No. 676,091. Patented June 11, 1901.

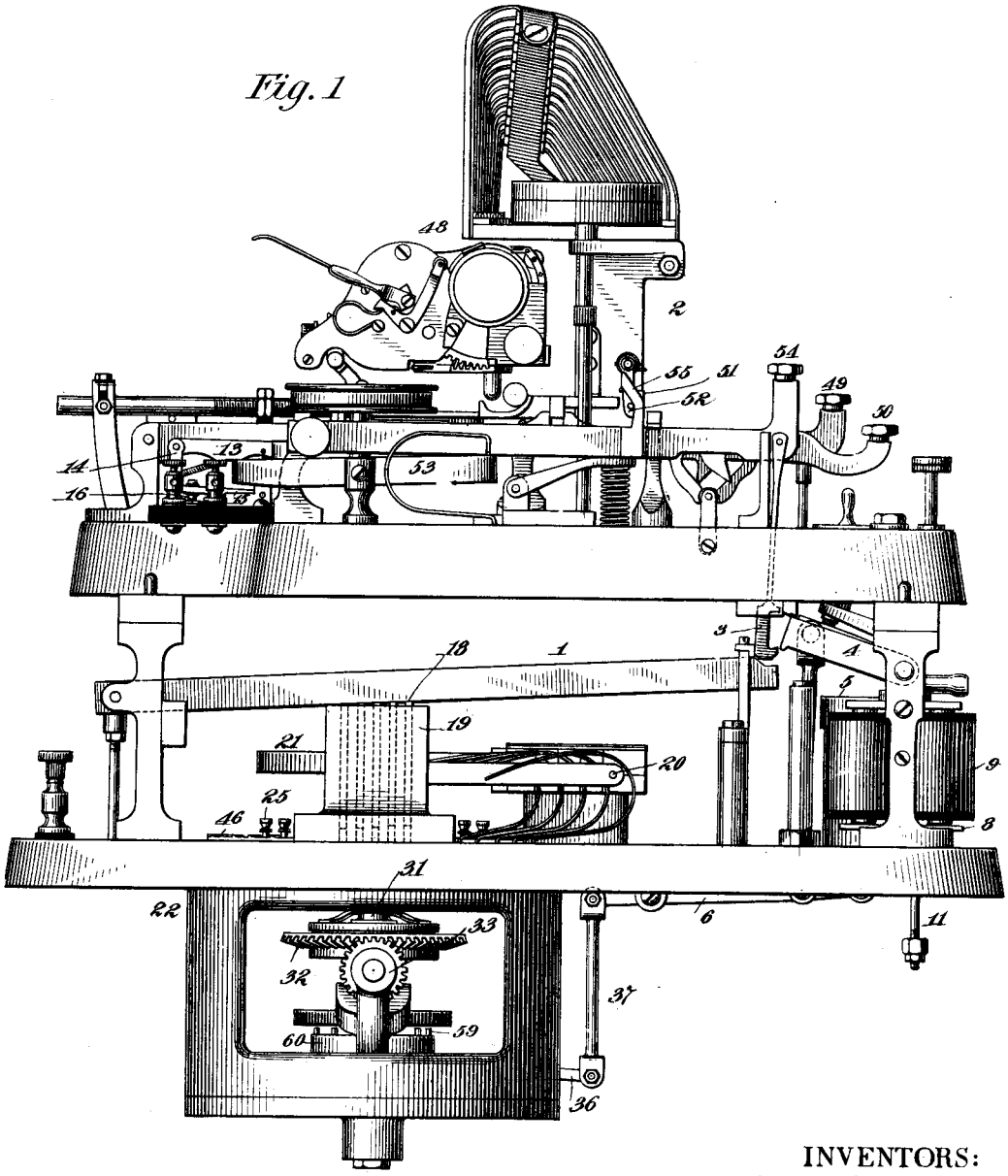
K. HIMROD, J. R. TUCKER & C. C. HINCKLEY.

PRINTING TELEGRAPH TRANSMITTING APPARATUS.

(Application filed Mar. 10, 1899.)

(No Model.) 10 Sheets—Sheet 1.

Fig. 1



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WITNESSES:

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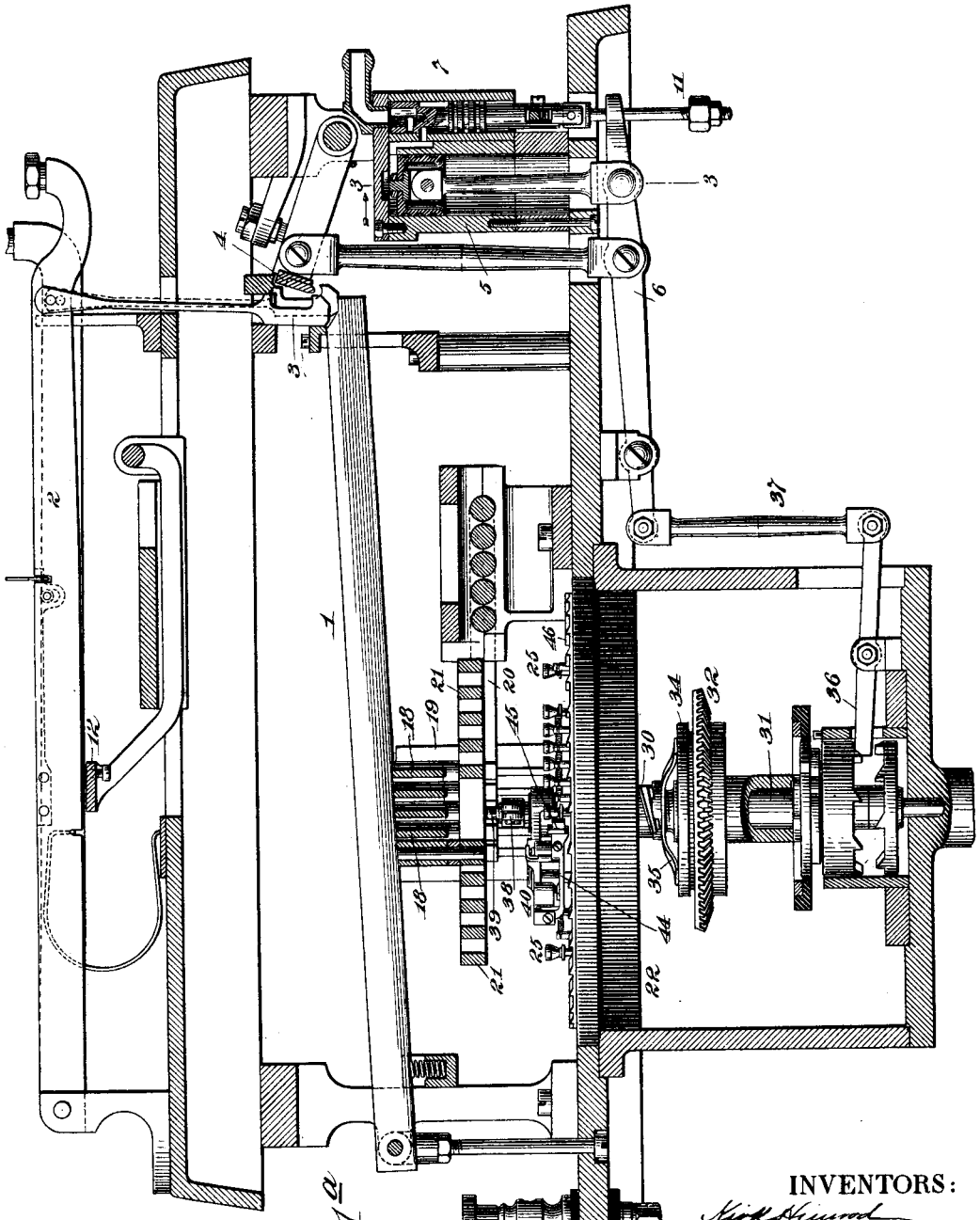

Fig. 1.

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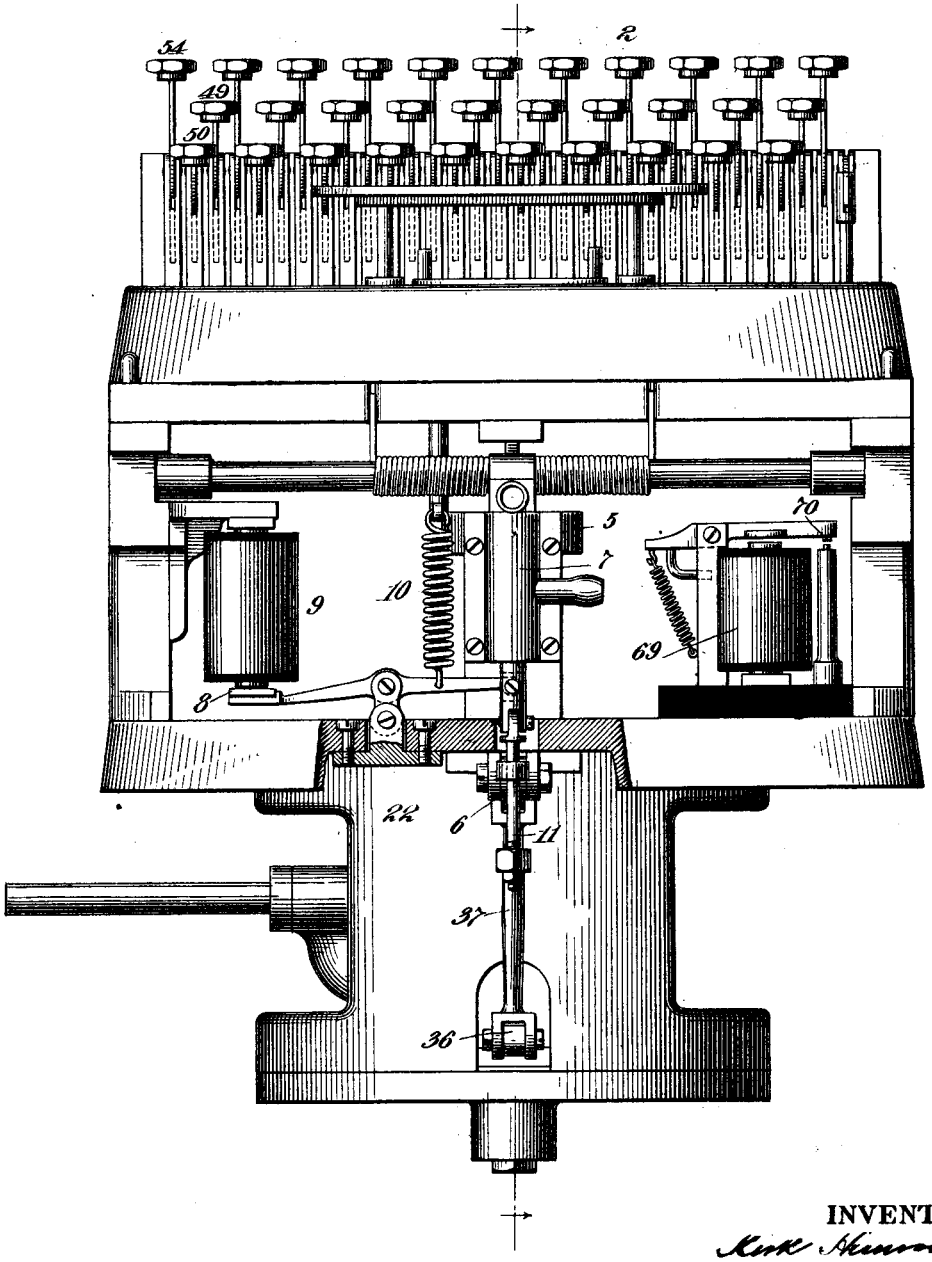
Fig. 2



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(No Model.) 10 Sheets—Sheet 4.

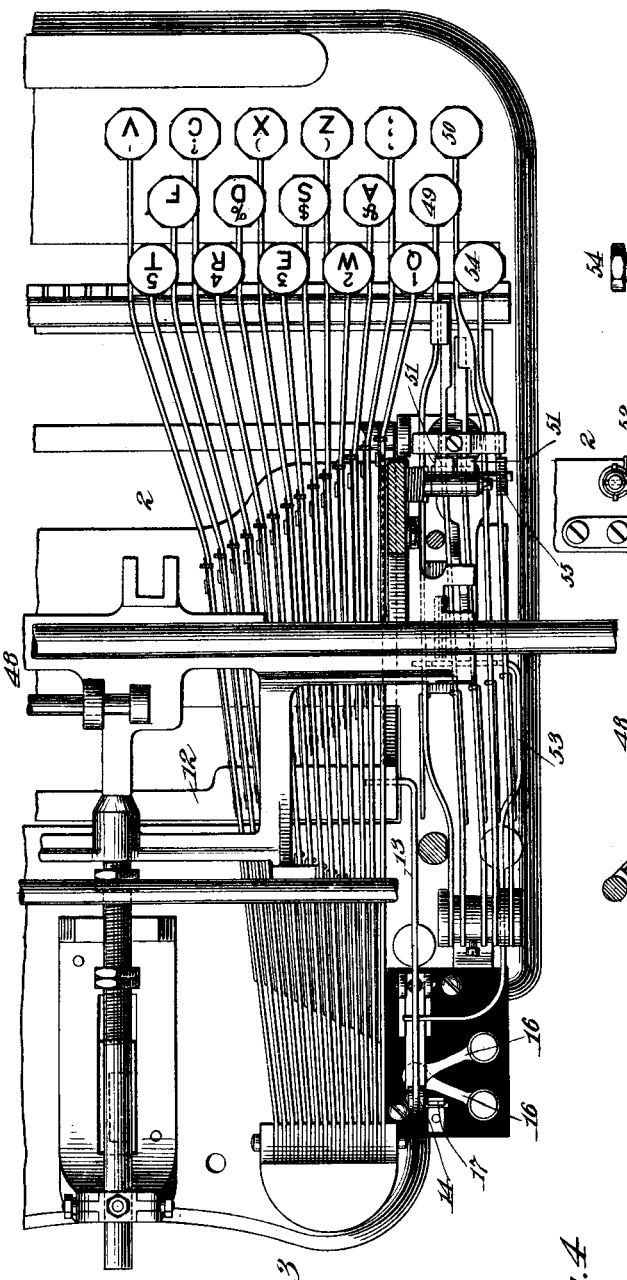

Fig. 3

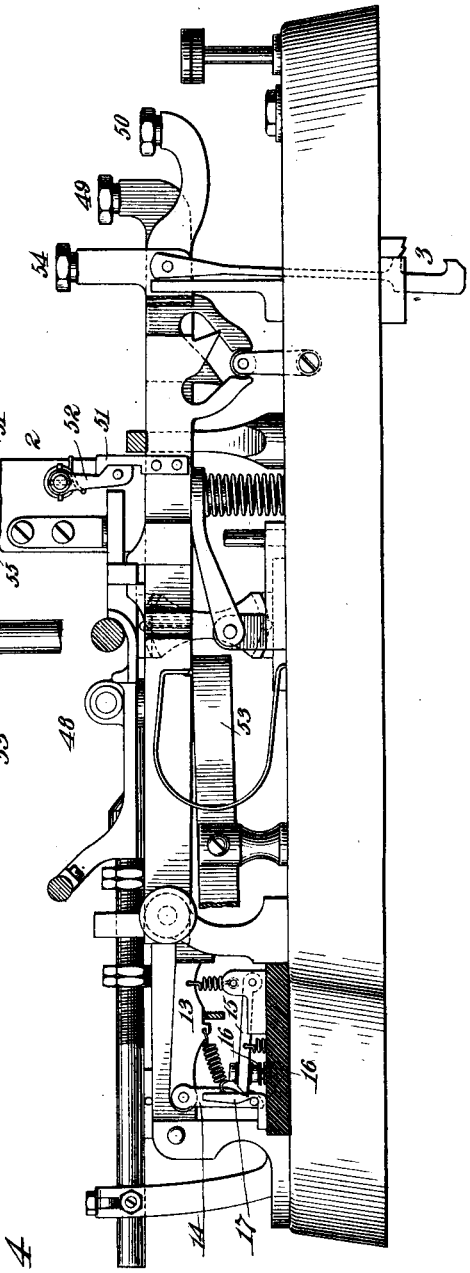

Fig. 4

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Fig. 5

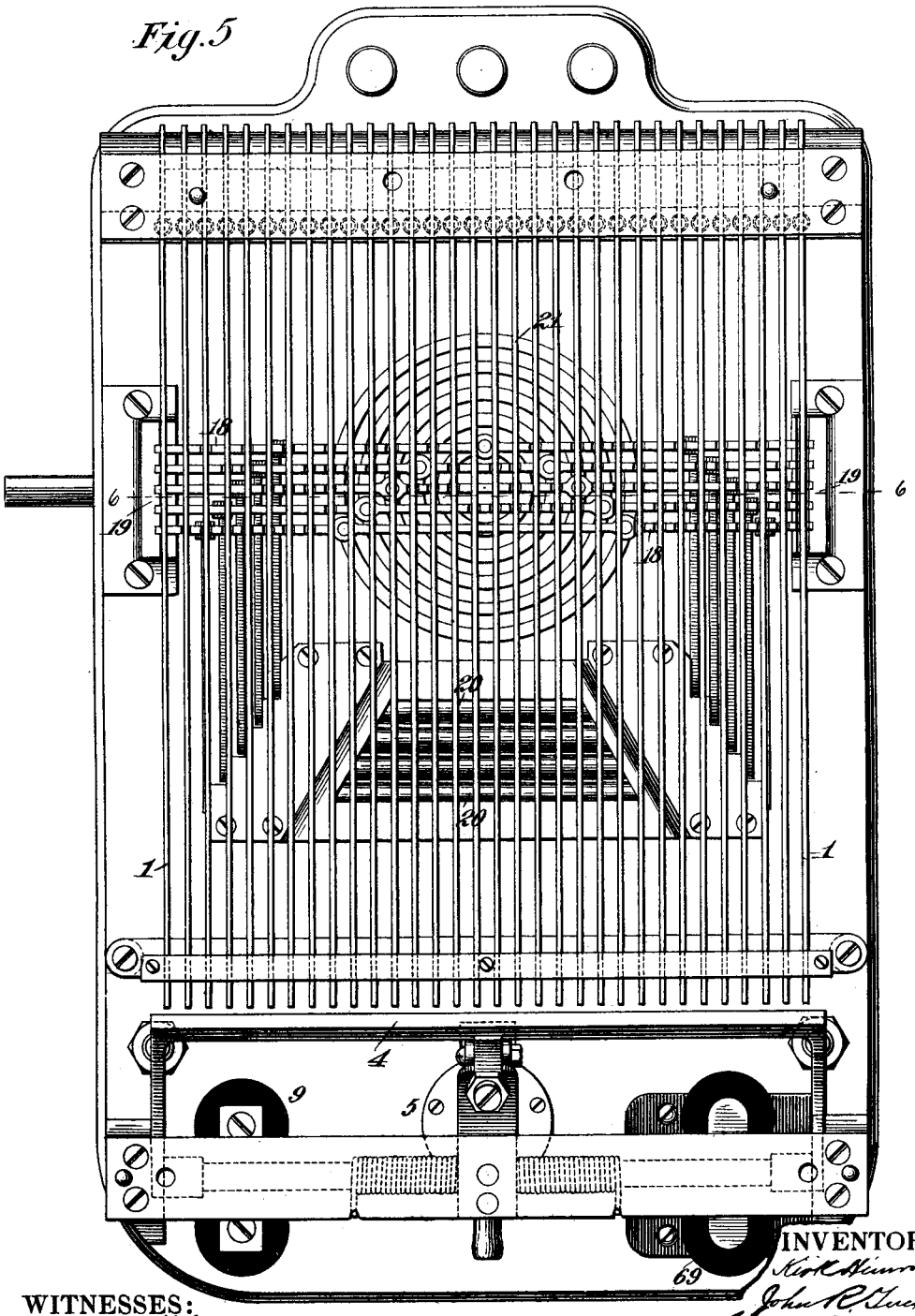

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Fig. 6

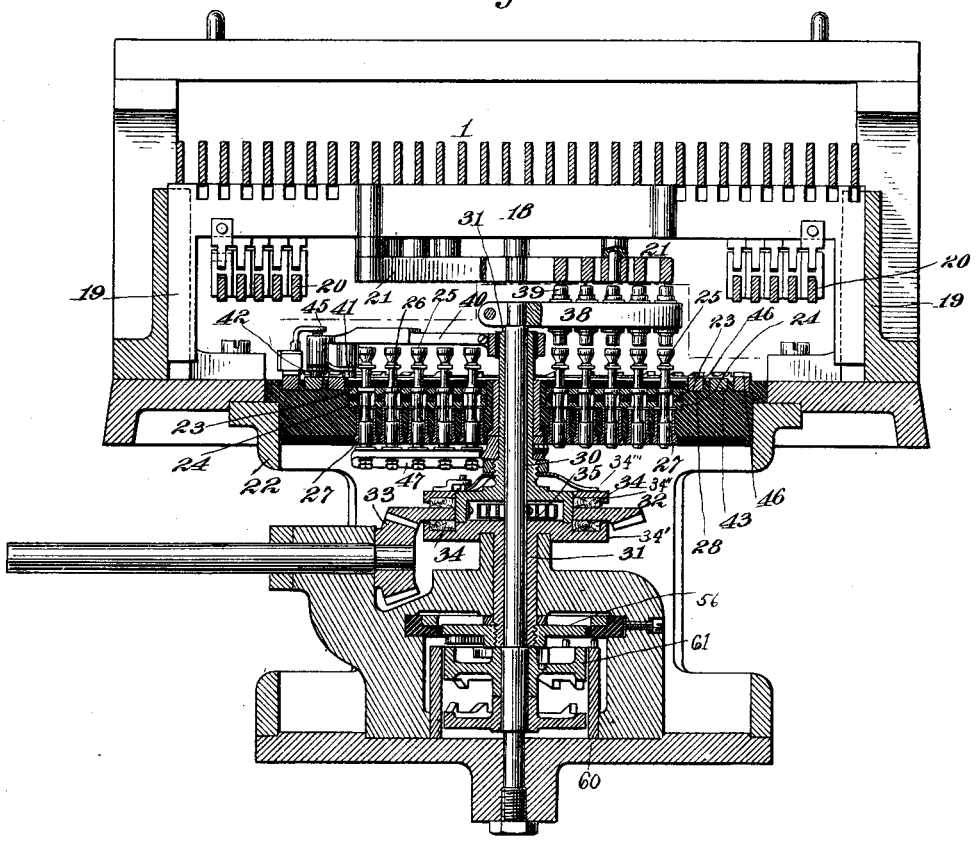
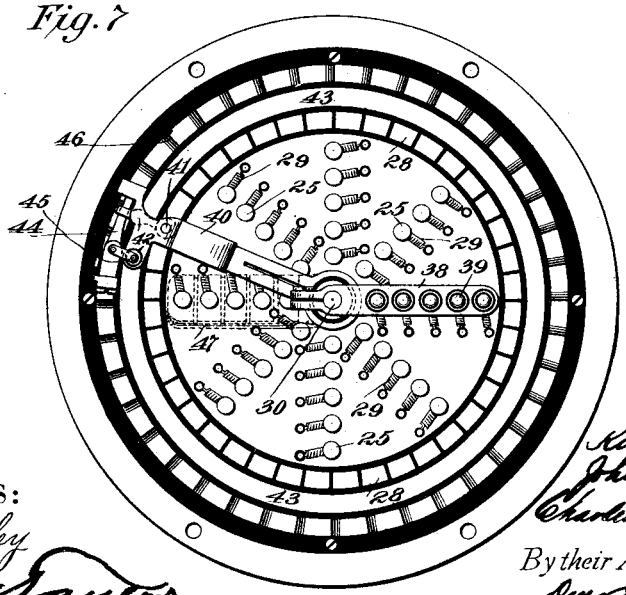


Fig. 7



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PRINTING TELEGRAPH TRANSMITTING APPARATUS

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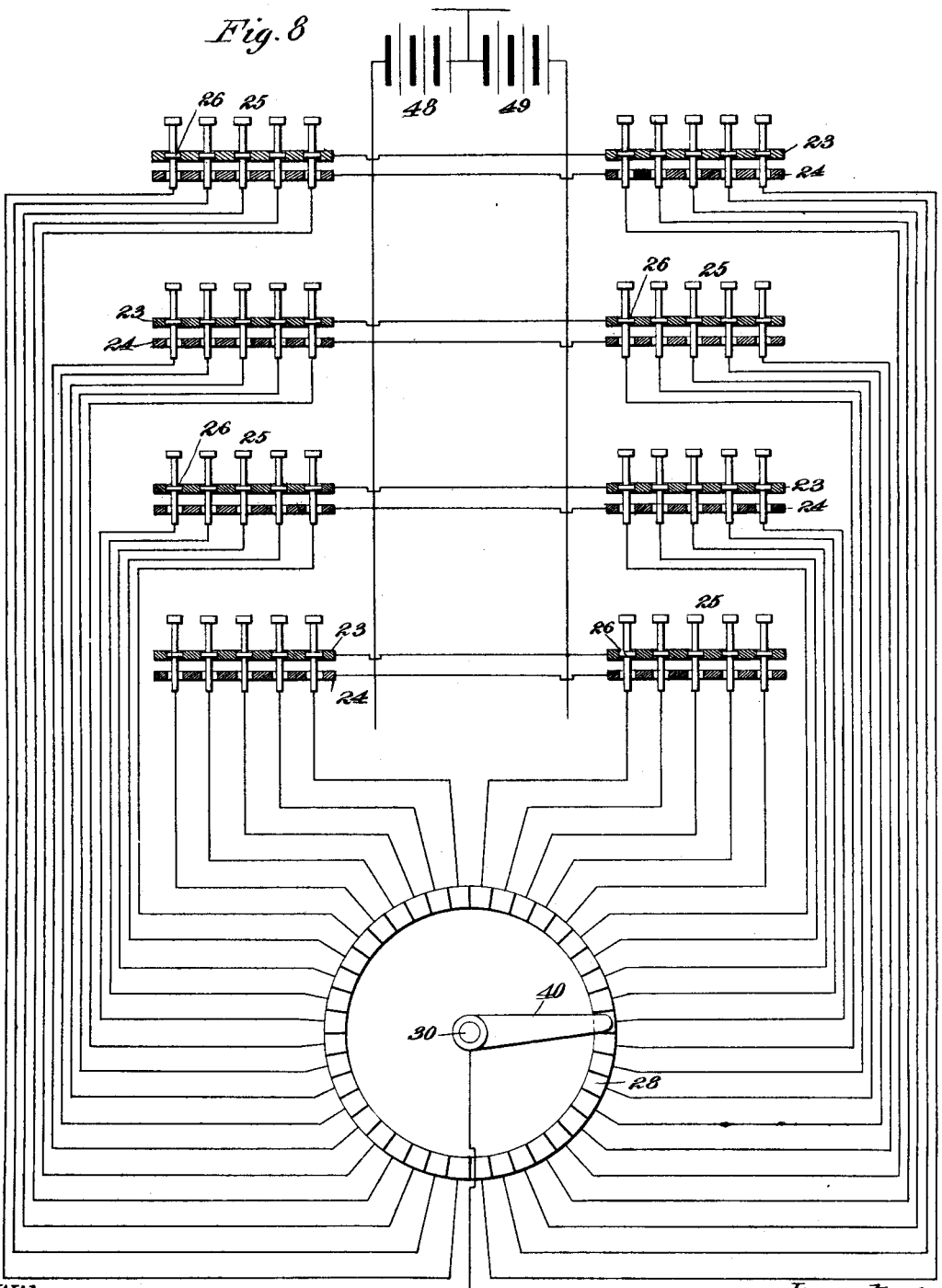
Fig. 8



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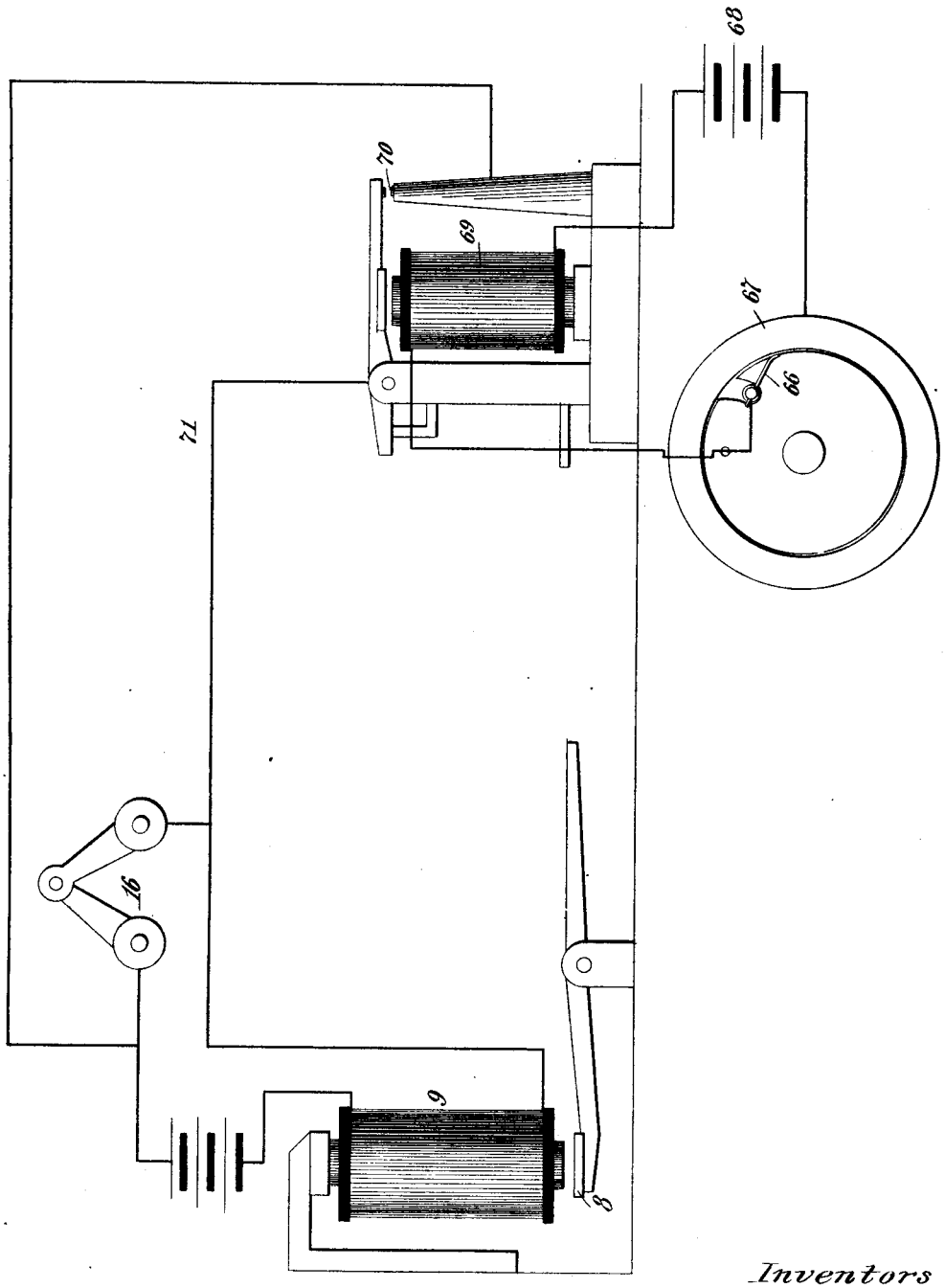

Fig. 9.

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Fig. 10

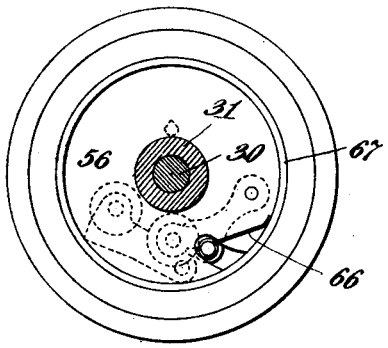


Fig. 14

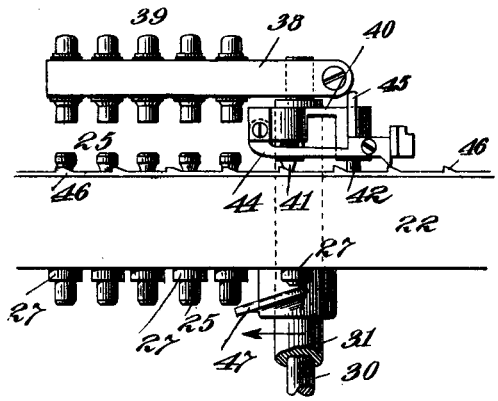


Fig. 11

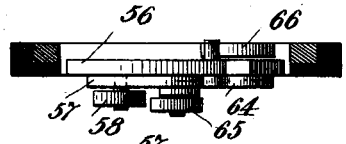


Fig. 12

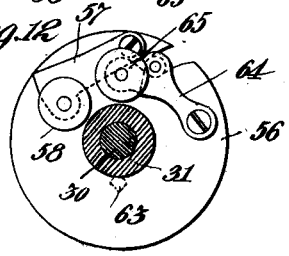


Fig. 15

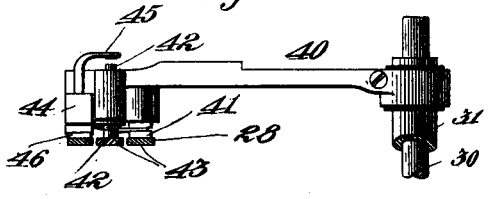
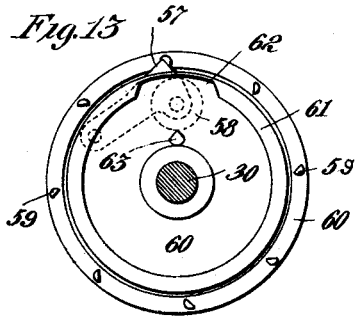


Fig. 13



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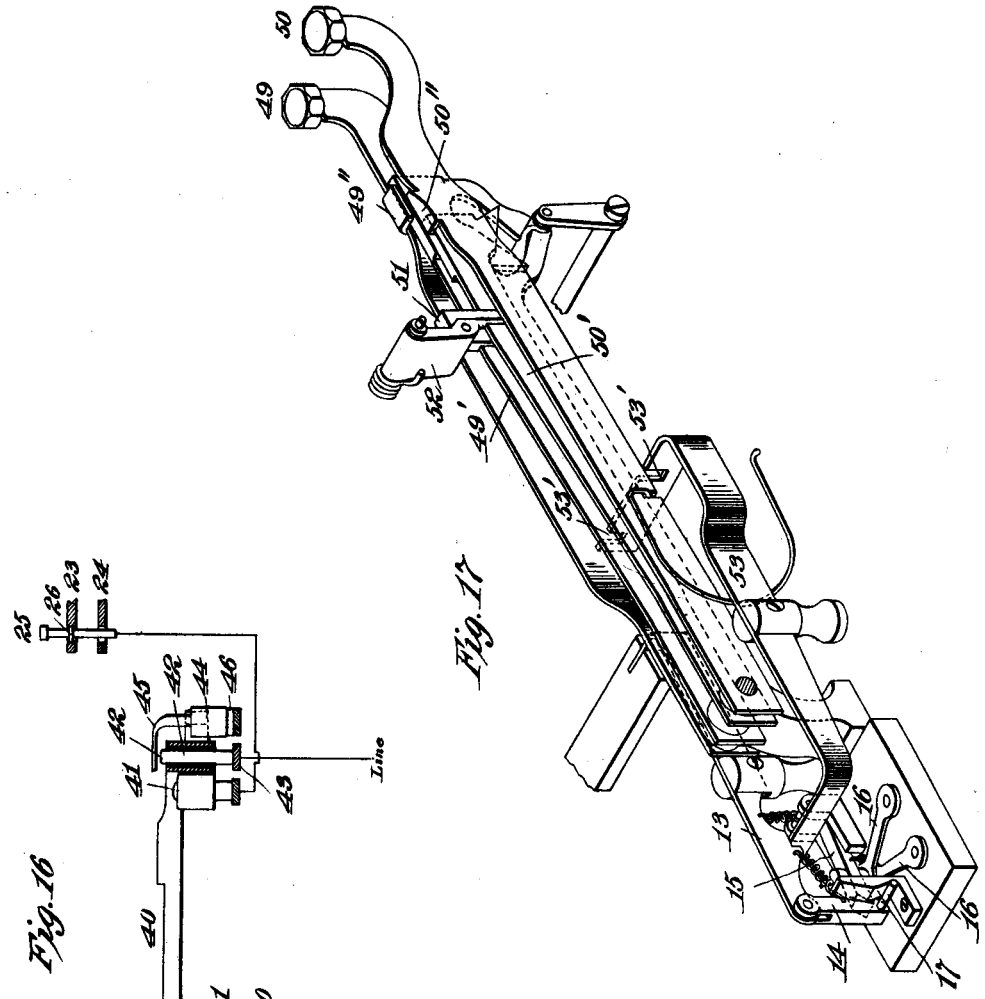

Fig. 17.

Fig. 16.

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John R. Tucker

Charles C. Hinckley

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UNITED STATES PATENT OFFICE.

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PRINTING-TELEGRAPH TRANSMITTING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 676,091, dated June 11, 1901.

Application filed March 10, 1899. Serial No. 708,597. (No model.)

To all whom it may concern:

Be it known that we, KIRK HIMROD, of Chicago, in the county of Cook, and JOHN R. TUCKER and CHARLES C. HINCKLEY, of Aurora, in the county of Kane, State of Illinois, citizens of the United States, have invented a certain new and useful Improvement in Printing-Telegraph Transmitting Apparatus, of which the following is a specification.

Our invention relates to various new and useful improvements in transmitters for use particularly in printing-telegraphs employing the system suggested by Baudot, wherein there are transmitted for each character over a single wire a series of electrical impulses of substantially equal duration, five or more, some of one polarity and some of the other polarity, each character being distinguished from all other characters by a particular permutation of the impulses, and wherein these impulses act upon a selecting mechanism at the receiving end of the line and so adjust it as to cause the operation of the printing mechanism to print the particular character.

In an application for patent filed by Kirk Himrod March 25, 1898, Serial No. 675,121, certain improvements in the Baudot system were described, some of which related to the transmitter. In that application was suggested for the first time the employment of a number of sets of pole-changers movable successively into relation with the keys, one set being always in position to be operated on by all of the keys. In this way the operation of the keyboard was made independent of the working of the line, and the operator might even work the keys in advance of the operation of the line, since the effect of the working of the keys was simply to shift in succession the different sets of pole-changers, these being connected to the line subsequently by the operation of the trailing arm on the sunflower. Furthermore, by employing a plurality of sets of pole-changers the line was not idle at any time, and a greater length of time was therefore provided for the sending of the line-impulses and the operation of the signaling apparatus, thus conducing to reliability.

Our object is to produce a transmitting apparatus employing a plurality of sets of pole-changers which will be capable of great speed and certainty of operation and will provide for the transmission of a large number of characters.

Before entering upon a description in detail of the apparatus with reference to the drawings its general characteristics will be briefly explained.

A plurality of sets of pole-changers are mounted radially in the head of a generally drum-shaped casing. Any number of these sets of pole-changers may be employed, eight sets of five each being a convenient number. All the pole-changers are connected to different plates of a sunflower which preferably encircles the pole-changers. The pole-changers normally are so connected as to send to line impulses of one polarity—for illustration, positive impulses. By shifting the position of any one of the pole-changers impulses of the opposite polarity will be sent to line. Mounted above the pole-changers is an arm which partakes of an intermittent feed, resting successively in line with each set of pole-changers, said arm carrying a series of plungers corresponding to the pole-changers, so that when one or more of said plungers is depressed the corresponding pole-changer or pole-changers will be operated. By giving to this arm an intermittent feed movement and by depressing the plungers carried thereby the proper permutation or arrangement corresponding to the character the several sets of pole-changers will be successively placed in an active position to represent the letters or characters desired. A trailing arm is mounted concentrically with the intermittently-fed arm and engages with the sunflower-plates to send to line impulses in the proper permutation to represent the letters or characters, the trailing arm being driven through a slipping friction and having a spring connection with the intermittently-fed arm, so as to allow the latter to be driven when the escapement therefor is actuated. A restoring device restores the pole-changers to their normal positions after the trailing arm has sent the impulses to line.

In the application of Himrod the pole-changers were arranged on a drum movable relatively to the keys, and a great number of collecting-rings were therefore required. With our present invention the pole-changers are mounted in a stationary casing, so that all collecting-rings are done away with. We provide devices in connection with the pole-changer mechanism to prevent the trailing arm from overtaking the intermittent arm if the work of the operator lags and to prevent the intermittent arm from overtaking the trailing arm should the work of the operator on certain words run over the maximum.

We have found that rubbing contacts are objectionable in connection with the sunflower mechanism of these transmitters, since the sparking tends to burn out the plates. We therefore make use of butting contacts on the transmitter, the circuit being broken between secondary-circuit breakers and remaining broken as the trailing brush passes the gap between the plates. This secondary-circuit breaker is provided with platinum points and is actuated by cams arranged parallel to the sunflower-plates.

In order to actuate the plungers for the pole-changers, we employ a series of concentric rings adapted to move the plungers when the latter are ready to engage any one of the sets of pole-changers. The concentric rings are carried on swinging frames and are connected to bars arranged side by side. Preferably five of these bars are used, representing five impulses for each letter and enabling a sufficient number of characters to be secured for all practical purposes. The bars are notched in their upper faces with the desired arrangement, and coöperating therewith are a series of key-levers. The notches in the said bars are so disposed that when any key-lever is depressed the concentric rings will be actuated to move the plungers which set the pole-changers in the proper sequence corresponding to the said key-lever. The key-levers may be operated directly by hand, in which case they will each be provided with a proper finger-piece bearing a suitable designation. We prefer, however, to operate the key-levers by a motor device, as by so doing we can very materially increase the speed and ease of transmission.

We also prefer to make use of a type-writer in connection with our improved transmitter in order that a copy of the work may be secured when operating duplex. In other words, if the apparatus is being used simplex—a single message being transmitted from the transmitter at one station to the receiver at the other—it will be possible, of course, for the operator at the transmitter-station to cause the proper impulses to actuate the receiver at his station, so that a copy of the message which he is sending will be printed upon his receiver. When, however, the apparatus is being used duplex—a message being transmitted simultaneously from two stations to each other's receiving apparatus—the transmitter at one station will be sending a different message from that which is being received by the receiver at the same station, so that each operator will be prevented from using his receiver for the making of a copy of his message. By using a type-writer, however, in connection with each transmitter each operator when operating duplex may secure a copy of the message which he is transmitting. We therefore mount a type-writer of any suitable character immediately above the key-levers of the transmitter, the type-writer keys corresponding to the transmitter-keys. Depending from each of the type-writer keys is a hook adapted to engage an angular face on the transmitter-key upon the preliminary movement of a type-writer key, which hook will be thus forced out into the path of movement of a motor device, preferably a swinging walking-beam operated from any suitable source of power, such as a pressure-cylinder. When a pressure-cylinder is employed, its valve is adapted to be controlled from a magnet in preferably a normally-closed circuit. The depression of any key operates a circuit-breaker to break the circuit to the control-magnet, thereby allowing the motor to operate, and the walking-beam engaging the hook of the type-writer key which has been depressed, forcing the type-writer key and the transmitter-key both downward, effecting the printing of the type-writer and moving the particular set of pole-changers with which the intermittent arm may at the time be in correspondence. This operation of the motor takes place immediately after the type-writer key has been moved and carries it down away from the finger of the operator; but the operation takes place with such rapidity as to be hardly noticeable other than by a slight tap on the finger as the key returns. We aim to increase the speed of this operation as much as possible, and we therefore arrange the valve of the motor when a pressure-cylinder is used so that it is reset upon the positive stroke, insuring absolute certainty of operation. Furthermore, when the motor is controlled by a magnet in a normally closed circuit we arrange the circuit-breaker therefor to immediately close the circuit through the controlling-magnet when its armature is out of its influence, thus giving the magnet an opportunity to build up, so that when its armature is positively reset by the motor it will be held with certainty in its operative position. With some type-writers the carriage is arranged so as to be shifted from a normal or lower-case position to a capital position and in some instances to a third or figure position. When such a device is employed, we make use of carriage-shift keys, which are provided with depending hooks and which coöperate with transmitter-keys as with the ordinary character-keys. The shift-keys are, however, adapted to be locked in their depressed position to

maintain the carriage shifted, and therefore in order to allow the circuit-breaker for the motor-control magnet to be returned to its normal position ready to be actuated by the depression of any one of the other keys while the carriage is shifted we make the shift-levers in two sections, one of which controls the operation of the circuit-breaker and the other of which is locked in its abnormal position to keep the carriage shifted We make use of locking devices in connection with the shift-keys, which will be explained in detail and by means of which when the carriage is in one of its abnormal positions the depression of the shift-key for the other abnormal position will first release the carriage and then move it, thus making it unnecessary to first release the carriage by the operation of an independent key for this purpose.

The advantages of our improved transmitter device will be obvious. By employing a series of pole-changers we are enabled to keep the line constantly occupied in the transmission of impulses, as is described in the application of Himrod. At the same time a very much simpler and improved construction is secured. By using a type-writer in connection with the transmitter we are enabled to make copies of the work and, if it be desired, to use the type-writer independently of the transmitter. The employment of a motor for operating the keys of a transmitter or of a type-writer increases the speed and ease of operation.

In the accompanying drawings we have illustrated what we consider the preferred embodiment of our invention, wherein a type-writer is used in connection with the transmitting apparatus. It will be understood, however, that the transmitter may be employed independently and that there are certain features of our invention which may be effectively made use of in connection with other forms of apparatus than printing-telegraphs—such, for example, as type-writers, type-setting machines, &c.

In the drawings, Figure 1 is a side elevation; Fig. 1ª, a longitudinal section through the apparatus with the transmitter removed; Fig. 2, a front elevation with the upper portion of the type-writer removed; Fig. 3, a plan of the same; Fig. 4, a vertical cross-section of the same; Fig. 5, a plan of the transmitter with the type-writer removed; Fig. 6, a cross-section on the line 6 6 of Fig. 5; Fig. 7, a plan of the pole-changer mechanism; Fig. 8, a diagram of the transmitter-circuits; Fig. 9, a diagram of the motor-circuits; Fig. 10, a detail view of the locking device for the trailing arm; Fig. 11, a longitudinal sectional view of the same; Fig. 12, a bottom view of the movable plate for the same; Fig. 13, a plan view of the upper escapement-ring; Fig. 14, a detail elevation of the upper end of the escapement-shaft, its sleeve, and their connections; Fig. 15, a detail view of the trailing arm and its contacts; Fig. 16, a diagram showing a single pole-changer and illustrating the circuit connections through the secondary-circuit breaker, and Fig. 17 a perspective view of the two double shift-keys.

In all of the above views corresponding parts are represented by the same numerals of reference.

The keys 1 of the transmitter are pivoted at one end and are arranged side by side in a horizontal bank. When five impulses are used for each character, thirty-two of these keys may be employed. The keys are normally pressed upward by springs, as shown. If desired, the transmitter-keys 1 may be operated directly, in which case they will be provided with the usual finger-pieces. Preferably, however, we employ a type-writer 2, removably carried above the transmitter-keys and of any suitable type. The keys of the type-writer correspond in number and location with the transmitter-keys 1, and each is provided with a hook 3, the lower end of which engages an angular ledge on the forward end of the corresponding transmitter-key. By depressing one of the type-writer keys the corresponding hook will engage the ledge of one of the transmitter-keys and be forced outward into the path of movement of a walking-beam 4, mounted on a rock-shaft and normally spring-pressed upward.

A motor device is employed for operating the walking-beam 4, and in the drawings we illustrate a pressure-cylinder 5 for this purpose, its piston connecting with a lever 6, fulcrumed on the bed of the transmitter, which lever is connected with the walking-beam 4, as shown. The cylinder 5 is provided with a valve 7, controlling the air-supply thereto, which valve is normally maintained in an inactive position to cut off the supply of air to the cylinder by connection with an armature 8 of a controlling-magnet 9 in a normally-closed circuit. When the circuit to the controlling-magnet 9 is broken, the armature 8 is released, whereby a spring 10 moves the valve 7 and allows the piston of the cylinder to operate to move the walking-beam 4 and engage any of the hooks 3 which may have been depressed and moved into the path of the walking-beam, thereby depressing the corresponding type-writer key and the transmitter-key, effecting a record on the type-writer and operating the pole-changers of the transmitter, as will be explained. The forward end of the lever 6 near the completion of its stroke engages a stop on a rod 11, connected to the valve 7, to restore the valve positively and to again engage the armature 8 with the pole of the controlling-magnet. The type-writer keys in operating move a plate 12, which is connected to the usual feed mechanism (not shown) for the platen and which is common to all type-writers. Engaging beneath this plate is the end of a lever 13, having a hooked arm 14 at its end, which arm engages beneath a spring-pressed lever 15, holding the two contacts 16 normally in engage-

ment. One of the contacts 16 is elastic and tends to separate from the other contact when the pressure of the lever 15 is removed by the elevation thereof by the hooked arm 14. It will be seen that when any one of the typewriter keys is depressed the hook 3 will be moved out into the path of movement of the walking-beam and the plate 12 will be moved, swinging the lever 13 and separating the contacts 16, the latter being included in the normally-closed circuit to the controlling-magnet 9. This breaks the said circuit, releasing the valve 7 and operating the walking-beam, as explained. In order that the controlling-magnet 9 may positively hold the armature 8 when it is restored on the downstroke of the piston, we arrange the contacts 16 so that they will be opened for an instant only and will again close the circuit to the controlling-magnet 9 when its armature is out of its influence. We therefore employ a cam-plate 17, which is adapted to disengage the hook 14 from the end of the lever as it moves upward, allowing for a break and an immediate closure of the motor-control circuit at the contacts 16 at the commencement of the operative stroke of any one of the keys. The transmitter-keys 1 bear on the five sliding plates 18, mounted in vertical guides 19. The upper surfaces of the plates 18 are notched, as shown, so that the depression of any one of the transmitter-keys will result in the movement of the desired number and combination of such sliding plates. The arrangement of notches in the plates is clearly shown in Fig. 5. In order that the plates 18 may travel with absolute parallelism under the action of any one of the transmitter-keys, we mount them on arms carried by rock-shafts 20, so that both ends of each plate move together, the said arms being connected to the plates by links to allow the swinging movement of the supporting-arms to take place while the plates move vertically in the guides 19. Each of the plates 18 is connected to one of the concentric rings 21, five of which are used.

Mounted beneath the base of the transmitter and in line with the rings 21 is a casing 22, carrying the pole-changers in its upper face. This casing is provided with two plates 23 and 24, insulated from each other and connected to opposite poles of a battery.

25 represents the pole-changers arranged radially in eight lines, as shown, five in each line. These pole-changers are provided with shoulders 26, normally in engagement with plate 23, but adapted to engage the plate 24 when any one of the pole-changers is depressed. The lower ends of the pole-changers are in constant engagement with a sleeve 27, connected to the different segments 28 of a sunflower. The pole-changers are held in their normal positions or in their depressed positions by light springs 29, which tend to jam the shoulders 26 in engagement with the passages in the plates 23 and 24.

Mounted in the casing 22 is a shaft 30, surrounding which is a sleeve 31, driven from a gear 32 and pinion 33. The latter is connected with any suitable source of power, such as an electric motor. The gear 32 drives the sleeve 31 through a slipping friction-clutch 34 of any suitable construction, which preferably constitutes a spring-barrel, in which is located a spring 35, connecting the clutch with the shaft 30. The form of friction-clutch shown particularly in Fig. 6 comprises the two friction-rings secured in place between two disks 34′ and 34″, the former of said disks being made integral with the sleeve 31 and being formed with the spring-barrel referred to, in which is located the spring 35. The latter disk 34″ is pressed downward by a spring 34‴ to compress the friction-disks upon the gear 32. By rotating the gear 32 the sleeve 31 will be driven through the slipping friction, and the shaft 30 will be driven through the spring 35. The shaft 30 carries an escapement device of any suitable type. We show an ordinary escapement comprising two escapement-wheels coöperating with a single pallet 36, the latter being connected with the lever 6 by a rod 37, so that an escape movement of the sleeve 31 takes place at each operation of the motor. The shaft 30 carries an arm 38 at its upper end, on which arm are mounted five spring-pressed plungers 39, adapted to rest at each feed movement over one of the sets of pole-changers, said plungers being interposed between the concentric rings 21 and said pole-changers. It will be observed that when any one of the transmitter-keys is depressed one or more of the rings 21 will be operated, forcing one or more of the plungers 39 downward and moving one or more of the pole-changers 25 to bring the shoulders 26 thereof into engagement with the plate 24 and out of engagement with the plate 23. The sleeve 31 carries at its upper end an arm 40, which is arranged to sweep over the sunflower-plates and send the impulses to line. We have found that rubbing contacts are objectionable in printing-telegraph transmitters of this type, as the sparking quickly burns out the plates. We therefore prefer to use a butting contact for this purpose, which we have shown. The arm 40 carries a brush 41, which bears on the segments of the sunflower, and a second brush 42, insulated from the arm and bearing on a collecting-ring 43. The upper end of the brush 42 is contracted and forms a contact which is preferably tipped with platinum. The arm 40 carries at its end a lever 44, having a curved arm carrying a contact 45, adapted to make contact with the upper end of the collecting-brush 42. The lever 44 is adapted to be periodically elevated by means of cam-teeth 46, arranged in its path, this operation of the lever taking place to break the circuit between the brush 42 and the arm 40 as the brush 41 passes the gap between each of the segments of the sunflower. In this way we break the

circuit to the brush 41 immediately before it passes one of the gaps between the sunflower-plates and complete the circuit thereto after it has passed the gap, thereby effectively preventing the destruction of the sunflower-segments due to sparking. The circuit connections between the pole-changers and the line through the secondary-circuit breaker are shown particularly in Fig. 16, from which it will be seen that each pole-changer is connected with a particular plate of the sunflower from which the current passes to the brush 41, thence to the contact 45, to second brush 42, to collecting-ring 43, and to the line. This circuit, it will be observed, will be broken between the contact 45 and the collecting-brush 42 as the lever 44 rides up on each cam-tooth 46. The sleeve 31 carries an inclined restoring-plate 47, arranged to sweep immediately beneath the several sleeves 27 and to engage the lower ends of any of the pole-changers which may have been operated to restore such pole-changers to their normal positions. This restoration of the pole-changers takes place immediately after the brush 41 has sent to the line impulses due to the position of such pole-changers. The proportion of the parts is such that at the preliminary movement of the air-engine driving the selected transmitter-key downward the particular set of pole-changers will be operated with which at the time the plungers 39 are in engagement, and at the end of the downward movement the escapement will be moved to allow the arm 38 to pass to an intermediate position in advance of the set of pole-changers which have just been operated. When the pressure-cylinder makes its negative stroke under the effect of the retracting-spring of the walking-beam, allowing the depressed key to return, the escapement will be again operated to advance the arm 38 to a position with the plungers 39 immediately over the next set of pole-changers. This prevents the possibility of the feed operation taking place in any position except when the arm 38 is directly over one of the sets of pole-changers and also prevents the possibility of the said arm reaching a set of pole-changers before the rings 21 have returned to their normal positions, because otherwise the plungers 39 will engage with the upper side of the pole-changers instead of passing above them, and thereby prevent a further feed from taking place.

The type-writer which we illustrate is provided with a carriage 48, which normally occupies a position to result in the printing of lower-case letters, but which is adapted to be moved to one side of that position for the printing of capitals and to the other side of that position for the printing of figures, punctuation-marks, &c. We have selected this form of type-writer as an illustration of an extreme type, it being possible with our transmitter to operate a receiving apparatus having a carriage adapted to occupy three positions. When a shiftable carriage is employed, we make use of two shift-keys 49 and 50, arranged to move the carriage to the two abnormal positions referred to. These shift-keys are provided with locks 51, arranged to be engaged beneath a latch 52 on the type-writer, so that when either of said keys is depressed it will be locked in that position. It will be obvious that if the shift-keys 49 and 50 were connected with the lever 13 to directly elevate it the latter would be locked in an elevated position and could not be operated when the carriage is shifted. In order, therefore, to provide an operative connection between the shift-keys and the lever 13, we make each shift-key of two parts—49 and 49′ and 50 and 50′—the two parts of each key being pivoted at the same point, as shown. The section 49 of one shift-key is provided with a shoulder 49″, which engages on top of the end of the section 49′ thereof, while the section 50 of the other shift-key is provided with a shoulder 50″, which engages over the end of the section 50′ thereof. It will therefore be seen that by depressing the section 49 or 50 of either shift-key the other section 49′ or 50′ of the corresponding key will be depressed. A lever 53 53 is pivoted to the base, as shown, Fig. 3, and engages beneath the lever 13 in the rear of its fulcrum. This lever 53 is provided with a turned-in end 53′, which engages beneath the several sections of the two shift-keys and also beneath the released key 54, to be presently referred to. The portion 53′ of the lever 53 is cut away, as shown, coincident with the sections 49′ and 50′ of the two shift-keys, whereby the said lever may be returned to its normal position even when one or the other of the sections 49′ or 50′ of the shift-keys is depressed. The locks 51 referred to are carried by the sections 49′ and 50′ of the two shift-keys. It will be obvious that by depressing one or the other of the shift-keys 49 or 50 the corresponding section 49′ or 50′ thereof will be similarly depressed, and the lock 51 will hold the section 49′ or 50′ in its lowermost position. The downward movement of the section 49 or 50 of the shift-key depresses the forward end of the lever 53 and elevates the rear end of the lever 13, so as to allow the contacts 16 16 to separate. The return movement of the section 49 or 50 of either shift-key will allow the lever 53 to resume its original position to close the contacts 16; but the lock 51 will hold the depressed section 49′ or 50′ in its lowered positon to keep the carriage locked in its shifted position. It will be observed that the lock 51 for each shift-key is provided with an inclined face engaging the latch 52 on the downstroke, so as to swing the latch and allow the latter to move in and over the lock. During this swinging movement of the latch the other shift-key will be released if it has been already locked. In this way it becomes possible to shift the carriage from one extreme

shifted position to the other extreme shifted position without making it necessary to first return the carriage to its normal position by the operation of an independent key, and this feature of our invention we consider of importance when a transmitting apparatus is used with type-writers having shiftable carriages. When the carriage has been moved to one or the other of its extreme positions, it may be returned to its normal position by the depression of a key 54, having a cam 55, which withdraws the latch 52 from any one of the shift-keys.

The circuit connections of the transmitter are shown diagrammatically in Fig. 8, the eight sets of pole-changers being separately illustrated. The plate 23, it will be observed, is connected to one pole of a divided battery 56 and the plate 24 to the other pole of such battery. The pole-changers 25 are connected at their lower ends (in practice through the sleeves 27) to the different segments 28 of the sunflower, over which travels the trailing arm 40. It will be observed that if none of the pole-changers is operated the trailing arm 40 in passing around the circuit of the sunflower-plates will send to the line 57 a series of positive impulses. If, however, any of the pole-changers are operated by the depression of one or more of the rings 21, the pole-changers will be connected with the negative pole of the double battery, and when the trailing arm 40 is in contact with the corresponding plates of the sunflower negative impulses will be transmitted over the line. By sending over the line a series of positive or negative impulses in proper sequence and order, five for each character, they will be caused to act upon a proper selecting mechanism, as is common in this art. In practice the trailing arm 40 will be frictionally driven from the power connection and the intermittent arm 38 will be driven from said trailing arm through the spring 35, the latter arm stopping over each set of pole-changers, which will be actuated in the proper sequence from one of the transmitter-keys, and the former, following such intermittent movement, engaging the sunflower-plates and sending the impulses to line, followed by the immediate restoration of the pole-changers ready to be again actuated as the arm 38 continues on its path of rotation. It will be obvious that if the operator should lag in the work there would be danger of the trailing arm 40 overtaking and passing the arm 38, resulting in a mutilation of the signals and a possibility of the pole-changers being actuated while the restoring-arm 47 is in engagement therewith. On the other hand, in writing very familiar words, the speed of the operator frequently is very much higher than the maximum ordinary operation, and there would be danger of the intermittent arm 38 overtaking and passing the trailing arm 40, which would be equally objectionable. We therefore prefer to employ a locking device coöperating with the trailing arm and by means of which said arm will be automatically locked from rotation whenever it approaches within one complete feed movement of the arm 38, the lock being withdrawn when a greater distance separates the two arms, and we also prefer to employ a circuit-controlling device which comes into play to prevent the operation of the controlling-magnet 9 when the arm 38 approaches the trailing arm 40 to remove the danger of the pole-changers being operated while in engagement with the restoring device. These two safety devices will be briefly described.

Carried by the sleeve 31, immediately above the upper escapement-wheel, is a disk 56, and mounted on said disk is a pivoted dog 57, carrying a roller 58 near its end. This dog is adapted to be engaged with a series of studs 59, carried on the upper face of the casing 60, in which the escapement device is located. The upper escapement-wheel is provided with a rim 61, having a notch 62 therein, and said wheel also carries a pin 63, located opposite the said notch. It will be observed that the pawl 57 being carried by the sleeve 31 is movable with the trailing arm 40 and that the pin 63 and notch 62 being carried by and formed in one of the escapement-wheels are movable with the intermittent arm 38. Normally the roller 58 on the pawl 57 will be in engagement with the inner face of the rim 61; but when the trailing arm 40 approaches objectionably close to the arm 38 the pawl 57 will overtake the pin 63 and be forced out thereby, with the roller 58 entering the notch 62 until the end of the pawl engages one of the pins 59. Movement of the trailing arm will thus be arrested, the friction-clutch 34 allowing slip between gear 32 and the sleeve. This arresting of the trailing arm 40 takes place not only when it approaches the intermittent arm 38, but also when the transmission of a message is stopped. When the arm 38 proceeds on its movement or movement thereof commences after a stoppage, the pin 63 will be advanced away from the roller 58, and the rear edge of the notch 62 will positively withdraw the pawl 57 from the pin 59 with which it may have been in engagement, thereby allowing the trailing arm 40 to be again driven through the friction-clutch.

Pivoted on the under side of the disk 56 is a lever 64, also having a friction-wheel 65 thereon, adapted to be engaged by the pin 63 and forced outwardly when the arm 38 approaches within an objectionable distance from the arm 40. The lever 64 carries a contact-spring 66 above the disk 56, which spring is adapted to make contact with a collecting-ring 67 when the lever 64 is thus moved outwardly by the engagement with the pin 63.

Referring to Fig. 9, it will be observed that the spring 66 is in a normally open circuit with a battery 68 and a relay 69, the latter being adapted to close at the contacts 70 a branch circuit 71 around the contacts 16.

When the arm 38 approaches too close to

the trailing arm 40, the pin 63 will be caused to engage with the roller 65, moving the lever 64 outwardly, engaging the contact-spring 66 with the collecting-ring 67, closing the circuit through the relay 69, the armature of which closes the branch circuit around the contacts 16 at the contacts 70. When this operation takes place, it will be observed that the depression of a key will not deënergize the controlling-magnet 9 for the motor, and in consequence the motor fails to operate. As soon, however, as the trailing arm 40 moves forward to carry the disk 56 onward, withdrawing the roller 65 from the pin 63 and breaking the circuit through the relay 69 at the contact-spring 66, the branch around the contacts 16 will be broken, allowing for the operation of the motor. It will be understood that this operation of the contact-spring 66 to render the motor inactive takes place only when in certain words a speed very much above the usual maximum is attained, and the locking of the motor against movement is practically momentary, occupying the time required for the printing of only one or two characters.

In the preceding description we have generally outlined the operation of the device; but we will briefly explain the connected operations which take place in the transmission of ordinary characters. The depression of a type-writer key causes the corresponding hook 3 to be moved out into the path of the walking-beam 4. The first movement of any key results in the depression of the bar 12, which in moving downward oscillates the lever 13, elevating the hook 14 and the spring-pressed lever 15, thereby allowing the contacts 16 16 to separate. This breaks the circuit to the controlling-magnet 9, allowing the spring 10 to open the valve to the pressure-cylinder, and the piston thereof moves the walking-beam 4 to actuate the type-writer key and the corresponding transmitter-key. Immediately after the contacts 16 16 have separated, the cam 17, over which the pin on the lower end of the lever 14 rides, will withdraw the hooked end of the lever 14 from the spring-pressed lever 15, releasing the latter and allowing it to immediately close the contacts 16. The preliminary movement of the type-writer key resulted in the breaking of the motor-control circuit and the immediate closure of said circuit, so that upon the completion of the positive stroke of the motor and the restoration of the armature 8 the said magnet will be fully built up to again hold its armature against the tension of the spring 10. After completing the positive stroke the walking-beam returns by spring-pressure, returning the motor-piston. The operation of the valve mechanism on both the positive and negative strokes will be understood more clearly from Fig. 1, which shows the valve in its operative position connecting the inlet-port with the cylinder, the supposition being that one of the keys has been depressed, as shown, the contacts 16 separated, and the magnet 9 deënergized, thus allowing the spring 10 to move the valve 7 to the position shown. The entrance of the compressed air forces the piston downward to positively operate the walking-beam, and near the completion of this stroke the forward end of the lever 6 will engage the nut 11 to move the valve 7 downward, and the said valve will be again locked in this position, with the port from the cylinder in line with the upper port in the valve which connects with the exhaust. Pressure being relieved from the piston, it will be returned to its former position by the spring which actuates the walking-beam. The depression of the particular transmitter-key 1 operates one or more of the plates 18 in the sequence, depending upon the particular letter, and the corresponding ring or rings 21 will be actuated. The depression of one or more of these rings operates the corresponding plungers 39, and the particular set of pole-changers with which said plungers may at the time be in engagement will be similarly actuated. Near the completion of the downward movement of the transmitter-key on the positive stroke of the motor the escapement device for the shaft 30 will allow one feed movement thereof to take place, carrying the arm 38 to a position midway between the pole-changers just operated upon and the succeeding set. This operation of the arm 38 will be effected under the tension of the spring 35, connecting the clutch 34 with the shaft 30. Upon the return movement of the transmitter-key a further feed of the arm 38 takes place to carry the plungers 39 over the next set of pole-changers; but this movement is not effected until the plungers have been entirely retracted, so that they pass over the upper faces of the pole-changers to engage them when again depressed. The intermittent feed movement of the arm 38 is effected by the depression of the type-writer keys, resulting in the operation of the transmitter-keys and the operation of the succeeding sets of pole-changers, each set corresponding to a letter or character, as will be obvious. After the pole-changers have been actuated the arm 38 is followed more or less closely by the trailing arm 40, which sends the respective impulses to line in the proper sequence and immediately restores the pole-changers. In this way it will be observed that the operator is constantly effecting the operation of the pole-changers, whereby no time is lost either in the transmission to the line or in restoring operations, as would be necessary if only a single set of pole-changers were used.

In our claims we will refer to the pole-changers as "bodily immovable" to distinguish them from the pole-changers which are described in the application of Himrod, above referred to. In the said application the pole-changers were not only movable on their own pivots to result in a change of polarity, but

were also bodily movable with respect to the keys, so as to be engaged successively thereby. Our pole-changers, in the sense that each is composed of the two plates 23 and 24 and the contact device 25, are bodily immovable, although the said contact device is movable with respect to said plates.

Having now described our invention, what we claim as new, and desire to secure by Letters Patent, is as follows:

1. In a telegraph-keyboard transmitter, the combination with a series of keys, of two or more sets of bodily-immovable pole-changers, and actuating mechanism intermediate the pole-changers and keys, arranged to successively connect the different sets of pole-changers with the keys, substantially as set forth.

2. In a telegraph-keyboard transmitter, the combination with a series of keys, of two or more sets of bodily-immovable pole-changers arranged radially, and means for bringing the sets of pole-changers into connection with the main line subsequent to the operation thereof by the keys, substantially as set forth.

3. In a telegraph-keyboard transmitter, the combination with a series of keys, of one or more sets of bodily-immovable pole-changers, arranged radially, a set of plungers movable successively into engagement with said pole-changers, and connections between said plungers and the keys, substantially as set forth.

4. In a telegraph-keyboard transmitter, the combination with a series of keys, of a series of bodily-immovable pole-changers, arranged radially, an arm having an intermittent movement arranged to be successively brought into line with the several sets of pole-changers, plungers carried by said arm for successively engaging the pole-changers, and connections between said plungers and the keys, substantially as set forth.

5. In a telegraph-keyboard transmitter, the combination with a series of keys, of two or more sets of bodily-immovable pole-changers arranged radially, means for bringing the sets of pole-changers consecutively under the operation of the keys, and a trailing arm for connecting the pole-changers successively with the line, substantially as set forth.

6. In a telegraph-keyboard transmitter, the combination with a series of keys, of two or more sets of bodily-immovable pole-changers arranged radially, means for bringing the sets of pole-changers consecutively under the operation of the keys, a trailing arm for connecting the pole-changers successively with the line, and a friction-clutch for driving said arm, substantially as set forth.

7. In a telegraph-keyboard transmitter, the combination with a series of keys, of two or more sets of bodily-immovable pole-changers arranged radially, means for bringing the sets of pole-changers consecutively under the operation of the keys, a trailing arm for connecting the pole-changers successively with the line, an intermittent arm, a spring connecting the trailing arm with the intermittent arm, and a series of plungers carried by the intermittent arm for engaging the pole-changers successively, substantially as set forth.

8. In a telegraph-keyboard transmitter, the combination with a series of keys and two or more sets of bodily-immovable pole-changers, of a set of plungers movable successively into engagement with said pole-changers, a corresponding set of concentric rings arranged to actuate the plungers in any position to which the latter may be moved, and connections between said rings and keys, substantially as set forth.

9. In a telegraph-keyboard transmitter, the combination with a series of keys and two or more sets of bodily-immovable pole-changers, of a set of plungers movable successively into engagement with said pole-changers, a corresponding set of concentric rings for operating the said plungers in any position to which the latter may be moved, and a corresponding set of notched plates, one connected to each of said rings and with which the keys cooperate, substantially as set forth.

10. In a telegraph-keyboard transmitter, the combination with a series of keys, of two or more sets of bodily-immovable pole-changers arranged radially, an arm having an intermittent movement arranged to be successively brought into line with the several sets of pole-changers, plungers carried by said arm for successively engaging the pole-changers, connections between said plungers and the keys, a trailing arm for connecting the pole-changers successively with the line, and means for preventing the trailing arm from overtaking the intermittently-fed arm, substantially as set forth.

11. In a telegraph-keyboard transmitter, the combination with a series of keys, of two or more sets of bodily-immovable pole-changers arranged radially, an arm having an intermittent movement, arranged to be successively brought into line with the several sets of pole-changers, plungers carried by said arm for successively engaging the pole-changers, connections between said plungers and the keys, a trailing arm for connecting the pole-changers successively with the line, and a pawl for automatically locking the trailing arm against movement when the latter tends to overtake the intermittent arm, substantially as set forth.

12. In a telegraph-keyboard transmitter, the combination of two or more sets of bodily-immovable pole-changers arranged radially, an arm having an intermittent movement, arranged to be successively brought into line with the several sets of pole-changers, means carried by said arm for operating the pole-changers, a trailing arm for connecting the pole-changers successively with the line, and means for preventing the intermittent arm from overtaking the trailing arm, substantially as set forth.

13. In a telegraph-keyboard transmitter, the combination with a series of keys, of a series of bodily-immovable pole-changers arranged radially, an arm having an intermittent movement, arranged to be successively brought into line with the several sets of pole-changers, plungers carried by said arm for successively engaging the pole-changers, connections between the said plungers and the keys, a motor for actuating the keys, a trailing arm for connecting the pole-changers successively with the line, and a contact-arm arranged to automatically prevent the operation of the motor when the intermittently-fed arm tends to overtake the trailing arm, substantially as set forth.

14. The combination of a series of pole-changers arranged radially in a single plane, an arm pivoted on the center from which said pole-changers radiate, devices carried by said arm for operating the pole-changers successively, and means for intermittently feeding said arm, substantially as set forth.

15. In a telegraph-keyboard transmitter, the combination with a series of keys and two or more sets of pole-changers operated therefrom, of a set of notched plates corresponding in number to the pole-changers of each set, connections between said plates and the pole-changers, and a swinging frame for each of said plates, substantially as set forth.

16. The combination of a series of pole-changers arranged radially in a single plane, an intermittently-fed arm pivoted on the center from which said pole-changers radiate and carrying devices for actuating the pole-changers successively, a trailing arm arranged to connect the pole-changers with the line, and an elastic connection between said arms, substantially as set forth.

17. The combination with the sunflower-plates, of a trailing arm having a brush movable over said plates, a secondary circuit-maker carried by the arm, and means for actuating said secondary circuit-maker to break the circuit to said brush as the latter passes the gap between the sunflower-plates, substantially as set forth.

18. The combination of the sunflower-plates, the trailing arm, the brush carried thereby, the secondary circuit-maker carried by said trailing arm, and the series of cams for actuating said secondary circuit-maker, substantially as set forth.

19. The combination with a series of keys, of a motor for operating them, controlled by the preliminary manual movement of any of said keys, substantially as set forth.

20. The combination with a series of keys, of a motor, a controlling device therefor actuated by the preliminary manual movement of any of said keys, and an actuator moved by the motor for engaging with and completing the movement of the key, substantially as set forth.

21. The combination with a series of keys, of a motor, an actuator moved by the motor for operating the keys, a magnet controlling said motor, and a circuit-breaker arranged to be actuated by any one of the keys and included in the circuit with said magnet, substantially as set forth.

22. The combination with a series of keys, of a motor, an actuator operated by said motor for moving any one of said keys, a magnet in a normally closed circuit controlling said motor, a circuit-breaker in said circuit, and a hook operated by any one of the keys for operating the circuit-breaker to break said circuit and to immediately close it, substantially as set forth.

23. The combination with a series of keys, of a series of hooks carried by said keys, a motor for operating the hooks to depress the keys, and a circuit-breaker operated by the preliminary manual movement of said keys and controlling the operation of said motor, substantially as set forth.

24. The combination with a carriage, of two shift-keys for moving the carriage to two extreme positions, a latch for locking either shift-key in its depressed position, and connections between said latch and the other shift-key, whereby the depression of one of said shift-keys results automatically in the release of the carriage, substantially as set forth.

25. The combination with a carriage, of a shift-key made in two parts, one of which is arranged to be locked in a depressed position, a circuit-breaker controlled by the other part, and a motor for actuating the shift-key controlled by said circuit-breaker, substantially as set forth.

26. The combination with a series of keys and a hook depending from each key, of a power-driven walking-beam movable in a path normally clear of said hooks, and means for manually moving any of said hooks into the path of said walking-beam, substantially as set forth.

27. The combination of a bank of typewriter keys, a hook depending from each of said keys, a corresponding bank of transmitter-keys having inclined forward ends with which the said hooks normally engage, and a power-driven walking-beam movable in a path which is clear of the normal position of said hooks, said walking-beam being adapted to engage the said hooks when the type-writer keys are partly depressed to move the corresponding hooks into the path of the walking-beam, substantially as set forth.

This specification signed and witnessed this 7th day of February, 1899.

KIRK HIMROD.
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Witnesses:
W. J. TYERS,
J. W. TUCKER.