Jan. 14, 1941. S. A. KRAFT ET AL 2,228,464

SHEET PERFORATING DEVICE

Filed Nov. 28, 1939 2 Sheets-Sheet 1

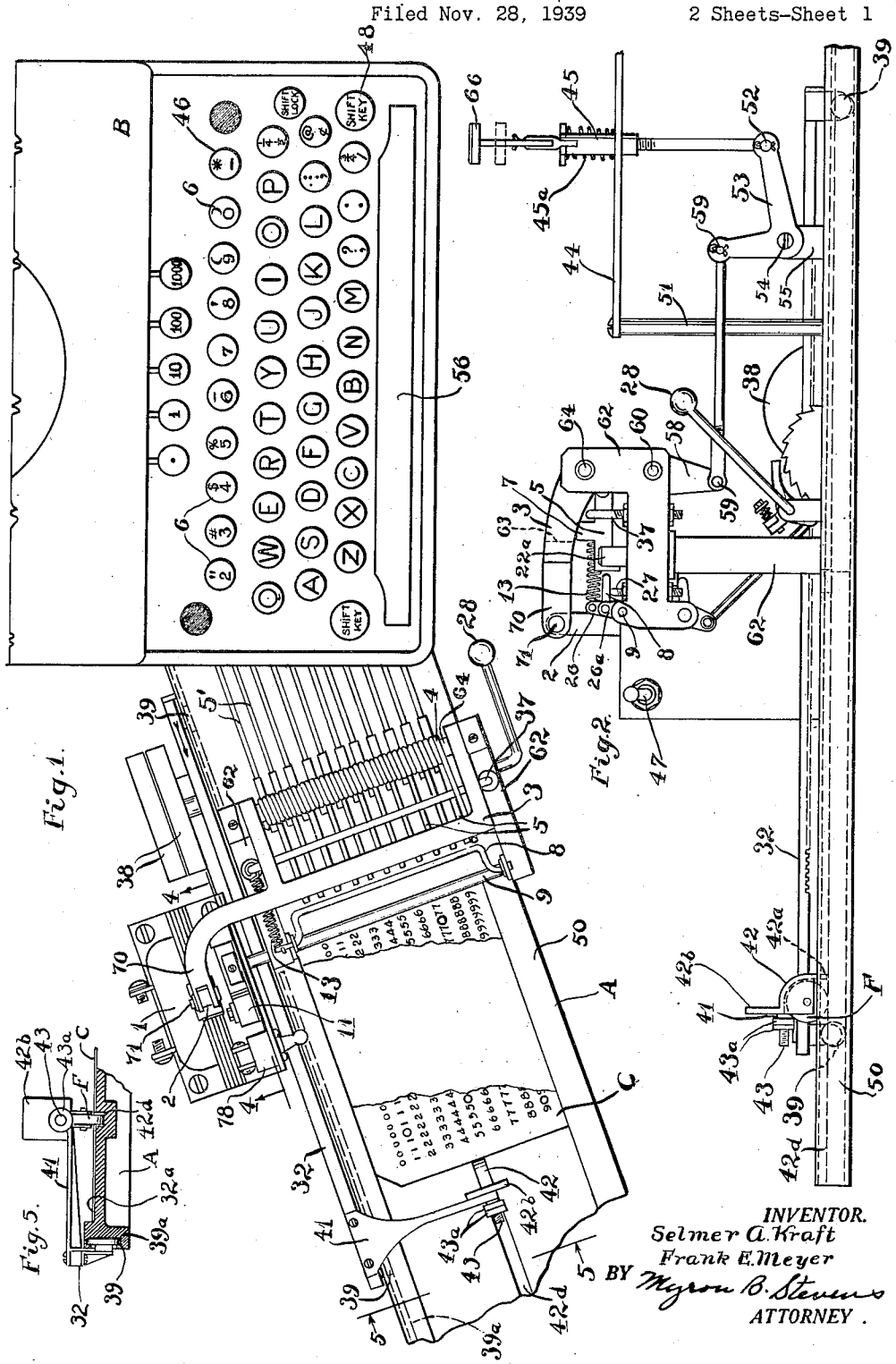


Fig. 1.

Fig. 5.

Fig. 2.

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Fig. 3.

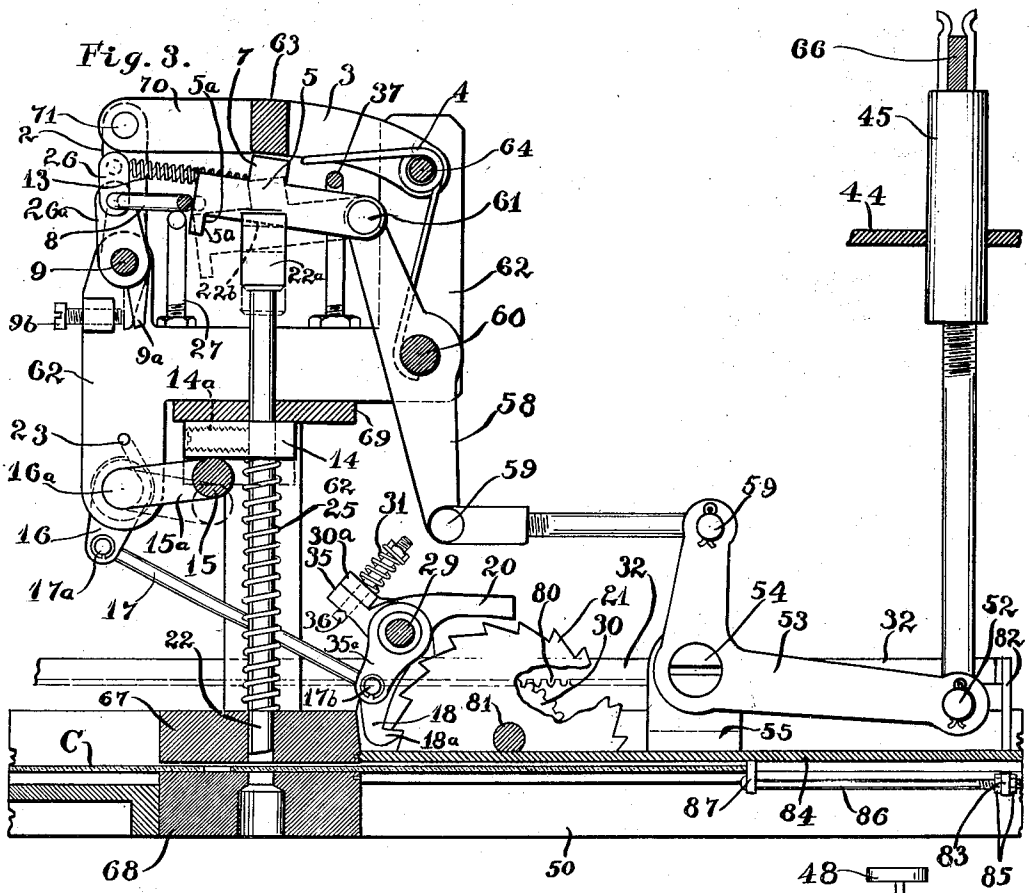
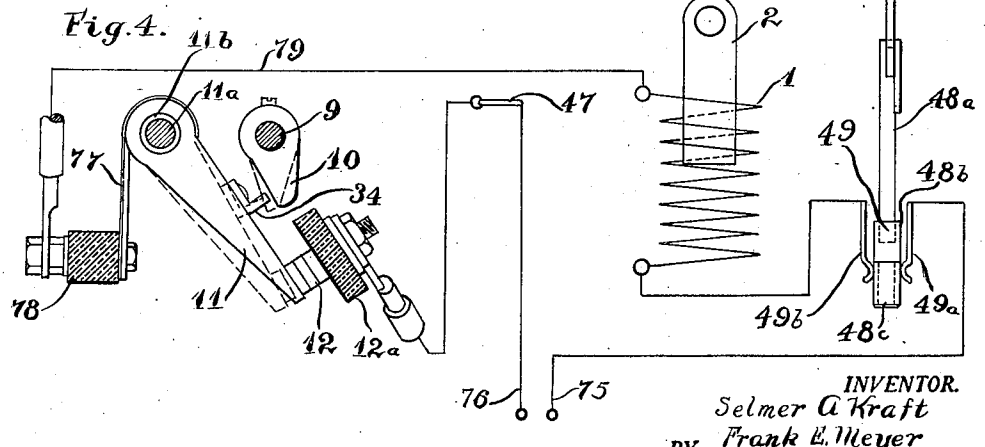


Fig. 4.



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UNITED STATES PATENT OFFICE

2,228,464

SHEET PERFORATING DEVICE

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Application November 28, 1939, Serial No. 306,554

9 Claims. (Cl. 164—112)

Our invention relates to devices for punching statistical cards and more particularly to such devices as comprise attachments for a standard typewriter. However, our device is susceptible of being constructed as a complete unit capable of being used apart from a typewriter.

An object of the invention is to provide an improvement over the patent to Frank E. Meyer, No. 1,439,184 of December 19, 1922 and the abandoned applications of Frank E. Meyer, Serial No. 183,030, filed January 3, 1938 and Serial No. 462,323, filed June 19, 1930.

A further object of our invention is to provide an improved card punching device having card punching means actuated by electricity.

A further object of our invention is to provide a card punching device having a plurality of card punching means which are selectively operated by a single electrically motivated actuating means.

A further object of our invention is to provide an electrically operated card punching means wherein means for moving a card to a new position is coupled to and actuated by said electrical operating means.

A further object is to provide an improved card punching attachment for a typewriter wherein operation of a single key of the typewriter, such as the shift key, renders said atttachment operative or inoperative.

A further object of our invention is to provide a card punching attachment for a typewriter having a positive mechanical connection to the typewriter which will permit substantially wide variations in the position of said attachment relative to said typewriter.

A further object is to provide a card perforating unit complete in itself and having electrical drive means.

A further object is to provide an electrically operated card perforating device having a manually operable card release.

A further object is to provide a key operated card perforating device wherein operation of any numeral key automatically selects a corresponding perforator by positioning a perforator selector in an operative position relative to said perforator, said selector being operative as it reaches its operative position to close an electrical circuit to an electrically driven actuating means for said perforator, said selector being thereafter movable by said actuating means with said perforator to break said circuit after the actuation of said perforator and said perforator being operative by the action thereof to advance the card to the next position.

A further object is to provide an electrically driven card perforating device having a single drive means for a plurality of perforating means and having a key actuated mechanical selector for each perforating means.

A further object is to provide a perforating device for cards or the like including means movable to perforate a card, a carriage for such card, means for advancing the carriage, and means on the perforating means and effective on perforating movement thereof to actuate said carriage advancing means.

A further object is to provide a carriage for a card or the like perforating device having card holding means, and means for adjusting said card holding means to vary the position of said card on said carriage.

Other objects and advantages reside in the particular structure of our device, combination and arrangement of the several parts, and in the particular mode of operation, all of which will be readily apparent to those skilled in the art upon reference to the drawings and the following specification.

In the drawings:

Figure 1 is a fragmentary plan view of one form of our invention showing the same attached to a typewriter;

Figure 2 is a fragmentary elevation of a modified form of the invention showing the same as a complete unit;

Figure 3 is an enlarged, fragmentary vertical section of a portion of Fig. 2;

Figure 4 is a fragmentary vertical section on line **4—4** of Fig. 1 of the switch for actuating the device and including an elevation of a circuit breaker for breaking the circuit and a diagram of the circuit; and

Figure 5 is a fragmentary vertical section taken on the line **5—5** of Fig. 1.

In the drawings, wherein like reference characters have been used throughout to designate like parts, and referring to Fig. 1, a standard typewriter B has connected thereto a card perforating attachment A. The attachment A includes a frame **50** on which are mounted a plurality of punch selector links **5'**. The links **5'** are each connected to a different number key **6** of the typewriter B for actuation thereby in any suitable manner (not shown) such as the connections illustrated in Fig. 2 of the aforesaid Patent No. 1,439,184 of Frank E. Meyer. Such connection results in axial movement of links **5'** upon

depression of the keys 6. Where the typewriter B does not have a key for the digit "1," the corresponding link 5' may be connected to the "L" key or to the end key 46 of the numeral row. The shift key 48 of the typewriter may be connected to a circuit breaker (to be described later) to permit use of the $-sign or other symbols of the numeral row without actuating the perforating attachment. Actuation of the other keys and of the space bar 56 will not, of course, actuate the perforating device, except where the "L" key is used for the digit "1," in which instance it would be necessary to break the circuit by use of the shift key 48.

In the form of invention of Fig. 1 the perforating device is substantially the same as that shown in Figs. 2 and 3. Consequently, it is not necessary to describe but one form except for the minor differences which will, of course, be described separately.

Referring more particularly to Figs. 2, 3 and 4, the perforating device comprises a frame 50 at one end of which a key guide plate 44 is mounted by any suitable means such as the uprights 51 (only one of which is shown). The plate 44 is provided with a plurality of holes in which are slidably mounted a plurality of plungers 45 to the upper ends of which are connected keys 66 in any suitable manner. For the purpose of clarity, but a single key, plunger and associated parts operated thereby has been shown but it is understood that as many additional like elements may be provided as may be desirable. The lower end of the plunger 45 is pivotally connected as at 52 to one end of a bell-crank lever 53 which is pivoted as at 54 to an ear or like element 55 of the frame 50. The other end of the bell-crank 53 is pivoted as at 59 to one end of a double armed lever 58. The lever 58 is centrally pivoted to a shaft 60 which extends across the frame 50 between uprights 62 thereof. The upper end of the lever 58 is pivoted as at 61 to one end of a punch selector lever 5. It will be obvious from the foregoing that when the key 66 is depressed the upper end of lever 58 will be moved forwardly and move the selector lever 5 from its retracted position of Fig. 2 to its operative position shown by full lines in Fig. 3. In the operative position, the selector lever 5 is directly beneath the bight portion 63 of a substantially U-shaped punching bar 3. The free ends of bar 3 are pivoted on a shaft 64 which extends across the frame 50 and has its ends seated in the uprights 62 thereof. The punching bar 3 is normally held in a raised position by a spring 4 which surrounds the shaft 64 and which has one end engaged with the lower shaft 60 of the frame and the other end engaged beneath one leg of the punching bar 3. The punching bar 3 is swung downwardly on its pivots, the bight 63 engages a lug 7 on the upper portion of the selector lever 5 and the latter is swung downwardly on its pivot 61 to the broken line position of Fig. 3.

Below each selector lever 5 is positioned a vertically reciprocal punch 22. The punch 22 has a head 22*a* providing a slot 22*b* in which the bottom edge of the selector lever 5 is slidably received and guided. The upper end of the punch 22 is guided in a hole in a guide plate 69 which extends transversely of the frame 50 and the lower end is guided in a hole in a transverse guide 67 and the punch die 68. A coil spring 25 which surrounds the intermediate portion of the punch 22 maintains the same normally in a raised position by bearing at its lower end against the upper surface of guide plate 67 and at its upper end against the lower surface of a tappet 14 which is secured to the punch 22 by a set screw 14*a*. The tappet 14 serves not only to limit the upward movement of the punch 22 by engaging with the guide plate 69 but has an additional function to be described later. Thus, as the selector lever is moved downwardly to the broken line position it drives the punch 22 downwardly to punch a hole in a card C which is slidably positioned between the lower guide plate 67 and the punch die 68.

The actuating means for the punch bar 3 comprises a solenoid 1 suitably attached to one side of the frame 50. The upper end of the plunger 2 of the solenoid 1 is pivotally connected as at 71 to an extension 70 of the punching bar 3. Energization of the solenoid 1 draws the plunger 2 downwardly taking with it the punching bar 3 whereby to actuate the punch 22 whose selector lever 5 has been moved to the operative position. The spring 4 retains the plunger 2 as well as the punching bar 3 in a raised position when the solenoid is not energized.

The solenoid is energized as follows: Assuming the leads 75, 76 (Fig. 4) are connected to a suitable source of current, not shown, and the switches 47 and 49 (to be described later) are closed, current will flow to the solenoid through the stationary and movable contacts 12 and 11 at each depression of an actuating key 6 or 66. Referring to Fig. 3, it is seen that as the selector lever 5 moves forward its front end bears against the bight portion of a U-shaped bar 8 the ends of which are pivotally secured to and between a pair of spaced lever arms 26*a* which are rigidly connected to a shaft 9. Thus, as the selector lever 5 moves forward the shaft 9 is rotated in a counter-clockwise direction carrying with it an additional lever arm 10 rigidly secured on said shaft. The arm 10 is normally in the broken line position of Fig. 4 where it holds the movable contact 11 out of engagement with the stationary contact 12. The movable contact 11 has an insulated bearing 11*b* which pivotally connects the contact to a shaft 11*a*. A current conducting spring 77 having one end connected to the contact 11 and the other to an insulating base 78 normally maintains the contact 11 in engagement with the contact 12 when the partial rotation of the shaft 9 has moved the lever arm 10 to the full line position of Fig. 4. Upon release of an actuating key 6 or 66, a spring 13 having one end connected to a lever arm 26 of bar 8 and the other to a keeper 37, rotates the shaft 9 in a clockwise direction to force the lever arm 10 into engagement with the contact 11 and move the same to break the circuit. Such return rotation is limited by a rigid stop arm 9*a* on the shaft 9 which engages with an adjustable stop 9*b* carried by the frame extension 62. The keeper 37 comprises an inverted U-shaped bar, the bight of which overlies the selector levers 5 and prevents them from flying out of the slots 22*b* of the punch heads 22*a* when the punches 22 are retracted. Rearward movement of the selector levers 5 is limited by downwardly projecting lugs 5*a* on the front ends thereof which engage with the punch heads 22*a*. It is to be noted, further, that the return movement of the bar 8 is permitted immediately after each punching act and before the key returns to its initial position by reason of the fact that the blow of the punching arm 3 depresses the selector lever 5 below the level of the arm 8, as is indicated in broken lines

in Fig. 3. Thus, the circuit to solenoid 1 is broken immediately after each punching act. The arm 8 is normally held in its operative position by the pull of the spring 13 on the other arm 26 of the bell crank. Downward movement of the bar 8 below the operative position is prevented by any suitable stop 27. The stop 9a, aforesaid, limits the return movement of bar 8 before the similar movement of selector lever 5 has been completed (Fig. 2) thereby permitting a normal return of the typewriter key 6 or the key 66 to its initial position.

The mechanism for moving the card C after each punching act is released by the punch 22 and comprises actuating means, releasing means and a card moving carriage 32. The carriage 32 comprises an elongated rack positioned along one side of the frame 50 outside of the adjacent frame extension 62 and is supported at each end by rollers 39 which travel in a runway 39a of the frame 50. The rack portion of carriage 32 has downwardly directed teeth 80 which mesh with a gear 30 rigidly secured on a shaft 81 which extends transversely of frame 50 with its ends journalled in the sides thereof. The rear end of carriage 32 mounts the upper end of a vertical leg 82 of an L-shaped arm, the horizontal leg 83 of which extends inwardly of the frame 50 below the frame plate 84 and terminates centrally of the frame 50. A rod 86 is adjustably connected to the horizontal arm 83 by adjusting nuts 85. The other end of rod 86 mounts a card engaging stop or plate 87 which engages the rear edge of the card C and pushes the same along with the carriage 32 a predetermined distance at each partial rotation of the gear 30. The card C is supported for sliding movement relative to the frame 50 in a recess 32a therein or by any other suitable means, as is well known in the art.

The forward end of the carriage 32 mounts an inwardly directed arm 41 (Figs. 1 and 5) to the free end of which is connected an adjustable stop 42 for the front edge of the card C. The stop 42 comprises a skirted, downwardly directed, card engaging portion 42a which fits in a longitudinally disposed groove 42d of the frame 50. The stop 42 also has an upstanding finger piece 42b and a threaded stud 43. The stud 43 extends through the free end of the arm 41 and carries adjusting nuts 43a for adjusting the stop 42 relative to the arm 41. A wheel F is mounted between the skirts of the portion 42a. The wheel F rides in the groove 42d and supports the inner end of the arm 41. It is apparent from the foregoing that by adjusting the front and rear stops 42 and 87, a card C can be positioned correctly beenath the punches for the initial punching act. Thereafter, the card is moved automatically to the next punching position by the means now to be described.

As the punch 22 descends (Fig. 3), the tappet 14 carried thereby engages the transversely extending bight of a U-shaped bar 15, the legs 15a of which are bent parallel to the bight as at 16a and are journalled in uprights 62. A bell crank arm 16 is rigidly connected to one shaft portion 16a of the bar 15. The free end of crank arm 16 is pivotally connected as at 17a to one end of a link 17. The other end of link 17 is pivotally connected as at 17b to an arm 35a of a pawl 20 which is freely mounted on a transverse shaft 29 of the frame 50. The pawl 20 is provided, also, with an apertured lug 35. The toe of the pawl 20 is, as shown, normally out of engagement with the teeth of a ratchet wheel 21 rigidly mounted on the shaft 81 which, as aforesaid, also mounts the carriage-driving gear 30. The shaft 81 is loaded for rotation in a counter-clockwise direction by any suitable means, such as the dual coil spring 38, which is mounted on one side of the frame 50 and which is connected to the adjacent end of shaft 81 in any suitable manner as is well known in the art. The lug 35 of the pawl 20 is positioned behind a similar lug 30a of a hook-pawl 18. A threaded stud 36 extends through the apertures in lugs 30, 35 and the two lugs are normally held in abutting relationship by a coiled spring 31 which is adjustably mounted on the stud 36. The pawl 18 is rigidly secured to the shaft 29 and the hook 18a thereof normally is engaged with a tooth of the ratchet wheel 21 to prevent rotation thereof by the spring 38. Thus, as the punch 22 descends, both pawls 18 and 20 are given a partial rotation in a clockwise direction and the hook 18a of pawl 18 is withdrawn from engagement with its ratchet tooth as the toe of pawl 20 descends to engage the ratchet 21. It will be noted, however, that there is a slight clearance between the toe of pawl 20 and the back of the adjacent ratchet tooth. This clearance is sufficient to permit a slight counter-clockwise rotation of the ratchet 21 by the spring 38 after the hook 18a clears its tooth. The card is punched just after this slight movement of the ratchet while the toe of pawl 20 holds the ratchet 21 against further rotation. As the punch ascends, the pawls 18 and 20 are given a partial rotation in a counter-clockwise direction by a spring 23 on the shaft 16a of the U-shaped bar 15, whereby the pawl 20 releases its ratchet tooth as the hook 18a of the pawl 18 engages the sloping peripheral surface of a ratchet tooth. Such engagement by the hook 18a is caused by the slight initial movement of the ratchet 21 when it engages the pawl 20. As the hook 18a cannot, of course, hold the ratchet against movement now, the spring 38 advances the ratchet 21 until the hook 18a is engaged behind the next ratchet tooth. This counter-clockwise rotation of the ratchet 21 moves the carriage 32 one step to the left through shaft 81, gear 30 and rack teeth 80. The card C is moved one step to the left simultaneously by the rear stop 87 of carriage 32 to the position shown in Fig. 3 where it is properly positioned for the next punching act. The punch 22 does not interfere with the forward movement of the card C because the punch has been withdrawn before both pawls have released the ratchet.

When it is desired to move the card C a step without perforating the card, the space bar 56 of the typewriter may be connected by links, etc. and a selector lever, identical to those of the number keys 6, to a punch-like member (not shown). Such punch like member is in all respects similar to the punches 22 except that it is sufficiently shorter that it will not perforate the card when it descends. It will, however, actuate the card advancing mechanism just described in exactly the same manner as do the punches 22.

A manual release for the pawls 18 and 20 is provided by the extension 28 of the shaft 29. Such extension 28 is upwardly turned to provide a handle. A slight downward movement of the handle 28 rotates shaft 29 and pawl 18 which is secured thereon in a clockwise direction. This action raises the pawl-hook 18a out of engage-

ment with the ratchet 21 without lowering the pawl 20 because the lug 30a of pawl 18 rides up stud 36 against the action of the spring 31 thereon. With the ratchet thus free to rotate, the spring 38 rotates shaft 81 and a partially punched card is rapidly ejected from the device. It is not necessary to use the manual release just described to remove a completely punched card from the device, although it can be so used, because a completely punched card will have its front edge extending sufficiently outwardly of the device to permit its being gripped by the hand of the operator and removed.

The punching mechanism and associated parts just described is the same in both forms of the invention except that in the Fig. 1 form the links 5' take the place of the links 55 of the form shown in Figs. 2 and 3 and are connected to the appropriate typewriter keys in a well known manner. Also, the form of Figs. 2 and 3 which provides a unitary device rather than a typewriter attachment, and which would usually have only the ten number keys commonly used in such devices, would have no particular need for a switch such as that illustrated at 49 in Fig. 4.

The switch 49 of Fig. 4 is shown applied to the form of invention disclosed by Fig. 1. The switch comprises a plunger 48a which is connected in any suitable manner to the shift key 48 of the typewriter. The lower end of plunger 48a is provided with an extension 48b formed of insulating material. Such extension 48b is provided at its lower end with a collar 48c of current conducting material. The extension 48b is slidable with its collar 48c between spring contacts 49a and 49b. It is apparent from the foregoing that when the shift key 48 is depressed, the insulating upper portion of the extension 48b is interposed between the contacts 49a and 49b and the circuit will be broken in the lead 75, whereby to permit use of the other symbols in the numeral row of the typewriter. Release of the shift key 48 raises the plunger 48a and positions the current conducting collar 48c between the contacts 49a and 49b thereby closing the circuit in lead 75.

The switch 47 is applicable to both forms of the invention and may be positioned at any suitable point on the frame 50. It may comprise the usual toggle switch and is used to break the circuit and prevent accidental actuation of the device when the same is out of service overnight or not being used. This makes it unnecessary to remove the leads 75 and 76 from the usual plug and socket connection with a source of electrical current.

The entire cycle of operation of the device is believed to be clear from the foregoing description. While it has not been described, the usual procedure is followed in inserting the card, and the data punched thereon is in keeping with the usual practice.

While we have shown and described what are now believed to be the preferred forms of our invention, it is to be understood that we do not limit ourselves to the precise forms shown and described except as hereinafter claimed.

We claim:

1. In a card perforating device, including a plurality of punches and means for selectively actuating each punch to perforate a card; a frame mounting said punches, a spring propelled card-carrying carriage movable along said frame, means on said frame for holding said carriage against movement in a card advancing direction, carriage releasing means operative to release said holding means to permit a limited card advancing movement of said carriage after the completion of each punching act and means fixedly carried by each punch to actuate said carriage releasing means.

2. In a card perforating device, including a plurality of punches and means for selectively actuating each punch to perforate a card; a frame mounting said punches, said punches having a working and a non-working stroke, a card-carrying carriage movable along said frame, a rotatable shaft on said frame, a driving connection between said shaft and carriage, a spring biasing said shaft to rotate in a direction to advance said carriage, a ratchet on said shaft, a second shaft, a pair of cooperating pawls on said second shaft, one of said pawls normally engaging said ratchet to prevent rotation of said first shaft, punch actuated means for simultaneously releasing said engaged pawl and moving the other pawl into a position to engage said ratchet after a slight movement thereof during each working stroke of each punch, means releasing said second pawl and simultaneously positioning said first pawl to re-engage said ratchet after a limited rotation of the same after the working stroke of each punch, whereby to permit a step-by-step advance of said carriage as said punches are actuated, said punch actuated means including a lateral extension on each punch, a swingable member engageable by each extension, and an operative connection between said swingable member and said second shaft

3. In a card perforating attachment for a typewriter having a keyboard and a shift key; comprising electrically driven card perforating punches operatively connected to keys of said key board for selective actuation thereby, electric means for actuating said punches, an electric circuit for said last means, a circuit breaker in said circuit, said circuit breaker being operatively connected to said shift key whereby each depression of said shift key opens said circuit breaker and breaks said circuit.

4. In a card perforating device, including a plurality of punches and means for selectively actuating each punch to perforate a card, a frame mounting said punches, a card-carrying carriage movable along said frame, a spring biasing said carriage in a card advancing direction, a ratchet associated with said spring, at least one pawl engageable with said ratchet to prevent propulsion of said carriage by said spring, and means rigidly carried by each punch, said means being adapted to disengage said pawl from said ratchet temporarily at the completion of each punching act.

5. In a card perforating device, including a plurality of key actuated punches, a frame mounting said punches, a card-carrying carriage movable along said frame, a spring biasing said carriage in a card advancing direction, a ratchet associated with said spring, at least one pawl engageable with said ratchet to prevent propulsion of said carriage by said spring, an operative connection between each punch and said pawl and adapted to disengage said pawl from said ratchet temporarily at the completion of each punching act, said operative connection comprising a lateral extension on each punch, a movable member adapted to be engaged by each extension and moved thereby during the working stroke of each punch, and means operatively connecting said movable member to said pawls.

6. A card perforating attachment for a typewriter having a plurality of keys, comprising a

plurality of punches, a driven member for actuating all of said punches, a selector lever for each punch advanceable to an operative position to connect the same to said driven member, mechanical connections between said levers and appropriate typewriter keys whereby each selector lever is advanced to its operative position by the depression of its typewriter key, electric means for driving said driven member, a normally open electric circuit for said last named means, a movable member for opening and closing said circuit, means biasing said movable member to a circuit opening position, said movable member being adapted to be engaged by each selector lever during its advancing movement and movable thereby to close said circuit, said driven member being adapted to disengage said lever from said movable member during each punching act to permit the latter to close said circuit.

7. A card perforating attachment for a typewriter having a plurality of keys, comprising a plurality of punches, a driven member for actuating all of said punches, a selector lever for each punch advanceable to an operative position to connect its punch to said driven member, mechanical connections between said levers and appropriate typewriter keys whereby each selector lever is advanced to its operative position by the depression of its typewriter key, electric means for driving said driven member, a normally open electric circuit for said last named means, a movable member for opening and closing said circuit, means biasing said movable member to a circuit opening position, said movable member being adapted to be engaged by each selector lever during its advancing movement and movable thereby to close said circuit, and means disengaging said lever from said movable member during each punching act to permit the return of said movable member to a circuit breaking position.

8. A card perforating attachment for a typewriter having a plurality of keys, comprising a plurality of punches, a driven member for actuating all of said punches, means advanceable to a position to connect a selected punch to said driven member, means connecting said first named means to an appropriate typewriter key whereby to advance said first means to its connecting position upon depression of said key, a motor driving said driven member, a movable member for starting and stopping said motor, means biasing said movable member to a motor stopping position, said movable member being adapted to be engaged by said first named means during its advancing movement and movable thereby to a motor starting position, and said driven member disengaging said first named means from said movable member during each punching act to permit the return of said movable member to a motor stopping position.

9. The structure of claim 3, said circuit breaker comprising a pair of spaced contacts and a member operatively connected to said shift key and slidable between said contacts, said member having an insulated portion and a current conducting portion, said current conducting portion being normally in engagement with said contacts, and said insulated portion being adapted to be interposed between said contacts when said shift key is depressed.

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