D. MURRAY.

PRINTER FOR MULTIPLEX PRINTING TELEGRAPH SYSTEMS.

APPLICATION FILED OCT. 1, 1909.

1,021,942. Patented Apr. 2, 1912.

2 SHEETS—SHEET 1.

Fig_1

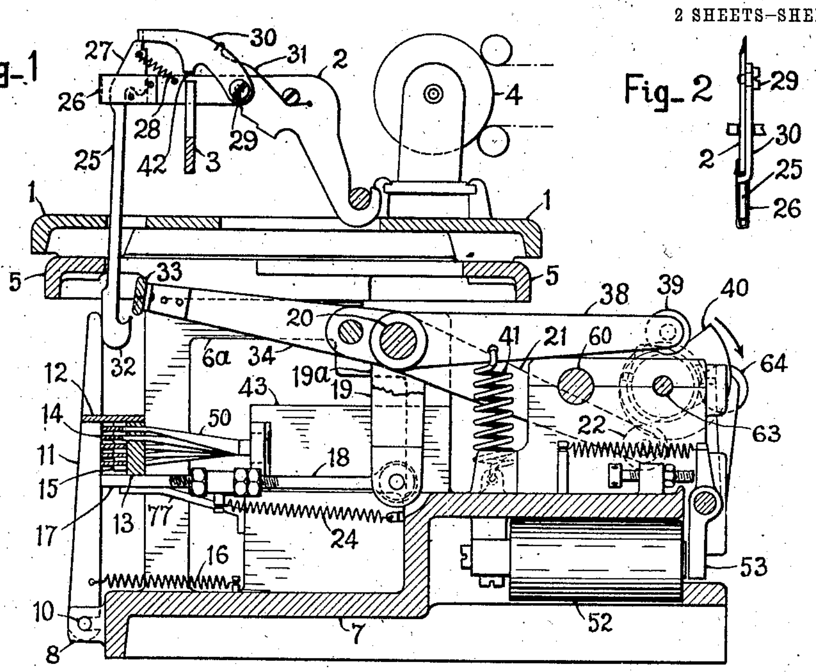
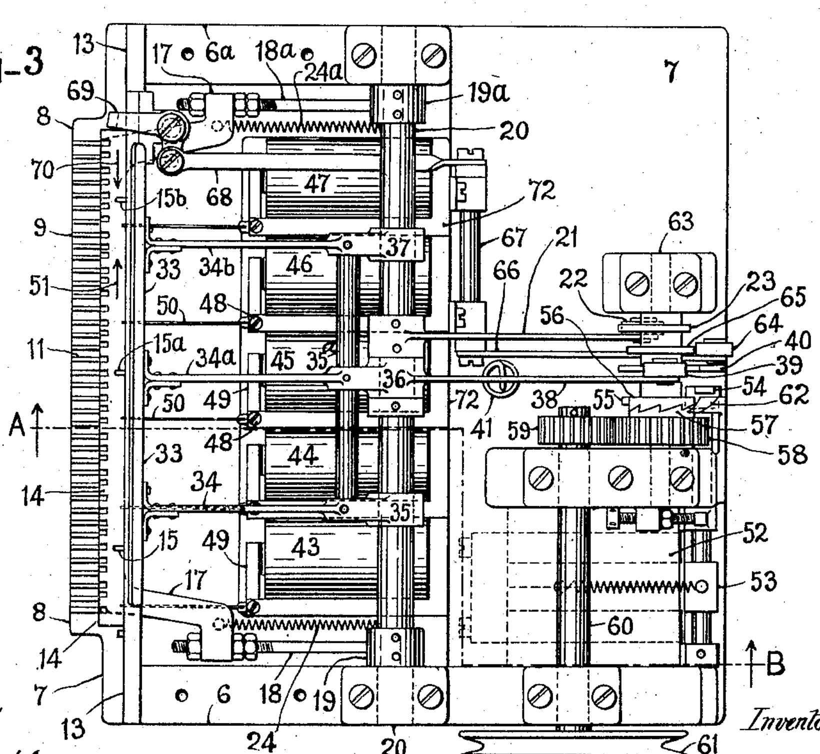


Fig_2

Fig_3



Witnesses
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2 SHEETS—SHEET 2.

Fig. 4

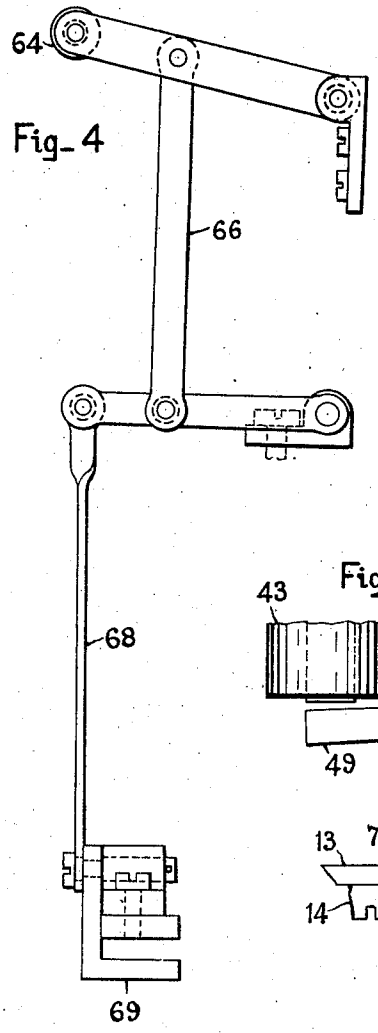


Fig. 5

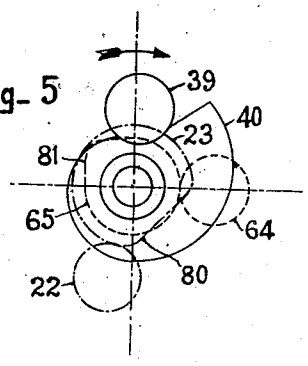


Fig. 6

Fig. 7

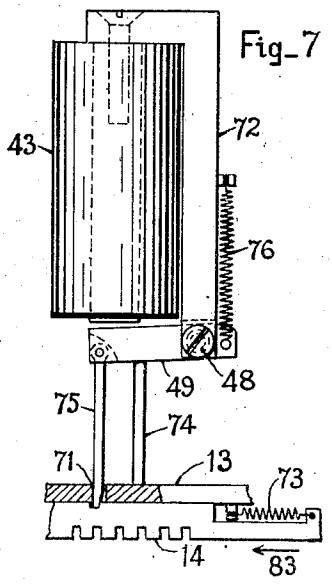
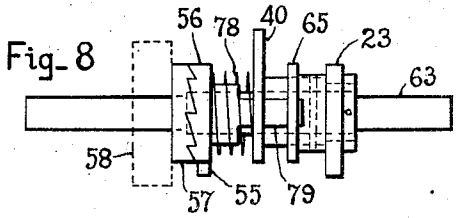


Fig. 8



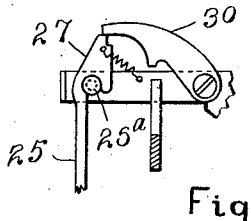


Fig. 9

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UNITED STATES PATENT OFFICE.

DONALD MURRAY, OF LONDON, ENGLAND.

PRINTER FOR MULTIPLEX PRINTING-TELEGRAPH SYSTEMS.

1,021,942. Specification of Letters Patent. Patented Apr. 2, 1912.

Application filed October 1, 1909. Serial No. 520,486.

To all whom it may concern:

Be it known that I, DONALD MURRAY, a subject of the King of Great Britain, residing at 3 Lombard Court, in the county of London, England, have invented a new and useful Improved Printer for Multiplex Printing-Telegraph Systems, of which the following is a specification.

My invention relates to an improved printing mechanism for recording in Roman type the signals transmitted over a telegraph line by a multiplex printing telegraph system.

It consists of a power-driven selecting and printing mechanism designed to operate any typewriter of the class provided with key levers.

The invention is illustrated in the accompanying drawings.

Figure 1 is a sectional elevation along the line A—B in Fig. 3. Fig. 2 is a detail. Fig. 3 is a plan view of the selecting and printing mechanism with the typewriter removed. Fig. 4 is a detail view showing the "comb" restoring mechanism. Fig. 5 is a diagram illustrating the cam actions. Fig. 6 is a detail view showing the action of the setting magnets. Fig. 7 is an alternative arrangement of the setting mechanism magnets. Fig. 8 is a detail view of the clutch and cam mechanism and Fig. 9 is a further detail.

Referring first to Fig. 1, the invention is illustrated in combination with a Blickensderfer typewriter. As this typewriter is a well-known machine the only portions of it that are shown are those necessary for illustrating the invention. These portions consist of the frame of the typewriter 1, one of the key levers 2, the slotted guide bar 3 for the key levers, and the platen and paper carriage 4. The typewriter is screwed to a plate 5, which in turn is screwed or clamped on to two bridge pieces 6 and 6^a, Figs. 1 and 3, of the frame 7 of the selecting and printing mechanism. On the front of the frame 7 there is a projection 8 which has a series of slots 9 cut in it and is bored to take a long pin 10. The slots and pin serve as guides and axis for a series of thin metal levers or cross-bars 11, one for each key of the typewriter. These cross-bars 11 are also held in position by a slotted guide-plate 12. Screwed to the frame of the machine there is a bar 13, Figs. 1 and 3, carrying a set of long thin slotted plates or "combs" 14. The combs are supported and kept separate from one another by several rows of pins 15, 15^a, 15^b, projecting from the plate 13. In the invention as here described there are five of these combs, but there may be six or more in accordance with the particular alphabet or code of signals employed in the printing telegraph system. In the present case the five-unit alphabet is used and five combs are sufficient. These combs have lengthwise movement of about 1.6 millimeters, and are differentially slotted like the combs in British Patent No. 11778/1899 so that for any given arrangement of the five combs lengthwise one series of slots and one only will be in line across all the combs. The cross-bars 11 are pulled in against the combs 14 by a series of springs 16, Fig. 1, but are held out just clear of the combs by a bridge-shaped lifting bar 17, the two ends of which are attached as shown to two connecting rods 18 and 18^a, Figs. 1 and 3. These connecting rods 18 and 18^a are coupled to the ends of two downwardly projecting levers 19 and 19^a, which are pinned to the shaft 20 so as to move as one piece with it. For the sake of clearness the supporting bar 17 in Fig. 1 is shown complete and not sectioned like the rest of the machine. The lower part of one of the downwardly projecting levers 19 may be seen in Fig. 1. The lifting bar is supported by a bracket piece 77. Pinned to the same shaft 20 there is another lever 21 carrying on its outer extremity a friction roller 22, which acts as a follower to the cam 23. The two springs 24 and 24^a tend to pull the lifting bar 17 inward to the right and this tension through the medium of the levers 19 and 21 keeps the friction roller 22 up against the cam 23. For every revolution of the cam 23 the lever 21 is allowed to rise slightly, and by means of the shaft 20 the lever 19 and the two connecting rods 18 and 18^a a reciprocating motion is given to the lifting bar 17. That is to say when the cam 23 acts the lifting bar 17 moves inward so as to permit the cross-bars 11 to rest against the combs 14.

For any given arrangement of the combs one series of slots only will be in line across the combs, and into this group of slots one of the cross-bars will be free to fall. In moving inward into the slots the selected cross-bar pushes in the hook-lever 25, Fig. 1. There is one of these hook-levers 25 for

each key of the typewriter and the corresponding cross-bar. The ordinary key buttons of the typewriter key levers are omitted and the key levers all cut to the same length as 2 in Fig. 1. The end of the key lever is cut into hook form and a U shaped loop of thin sheet metal 26 is riveted on to it. The hook-lever 25 hangs on the hooked end of the key lever and the U shaped strip 26 keeps it in place. Springs 28 tend to throw each hook 25 out against the cross-bars. Screwed on to the side of the key levers 2 by shoulder screws 29 is a series of pawls 30, one for each key. The end of each pawl is bent round as may be seen more clearly in Fig. 2, and this bent portion rests on the top 27 of the hook-levers 25, the pawls being kept down in place by springs 31. An alternative arrangement shown in Fig. 9 is to hang the hook-levers on shouldered rivets 26^a on the side of the ends of the key levers. In this case the pawls 30 will be straight. When any given hook-lever 25 has been pushed inward by a cross-bar the top 27 of the hook-lever moves out sufficiently to allow the end of the pawl 30 to fall into the notch in the top of 27. The hook-lever that has been selected and thrown inward is by this means retained in the inward position. The hook end 32 of the lever 25 that has been locked in in this way comes under the universal striker-bar 33. This striker-bar is fastened to the ends of three light steel blades 34, 34^a and 34^b, the whole being pinned into one rigid frame-work by the aid of the rod 35^a. The blades 34, 34^a, 34^b, terminate in collars 35, 36, and 37, which are free to oscillate on the shaft 20. Forming one piece with the collar 36 and projecting to the right is a lever 38 carrying on its outer end a friction roller 39 which rests on a snail-shaped cam 40. The spring 41 makes the roller 39 follow the cam 40. Levers 34, 34^a, 34^b and 38 all forming one piece, the rotation of the cam 40 will raise 38 and 39 and correspondingly depress the striker-bar 33. At the same time the striker-bar will depress the selected hook-lever 25 and with it the corresponding key 2 of the typewriter. As the key 2 is depressed, the foot 42 of the pawl 30 strikes the slotted guide plate 3. In this way the pawl 30 is thrown out of engagement with the top 27 of the hook-lever 25. As the hook-lever 25 and the key 2 are suddenly released at the end of the printing stroke the inertia of the pawl 30 prevents it reëngaging in the notch on 27 before the lever 25 is pulled back into its inactive position against the cross-bar by the spring 28. The pawl then rests on top of 27 ready to lock the lever 25 the next time it is selected and pushed inward. The depression of the key 2 operates the typewriter and prints a letter in the usual way. This locking pawl 30 and the mechanism connected with it form an essential feature of the present invention, and the importance of the arrangement will be explained presently. In conjunction with this explanation it should be noted that the hook shape of the end 32 of the levers 25, Fig. 1, prevents them from becoming disengaged from the striker-bar once the striker-bar begins to depress them. From this moment the printing operation becomes independent of the other operations of the machine. The function of the locking pawls 30 is to preserve any given selection up to the time when it is taken care of by the striker-bar 33. The disengagement of the locking pawl by the depression of the key takes place immediately after this.

It remains to be described how the combs 14 are moved into their various permutations lengthwise in accordance with the letter signals arriving over the telegraph line so that any required cross-bar and hence any required key of the typewriter is operated as above described. On a platform along the center of the instrument there is placed a row of five magnets 43, 44, 45, 46, and 47, Figs. 1 and 3. This arrangement of the magnets in a row at the back of the combs is one of the novel features of the present invention. It has the advantage that it is compact and yet provides plenty of room for the magnets, which can therefore be made in a cheap commercial shape. They are single coil magnets with L shaped yokes 72. They are each provided with armatures pivoted at 48. Projecting from these armatures are five stiff clock-spring steel blades 50 fanned out as best seen in Fig. 1. For the sake of clearness the two magnets 43 and 44, Fig. 3, have been included in Fig. 1, though the section is taken beyond them. This enables their blades 50 to be seen completely. It will be noticed that the tip of each of these blades engages in a notch in one of the five combs. Consequently an electrical impulse passing through any one of the five setting magnets 43 to 47 will cause the magnet to attract its armature and the blade 50 will move the corresponding comb about 1.6 millimeters in the direction shown by the arrow 51. In Fig. 3 all the magnets are shown with the armatures attracted and the combs all moved from zero position. The arrangement is shown in detail in Fig. 6. In this case the armature is in the open position ready to be attracted. It will be noticed that in the bar 13, Fig. 3, there is a hole 71 large enough for the spring lever 50 to move freely back and forward, and that the tip of 50 engages in a notch in the comb 14. The slight friction of the comb in its bearings is sufficient to hold the comb and also the armature in either of the two positions in which they may be set by the magnets or pushed back

by the restoring mechanism presently to be described. The invention, however is not confined to this particular arrangement, because is is obvious that the combs may either be set by the magnets direct, or by springs, the magnets in the latter case operating trigger releases, the energy moving the combs being supplied from the driving motor by means of the restoring mechanism shown in Fig. 4. One method of carrying out the latter plan is shown in Fig. 7. In this case a pawl 75 is pivoted on the end of the armature 49. This pawl takes the place of the blade 50, and engages in the notch in the comb. 74 is a back-stop for the armature. In this case the hole 71 is just large enough to permit the pawl 75 to move up and down freely. The armature is retracted by the spring 76. When the armature is attracted, the corresponding comb is released and is moved in the direction of the arrow 83 by its corresponding spring 73. The mechanism in Fig. 4 returns the combs to zero position, where they are again caught and retained by the pawls 75.

The distributer of a multiplex printing telegraph system such as the Baudot distributes the arriving telegraph signals into one or more of the five setting magnets 43 to 47, and the combs 14 then move into a corresponding permutation so as to select a given cross-bar by the mechanism already described. Immediately after distributing a group of letter signals into one or more of the five setting magnets, the distributer sends an impulse through a printing magnet 52. This attracts its armature 53. This moves out a pawl 54, Fig. 3, and allows a tooth 55 on the rim of a clutch 56 to escape. The clutch piece 56 then moves along its axis into engagement with its corresponding half 57 fixed to the pinion 58. The pinion is constantly driven by a motor by means of the pulley 61, the shaft 60 and the pinion 59 gearing with 58. The clutch when in engagement causes the cam spindle 63 with its group of cams to make one revolution. When completing the revolution the tooth 55 of the clutch strikes the inclined plane 62, which throws the clutch out of engagement and the tooth 55 comes to rest on the top of the pawl 54. The details of this clutch are more clearly seen in Fig. 8. It is similar to that used in the Blickensderfer electric typewriter, but any well-known single revolution clutch will answer the purpose.

After a letter has been printed the combs 14 must be restored to zero position ready to be set again in another letter permutation. This is done by another cam 65 on the cam spindle 63. This operates the friction roller 64, which by a chain of levers and connecting rods, 66, 67, 68, moves the oscillating arm 69 so as to press it against the ends of the combs 14 and move them in the direction of the arrow 70, restoring the combs to their normal zero position ready for the next letter. This chain of levers and connecting rods is best seen in Fig. 4.

Turning to Fig. 8, showing the cam and clutch mechanism, the three cams 23, 65, and 40, are pinned to the shaft so as to move as one piece with it. The half of the clutch 57 is riveted to the pinion 58 shown in dotted outline, both revolving freely on the spindle. The other half of the clutch 56 is free to move lengthwise so as to come into and out of engagement with 57 as already described. A tongue 79 projecting from 56 engages easily in a keyway in the cam sleeve and a light spring 78 tends to throw 56 into engagement with 57, but this is prevented by a pawl engaging with the stud 55. The printing magnet momentarily frees the stud and the cams and cam spindle make one complete revolution.

The most novel and essential feature of the invention is the timing of the various actions of the machine. This will be best understood by the following description and by reference to the cam diagram, Fig. 5. The machine is driven by a small electric motor, and the speed is reduced by belt and gearing so that the cam spindle 63 makes about 300 or 400 revolutions per minute. In a multiplex printing telegraph the transmission of the signals and the printing of a letter have to take place during one revolution of the contact arm of the distributer. In the case of a double multiplex (that is to say a multiplex giving two channels of communication on one telegraph line), half the total time of the revolution of the distributer contact arm is required for the reception of the signals, and the printing has to take place during the remaining half of the revolution. This is the most unfavorable condition. With a triple or quadruple multiplex there is more time for printing. Taking therefore the case of the double multiplex and assuming a speed of 40 words a minute for each channel, the distributer has to make 240 revolutions per minute, or four revolutions per second. As printing (unless some special arrangement is made) must take place in half a revolution, it must take place in one eighth of a second. Actually the time available is still less, because the motor may vary somewhat in speed, and a safe working margin must be allowed. Hence the time available for printing is only about one tenth of a second. This corresponds to a speed of ten letters per second, or 100 words per minute, a speed at which it is injurious to run any ordinary typewriter for any prolonged period. The present invention overcomes the difficulty in the following manner: A description has al-

ready been given of the lever 25 and locking pawl 30 on each of the keys of the typewriter. This arrangement has two beneficial results. In the first place in most typewriters the depression of the various keys is seldom uniform, so that the hook-levers 25 have to be of varying lengths. The locking pawl arrangement insures that the striker-bar will engage with all hooks regardless of their length. In the second place this arrangement results in very little time being required for the in and out motion of the cross-bars. The selected cross-bar does not need to remain in the inward position holding the selected hook-lever 25 in till the striker-bar engages with it. Hence the cam 23, Fig. 5, controlling the lifting bar 17, Figs. 1 and 3, which controls the cross-bars, may be made very quick in its action. It will be seen that there is only a short depression 80, Fig. 5, in this cam, the rest of the cam being circular and therefore inactive. The moment the lifting bar has lifted the cross-bars clear of the combs, the projection 81 on cam 65 can come into action. This is the cam that thrusts the combs back to zero position ready to be set for the next letter. Once a hook has been thrown into the path of the striker-bar the printing cam 40, Fig. 5, can come into operation, and the printing action proceeds simultaneously with the setting of the combs for the next letter, the last letter having been stored up, so as to speak, in the printing mechanism. The result is that nearly the whole time of revolution of the distributer is available for printing, and the speed of action of the typewriter need not then exceed the moderate and satisfactory rate of fifty or sixty words per minute.

What I claim is:—

1. In a printing telegraph the combination with a typewriter mechanism, a selecting mechanism, and devices associated with the typewriter mechanism capable of receiving a selection from and retaining it independently of the selecting mechanism, of means for printing and for restoring the selecting mechanism, and independent means for operating the selecting mechanism.

2. In a printing telegraph, the combination of selecting mechanism, printing devices, levers connected to respective printing devices and adapted to be displaced or set by the selecting mechanism, means tending normally to restore said levers, and locking devices adapted to retain the levers in the displaced or set position.

3. In a printing telegraph, the combination with selecting devices and printing devices, of a rotating shaft, means operated by said shaft for effecting printing and the restoration of the selecting devices, and means independent of said shaft for operating the selecting devices.

4. In a printer for a printing telegraph system, the combination of printing devices, a selecting mechanism, levers connected to respective printing devices and adapted to be displaced or set by the selecting mechanism, means for retaining a lever in its displaced position and for subsequently releasing said lever, and means engaging with any displaced lever to operate the corresponding printing device.

5. In a printer for a printing telegraph system, the combination with printing devices and means for operating said devices, a selecting mechanism means for operating and means for restoring said mechanism, and means for retaining the selection while the selecting mechanism is restored, of a cam shaft and cams thereon adapted to operate the printing mechanism and the restoring mechanism at the beginning of the operation of the printing mechanism.

6. In a printer for a printing telegraph system the combination with selecting means and printing means, mechanism intermediate between said selecting and printing means and connected to the latter, said mechanism being adapted to be set by the selecting mechanism and to retain its setting until the printing operation, of a cam shaft and cams thereon adapted to operate the printing mechanism and at the same time to restore the selecting mechanism at the beginning of the printing operation.

7. In a printer for a printing telegraph system, the combination with printing devices, a selecting mechanism, levers connected to respective printing devices and adapted to be displaced or set by the selecting mechanism, means for retaining a lever in its displaced position and for subsequently releasing said lever, and means engaging with any displaced lever to operate the corresponding printing device, of a cam shaft and cams thereon adapted to operate the printing mechanism and at the same time to restore the selecting mechanism at the beginning of the operation of printing.

8. In a printing telegraph, the combination of selecting devices, selector levers cooperating with said selecting devices so that one lever alone moves on the completion of any selection, and independent levers associated with the printing devices unconnected with but each adapted to be moved by one of the selector levers.

9. In a printing telegraph the combination with selecting devices and printing devices, of levers suspended from respective printing devices, selector levers coöperating with the selectors and each adapted to move a suspended lever in one direction only.

10. In a printer for a printing telegraph system, the combination of printing devices, a selecting mechanism, levers connected to respective printing devices and adapted to

be displaced or set by the selecting mechanism, pawls pivoted to said printing devices adapted to engage and hold a displaced lever and to be released at the printing operation, and means engaging with any displaced lever to operate the corresponding printing device.

11. In a printing telegraph the combination of a typewriter mechanism, selecting devices, and mechanisms associated with individual typewriter keys, each adapted to maintain the selection of its key while all the remaining devices and mechanisms are restored.

12. In a printer for a printing telegraph system, combs capable of relative longitudinal motion, cross-bars coöperating therewith, pivoted levers engaging with the cross bars and adapted to be displaced thereby, means for disengaging the cross-bars from the combs to permit restoration of the latter and means for retaining a pivoted lever in its displaced position during such restoration.

13. In a printer for a printing telegraph system, combs capable of relative longitudinal motion, electromagnets controlling the movement of the respective combs, cross-bars coöperating with said combs, pivoted levers engaging with the cross bars and adapted to be displaced thereby, and means for retaining a lever in its displaced position independently of the cross-bars.

14. In a printer for a printing telegraph system, combs capable of relative longitudinal motion, electromagnets controlling the movement of the respective combs, cross-bars coöperating therewith, pivoted levers engaging with the cross bars and adapted to be displaced thereby, means for disengaging the cross-bars from the combs to permit of restoration of the latter and means for retaining a pivoted lever in its displaced position during such restoration.

15. In a printer for a printing telegraph system, combs capable of relative longitudinal motion, springs drawing said combs lengthwise, catches retaining the combs, electromagnets adapted to release the respective combs, cross-bars coöperating therewith, pivoted levers engaging with the cross-bars and adapted to be displaced thereby, and means for retaining a lever in its displaced position independently of said cross-bars.

16. In a printer for a printing telegraph system, combs capable of relative longitudinal motion, springs drawing said combs lengthwise, catches retaining the combs, electromagnets adapted to release the respective combs, cross-bars coöperating therewith, pivoted levers engaging with the cross-bars and adapted to be displaced thereby, means for disengaging the cross-bars from the combs to permit restoration of the latter and means for retaining a pivoted lever in its displaced position during such restoration.

17. In a printing telegraph, the combination of printing devices, selecting devices, levers associated with respective printing devices adapted to be moved by the selecting devices, and pawls adapted to engage respective levers when moved so as to maintain the selection.

18. In a printer for a printing telegraph system, the combination of selecting means and printing means, with mechanism intermediate between said selecting and printing means connected to the latter, and adapted to be set by the selecting mechanism and locking devices operative on the setting of said intermediate mechanism causing it to retain its setting.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

DONALD MURRAY.

Witnesses:
A. E. ODELL,
LEONARD E. HAYNES.