable element coacting with said brushes to form a switch and having two contacts for selective engagement with pairs of said brushes, a detent device to position the switch in circuit closing positions, and detent device controlled means including resistance elements and circuit breakers to control the current at times of circuit making and breaking.

17. In a switch, two parallel plates of insulating material, metal posts connecting said plates, brushes on said posts, conductors connecting said brushes with terminals on one of said plates, and a rotatable member mounted in said plates and having conductors to cooperate with said brushes.

18. In a switch, two parallel plates of insulating material, metal posts connecting said plates, brushes on said posts, conductors connecting said posts with terminals on one of said plates, and a rotatable member mounted in said plates and having contacts to cooperate with said brushes, and slip rings electrically connected with said contacts to cooperate therewith in circuit closing and opening.

19. In a switch, a plurality of brushes arranged in a circular arc, and a rotatable member having two contact devices for selective engagement with pairs of said brushes, each of said contact devices comprising two conductors separated by insulating material, a pair of contact rings connected with the conductors of one of said contact devices, and a pair of contact rings connected with the conductors of the other contact device.

20. In a switch, a plurality of brushes arranged in a circular arc; a rotatable member having two contact devices for selective engagement with pairs of said brushes, each of said contact devices comprising two conductors separated by insulating material, a pair of contact rings connected with the conductors of one of said contact devices, and a pair of contact rings connected with the conductors of the other contact device; and means, including a circuit breaker for each contact device, to prevent sparking.

21. In a device of the class described, a rotatable shaft for the switch, a member fixed on said shaft and having upwardly projecting pins, two levers pivoted on said shaft and crossed so as to engage said pins on opposite sides of the shaft, a spring connecting the levers at one side of the shaft to urge the arms of the lever toward said pins, a member pivoted on said shaft and having two pins projecting downwardly between the arms of said levers and having openings therein along the diameter perpendicular to that determined by the downwardly extending pins, and a manually operable device having pins to enter the openings in the last mentioned member.

In testimony whereof I affix my signature.

HARRY S. MARSH.

CERTIFICATE OF CORRECTION.

Patent No. 1,795,341. Granted March 10, 1931, to

HARRY S. MARSH.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, line 16, for the misspelled word "ellpitical" read elliptical; page 4, line 64, for "conjunciton" read conjunction; same page, line 109, for "from" read form; page 7, line 63, claim 6, for "menber" read member; page 8, line 7, claim 13, for "brushes" read brush, and line 13, for "device" read devices; same page, line 19, claim 14, for "brushes" read brush; strike out lines 101 to 116, comprising claim 21; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 21st day of April, A. D. 1931.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)