

C. L. AND H. L. KRUM.
TELEGRAPH TRANSMITTER.

APPLICATION FILED SEPT. 18, 1916. RENEWED MAR. 19, 1920.

1,374,152.

Patented Apr. 5, 1921.

3 SHEETS—SHEET 1.

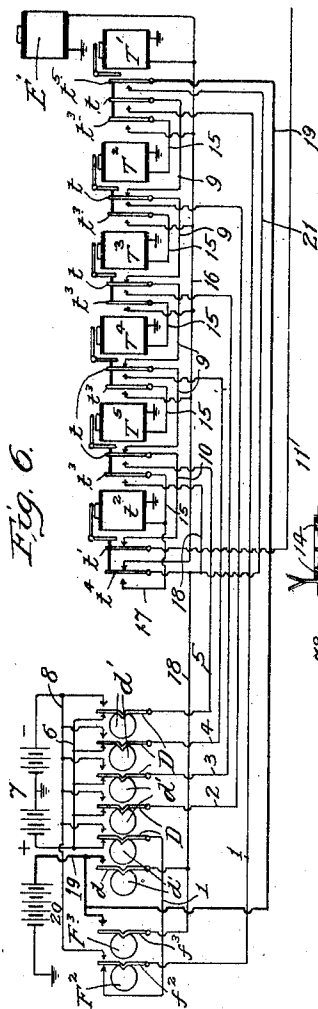


Fig. 6.

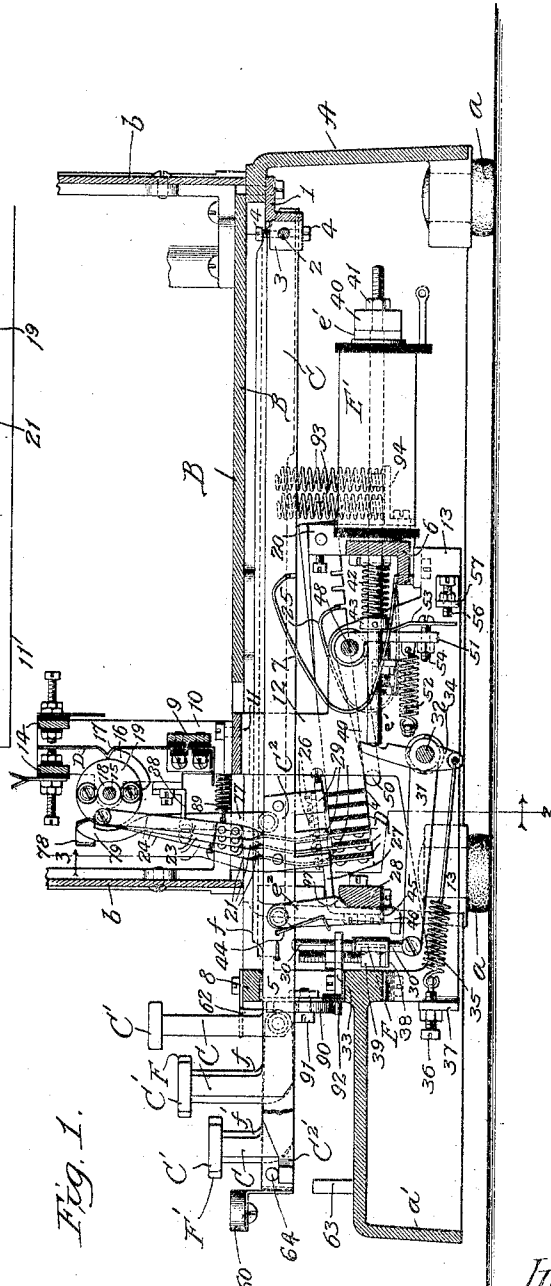


Fig. 1.

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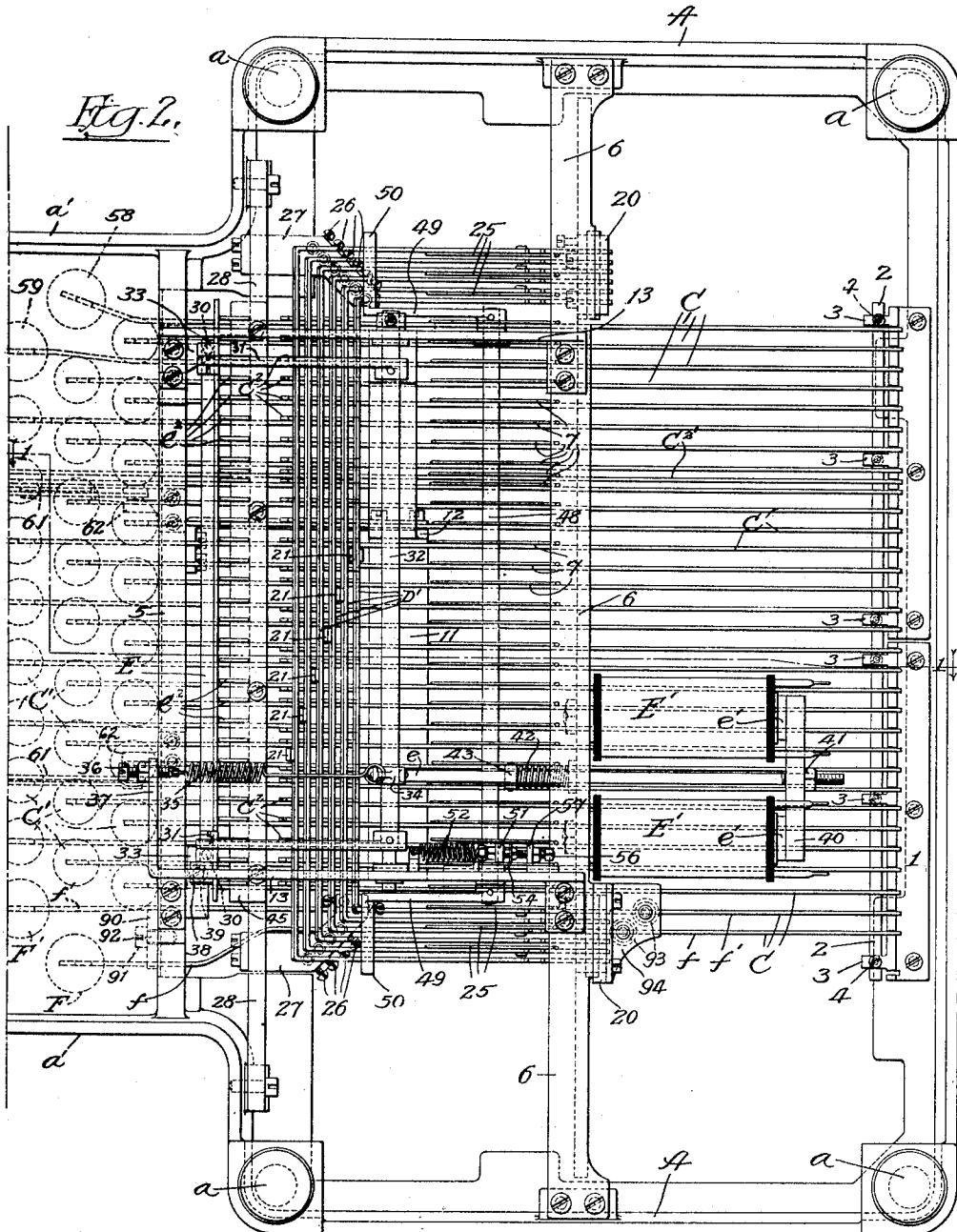
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3 SHEETS—SHEET 2.



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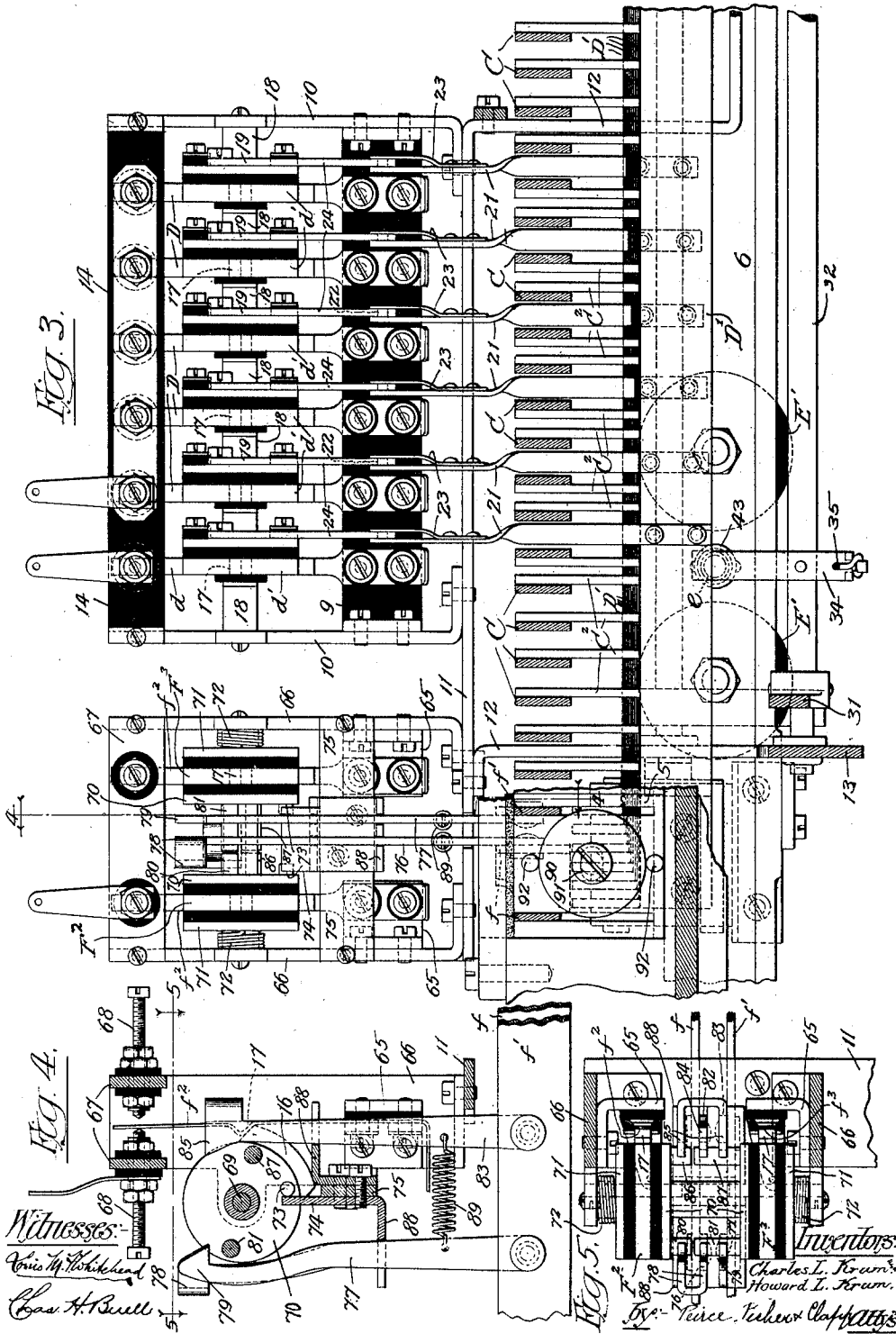
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3 SHEETS—SHEET 3.



UNITED STATES PATENT OFFICE.

CHARLES L. KRUM AND HOWARD L. KRUM, OF CHICAGO, ILLINOIS, ASSIGNORS TO
MORCRUM COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION.

TELEGRAPH-TRANSMITTER.

1,374,152.

Specification of Letters Patent.

Patented Apr. 5, 1921.

Original application filed November 29, 1909, Serial No. 530,455. Patent No. 1,232,045. Divided and this application filed September 18, 1916, Serial No. 120,606. Renewed March 19, 1920. Serial No. 367,122.

To all whom it may concern:

Be it known that we, CHARLES L. KRUM and HOWARD L. KRUM, citizens of the United States, and residents of the city of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Telegraph-Transmitters, of which the following is a specification.

The present invention is a division of an earlier application filed by us in the United States Patent Office issued as Patent No. 1,232,045, July 3, 1917.

The invention relates to telegraph transmitters and seeks to provide an improved transmitter of the keyboard type more particularly adapted for use in connection with selective or printing telegraphs. The invention consists in the features of improvement hereinafter set forth, illustrated in the preferred form and arrangement in the accompanying drawings and more particularly pointed out in the appended claims.

In the drawings, Figure 1 is a longitudinal section of the improved transmitter. Fig. 2 is an inverted plan view thereof. Fig. 3 is a detail vertical section on line 3—3 of Fig. 1. Fig. 4 is a detail vertical section on line 4—4 of Fig. 3. Fig. 5 is a detail horizontal section on line 5—5 of Fig. 4. Fig. 6 is a diagram of the transmitter circuits.

The transmitter keyboard and parts operated thereby are arranged upon a base frame A provided with feet *a*. Preferably, as set forth in the prior application referred to, a receiving printer (not shown) is arranged upon the upper frame portion mounted upon the base frame A and comprising a plate B and corner post *b* rising therefrom.

A series of horizontal key levers C are arranged in the upper portion of the frame A are engaged at their rear and front ends by transverse comb bars 1 and 5. A fulcrum rod 2 extends through the rear ends of the key levers and through lugs 3 on the comb bar 1, and is held in position by set screws 4. The forward ends of the key levers extend through a transverse opening in the front wall of the base frame and over a frame extension *a'*. The forward ends of the key levers are upturned and carry a series of keys C' arranged in banks like the keys of an ordinary typewriter. A transverse bar 6

extends between the sides of the frame A below the key levers and a series of U-shaped springs 7 interposed between the bar 6 and the key levers normally hold the latter with their forward portions against the transverse stop bars 8.

The characters or signals are represented by permutations of a definite number (preferably 5) of impulses of opposite polarity and the transmitting keys control a set of five signal selecting switches or pole changers. These pole changers are preferably in the form of spring arms D (see Figs. 1 and 3) and together with a switch *d*, also controlled by the key levers, are mounted upon a transverse bar 9. The latter is fixed to uprights 10 on a horizontal cross bar 11 that is supported by two uprights 12 on a pair of side plates 13. The side plates 13 are arranged within the frame A and extend between and are secured to the cross bar 6 and to the front portion of the frame.

The selecting switches or pole changers D and the switch *d* are insulated from their supporting bar 9 and extend upwardly therefrom between insulated, adjustable front and back contact screws on two cross bars 14 that extend between the upper ends of the uprights 10. The switch arms D and *d* are shifted by cam disks *d'* which are rotatably mounted upon a transverse supporting shaft 15 extending between the uprights 10. In the form shown, the cam disks are provided with lugs 16 which engage offsets formed on the switches. The disks are also provided with face plates 19, are held apart by spacing sleeves 18, and are insulated from the base plates, sleeves and supporting shaft.

A series of six U-bars or bails D' are arranged below the key levers C (see Figs. 1 and 2) and are pivoted at their upper ends upon lugs 20 on the cross bar 6. The bails are respectively connected to the face plates 19 of the switch operating cams *d'* by studs or links 21 and 24. The links 21 are riveted to the front cross bars of the bails and are provided with pins 22 and spring clips 23 that detachably engage the lower ends of the set of links 24. The latter are pivotally connected at their upper ends to the face plates 19. U-shaped springs 25 interposed between the cross bar 6 and the side arms of the bails D' hold the latter and the switch

operating cams in normal position with the bails against a series of adjustable stop screws 26. The latter are carried upon two arms 27 that are fixed to and project rearwardly from a transverse bar 28 extending between the side portions of the frame A near the forward end thereof. The outside bail D' is connected to the operating cam for the switch d which initiates each operation of the transmitter. The other bails are connected to the actuating cams for the pole changing or signal selecting switches D. Each key is provided with a member C² fixed thereto and provided with a series of downwardly extending teeth 29 that engage and operate the bails. The teeth on the different members are so arranged that each key operates the outside bail to thereby shift the switch d and each is arranged to operate a particular combination of the other bails that shift the pole changing switches D to thereby select a particular permutation of five impulses of opposite polarity.

While the movement of the keys is initiated by the operator, the shift thereof is preferably completed by a combined key actuator and lock-out comprising a transverse universal bar E. This universal bar is angular in cross section and is fixed at its ends to a pair of upright pins 30 that are pivoted at their lower ends to the forward ends of two crank arms 31. The latter are mounted on a transverse shaft 32 journaled in the side plates 13. The upper ends of the pins 30 extend through openings in two fixed guide lugs 33 so that the pins and the universal bar E have substantially a straight line movement in vertical direction. An arm 34 on the cross shaft 32 is connected to a spring 35 the opposite end of which is connected to an adjustable screw carried by a lug 37 on one of the side plates 13. This spring holds the shaft 32 and the universal bar E in normal position with the lugs 38 on the ends of the bar engaging adjustable stop screws 39, that are carried by the lugs 33. A horizontal actuating rod e extending through a guide opening in the cross bar 6 engages the upper end of the arm 34 and, at its rear end, is connected to a cross bar 40. The latter is connected to the cores e' of a double spool, solenoid magnet E', the spools of which are secured to the cross bar 6 and project rearwardly therefrom. The actuating rod e is adjustably threaded through the cross bar 40 and is provided with a lock nut 41. A coil spring 42 extends between the cross bar 6 and a collar 43 on the rod and holds the forward end of the latter against the arm 34 on the shaft 32.

The key levers are coupled to the universal actuating and lock-out bar E by a set of latches e^2 which are pivoted to the key levers and depend therefrom in front of the trans-

verse bar 28. Springs 44 press the latches against the cross bar 28 and away from the actuator bar E. The latches extend through a comb bar 45 on the lower face of cross bar 28 and are provided at their lower ends with forwardly projecting lugs 46. The rear edges of the latches have cam lugs 47 that cooperate with the beveled upper edge of the bar 28 in such a manner that, when any key is partially depressed, the corresponding latch e^2 is moved forwardly against the tension of its spring 44 to thereby move the lug 46 thereon beneath the actuator bar E. This preliminary shift of any key also moves the switch d which closes the circuit of the magnet E'. The latter is then energized and through the medium of the connections described completes the movement of the selected key. Moreover, as the bar E moves down in front of the lugs 46 on the latches e^2 of the remaining keys, the latter are locked against operation until the magnet E' is deenergized and the selected key released. The magnet E' remains energized until the transmission of the selected signal is completed and thus prevents overlapping of the signals. Moreover, since the operator merely initiates the shift of the keys, the touch is light and the keys can be rapidly operated.

To provide a uniform tension on the key levers and bails, a cross shaft 48 is journaled in the side plates 13 and a pair of forwardly projecting arms 49 (see Figs. 1 and 2) mounted on the shaft are provided with laterally projecting pins 50 that extend beneath the side arms of the several bails D'. An arm 51 on the shaft 48 is connected by a spring 52 to a stud on one of the side plates 13. The tension of this spring is applied to all the bails and keys to render the touch uniform and also to resist the depression of the keys at the lower ends of their movement. A spring 53 on the arm 51 is provided with an adjusting screw 54. At the end of the down stroke of any key, this spring engages an adjusting screw 56 on a lug 57 carried by one of the side plates 13 and thus forms a yielding stop for the key action. By adjusting the screws 54 and 56, the resistance to the depression of the keys at the lower ends of their movement can be regulated. This spring also serves to throw the keys back quickly when released.

The keyboard is provided with two special keys 58 and 59 (see Fig. 2) transmitting special signals to effect the carriage return and line space operations of the printing mechanism. A space key or bar 60 is mounted on two arms 61 that are pivoted to clips 62 on the cross bar 8. This space bar is arranged above a stop pin 63 on the frame extension a' and one of the arms 61 has a pin 64 that engages and operates a special key lever C² which controls the transmission of

a special signal for effecting the letter space mechanism of the receiving printer mechanism.

The keyboard, also, has capital and figure shift keys F , F' carried on key levers f , f' . These levers, unlike the other key levers, do not operate the bails D' and the set of pole changing switches D . Instead, the key levers f , f' control two special, insulated switch arms f^2 and f^3 (see Figs. 3, 4 and 5). These switches are mounted on the lugs 65 of two uprights 66 on bar 11. The uprights 66 are connected at their upper ends by two transverse bars 67 which carry adjustable, insulated contact screws 68 for the switch arms f^2 and f^3 . Switch arm f^2 is a pole changer like the switches D , whereas f^3 , like switch d , initiates the operation of the means for imparting selected permutations to the line. Insulated cam disks F^2 and F^3 are rotatably mounted on a cross support extending between uprights 66, and like the cam disks d' , are provided with lugs 16 for engaging the offset or bent portions 17 of the switches f^2 and f^3 . Each of these cam disks is insulated from the support 69 and each is provided with face plates 70 and 71 insulated therefrom. Coil springs 72 connected to the cam disks F^2 and F^3 hold the same in normal position with stop pins 73 on the inner face plates thereof engaging the stop plate 74 on the cross bar 75. The shifting key levers f and f' are provided with pivoted shifter arms 76 and 77 which extend upwardly in front of the cams F^2 and F^3 and have hooks 78 and 79 at their upper ends for engaging pins 80 and 81 on the inner face plates 70 of the cams. Two shifter arms 82 and 83, behind the cams, are pivoted to the key levers and have beveled lugs 84 and 85 at their upper ends for engaging pins 80 and 86 on the face plates 70. Shifter arms 76, 77, 82 and 83 extend through slots in a pair of guide lugs 88 on the cross bar 75 and springs 89 extend between the arms and hold them in engagement with the lugs 88 which form stops for limiting the inward movement of the shifter arms toward the cams F^2 and F^3 .

The hooks 78 and 79 have beveled upper faces and lower abrupt faces so that they operatively engage the pins 80 and 81 to oscillate the cams F^2 and F^3 and thereby operate the switches f^2 and f^3 only on the down stroke of the keys F and F' . On the up stroke of the keys, the beveled faces of the hooks engage the pins and pass idly over the same. The hook 78 is double and serves to operate both switches f^2 and f^3 , whereas hook 79 only operates the switch f^3 . The upper end portions 84 and 85 of the shifter arms 82 and 83 have abrupt upper faces and beveled lower faces and pass idly over the pins 86 and 87 on the down stroke of the key levers but engage the pins and rock the

switch actuating cams F^2 and F^3 on the up stroke. The part 85 is double and engages both pins 86 and 87, whereas the part 84 operates only on the pin 87. By this arrangement, key lever f shifts both switches f^2 and f^3 on its down stroke and switch f^3 alone on its up stroke, while the key lever f' shifts switch f^3 alone on its down stroke and both switches on its up stroke. At the end of the up and down strokes of either key, springs 72 restore the cams to normal position. These special key levers f and f' do not lock the other key levers. When the operator desires to transmit capitals or figures, he holds the proper shift key depressed and operates the character keys as in the operation of an ordinary typewriter. A depression of the shift key effects the transmission of the proper signal for shifting the type mechanism at the receiver and the release of the key transmits the proper combination of impulses to restore the same.

A locking disk 90 (see Fig. 3) is mounted on a screw 91 which is threaded into the comb-bar and extends through a transverse slot in the disk so that the latter can shift laterally to a limited extent between two guide pins 92. The disk is arranged between the key levers f and f' , and when one is depressed, the disk is shifted laterally and locks the other key lever. The shift key levers are upheld in normal position by two cushion springs 93 (see Figs. 1 and 2) extending between the same and a lug 94 on one end of the bar 6.

The uprights on the transverse bar 11 which support the switches D , d , f^2 and f^3 and their operating cams, extend upwardly through an opening in the front portion of the plate B. The cam lugs of the switch operating disks are so arranged that the initial movement of any key quickly moves the switches to their shifted position and holds them firmly in engagement with their front contacts during the continued movement of the keys and until the latter are restored to normal position and until the selected permutation or combination of impulses has been imparted to the line circuit.

As indicated in the diagram of Fig. 6, the set of signal selecting switches or pole changers D of the transmitter are connected respectively to five branch conductors 1, 2, 3, 4 and 5 that are arranged to be successively connected to the line circuit by a set of transmitting relays T^1 , T^2 , T^3 , T^4 and T^5 , the branch conductors being connected to the normally disengaged contacts of the transmitting switches t that are operated by the relays. The special switch f^2 and its normally engaged contact are interposed, as shown, in the branch conductor 1. The contacts of the pole changers D are connected by conductors 6 and 8 to the opposite poles of the divided line battery 7, the normally

engaged contacts of these switches and also the switch f^2 being connected to the positive pole of the line battery and the normally disengaged contacts thereof to the negative pole.

Each transmitter switch t is connected to the normally engaged contact of the next switch in the series by a conductor 9 and the last transmitter switch controlled by relay T^5 is connected by a conductor 10 to the back contact of the normally closed switch t' of an unlocking relay t^2 . The conductor 11 connects switch t' directly to the line or to a pole changing relay for imparting permutations of impulses to the line circuit. Each transmitting relay operates a normally open switch t^3 which is connected to the coil of the next relay of the set by a conductor 15. The conductor 15 from the switch t^3 of relay T^5 leads to the coil of the unlocking relay t^2 . The latter operates a normally closed unlocking switch t^4 , the normally engaged contact of which is connected by a conductor 16 to the contacts of the switches t^3 and also to the first transmitter relay T' and to the magnet E' . The normally disengaged contact of the switch t^4 is connected by a conductor 17 to the coil of the magnet t^2 and the switch is connected by a conductor 18 to the normally open switches d and f^3 which are operated respectively by the cams d' and F^3 . The contacts of the switches d and f^3 are connected by a conductor 19 to a local battery 20. The first transmitter relay T' operates a switch t^5 connected to the local battery wire 19 and having a normally disengaged contact connected by conductors 21 and 18 to the unlocking switch t^4 .

The transmitter relays, the relay t^2 and the magnet E' are all connected on one side to ground or by a suitable return wire to local battery 20.

When any one of the transmitting key levers C is depressed, one or more of the five pole changers D is shifted and one or more of the five branch conductors 1, 2, 3, 4 and 5 are connected thereby to the negative pole of the line battery 7, while the others remain connected to the positive pole thereof. Starting switch d is also shifted by any key lever C and current then flows from local battery 20 through conductors 19, 18, unlocking switch t^4 , conductor 16, to magnet E' and the first transmitter relay T' . The magnet E' is then energized and, as previously described, completes the shift of the selected key and locks out the remaining keys. The first transmitter relay T' shifts its switch t^3 and thereby connects the second transmitter relay T^2 to the local battery through the conductor 16, switch t^3 and conductor 15. The second relay T^2 is then energized, shifts its switch t^3 and connects the third transmitting relay T^3 to a local battery. The operation of this relay in like

manner connects the fourth transmitting relay T^4 to the local battery and the latter connects the fifth transmitter relay T^5 thereto. Relay T^5 then shifts its switch t^3 and connects magnet t^2 to local battery through switch d and conductors 18 and 15. Magnet t^2 then shifts switch t^4 and disconnects the conductors 18 and 16 and opens the circuit of the transmitter relays and of magnet E' so that the parts are restored to the normal condition. The transmitter relays and switch t are thus successively operated in proper order to transmit the selected permutations or combination of impulses by successively connecting the branch conductors 1, 2, 3, 4 and 5 to the line conductor 11. When switch t of the first transmitter relay T' is shifted, current flows from line battery 7 by conductors 6 or 8 (in accordance as to whether or not the first pole changing switch D has been shifted) to the switch, thence by conductor 1 to the switch f^2 to the first transmitter switch t , through the transmitter switches in order to the main line conductor 11. The second transmitter relay T^2 then shifts its switch t , thereby disconnecting branch conductor 1 from the line and connecting branch conductor 2 thereto. Similarly, the successive operations of the transmitter relays T^3 , T^4 and T^5 disconnects the preceding branch conductor, interrupts the preceding impulse and connects the next branch conductor to effect the transmission of the succeeding impulse until all five impulses of the permutation have been transmitted. The fifth impulse is interrupted by the operation of the relay t^2 which opens the switch t' . This relay also shifts the switch t^4 and opens the local circuit through the transmitting relays. But the circuit through relay t^2 is locked in closed condition by switch t^4 since, when the latter is shifted, current flows from conductor 18 through switch t^4 and conductor 17 to the coil of the relay t^2 . This relay thus remains energized and the transmitting relays and the magnet E' are cut off both from the local battery and also from the line circuit until the depressed key is released to restore switch d and thereby open the circuit of relay t^2 .

By this arrangement, the signals cannot overlap. When any key is depressed, it initiates the operation of the transmitting relays, is locked in depressed position and the remaining keys are held against operation by the lock-out magnet E' until the transmission of the selected permutation is completed. Magnet E' is then deenergized and the operator may depress any key but he cannot transmit the succeeding signal until he releases the first key depressed to restore switch d and open the circuit of the magnet t^2 . The keys may thus be rapidly manipulated without causing any confusion in the

signals, since the operator cannot depress one key before he has entirely released the preceding key and at the same time, as already noted, it is not possible for the succeeding signals to overlap on the line circuit.

It should also be noted that the operation of the switch t^5 insures the complete operation of the transmitter, even though a key is not held down for a sufficient time interval to energize the lock-out magnet E' .

The switch t^3 of the last transmitter relay T^5 connects the conductor 18 to the coil of the magnet t^2 and its contact is not connected to the conductor 16 as are the other switches t^3 , for, if this were done, the magnet t^2 would be opening and closing its own switch and a buzzer-like action would be produced.

When shift key F is depressed, the cams F^2 and F^3 momentarily shift both of the switches f^2 and f^3 and, when this key is released, cam F^3 momentarily shifts switch f^3 . On the depression of the shift key F' , switch f^3 is momentarily shifted and when this key is released, both switches f^2 and f^3 are operative.

Switch f^3 , like switch d , connects the local battery 20 to conductor 18 and initiates the successive operation of a set of transmitting relays. Even though switch f^3 is only momentarily shifted, the entire set of relays will operate, since the first relay T' connects the conductor 18 to local battery 20 independently of the switch f^3 through the conductor 19, switch t^5 , conductor 21 and switch t^4 . If switch f^3 alone is shifted, the transmitter signal comprises five positive impulses. If switch f^2 is also shifted, line branch 1 is connected thereby to the negative pole of the line battery 7 as the transmitter relays T' and T^2 operate and the first impulse will be negative. Thus, when shift key F is depressed, a permutation comprising one negative impulse followed by four positive impulses is transmitted and, when this key is released, a permutation comprising five positive impulses is transmitted. These same combinations are transmitted in reverse order when shift key F' is depressed and released. These combinations, when transmitted in one or the other order, effect the shifting of the type mechanism of the receiving printer to print either capitals or figures in accordance as to which of the permutations is first transmitted, and, when the second permutation is transmitted, to restore the type mechanism to normal position.

It is obvious that numerous changes may be made in the details set forth without departing from the details of the invention and that parts of the invention may be employed without its adoption in entirety. Thus, while the set of transmitting relays for successively connecting the key con-

trolled pole changers to the line circuit is herein set forth and forms the subject matter of certain of the claims, a mechanically operated local switch could, if desired, be employed instead. Other changes could also be made without departing from the scope of the invention as defined by the appended claims.

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

1. In a telegraph system in which the characters are represented by different permutations of a definite number of impulses of opposite polarity, a key-board transmitter comprising a set of pole changers, said pole changers having normally engaged and disengaged contacts connected to current sources of opposite polarity, a set of branch conductors connected to said pole changers, a set of separate transmitter switches having fixed and shiftable members connected to said conductors, and means controlled by the key-board transmitter for automatically and successively operating the shiftable of said set of transmitter switches to impart the permutations to the line.

2. In a telegraph system in which the characters are distinguished by different permutations of a definite number of impulses of opposite polarity, a key board transmitter comprising a set of shiftable pole changers having normally engaged and disengaged contacts connected to current sources of opposite polarity, a set of separate transmitter switches having fixed and shiftable members for connecting and disconnecting said pole changers to and from the line, a set of magnets for automatically and successively actuating said transmitter switches, a series of finger keys having means for shifting said pole changers in different combinations, a switch controlled by each of said keys for initiating the operation of said set of magnets, and means controlled by the first magnet of said set for compelling the complete operation thereof independently of the selected key.

3. In a telegraph system in which the characters are distinguished by different permutations of a definite number of impulses of opposite polarity, a transmitter comprising a set of shiftable pole changers having normally engaged and disengaged contacts connected to current sources of opposite polarity, a set of transmitter switches having fixed and shiftable members for respectively connecting said pole changers to the line and disconnecting the same therefrom, a set of magnets for automatically and successively actuating the shiftable members of said set of transmitter switches, a set of finger keys for shifting said pole changers in different combinations, a lock-out magnet, a switch controlled by

each of said finger keys for effecting the operation of said lock-out magnet and for initiating the operation of said set of transmitter magnets, and means controlled by the operation of said set of magnets for releasing said lock-out magnet.

4. In a telegraph system in which the characters are represented by different permutations of a number of impulses of opposite polarity, a transmitter having a set of key-controlled pole changers, a set of separate transmitter switches for respectively connecting said pole changers to line, a set of magnets for automatically and successively operating said switches, each of said magnets being arranged to close the circuit of the next succeeding magnet of the set, a key-controlled switch for closing the circuit of the first magnet of the set and means controlled by the last magnet of the set for opening the circuit of said magnets and for holding the same open while said key-controlled switch is held closed, substantially as described.

5. In a telegraph system, a set of successively operating magnets each of which is arranged to control the circuit of the succeeding magnet in the set, a key-operative switch for controlling the circuit of the first magnet of the set, a set of switches operated by said set of transmitter magnets for imparting a succession of impulses to the line, key-controlled means for modifying the imparted impulses, and a locking switch controlled by the last magnet of the set for holding its own circuit closed and the circuits of the other magnets open while said key-controlled switch is closed, substantially as described.

6. In printing telegraphs, the combination with transmitting mechanism, of two special shift keys therefor, each arranged to transmit a special code signal when depressed and another special code signal when returned to normal position, said keys transmitting the same code combinations but in reverse order.

7. In an electric telegraph apparatus, the combination with a set of shiftable selecting switches, cooperating contacts therefor, a series of oscillating cams for shifting said switches and holding the same in engagement with their contacts, a set of bails connected to said cams, and a series of finger keys for selectively operating said bails.

8. In a printing telegraph apparatus, in which the characters are represented by permutations of a definite number of impulses of opposite polarity, of a set of selecting pole changing switches, a set of oscillating cams for operating said switches, a set of operating members, one for each of said cams, a series of transmitter keys for variably operating said members, an electro-magnet controlled by each key, means oper-

ated thereby for completing the shift of any selected key and for locking out the other keys until the transmission of the selected permutation is completed, and means controlled by each key for transmitting the selected permutation.

9. In a printing telegraph apparatus, the combination with a set of transmitting keys, of two special shift keys, and a pair of selecting switches controlled by said shift keys, one of said keys being arranged to operate one of said switches when it is depressed and both of said switches when it is released, and the other of said keys being arranged to operate both of said switches when it is depressed and one when it is released.

10. In a printing telegraph apparatus, the combination with a set of transmitter keys, of two special shift keys, two switches controlled by said keys, a pair of operating cams for said switches, a pair of shifters for said cams operated by each of said keys, one pair of shifters being arranged to operate both cams when the corresponding key is depressed and one cam when its key is released, and the other pair of shifters being arranged to operate one cam when its key is depressed and both when the key is released.

11. In an electric telegraph transmitter, the combination with a set of pole changers having front and back contacts, said pole changers being spring-held in engagement with their back contacts, a series of cam members for shifting and holding said pole changers in engagement with their front contacts, a set of actuators, means for selectively operating said cams in different combinations, and means for successively connecting said pole changers to the line.

12. In an electric transmitter, the combination with a set of pole changers having front and back contacts, said pole changers being spring-held in engagement with their back contacts, a series of cam members for shifting and holding said pole changers in engagement with their front contacts, a set of actuators, a set of actuating members for said cams, a series of finger keys for selectively operating said members in different combinations, and means controlled by each of said keys for successively connecting said pole changers to the line.

13. In a transmitter for electric telegraphs, the combination with a set of switches for selecting different combinations of impulses, switch mechanism for successively imparting the selected impulses to the line, a set of actuating bars for said selecting switches, a set of finger keys for operating said bars in different combinations, said bars and finger keys being individually spring-held in normal position, and a spring-held member common to all of said bars for equalizing the tension on said finger keys.

14. In a transmitter for electric telegraphs, the combination with a set of switches for selecting different combinations of impulses, switch mechanism for imparting the selected impulses to the line, a set of actuating bars for said selecting switches, a set of finger keys for operating said bars in different combinations, said actuating bars and finger keys being spring-held in normal position and a member common to all of said bars forming a yielding stop to limit the depression of said keys and bars.
15. In a telegraph transmitter, the combination of a set of impulse selecting switches, transmitter switch mechanism for successively imparting the selected impulses to the line, a set of finger keys for operating said selecting switches in different combinations and for controlling the operation of said transmitter switch mechanism, means controlled by each key for holding the selected key in shifted position and locking out the other keys until the completion of the signal, and means for preventing further operation of said transmitter until the selected key is released.

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