

Nov. 1, 1938.

R. F. DIRKES ET AL

2,135,377

TELEGRAPH TRANSMITTER

Filed Aug. 22, 1935

5 Sheets-Sheet 1

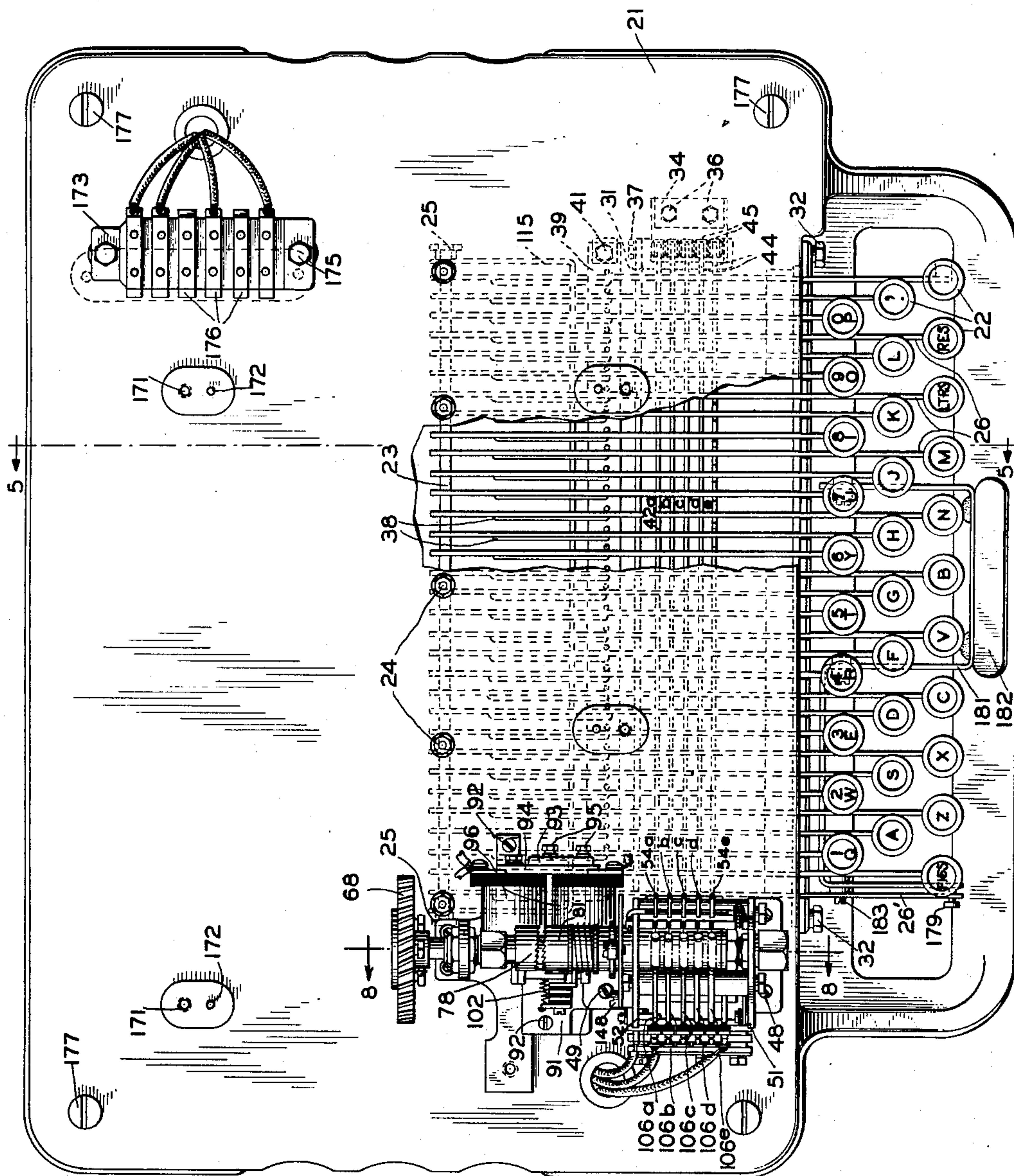


FIG. 1

INVENTORS
R.F. DIRKES
G. I. ROBERTS
BY *Eugene C. Brown*
ATTORNEY

Nov. 1, 1938.

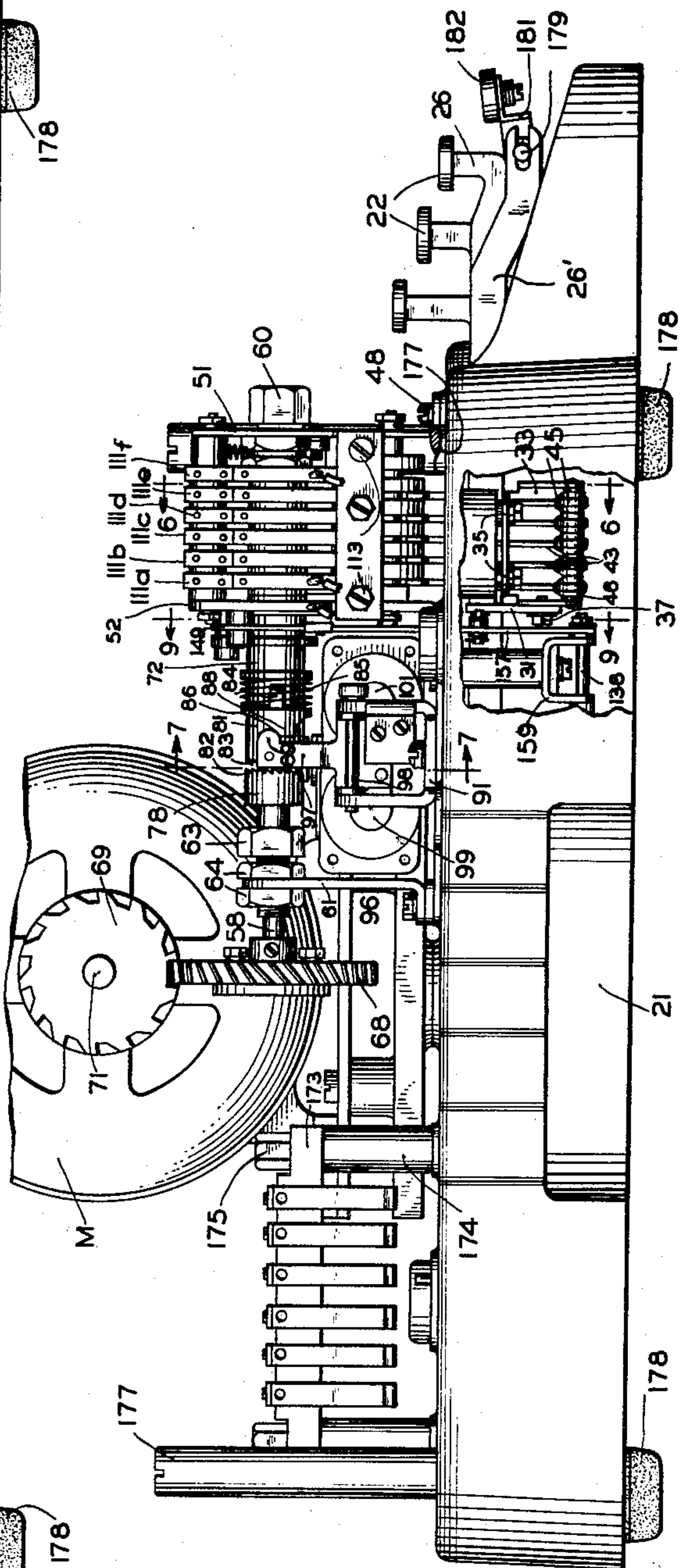
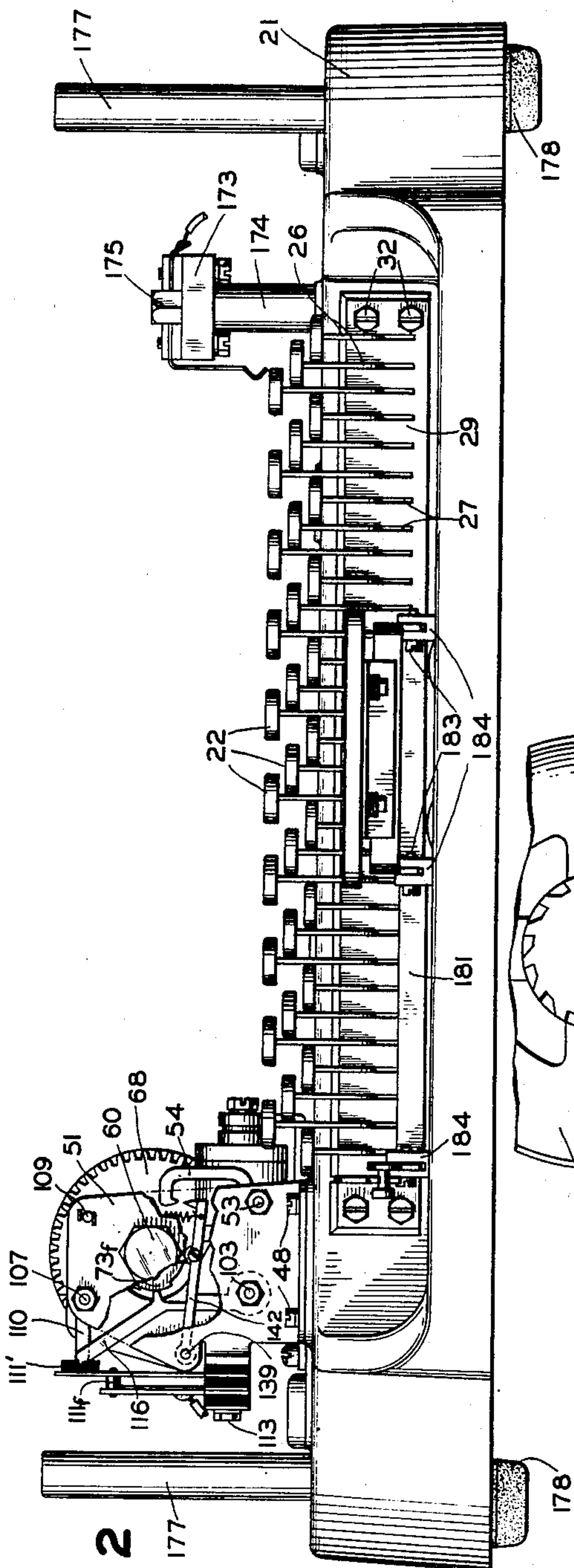
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TELEGRAPH TRANSMITTER

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5 Sheets-Sheet 2



Nov. 1, 1938.

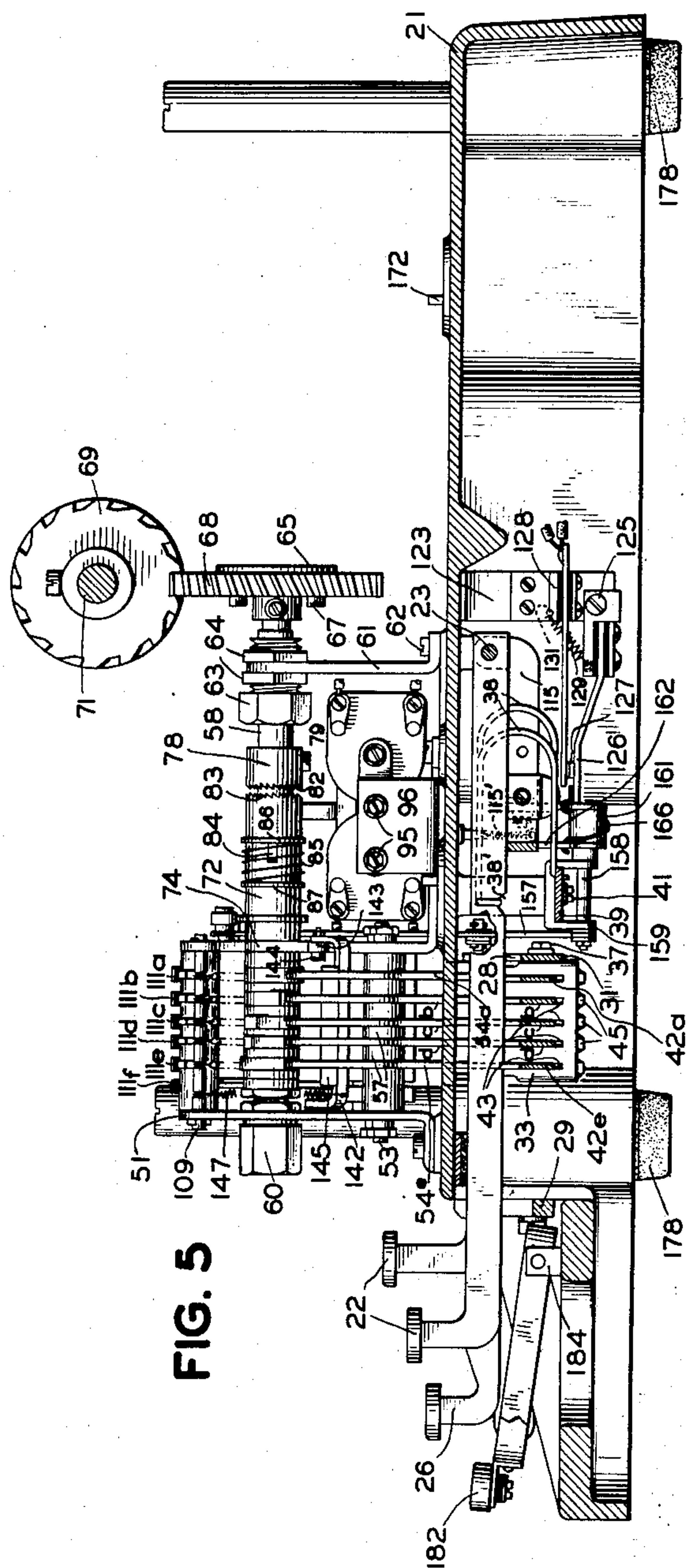
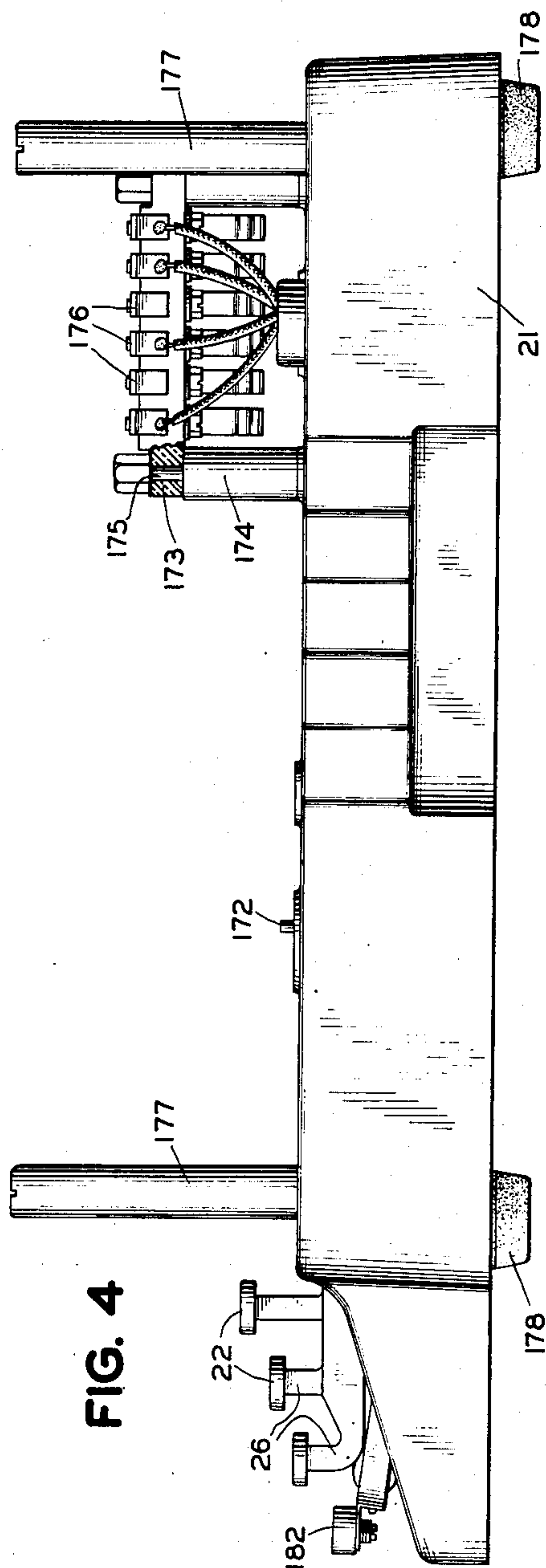
R. F. DIRKES ET AL

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TELEGRAPH TRANSMITTER

Filed Aug. 22, 1935

5 Sheets-Sheet 3

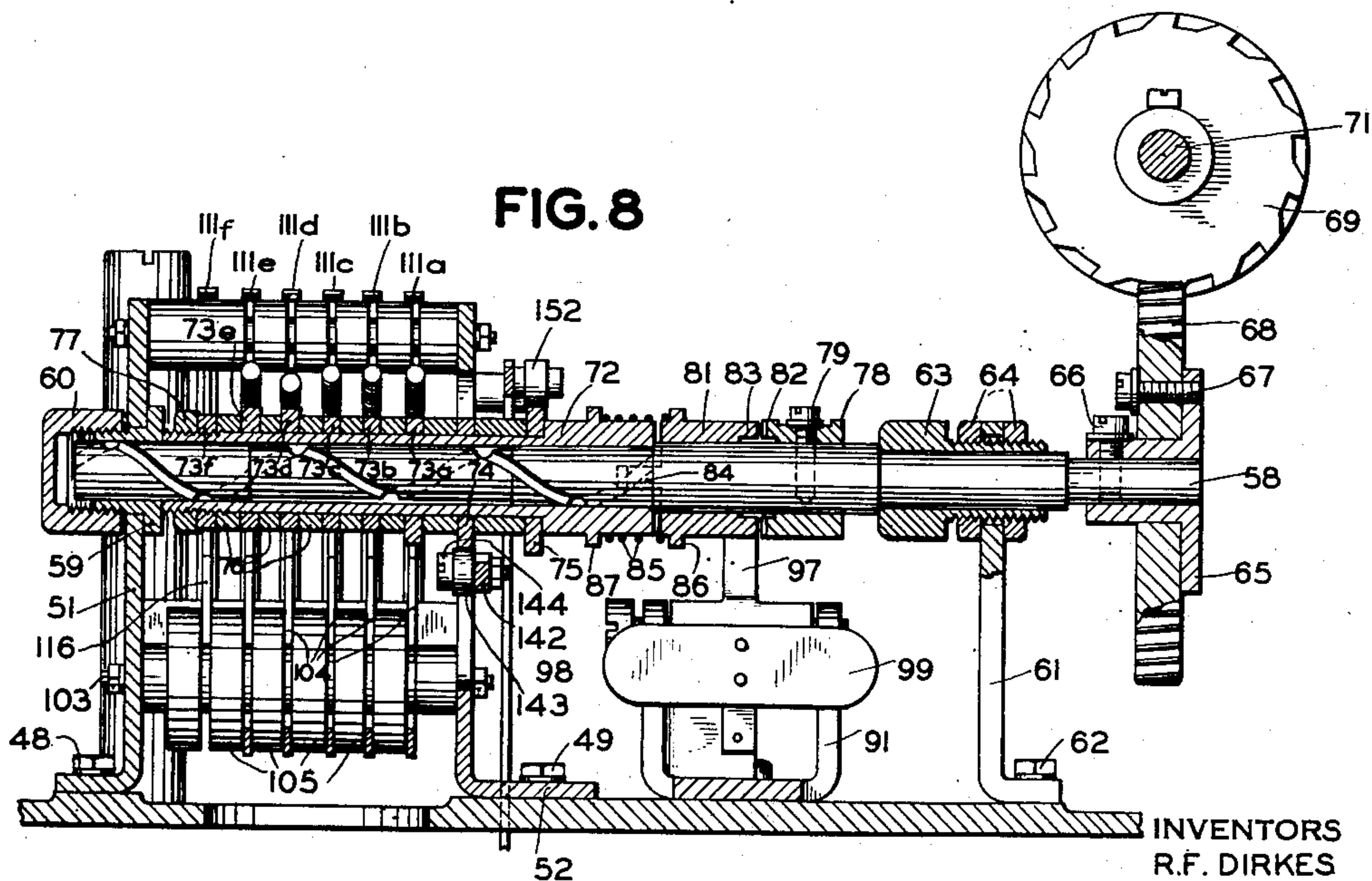
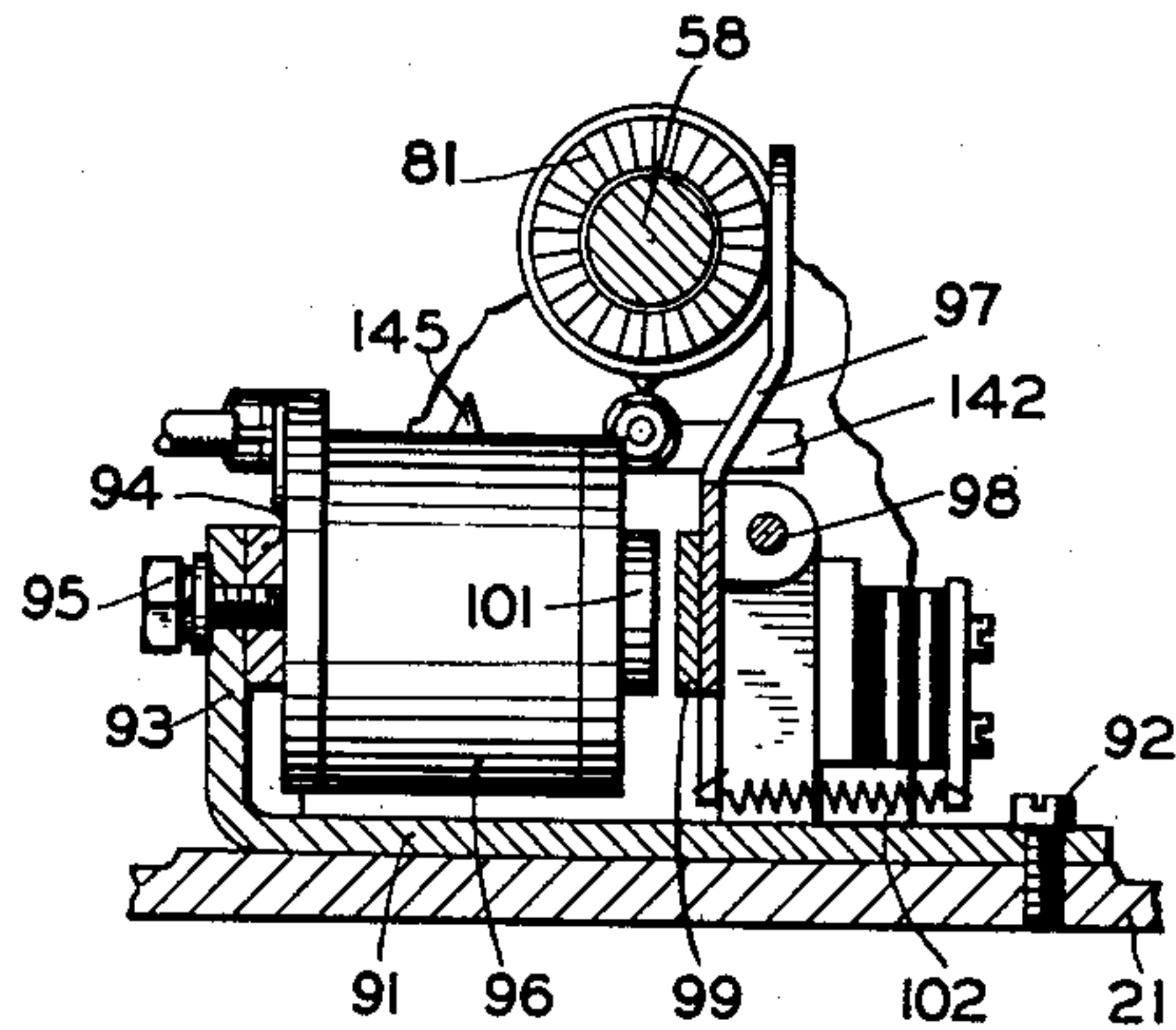
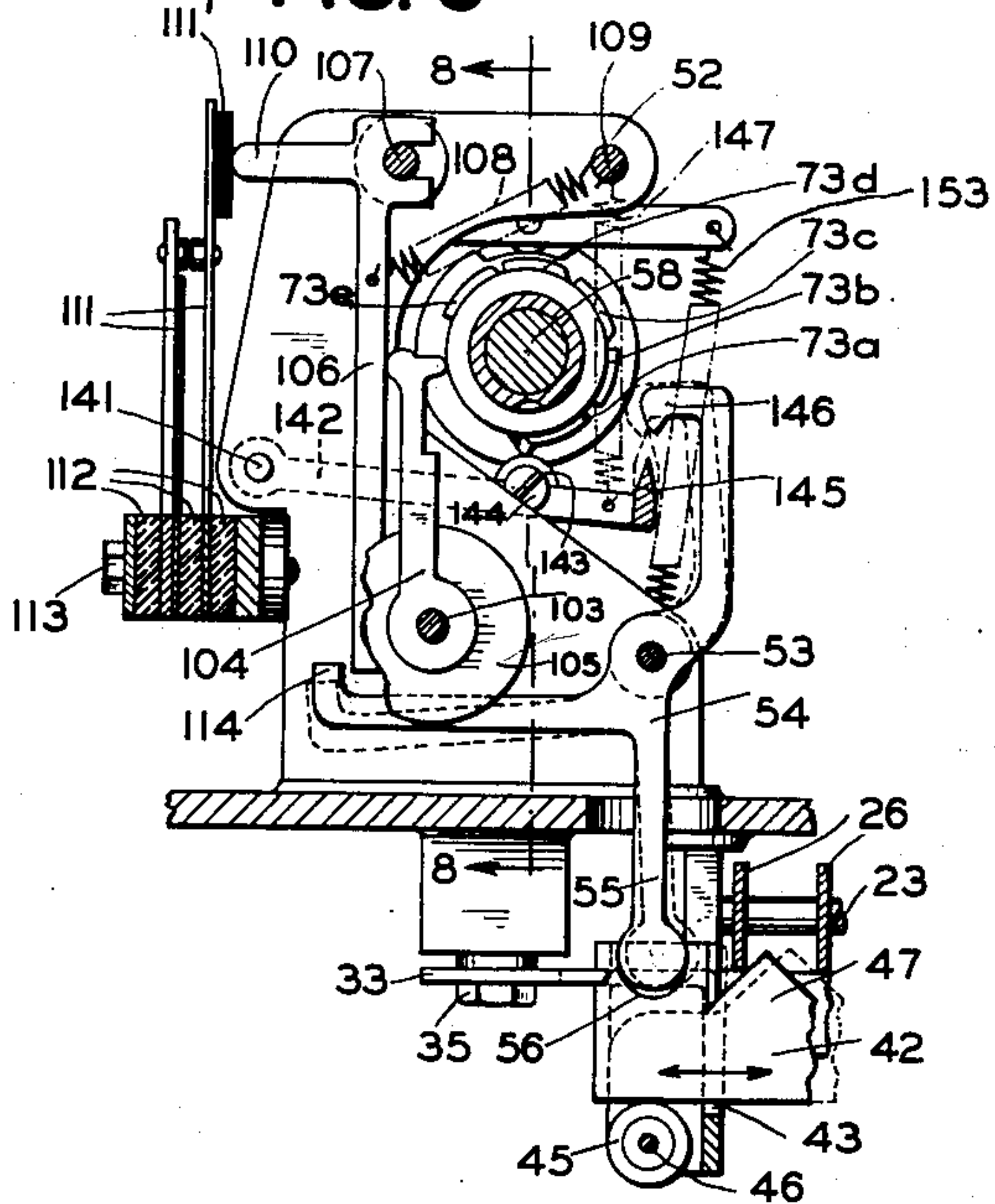


INVENTORS
R.F. DIRKES
G.I. ROBERTS

ATTORNEY

2,135,377

5 Sheets-Sheet 4



Eugene L. Brown
ATTORNEY

Nov. 1, 1938.

R. F. DIRKES ET AL

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TELEGRAPH TRANSMITTER

Filed Aug. 22, 1935

5 Sheets-Sheet 5

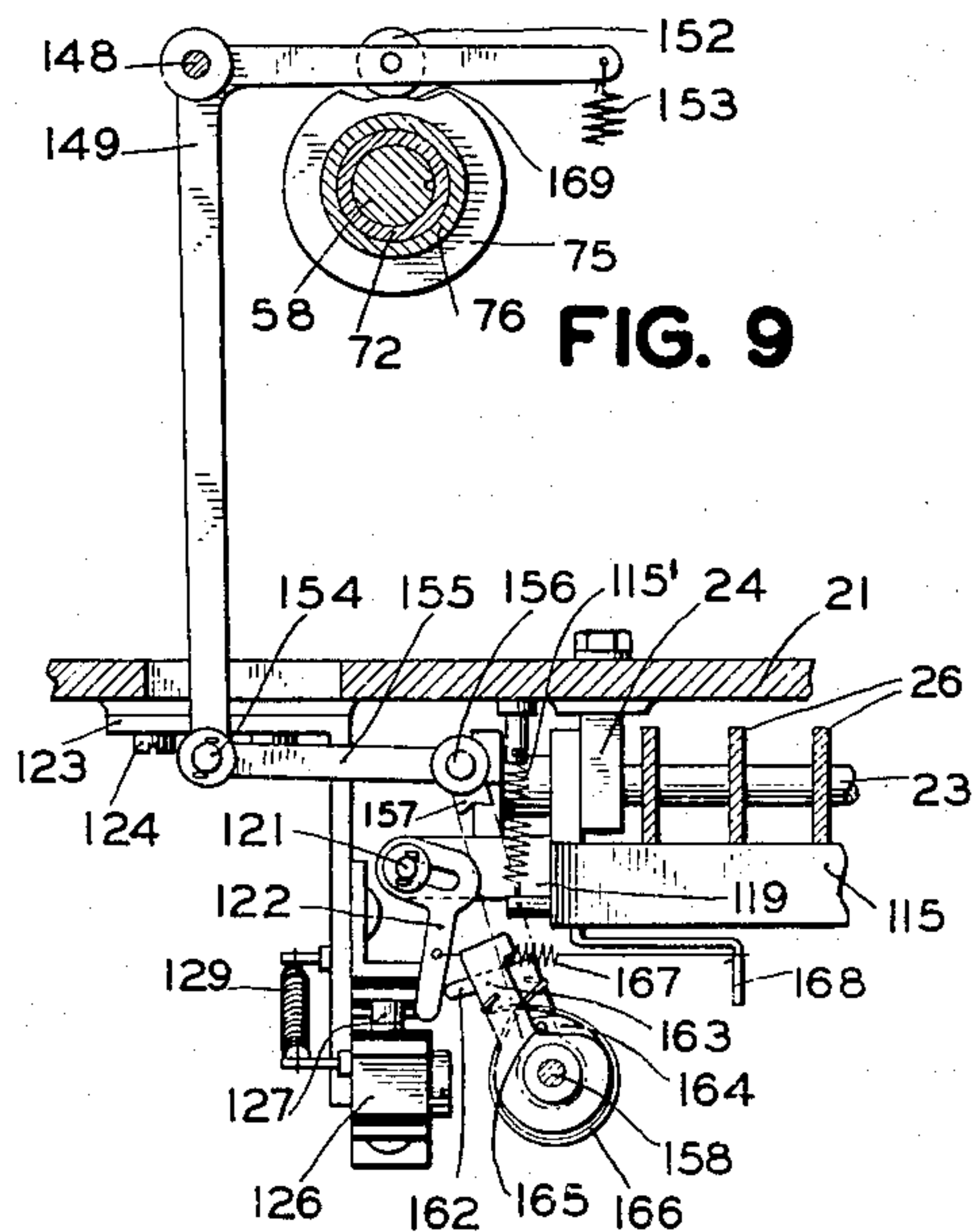


FIG. 9

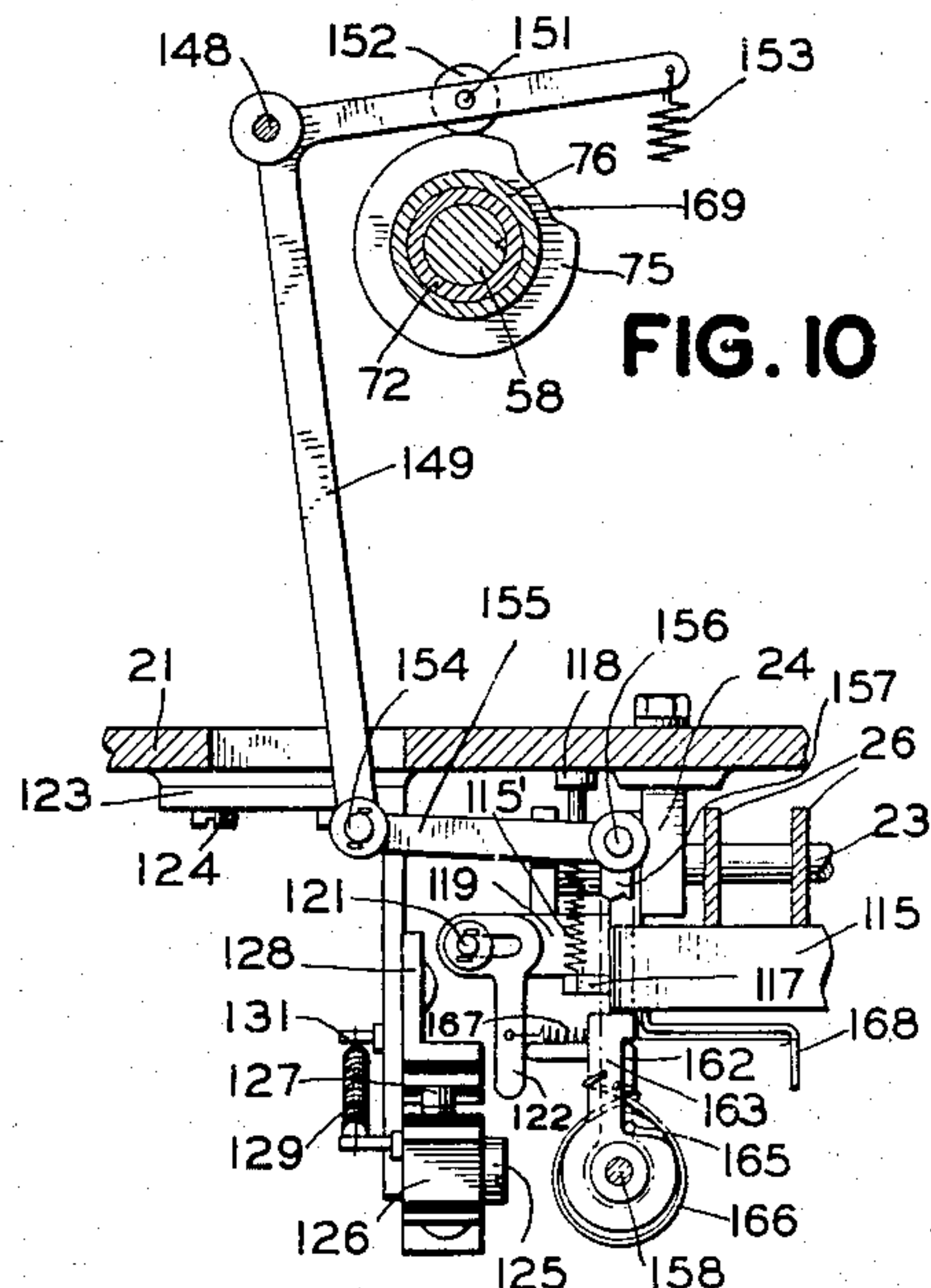


FIG. 10

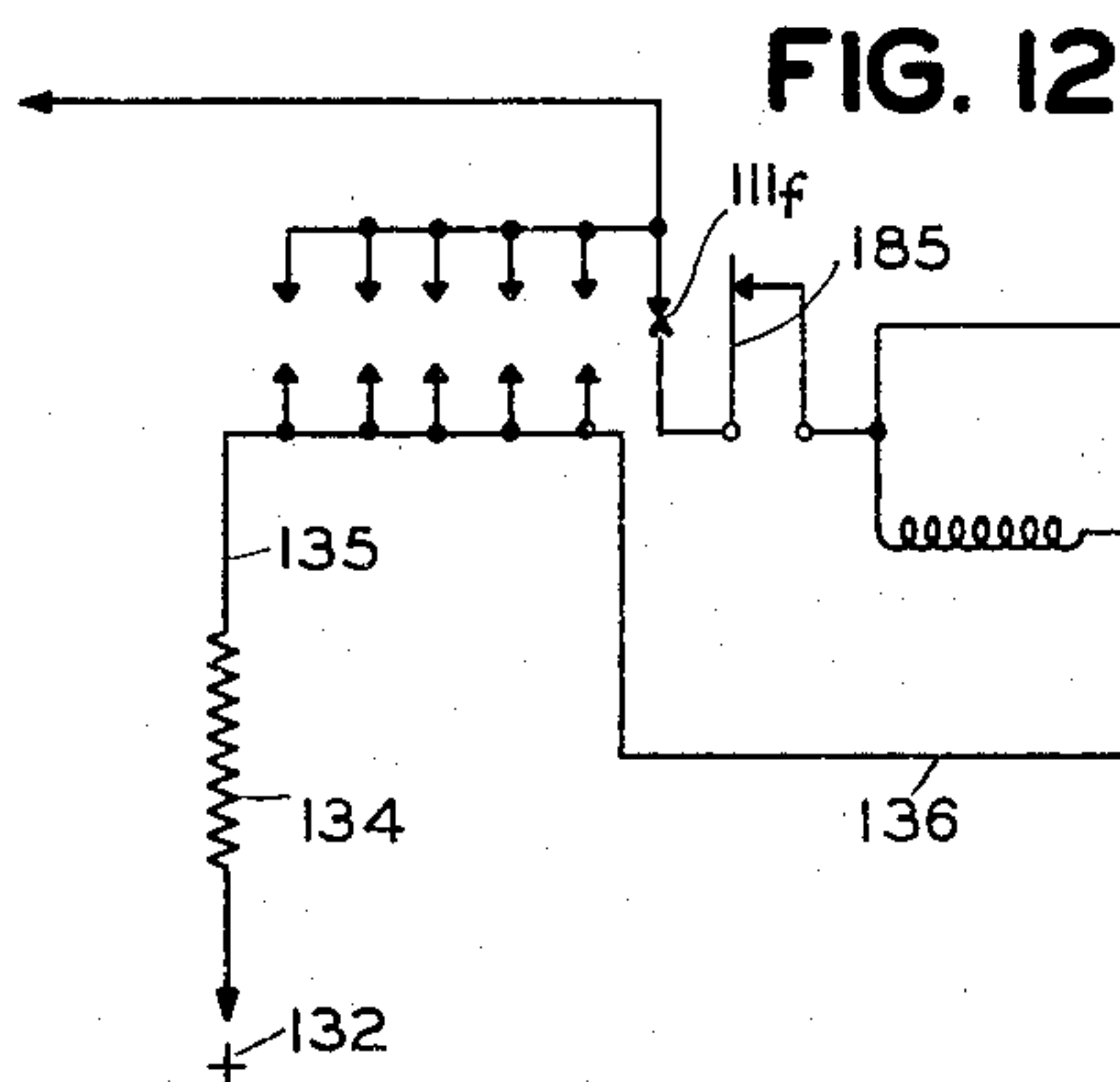


FIG. 12

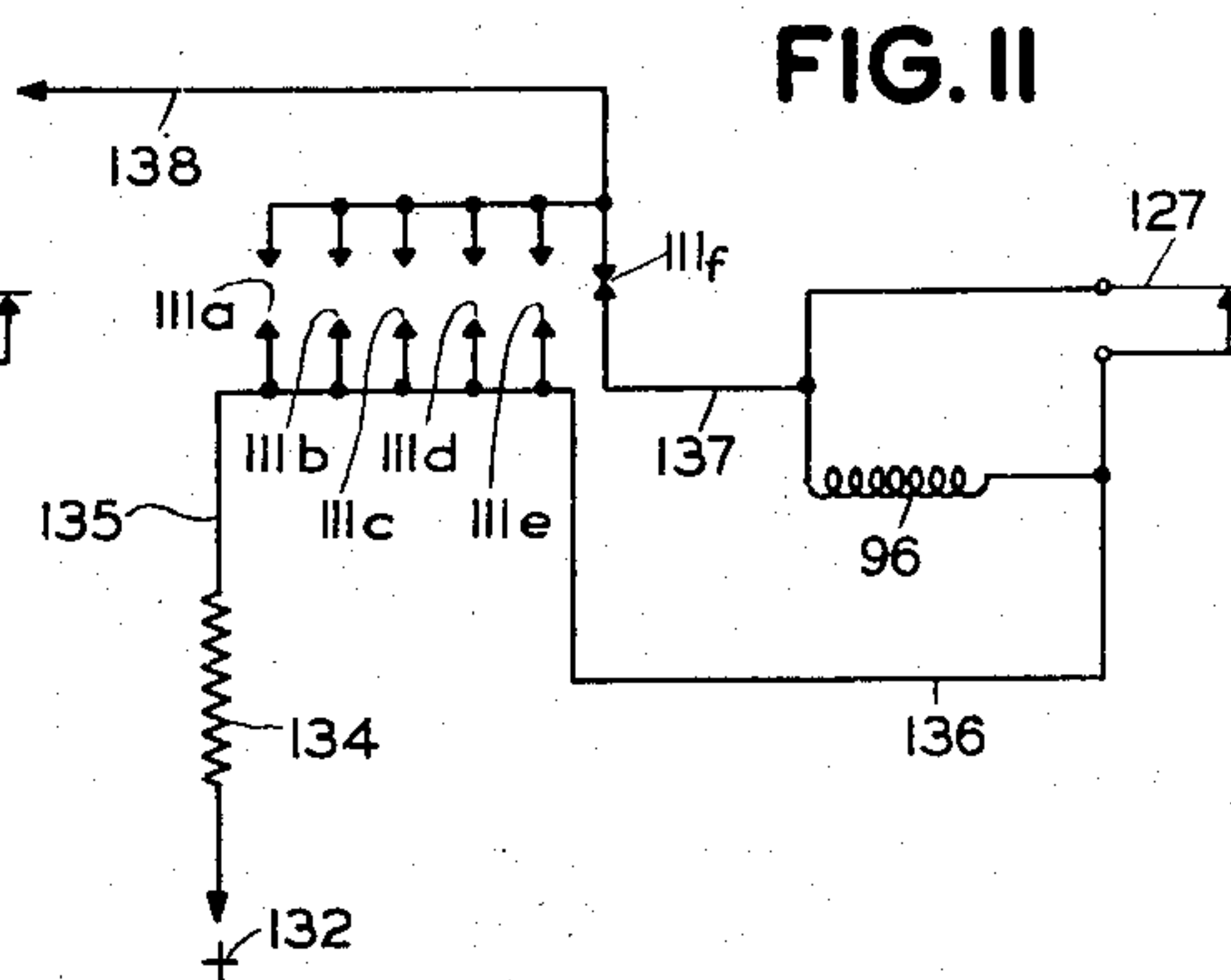


FIG. 11

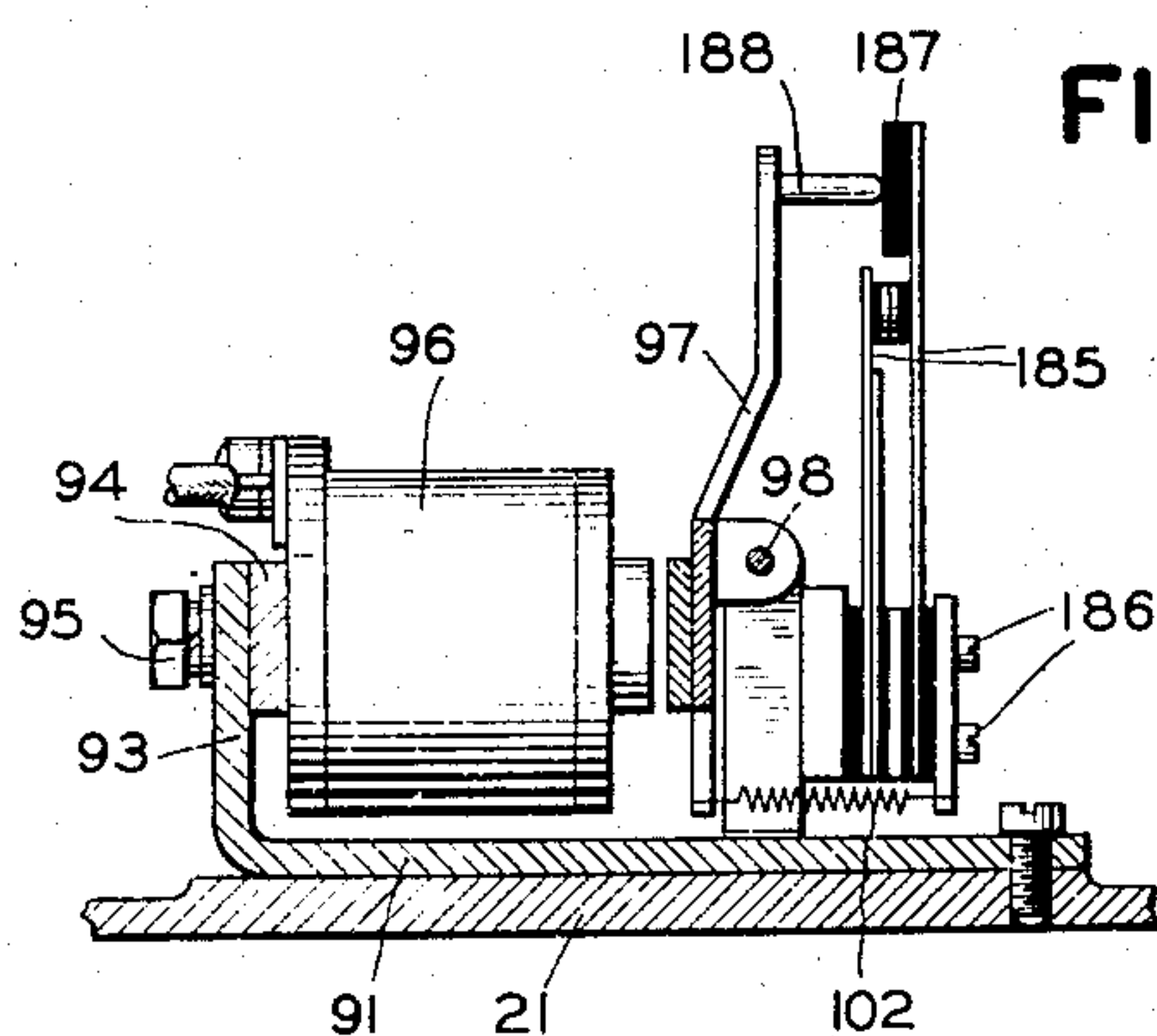


FIG. 13

INVENTORS
R. F. DIRKES
G. I. ROBERTS
BY *Eugene C. Brown*
ATTORNEY

UNITED STATES PATENT OFFICE

2,135,377

TELEGRAPH TRANSMITTER

Robert F. Dirkes, Jamaica, N. Y., and George I. Roberts, Cresskill, N. J., assignors to The Western Union Telegraph Company, New York, N. Y., a corporation of New York

Application August 22, 1935, Serial No. 37,402

24 Claims. (Cl. 178—79)

This invention relates to transmitters for printing or selective telegraphs and more particularly to apparatus of this nature which is integral with and controlled by an associated keyboard.

5 The preferred embodiment of this invention is adapted for use with a telegraph system known as the simplex or start-stop system, wherein the signals comprise permutations of impulses corresponding to two different line conditions extending throughout a definite number of time intervals. The selecting intervals or impulses of each signal are preceded by a starting impulse or interval of uniform line condition and followed by a stopping or rest impulse or interval which is always the same and of opposite line condition from that of the starting impulse.

10 It is a custom in telegraph practice to further distinguish the two different line conditions by referring to them as intervals during which marking or spacing impulses are transmitted. The marking impulses correspond to intervals during which current is transmitted and the spacing impulses correspond to intervals during which no current is transmitted. In the preferred embodiment of the invention the transmitting mechanism is adapted to transmit a spacing impulse for the start impulse and a marking impulse for the rest impulse.

15 A simplex system may be operated from a distributor transmitter in conjunction with a tape transmitter and a perforated tape. However, from the standpoint of economy and reduced equipment required, it is more often desirable to operate simplex systems directly from a unit comprising a combined keyboard and distributor transmitter. Accordingly, one of the objects of this invention is to provide a keyboard controlled transmitting mechanism of improved efficiency and durability which will transmit to a telegraph circuit combinations of code impulses corresponding to and representing, according to a predetermined arrangement, actuated key levers.

20 Another object of this invention is to provide a keyboard transmitter in which it is impossible to depress more than one key lever at a time.

25 Still another object of this invention is to provide a keyboard transmitter in which it is impossible to depress a subsequent key lever until the complete transmission of the code combinations of impulses representing the previously depressed key lever.

30 Still another object of this invention is to provide a keyboard transmitter in which, if an actuated key lever is held depressed for a length of time longer than is necessary for the trans-

mission of the associated code combinations of impulses, said code combinations of impulses will not be repeated.

These and further objects of this invention will hereinafter appear.

5 The preferred embodiment of this invention contemplates the employment of a mechanism selectively responsive to the actuation of keys and key levers for controlling a plurality of current controlling contacts in various combinations, according to the signal character to be transmitted, in conjunction with a distributor mechanism for distributing the current impulses to a telegraph circuit in the proper sequential order.

10 The main structural part of the machine comprises a hollow cast metal base or frame upon and in which the various combinations and sub-combinations of the associated mechanisms and parts are mounted. The keys and key levers are arranged in substantially the same manner as those of an ordinary typewriter and are adapted to actuate a series of permutation or selecting bars in various combinations according to the actuated key lever. The selecting bars are provided with beveled slots therein in a manner well known in the art and are operatively engaged with associated individual members which in conjunction with an independently rotatable cam sleeve and a series of contacts, transfer the combinations of mechanical selections of the selecting bars, according to a predetermined arrangement, into associated and corresponding combinations of electrical impulses.

15 As hereinbefore stated, this invention is adapted to operate in conjunction with a simplex signaling code, and five time intervals are employed during which combinations of impulses are transmitted, exclusive of the starting and stopping impulses. It is to be understood, however, that with modifications the invention may be adapted to operate in conjunction with other codes.

20 The maximum number of possible combinations of impulses available with a five unit code is 32 and in order to transmit the requisite number of characters comprising numerals, letters, punctuation marks and printer functions, case grouping of signals is employed. Accordingly two case shift signals are employed called a shift signal and an unshift signal. As is well known to those versed in the art, the shift and unshift signals are printer functions. The purpose of the shift signal is to position the receiving recorder so that the following received combinations of impulses will be properly recorded in the figures group. The purpose of the unshift signal is to position

the receiving recorder so that the following received combination of impulses will be properly recorded in the letters group. Thus, two characters may be common to one key lever and which of these two characters will be recorded is dependent on the last case shift signal transmitted. Some of the selections are common to both case groups such as the letter space signal and some punctuation marks.

A more complete and thorough understanding of the invention may be had from the following detailed description taken in conjunction with the accompanying drawings forming a part of this specification showing preferred and modified embodiments thereof in which:

Figure 1 is a plan view of a preferred embodiment of the invention in which the front of the machine is shown at the bottom of the drawing;

Figure 2 is a front elevational view thereof;
Figure 3 is a left end elevational view thereof;
Figure 4 is a right end elevational view thereof;
Figure 5 is a sectional view taken on the line 5—5 of Figure 1;

Figure 6 is an enlarged fragmentary sectional view taken on line 6—6 of Figure 3;

Figure 7 is an enlarged fragmentary sectional view taken on line 7—7 of Figure 3;

Figure 8 is an enlarged fragmentary sectional view taken on lines 8—8 of Figures 1 and 6;

Figure 9 is an enlarged fragmentary sectional view taken on line 9—9 of Figure 3 showing a part of the mechanism in its normal condition;

Figure 10 is a view showing the mechanism shown in Figure 9 in its operated position;

Figure 11 is a circuit diagram of the preferred embodiment of the invention;

Figure 12 is a circuit diagram of a modified form of the invention; and

Figure 13 is a fragmentary sectional view similar to that of Figure 7 showing the location of an addition contact adapted to be used in conjunction with the modified form of the invention.

Referring first to Figure 1 in which some of the mechanism is shown dotted, there is provided a hollow case base or frame 21 comprising the main structural part of the invention upon and in which the various mechanisms and elements of the invention are mounted. As is evident from Figure 1, the arrangement of the character keys is substantially the same as that of any well known three row typewriter keyboard. The keys 22 are mounted on the front end of associated key levers 26 which are pivotally mounted at their rear ends on a rod 23 which is supported in a series of brackets 24, one of which is better shown in Figure 9, attached to the inside of the base 21. The rod 23, (Fig. 1) is provided with nuts 25 in threaded engagement with the ends thereof which prevents the rod from moving longitudinally. The key levers 26 are prevented from moving longitudinally and are guided in their vertical movement by vertical slots 27 and 28 (Figs. 2 and 5) individual to each key lever in front and rear guide plates 29 and 31 respectively. The front guide plate 29 is attached to a front vertical section of the base 21 by screws 32. Right and left selecting bar guide brackets 33 and 34 (Figs. 1, 3 and 5) are attached to the inside of the base by screws 35 and 36 respectively and attached to them by screws 37 is the rear guide plate 31. Each key lever 26 is provided with a single wire spring 38 (Figs. 1 and 5) which tends to elevate the front end thereof. One end

of each spring 38 is engaged in a notch 38' in its associated key lever, the other end being located in an individual hole in a spring mounting bar 39 attached to the inside of the base by screws 41. Situated directly beneath and extending horizontally in a direction at right angles to the key levers are a series of five selecting bars indicated in general at 42 in Figure 6 and individually by reference characters 42a to 42e in Figures 1 and 5. The selecting bars 42 are adapted to slide transversely and are guided by individual slots 43 and 44 (Figs. 1 and 5) in the guide brackets 33 and 34 respectively. Rollers 45 individual to each selecting bar are pivotally supported on rods 46 (Fig. 3) in the selecting bar guide brackets 33 and 34 and upon these rollers the selecting bars rest, thereby permitting said bars to slide with a minimum amount of friction. Each of the selecting bars 42 has thereon a different arrangement of upwardly extending bevelled projections 47 (Fig. 6) which are so arranged that the bars will slide transversely from left to right in various combinations as various key levers are depressed. When any one of the key levers 26 is depressed, the lower edge of the lever engages the bevelled projections 47 of the selecting bars 42 and actuates them transversely in accordance with a predetermined arrangement as is well understood in the art.

Attached to the top of the keyboard base 21, by screws 48 and 49 (Figs. 1, 3, 5 and 8) are brackets 51 and 52 respectively. On a rod 53 (Fig. 6) secured in the brackets 51 and 52 are pivotally mounted a group of five selecting bar levers indicated in general at 54 in Fig. 6 and individually by reference characters 54a to 54e in Figs. 1 and 5. An arm 55 (Fig. 6) of each selecting bar lever extends downwardly through a hole in the base 21 and is engaged by a U-shaped slot 56 in the left end of an associated selecting bar 42. Thus transverse movement of the selecting bars 42 causes the selecting bar levers 54 to rock about their pivot mounting point. The selecting bar levers are kept in alignment with their respective selecting bars by the slots 43 in the left selecting bar mounting bracket 33 and spacers 57 (Fig. 5) on the lever pivot rod 53.

The transmitting mechanism of the preferred embodiment above mentioned will now be described. Its principal function is to transfer the mechanical selections of the selecting bars into corresponding sequential electrical impulses. It performs this function by means of an independently rotatable cam sleeve, a series of contacts, contact levers and associated parts.

A horizontal transmitting cam shaft 58 (Figs. 3, 5 and 8) is journaled at the front end in a flanged bushing 59 (Fig. 8) supported in the bracket 51 by a nut 60. A bracket 61 secured to the base 21 by screws 62 supports a bearing sleeve 63 by means of nuts 64 which serves as another journal for the shaft 58 adjacent the rear end thereof. A gear hub 65 is attached adjacent the rear end of the shaft 58 for rotation therewith by a screw 66. Secured to the gear hub 65 by screws such as 67 is a helical gear 68 adapted to mesh with another helical gear or pinion 69 on the drive shaft 71 of an electric motor M. The electric motor M is arranged for continuous rotation and therefore the transmitting cam shaft will be continuously rotated by means of the gears 68 and 69. Loosely mounted on the front section of the transmitting cam shaft 58, which is of reduced diameter, is a cam sleeve 72 in abutting

relation with the flanged bushing 59. A series of eight disc cams 73a to 73f, 74 and 75 disposed on the cam sleeve 72 in a predetermined arrangement between intermediate spacers 76 are clamped for rotation therewith by a nut 77 in threaded engagement with the end of the cam sleeve. The cam sleeve 72 is adapted to be rotated with the transmitting cam shaft 58 by means of a hereinafter described ratchet or grab clutch. The clutch comprises a driving member or sleeve 78 and a driven member or sleeve 81. The driving member 78 is fixed to the shaft 58 for continuous rotation therewith by a screw 79. Teeth 82 disposed on the left face (Figs. 5 and 8) of the driving sleeve 78 are adapted to operatively engage similar teeth 83 disposed on the right face of the driven member 81. The driven member 81 loosely mounted on the shaft is operatively engaged with the cam sleeve 72 by means of inter-engaging tooth members 84. The driven member 81 is thus engaged with the cam sleeve 72 for rotation therewith, but is adapted to slide along the transmitting shaft 58 to bring its teeth 83 into or out of engagement with the teeth 82 on the driving member 78. The means by which the driven member 81 is actuated along the shaft 58 will be hereinafter described. A circular coiled spring 85 disposed between flanges 86 and 87 on the driven member and cam sleeve respectively normally tends to keep the driven member 81 engaged with the driving member 78.

The left edge of the flange 86 of the driven member 81 as seen in Figure 3, extends axially to form a side cam surface 88 which is adapted to operatively engage a cam follower 89. In the normal or rest position of the cam sleeve 72, the cam follower 89 is engaged with the wide part of the cam surface 88 and thus holds the sleeve member 81 to the front as shown in Figure 3 and its teeth out of engagement with the teeth on the driving member 78.

A transmitter start magnet mounting bracket 91 (Figs. 1 and 7) is attached to the left top section of the keyboard base 21 by screws 92. Attached to a vertical section 93 of the bracket 91 by screws 95 is a magnet base 94 and a transmitter magnet composed of two electro-magnetic coils 96. An armature lever 97 (Figs. 3, 7 and 8) is pivotally mounted adjacent the center thereof on a pin 98 supported by the bracket 91. Rigidly attached adjacent the lower end of the armature lever 97, is the start magnet armature 99 in operative relation with the pole pieces 101 of the start magnets 96. A spring 102 (Figs. 1 and 7) attached to the lower end of the armature lever 97 normally keeps the armature lever in its unoperated position whereupon the cam follower 89 (Fig. 3) integral with the upper end thereof is adapted to engage or be in the path of the side cam surface 88. Upon the energization of the magnet 96, the armature lever 97 is rocked in a clockwise direction as seen in Figure 7 to cause the disengagement of the cam follower 89 (Fig. 3) and the side cam surface 88. Thereupon the driven member 81 is free to slide along the shaft 58 by action of the spring 85 and bring its teeth 83 into engagement with the teeth 82 on the driving member 78. The driven member 81 and the cam sleeve 72 will thereupon rotate with the transmitting cam shaft 58 until the clutch members are forced apart as will be hereinafter described in conjunction with the description of the means for energizing the start magnet 96 to initiate the rotation of the cam sleeve 72.

Pivotally mounted at their lower ends on a

rod 103 supported in the brackets 51 and 52 (Fig. 8) are five contact lever hammers 104 in operative relation with associated cams 73a to 73e on the cam sleeve 72. These hammers 104 will be rocked about their pivot mounting point as is evident from Figure 6, in the desired sequential order by their associated cams as the cam sleeve 72 revolves. They are kept aligned with their associated cams by spacers 105 intermediate with each hammer. In operative relation with each hammer 104 (only one of which is shown in Fig. 6) are associated T-shaped contact levers 106a to 106e (Fig. 1) which have the right top part thereof bifurcated to receive the rod 107 (Fig. 6) onto which they are urged by springs 108 individual to each lever. The rod 107 and a rod 109 to which the stationary ends of the springs 108 are attached are secured in the upper part of the brackets 51 and 52. A set of six spring contacts 111a to 111f (Fig. 3) normally tending to open by means of their spring tongues are mounted between insulating bars 112 attached to the brackets 51 and 52 by screws 113 (Fig. 6). Individual pieces of insulating material 111' attached to the upper end of each spring tongue 111a to 111f press against the left top arm 110 of associated contact lever 106. In the rest position of the cam sleeve 72 the cam 73f, as shown in Figure 2, actuates a rest contact lever 116 which is pivoted on the rod 103 so that the upper end thereof engages the insulating material 111' on the tongue of contact 111f to close said contact. The contact levers 106a to 106e (Fig. 1) are adapted to be actuated by their associated hammers 104 and cams 73a to 73e respectively (Fig. 8) to close the contacts 111a to 111e in predetermined arrangements as will be hereinafter described. The downwardly extending arm of each contact lever 106 (Fig. 6) is adapted to be operatively engaged with a vertical projection 114 on the left end of a substantially horizontal arm of its associated selecting bar lever 54.

A U-shaped universal bar 115 (Figs. 1, 5 and 10) pivoted at the ends on the rod 23 normally has the top edge of the cross part thereof held in contact with the bottom edge of the key levers 26 by a spring 115' attached to a pin 117 in the universal bar and to a spring post 118 in the base 21. The universal bar 115 is adapted to be rocked about its pivot point whenever the key lever 26 is actuated. A bracket 119 (Figs. 9 and 10) attached to the left side of the universal bar 115 carries a pivot pin 121, on which is loosely mounted a transmitter start magnet contact operating member 122. Another bracket 123 fixed to the underside of the base 21 by screws 124 has in its lower end a shoulder screw 125 upon which the tongue 126 (best shown in Fig. 5) of a contact 127 is pivotally and insulatively mounted. The back stop of the contact is insulatively mounted on a bracket 128 attached to the bracket 123. A spring 129 insulatively attached to the tongue 126 and to a spring post 131 in the bracket 123 tends to keep the tongue in contact with its back stop. With the cam sleeve 72 in its rest position (Fig. 9) the contact operating member 122 is adapted to operatively engage with the tongue 126 to open the contact 127 when an actuated key lever nears the limit of its downward movement. Referring to the circuit diagram (Fig. 11) the contact 127 is shunted around the coils of the transmitter start magnet 96. Thus when the contact 127 is open the magnet 96 will be energized which as hereinbefore described actu-

ates the armature lever 97 (Fig. 3) to disengage the cam follower 89 and side cam surface 88 which initiates the rotation of the cam sleeve 72.

5 The operation of the various mechanisms on the actuation of a key lever will now be described in conjunction with the transmission of its associated code combination of impulses. Assume that a key lever 26 representing the letter
10 "A" is to be depressed and according to a pre-arranged signaling code its respective five impulses are 1 and 2 marking and 3, 4 and 5 spacing. In the preferred embodiment the marking position of the selecting bars 42 is to the left as
15 seen in Figure 6 and the spacing position is to the right. Accordingly the beveled edges 47 on the selecting bars are so arranged that when the "A" key lever is depressed the selecting bars 42a and 42b (Fig. 1) will be slid to the left into
20 their marking position and the selecting bars 42c to 42e will be slid to the right into their spacing position. With a selecting bar 42 (Fig. 6) in its marking or left position, its associated selecting bar lever 54 will be in its marking
25 position as shown by the full lines in Figure 6. Similarly when a selecting bar is in its spacing or right position its associated selecting bar lever 42 will be in its spacing position as shown by the dotted lines in Figure 6.

30 Assume that the "A" key lever is depressed and after the selecting bars 42a to 42e have practically reached their respective positions the contact 127 (Fig. 5) is opened and, as described, causes the disengagement of the side cam sur-
35 face 88 (Fig. 3) and cam follower 89. The driven member 81 of the clutch is thereupon free to slide to the left by action of the spring 85 and cause its teeth 83 to engage the teeth 82 on the driving member 78 whereupon the cam sleeve 72 will rotate with the shaft 58. When
40 the cam sleeve is in its predetermined rest position, the cam 73f (Fig. 2) actuates the rest contact lever 116 to close its associated rest contact 111f which as shown in the circuit diagram Figure 11 completes the circuit from bat-
45 tery to line. Referring again to Figure 11, battery 132 is connected through appropriate resistance 134 over conductor 135 to the tongue of contacts 111a to 111e in parallel, and thence over conductor 136 to the contact 127 in parallel
50 with the coils 96 of the transmitting start magnet and then over conductor 137 to the tongue of contact 111f. The back stops of the contacts 111a to 111f are connected in parallel to the outgoing line or telegraph circuit 138. Shortly
55 after the cam sleeve 72 starts to rotate, the high part of cam 73f (Fig. 2) passes out of engagement with the rest contact lever 116 and allows the contact 111f to open by means of its spring tongue. Before the high part of any of
60 the other cams 73a to 73e (Figs. 6 and 8) engage their respective hammers 104, there is an interval equal to about one-seventh of a revolution of the cam sleeve when all the contacts 111a to
65 111f are open. As this disconnects the battery 132 (Fig. 11) from the line 138, there is therefore shortly after the start of every revolution of the cam sleeve an interval in which no current is transmitted to the line 138 and it is known as
70 the start impulse. This conforms with the code combination of impulses employed in which a no current or spacing impulse is transmitted for the start impulse. As the cam sleeve rotates further the high part of cam 73a (Fig. 6) starts
75 to engage its associated hammer 104 and rock it

in a counter-clockwise direction about its pivot. The hammer in turn starts to rock its asso-
ciated contact lever 106a in a clockwise direc-
tion with the rod 107 serving as a pivot. As will
be remembered, the selecting bar 42a was ac-
5 tuated to its marking position and consequently the selecting bar lever 54a will be in its marking position. With the selecting bar lever in this position, the lower end of the contact lever 106a
10 is adapted to operatively engage the projection 114 on the right arm of the selecting bar lever 54a as the cam 73a and associated hammer rock the contact lever. Therefore as the hammer 104
15 is rocked further the lower end of the contact lever 106a will engage the projection 114 and thereafter the contact lever 106a will rock in a counter-clockwise direction with the lower end
20 thereof in contact with the projection 114 acting as a pivot point. The bifurcated upper end of the contact lever will slide to the left on rod 107 and allow the arm 110 to close the contact
25 111a. As there is but little clearance between the lower end of the contact lever and the projection 114, the contact lever will be rocked in a counter-clockwise direction to close the con-
30 tact 111a shortly after the cam 73a starts to engage the hammer 104. The hammer 104 remains in contact with the high part of the cam 73a for about one-seventh of the revolution of
35 the cam sleeve and consequently keeps the associated contact 111a closed for a substantially equal length of time. The hammer 104 in passing out of engagement with the high part of
40 the cam 73a allows the attached spring 108 to return the contact lever 106a and associated hammer 104 to their normal unoperated position whereupon the contact 111a is allowed to open
45 by action of its spring tongue. Referring again to Figure 11, it is evident that while contact 111a is closed, battery 132 is connected to the line 138 and thus an interval of current is trans-
50 mitted. This corresponds to the first impulse, which is marking, of the code combination of impulses of the selected character representing the letter "A". As the high part of the cam 73a
55 is passing out of engagement with its associated hammer 104, the high part of the cam 73b starts to engage its associated hammer 104. The selecting bar lever 54b being in its marking position, the contact 111b will be closed by its as-
60 sociated contact lever 106b, in the same manner as contact 111a was closed and thus transmit to the sending circuit another marking impulse which corresponds to the second impulse of the
65 code combination of impulses representing the letter "A". In the preferred embodiment of the invention the contacts 111a to 111e and cams 73a to 73e are so arranged and adjusted that
70 when the code combinations of impulses are such that two or more consecutive impulses are marking there will be no break in the transmission of such marking impulses, they being trans-
75 mitted as one continuous marking impulse substantially equal in length to the sum of its individual impulses.

As the high part of cam 73b passes out of engagement with its associated hammer 104, the high part of the cam 73c starts to rock its asso-
ciated hammer about its pivot mounting point. As described above, the selecting bars 42c to 42e
70 in their spacing position will actuate their associated selecting bar levers 54c to 54e to their spacing position. This renders the projection 114 on said selecting bars, as shown by the
75 dotted selecting bar lever in Figure 6, out of the

path and therefore unengageable with the lower ends of their associated contact levers 106c to 106e. Thus as the hammer 104 rocks in a counterclockwise direction it will cause its associated contact lever 106c to pivot about the rod 107 with practically no horizontal movement of the arm 110 and therefore contact 111c will remain open. Referring again to the circuit diagram Figure 11, all the contacts 111a to 111f being open allows a no current impulse to be transmitted to the line which corresponds to the third impulse of the code combination of impulses representing the letter "A". Contacts 111d and 111e are allowed to remain open as the high part of their respective cams engage their associated hammers in the same manner as contact 111c was allowed to remain open. Accordingly the fourth and fifth impulses are impulses of no current and are transmitted to the line and correspond to the fourth and fifth impulses representing the selecting character. Referring to Figures 2, 5, 6 and 11, as the cam sleeve 72 nears the end of its revolution, the hammer 104 associated with the cam 73e disengages the high part of said cam whereupon the high part of cam 73f actuates its associated rest contact lever 116 to again close the rest contact 111f. This connects battery to the line and thus transmits the marking rest impulse. While the cam 73f is engaged with its contact lever 116, the cam sleeve 72 will be brought to rest in its predetermined rest position at the completion of one revolution thereof as will be hereinafter described. Referring to Figure 11 in conjunction with the above paragraphs, it is evident that shortly after the cam sleeve started to revolve there was an interval when all the contacts 111a to 111f were open. Thus an interval of no current was transmitted which corresponds to the start impulse of the signal. On the following two intervals contacts 111a and 111b respectively were closed and consequently transmitted to the line two intervals of current. As no contacts were closed for the next three intervals, three intervals of no current were transmitted. On the last part of the revolution of the cam sleeve the contact 111f was again closed to transmit the rest impulse of the signal. Thus the five impulses representing, according to a predetermined arrangement, the letter "A" preceded by a spacing start impulse and followed by a marking rest impulse were transmitted.

Pivotally mounted on pins 139 and 141 (Figs. 2, 5 and 6) in the brackets 51 and 52 respectively, is a U-shaped selecting bar lever locking-member 142. A roller cam follower 143 pivotally carried on a shoulder screw 144 in an arm of the member 142 is in operative relation with the cam 74 on the cam sleeve 72. The cross section 145 (Fig. 6) of the locking member 142 is wedge-shaped and is adapted to be operatively engaged with the hooked upright arms 146 of the selecting bar levers 54. A spring 147 attached to the locking member tends to keep the cam follower 143 engaged in its associated cam 74. When the cam sleeve 72 is in its rest position, the cam follower 143 is engaged with the high part of the cam 74 and therefore the cross section 145 of the locking member is out of engagement with the hooked ends 146 of the selecting bar levers. When the cam sleeve 72 has rotated a few degrees from its rest position, the high part of the cam 74 passes out of engagement with the follower 143 and the spring 147 is allowed to raise the locking member 142. Thereupon its wedge section 145 will engage with either the right or left side

of the hooked ends 146 of the selecting bar levers 54a to 54e, depending on their respective positions as shown in Figure 6 by the dotted outline of the wedge section 145 and a hooked end 146. Near the end of the revolution of the cam sleeve 72, the high part of the cam 74 again engages the cam follower and actuates the locking member 142 to disengage the wedge section 145 thereof from the hooked ends 146 of the selecting bar levers. The locking member 142 thus holds the selecting bar levers in their actuated positions during substantially the whole revolution of the cam sleeve 72 and prevents them from moving during the transmission of the code combination of impulses which their position represents.

A mechanism is provided whereby a subsequent key lever can not be depressed until the transmission of the code combination of impulses corresponding to the previously actuated key lever has been completely transmitted, which prevents the subsequent code combination of impulses from breaking in on the previous combination of impulses. This mechanism called the "safety device" also provides means whereby the code combination of impulses transmitted will not be repeated if its associated key lever is held depressed for a longer length of time than is necessary for the transmission of said impulses. Thus if repeat signals are desired, the key lever must be returned to its normal position and depressed again at the end of the transmission of the first combination of impulses as allowed by the safety device which will now be described.

Pivoted on a shoulder screw 148 (Fig. 1) in the bracket 52 is a bell crank 149 (Figs. 9 and 10). Pivotally carried on a shoulder screw 151 in an arm of the bell crank 149 is a roller cam follower 152 in operative relation with the cam 75. A spring 153 attached to the bell crank keeps the cam follower 152 engaged with the cam 75. The downwardly extending arm of the bell crank 149 extends through a hole in the base 21 and carries on the lower end thereof a pin 154 on which is pivoted the left end of a link 155. The right end of the link 155 is pivoted on a pin 156 carried in the upper end of a lever 157. The lever 157 is fixed for rotation therewith to a rod 158 supported by a bracket 159 (Figs. 3 and 5) which in turn is attached to the underside of the base 21. Also fixed to the rod 158 for rotation therewith is a collar 161 and a hammer 162 which is in operative relation with the contact operating member 122 (Figs. 9 and 10). Pivotally mounted on the end of the rod 158 is a universal bar stop arm 163 which is limited in its pivoting with respect to the collar 161 (Fig. 5) by a notch 164 (Figs. 9 and 10) in the stop arm engaging with a pin 165 carried in the collar 161. A spring wire 166 coiled about the collar has one end engaged by the stop arm 163 and tends to rotate the stop arm in a clockwise direction as seen in Figs. 9 and 10 so as to keep the left side of the notch 164 against the pin 165. A retractile spring 167 attached to the contact operating member 122 and to a bracket 168 attached to the universal bar 115, keeps the hammer 162 and contact operating member 122 engaged. Fig. 9 shows the position of a part of the safety mechanism when the transmitter cam sleeve 72 is in its rest position. The depression of a key lever, as heretofore described, actuates the universal bar 115 and contact operating member 122 to open the contact 127 during the last part of the stroke of said key lever 26, whereby to initiate the rotation of the cam sleeve 72. Shortly after the cam

sleeve starts rotating, a notch 169 in the cam 75 passes out of engagement with the follower 152 and consequently rocks the bell crank 149, and by means of the link 155 and arm 157, rocks the rod 158 and collar 161 in a clockwise direction into the position shown in Fig. 10. For this cycle of operation of the keyboard, it will be assumed that the actuated key lever 26 was released immediately after being depressed, whereupon the key lever and universal bar 115 will return to their normal position. Now, as the hammer 162 and stop arm 163 rock with the rod 158, the hammer 162 will allow the spring 167 to pull the contact operating member 122 out of operative relation with the tongue 126 of the contact 127 and the stop arm 163 will be in a position with the upper end thereof beneath the universal bar 115. Therefore, no key lever 26 can be depressed an appreciable amount since they are blocked by the universal bar 115 coming in contact with the top of the stop arm 163. As is apparent from the shape of the cam 75, the stop arm 163 and hammer 162 will remain as shown in Fig. 10 for practically the complete revolution of the cam sleeve 72, returning to their normal position as shown in Fig. 9 when the cam follower 152 drops into the notch 169 as the cam sleeve is brought to rest by means to be hereinafter described. When the contact operating member 122 disengages the tongue 126 of the contact 127, the spring 129 closes the contact. As shown in the circuit diagram (Fig. 11) this provides a shunt circuit around the coil 86 of the transmitter start magnet whereupon the magnet will be deenergized. This in turn allows the armature lever 97 (Fig. 3) to return to its unoperated position, whereupon the cam follower 89 integral with the upper end thereof, will be in the path of the side cam surface 88. As the cam sleeve 72 nears the end of a revolution, the cam follower 89 engages the side cam surface 88 and due to the shape of the side cam surface, causes the driven member 81 to slide to the right on the transmitting cam shaft and consequently disengage its teeth 83 from the teeth 82 on the driving member 78. The driven member 81 continues to rotate due to its inertia until a further projection of the side cam surface 88 engages the cam follower 89 and stops the cam sleeve 72 and associated parts in their predetermined rest position. From the above description it is apparent that a second key lever can be operatively actuated only after the completion of the transmission of the code combination of impulses corresponding to the preceding actuated key lever. This prevents the premature starting of transmission of a second combination of impulses before the complete transmission of the preceding combination.

The operation of the safety mechanism will now be described in conjunction with the transmission of a combination of impulses when the associated actuated key lever is held down for a length of time longer than is necessary for the transmission of said impulses. The rotation of the cam sleeve will be initiated as usual by the actuation of a key lever, whereupon it proceeds to transmit the representative combination of impulses as heretofore described. In accordance with the above stated conditions the universal bar 115 (Figs. 9 and 10) will be held in its operated position by the actuated key lever 26 and the contact operating member 122 will remain engaged with the tongue of the contact 127 until the bell crank 149 causes the rod 158 to be rotated into the position shown in Fig. 10. Whereupon

the hammer 162 rotating with the rod 158 allows the spring 167 to slide the lower end of the contact operating member 122 to the right and out of engagement with the tongue 126 of the contact 127. The contact 127 then closes and causes the cam sleeve 72 to be stopped when it reaches its predetermined rest position as hereinbefore described. As the rod 158 rotates from its first position, the spring 166 brings the top of the universal bar stop arm 163 against the side of the universal bar 115 where it remains until the rod 158 rotates into its normal position as the cam follower 152 drops into the notch in the cam 75 at the end of the revolution of the cam sleeve. As the rod 158 and the hammer 162 rotate to their normal position, the hammer rocks the contact operating member 122 and causes the lower end thereof to come in contact with the side of the contact tongue 126 and further rotation of the hammer 162 causes the slot in the upper end of the contact operating member 122 to slide on the pin 121. Thus the contact 127 cannot be opened to initiate the rotation of the cam sleeve 72 for another cycle of operation until the actuated key lever has been returned to its normal position. When the universal bar 115 finally rises, it causes the contact operating member 122 to disengage with the side of the contact tongue 126 and allows the spring 167 to return it to its normal position where it is again in operative relation with the upper face of the contact tongue, as shown in Fig. 9. If, in the above described cycle of operation, the depressed key lever had been released during the transmission of its associated combination of impulses, the spring 166 would have urged the universal bar stop arm 163 beneath the universal bar 115 and as described in the first cycle of operation, prevented the actuation of the same or another key lever until after the combination had been completely transmitted. The key levers controlling the release of the cam sleeve are therefore adapted to be actuated only when the cam sleeve has very nearly completed its revolution or is in its predetermined rest position. As an appreciable length of time is required to actuate a key lever, the cam sleeve is certain to be brought to a stop in its predetermined rest position at the end of every revolution before it can again be released. This assures that the associated recorder will start every cycle of operation in correct phase relationship with the transmitting keyboard.

This keyboard is intended primarily for use in conjunction with an associated recording unit which is adapted to be removably attached to the top of the base 21. Screw-holes 171 and locating pins 172 are provided in the top of the base to insure the proper locating of the recording unit thereon. When operated in conjunction with an associated recorder, a common motor is used to furnish local power through appropriate gearing for both units, the motor being attached to the recording unit. It is to be understood, however, that the keyboard may be used as a separate unit by providing a motor M to continuously rotate the gear 68, such a motor being shown in Fig. 3. The combined units may be used to alternately receive or transmit in which case the selector magnet of the recorder is connected in series with the outgoing line.

A Bakelite block 173 (Figs. 1 to 4) mounted on posts 174, is attached to the base 21 by screws 175. Attached to the Bakelite block 173 are a series of spring clips 176 which are adapted to make electrical connections with similar clips on

the associated recorder unit. Four posts 177 secured in the four corners of the base 21 serve as guides for a silencing cover used to keep dust and dirt out of the combined units. A series of
 5 four rubber feet 178 attached to the underside of the base casting prevents the keyboard from resting directly on a table or other supporting means. Ample space is provided in the rear of the keyboard housing for attaching resistances
 10 and condensers that may be used in conjunction with a motor governor. The letter space key lever 26', which is the first key lever from the left, engages with a pin 179 (Figs. 1 and 3) on the left arm of a space key lever operating member 181. The space key operating member sup-
 15 ports an elongated space key 182 at the center of the keyboard and is pivotally mounted on screws 183 (Figs. 2 and 5) in blocks 184 attached to the keyboard base 21.

20 A modification is shown in Fig. 13 which is adapted to be used in conjunction with the preferred form of the invention. The modification consists of a contact 185 which is connected in series with the rest contact 111f as shown in the
 25 modified circuit diagram (Fig. 12). This contact 185 is insulatively mounted by screws 186 to the start magnet mounting bracket 91 and is closed in its normal position. The tongue of the contact has an insulating block 187 attached to
 30 its upper end which is adapted to be operatively engaged by a contact operating member 188 attached to the upper end of the armature lever 97. When the start magnet 96 is deenergized, the contact 185 will be closed by action of its
 35 spring tongue and when the start magnet is energized, the contact operating member 188 is adapted to open the contact 185 simultaneously with the release of the cam sleeve 72 and prior to the opening of the contacts 111f by the cam
 40 73f. Referring to the modified circuit diagram (Fig. 12) it can be seen that when contact 185 is opened, it initiates the start impulse. The initiating of the start impulse by the contact 185 permits the contact 111f to be opened later in the
 45 cycle but, of course, prior to the transmission of the first selecting impulse.

It is obvious, of course, that various other modifications of the apparatus and circuits shown and described herein may be made without departing
 50 from the spirit or essential attributes of the invention and it is desired, therefore, that only such limitations shall be placed thereon as are imposed by the prior art or are specifically set forth in the appended claims.

55 What is claimed is:

1. In a keyboard transmitter, a rotatable sleeve member, a plurality of key levers, a plurality of code bars operative to various combinations of settings by said key levers, a plurality of rock-
 60 able members individual to each of said code bars and operated in accordance with the position of said code bars, a set of transmitting contacts, a set of contact operating members, a set of associated actuators for said contact oper-
 65 ating members operable by said rotatable sleeve member, and means whereby said contact operating members are selectively operated by said associated actuators to operate said contacts in accordance with the positions of said rockable
 70 members.

2. In keyboard transmitting apparatus for telegraphs employing a definite interval start-stop code, a set of selecting bars, a set of trans-
 75 mitting contacts and a rest contact, a distributor mechanism normally actuating said rest contact

to transmit a rest impulse and adapted upon the movement of said distributor mechanism from a normal position to invariably transmit a start impulse and thereafter cooperating with means controlled by said selecting bars to selectively
 5 actuate said transmitting contacts to transmit impulses corresponding to the settings of said selecting bars and invariably thereafter again actuate said rest contact to transmit another rest
 10 impulse, electrical means for initiating the operation of said distributor mechanism and means for bringing said distributor mechanism to normal condition after each operation thereof.

3. In a permutation keyboard for telegraphs and the like, a set of transmitting contacts, a
 15 set of contact operating members adapted to pivot about one of two points thereof, means for determining the pivot points of said contact operating members, and means for pivoting said
 20 contact operating members about determined pivot points to selectively actuate said contacts.

4. A permutation keyboard mechanism comprising a rotatable cam sleeve, a group of key levers, a set of selecting bars, a plurality of transmitting contacts, a plurality of contact op-
 25 erating members, means controlled by said selecting bars to variably condition said contact operating members for operation, and means operated by said rotatable cam sleeve for invariably actuating said contact operating members to
 30 variably operate said transmitting contacts.

5. In a telegraph transmitter, a group of key levers, a universal bar adapted to be operated by any one of said key levers, a rotatable distributor mechanism, means controlled by said universal
 35 bar to initiate the rotation of said distributor mechanism, means operated by said distributor mechanism to stop the rotation thereof at the end of one revolution and means controlled by said distributor mechanism and cooperating with
 40 said universal bar to prevent subsequent operation of a key lever during the rotation of said distributor mechanism.

6. In apparatus for telegraph systems employing signals separated by space intervals and
 45 each comprising a starting interval and a definite number of selecting intervals, a plurality of current controlling contacts, key levers, a plurality of permutation bars selectively responsive to actuated ones of said key levers, a plurality of con-
 50 tact controlling members, a plurality of members operable by said permutation bars cooperating with said contact controlling members, an independently rotatable cam sleeve, a plurality of rockable members for selectively actuating said
 55 contacts in accordance with the position of said permutation bars, electrically controlled means for releasing for rotation said cam sleeve simultaneously with the positioning of said permutation bars and means for stopping said cam sleeve
 60 at the completion of one revolution.

7. In a keyboard transmitter, a rotatable cam sleeve, a bank of key levers, a set of contacts selectively and indirectly operated by said cam sleeve to transmit code combinations of impulses,
 65 and electromagnetic means controlled by said key levers to initiate the rotation of said cam sleeve and means operated by the above mentioned means independent of said cam sleeve for initiating a start impulse whereby a start impulse
 70 invariably precedes a combination of impulses.

8. A keyboard transmitter employing a definite interval code, a set of contacts, a distributor mechanism cooperating with said set of contacts to transmit code combinations of impulses, a 75

bank of key levers, electro-magnetic means controlled by said key levers to initiate the operation of said distributor mechanism, means controlled by said distributor mechanism to invariably return said distributor mechanism to a normal condition after each operation thereof, means operated by said electro-magnetic means to initiate a start impulse to precede each combination of impulses and means operated by said distributor mechanism to follow each combination of impulses with a rest impulse.

9. In a telegraph transmitter, an independently rotatable member, means for rotating said member, electromagnetic means for rendering said last named means operable to rotate said member, means for stopping the rotation of said rotatable member in a predetermined point in its rotation, a group of current controlling contacts, a series of pivoted members, means operated by said rotatable member to sequentially actuate said series of pivoted members, and means operated by said pivoted members to selectively and sequentially operate said group of current controlling contacts.

10. In a telegraph transmitter, a rotatable member with a plurality of cams prearranged thereon, means for rotating said member, means for rendering said last mentioned means operable, means for invariably stopping the rotation of said member after one revolution thereof, a plurality of rockable members, means operable by said cams to sequentially actuate said rockable members, a set of current controlling contacts and means operated by said rockable members whereby said set of current controlling contacts are selectively and sequentially operated in combinations according to the code combinations of impulses to be transmitted.

11. In a telegraph transmitter for transmitting code combinations of impulses, a group of members having two varieties of motion but normally restrained from motion, a transmitting contact individual to each member of said group, means operative to actuate said members in successive order and solely mechanically operated means to restrain the movement of said members in one variety of motion and thereby compel the movement of said members in the other variety of motion in combinations according to the signal to be transmitted.

12. In a keyboard transmitter, a set of key levers, an independently rotatable member, a set of current controlling contacts, a series of contact levers having two varieties of motion, means operable by said rotatable member to sequentially actuate said contact levers in one variety of motion and means controlled by the actuation of one of said key levers to restrain the movement of said contact levers in said first variety of motion and to compel the movement thereof in a second variety of motion whereby said contacts are actuated in combinations corresponding to the actuated key lever.

13. A telegraph transmitter comprising a rotatable cam sleeve, a series of variably operable current controlling contacts, an associated series of elements having two varieties of motion but normally restrained from motion by two unequal pressures, means operable by said cam sleeve to move said elements in successive order, means to positively restrain the movement of said elements in the motion of least normal restraint and to compel thereby the movement thereof in the motion of greater normal restraint to actuate associated current controlling contacts in combinations according to the signal to be transmitted.

nations according to the signal to be transmitted.

14. In a telegraph signaling mechanism for transmitting telegraphic code impulses of the start-stop variety, a series of key levers, an independently rotatable member for controlling the transmission of said code impulses, means for limiting the operation of said key levers, an electro-magnetic mechanism, means controlled by the operation of any one of said key levers to render said electro-magnetic mechanism operable, means controlled by said electro-magnetic mechanism to initiate the rotation of said rotatable member jointly with the initiating of a start impulse, means for rendering said electro-magnetic means nonoperative during the rotation of said rotatable member and means whereby said electro-magnetic controlled means invariably stops the rotation of said rotatable member after one cycle thereof.

15. In a signaling transmitter, an independently rotatable distributor, means operable by said distributor to transmit combinations of a definite number of line condition impulses, means independent of said distributor to invariably initiate, prior to the transmission of said combinations of line conditions, the transmission of an impulse of uniform line condition and means operable by said distributor to terminate said impulse of uniform line condition.

16. In a signaling transmitter, a rotatable distributor mechanism, means operable by said distributor mechanism to transmit code combinations of impulses, and means independent of said distributor mechanism to invariably precede each combination of impulses with an impulse of uniform condition.

17. In apparatus for telegraph systems employing a definite interval code, a group of transmitting contacts, a set of key levers, a rotatable member, means cooperating with said rotatable member to selectively and sequentially actuate said contacts to transmit combinations of impulses according to an actuated key lever, means independent of said rotatable member to invariably transmit a start impulse prior to the actuation of said contacts and means operable by said rotatable member to invariably transmit a rest impulse following the transmission of said combinations of impulses.

18. In a telegraph mechanism for transmitting combinations of a definite number of impulses preceded by a starting impulse and followed by a resting impulse, a set of transmitting contacts equal in number to the impulses in said combinations, a rest contact, a start contact in series with said rest contact, a rotatable member cooperating with means to selectively control said transmitting contacts, means for releasing said rotatable member, means cooperating with said start contact to invariably transmit a start impulse, means operable by said rotatable member whereby said start contact is normally positioned and means for invariably operating said rest contact to transmit a rest impulse after actuation of said transmitting contacts.

19. In a telegraph transmitter for transmitting combinations of a definite number of impulses separated by space impulses and preceded by starting impulses, a set of current controlling contacts, an associated set of controllers therefor, an independently rotatable member, means cooperating with said rotatable member and said contact controllers to selectively and sequentially control said contacts, a start magnet for initiating the rotation of said rotatable

member and means operable directly by said start magnet to transmit said starting impulse.

20. In a telegraph transmitter, an independently rotatable distributor mechanism, a magnet
5 for controlling the rotation of said distributor mechanism, a first contact adapted to render said magnet energized whereby said distributor mechanism is released for rotation, means for actuating said first contact, a second contact,
10 means controlled by said magnet after the release of said distributor mechanism whereby said second contact is actuated to interrupt the circuit to said magnet whereupon said magnet controlled means is conditioned to stop the ro-
15 tation of said distributor mechanism after one cycle thereof and means operable after a predetermined amount of rotation of said distributor mechanism to render said first contact actuating means unoperable during the remainder of
20 the cycle of operation of said distributor mechanism.

21. In a keyboard transmitter, a distributor mechanism, magnetic means for controlling said distributor mechanism, a set of key levers, a uni-
25 versal bar operable by said key levers, a contact for controlling said magnetic means, means carried by said universal bar to operate said contact and means operable by said distributor mechanism for rendering said contact operating
30 means unoperable during the operation of said distributor mechanism.

22. A keyboard transmitter comprising an independently rotatable member, a bank of key levers, a universal bar operable on the actuation
35 of any one of said key levers, magnetically operated means for initiating and stopping the rotation of said rotatable member, a contact for controlling said magnetic means, a contact operating member carried by said universal bar,
40 means operable when said rotatable member is normally positioned whereby said contact oper-

ating member is adapted to actuate said contact to initiate the rotation of said rotatable member, and means operable by said last mentioned means whereby said contact operating member is rendered unoperative with respect to said contact
5 during the rotation of said rotatable member whereupon said magnetic means is rendered operable to stop the rotation of said rotatable member at a predetermined point in its rotation.

23. In apparatus for telegraph systems employing a definite interval code, a group of transmitting contacts, a set of key levers, a rotatable member, means cooperating with said rotatable member to selectively and sequentially actuate
10 said contacts to transmit combinations of impulses according to the actuated key lever, means to concomitantly release said rotatable member and initiate a start impulse prior to the operation of said contacts, means operable by said ro-
15 tatable member to terminate said start impulse and other means operable by said rotatable member to invariably transmit a rest impulse following the transmission of said combination of impulses.

24. In a telegraph transmitter, a plurality of
25 key levers, a set of transmitting contacts, means for actuating said contacts in accordance with the operation of said key levers to transmit representative groups of code combinations of impulses, means tending to return operated key
30 levers to a normal position, said means being operative to return an operated key lever to normal immediately on the release thereof, and means for preventing the reoperation of a key lever until substantially the completion of the
35 transmission of the code group in response to the initial operation thereof.

ROBERT F. DIRKES.
GEORGE I. ROBERTS. 40