

(No Model.)

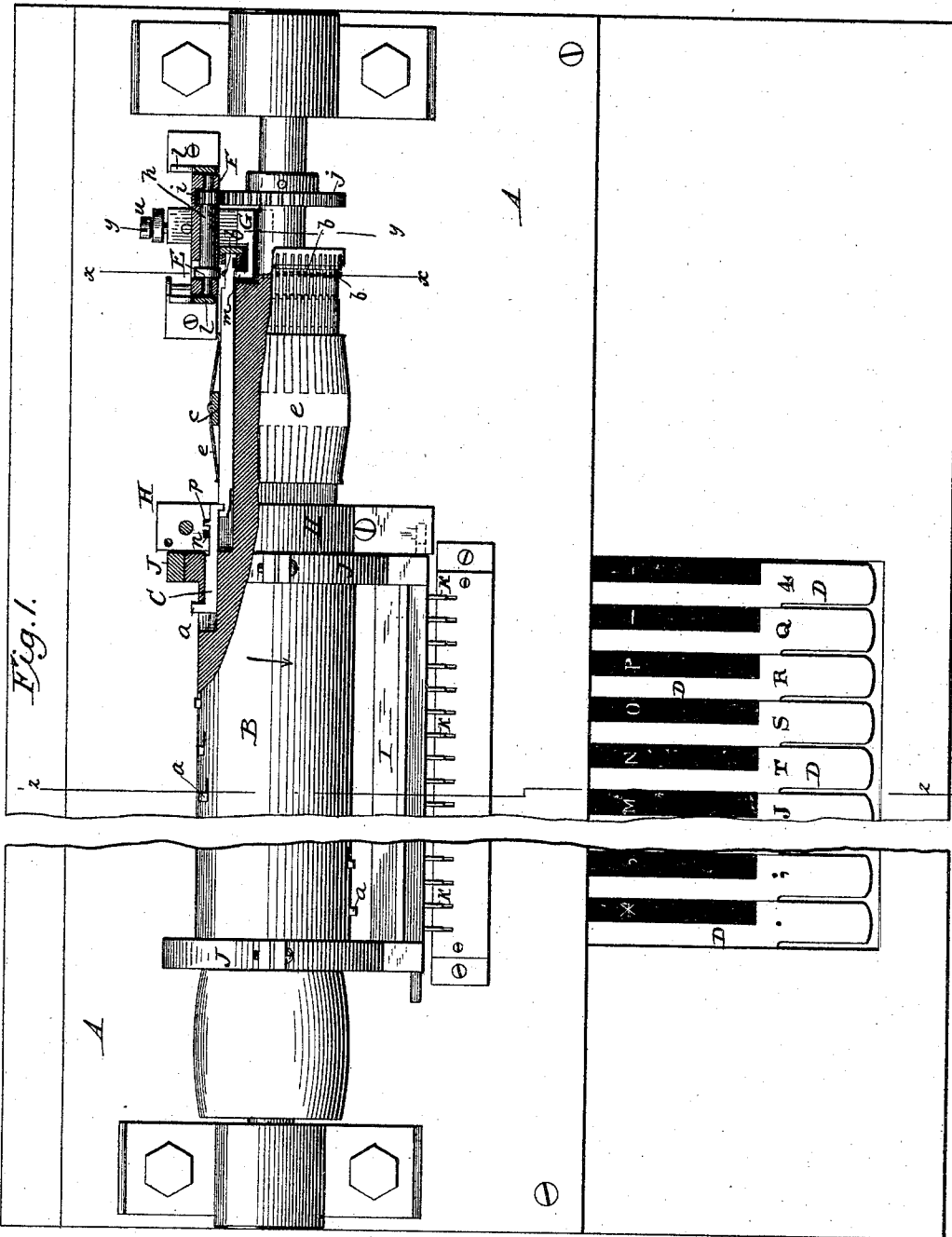
3 Sheets—Sheet 1.

# O. MERGENTHALER.

## MATRIX MAKING AND PRINTING MACHINE.

No. 328,960.

Patented Oct. 27, 1885.



WITNESSES

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INVENTOR

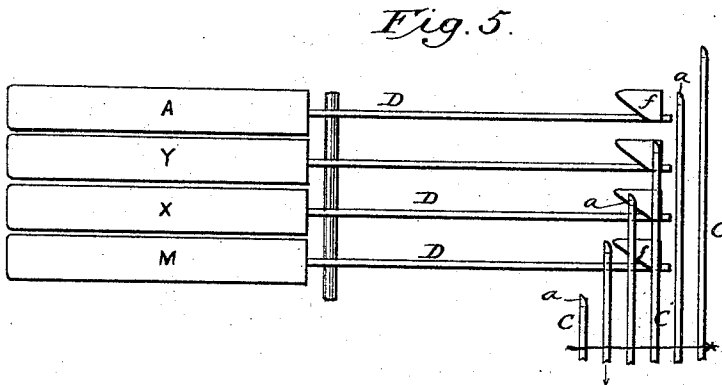
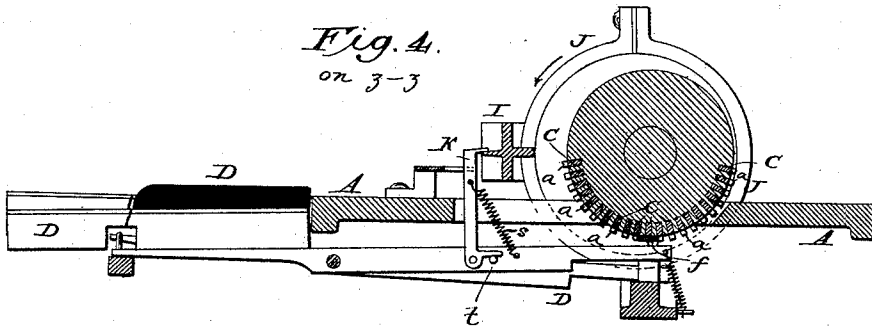
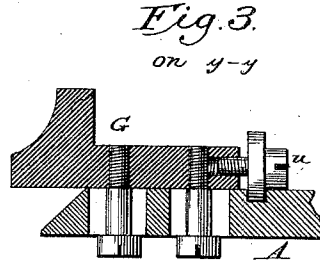
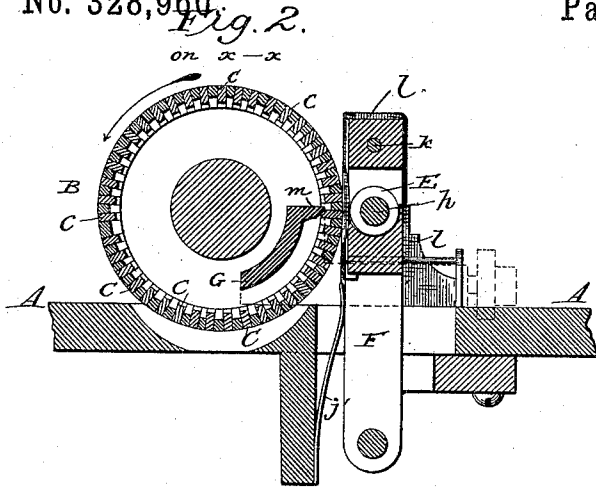
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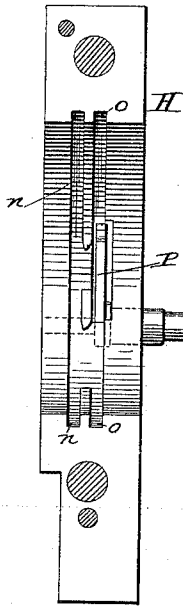


Fig. 6.

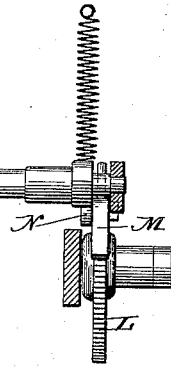


Fig. 7.

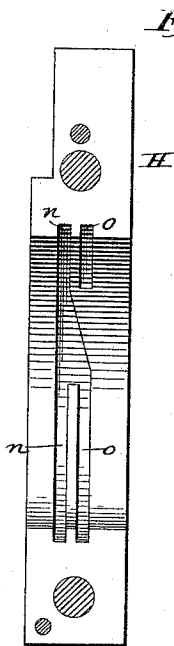


Fig. 8.

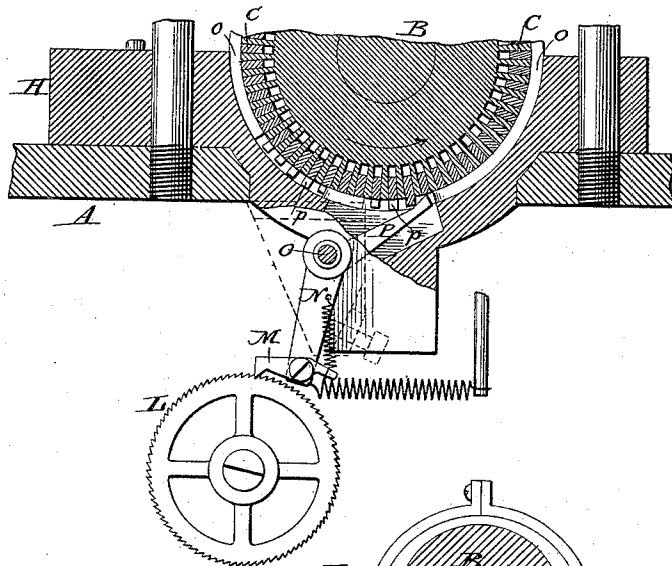


Fig. 9.

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# UNITED STATES PATENT OFFICE.

OTTMAR MERGENTHALER, OF BALTIMORE, MARYLAND, ASSIGNOR TO THE NATIONAL TYPOGRAPHIC COMPANY, OF WASHINGTON, D. C.

## MATRIX-MAKING AND PRINTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 328,960, dated October 27, 1885.

Application filed June 4, 1884. Serial No. 133,819. (No model.)

*To all whom it may concern:*

Be it known that I, OTTMAR MERGENTHALER, of Baltimore, in the State of Maryland, have invented certain Improvements in Matrix-Making and Printing Machines, of which the following is a specification.

This invention relates to a power-driven machine controlled by finger-keys for the purpose of printing on or impressing into a strip or sheet of paper or equivalent material letters or characters successively in the order in which they are to be read. It may be employed for surface-printing or for the formation of stereo-type-matrices from which to cast surfaces for letter-press printing in relief.

The invention has reference particularly to a machine in which a revolving cylinder is provided with longitudinally-moving slides actuated by finger-keys, the slides being provided with type or dies, which co-operate with a pressure device in passing the same; and it consists in the various details and combinations hereinafter specifically described and claimed.

Referring to the accompanying drawings, Figure 1 represents a top plan view of a machine constructed on my plan, a portion of the cylinder and attendant parts being broken away in order to expose to view the internal construction. Fig. 2 is a vertical cross-section on the line  $xx$  of Fig. 1. Fig. 3 is a sectional view on the line  $yy$  of Fig. 1, showing the means by which the cam may be adjusted to vary the depth of impression. Fig. 4 is a vertical cross-section on the line  $zz$ , showing the arrangement of the finger-keys and the manner in which they act upon the slides. Fig. 5 is a diagram illustrating in top plan view the finger-keys and the arrangement of the slides in relation thereto. Fig. 6 is a top plan view showing the arrangement of the feed mechanism in connection with the cam-grooves traversed by the studs upon the slides. Fig. 7 is a side elevation of the same. Fig. 8 is a face view looking upward against the interior of the upper part of the bearing represented in Fig. 6, showing the cam-groove therein. Fig. 9 is a view showing a modified construction of the devices for locking the finger-keys in an operative position.

In constructing my machine I provide a suit-

able frame-work, A, having thereon bearings or boxes to receive the journals of a horizontal cylinder, B. This cylinder, which is commonly made of a length of about twenty-four inches and of a diameter of about three and one-half inches, is provided in its circumference with a series of longitudinal grooves exceeding by one or two the letters which the machine is designed to print. In each of these grooves I mount a long narrow slide, C, having at a suitable point in its length a stud or projection,  $a$ , extending outward therefrom and having at one end a type or die,  $b$ , formed or fixed rigidly thereon and facing radially. The slides in the extra groove or grooves before alluded to are designed to secure a feed for spacing purposes, and, with the exception that they carry no letters or characters, they are similar to their companions. Each of these slides is free to move not only in a longitudinal direction, but also at the end bearing the type in a radial direction to a limited extent. They are confined in position within the grooves by means of a band or collar,  $c$ , encircling them, as shown in Fig. 1, this collar being at such distance from the end that the latter may spring outward. The slides are preferably constructed of steel or similar elastic material in order to spring inward to their normal positions when released; but as an additional means of pressing them inward, as well as to prevent any accidental longitudinal motion, I encircle the cylinder with a thin sheet-metal tube or sheet,  $e$ , divided at the end by numerous longitudinal slots or incisions into a series of fingers, which act with a spring-pressure upon the respective slides, as plainly represented in Fig. 1.

For the purpose of effecting the longitudinal movement of the selected slides, one at a time, I provide a series of finger-keys, D, mounted on horizontal pivots, and provided at their inner ends with laterally-inclined lips or projections  $f$ , underlying the cylinder, and designed to act upon the studs  $a$ , projecting from the slides, as before explained. The inner ends of the keys stand normally below the path of the studs, to which they are raised by pressure on their outer ends.

The various slides have their studs  $a$  arranged at different points in their length, and

in such relation with respect to each other that when the slides are in their normal positions the series of studs will extend in a spiral line about the cylinder. In consequence of this spiral arrangement, and of the fact that the beveled ends of the keys stand in line with the axis of the cylinder, it follows that when the cylinder is rotated the studs of the successive slides will be presented one after another to the corresponding keys. As a consequence of this arrangement, the slides will be acted upon by the keys successively one at a time, the arrangement precluding the simultaneous projection of any two slides.

For the purpose of supporting the paper or other material upon or in which the impression is to be made against the action of the type, I employ a revolving pressure-roll, E, in such position that the type upon those bars which have been moved endwise will be carried directly past its face. This roll is secured on the revolving shaft or spindle *h*, the opposite end of which is provided with a pinion, *i*, driven by a gear-wheel, *j*, fixed on the shaft or journal of the cylinder.

The parts are so proportioned and arranged that the pressure-roll has a surface-speed equal to that by which the type are carried by the rotation of the cylinder, so that acting on the back of the paper it co-operates with the moving type at the front to advance the same between them.

In order to permit the convenient insertion of the paper in commencing operations, and to give access to the working parts for other purposes, I mount the impression-roll E in a swinging frame, F, which is pivoted at its lower end, so that it may be swung backward in order to carry the roll away from the cylinder. A spring, *j'*, applied to the main frame, acts against the roll-frame to move it backward when relieved. I propose to lock the roll-frame in its forward position by devices of any suitable character; but I recommend for the purpose a rod, *k*, inserted through its upper end, as in Fig. 2, and bearing in stationary plates or supports *l*. The slides having been moved endwise to present the selected letters in line with the impression-roll, it is next necessary to move them radially at the instant they are passing the roll in order to effect the impression. To secure this result I mount firmly on the main frame or bed plate, as shown in Figs. 1, 2, and 3, an arm, G, one end of this arm being extended into the recessed end of the cylinder and fashioned into a cam or incline, *m*, adapted to act against the slides on the inner side, and thus force them outward one at a time toward the impression-roller as they are carried thereby. This action of the cam is plainly illustrated in Figs. 1 and 2. The cam is arranged to slide horizontally, and is adjusted by means of a screw, *u*, by which the cam may be advanced or retracted so as to give the slides a greater or less depth of impression. Any construction of the parts which will admit of the cam acting

against the inner edges of the slides to force them in a radial direction may be adopted; but I recommend, as shown in the drawings, the formation on each slide of a stud or lip extending through a slot in the cylinder into an internal space occupied by the cam. It will be noticed on reference to Fig. 1 that the cam will encounter those slides only which have been moved endwise by the finger-keys, so as to present their type in position for printing. The studs of the remaining slides which stand in their normal or retracted position will pass by the end of the cam without being encountered thereby. In other words, all slides, the keys of which have not been operated, will remain inactive within the cylinder, being carried passively therewith.

For the purpose of assisting the keys in moving the slides endwise to a printing position, and to return them endwise to their normal positions after the printing action has occurred, I provide one of the bearings, H, by which the cylinder is encircled, with two internal grooves, *n* and *o*, encircling its inner face, as represented in Figs. 1, 6, and 7. The groove *n* makes the complete circuit of the cylinder in a plane at right angles to its rotation, while the groove *o* extends but partly around the cylinder, and has its ends connected by oblique or lateral portions with the groove *n*, whereby it is adapted to serve as a switch to engage studs *p*, formed on the slides. Each slide bears one of these studs. So long as the slide remains idle its stud travels around and around within the groove *n*. When, however, the slide is acted upon by its key and moved endwise, its stud moves laterally from the groove *n* into the cam-groove *o*, through which it travels during the time that it remains in its forward position and until after the printing action. Immediately after the bar has passed the printing position its stud *p* will encounter the incline surface of the cam-groove and be forced backward thereby, so as to return the slide endwise to its original position. In place of the cam-groove and stud, a cam or incline acting in any other suitable manner upon the slides, or any equivalent mechanism for the purpose, may be employed to return them to the normal position.

In order that the machine may be operated with great rapidity, I have provided means by which the keys that have been depressed to effect the printing of corresponding characters may be locked automatically in an operative position until after the printing action, the hands of the attendant being in the meantime left free to actuate other keys. The means which I have devised for this purpose consist of a horizontal locking-bar, I, extended across and above the entire series of keys, and moved to and fro in the direction of the length of the keys by means of eccentric straps J, which are attached to the ends of the bar, and arranged to encircle eccentrics on the ends of the cylinder, the arrangement being such that the bar is moved once forward and back at

each revolution of the cylinder. In connection with this bar, I employ a series of yielding locking dogs or catches, K, pivoted one to each key, with a hook or lip at the upper end in position to engage over the bar and thus hold the end of the key in its elevated position, so as to act upon the stud of the corresponding slide when it is brought thereto by the rotation of the cylinder. As the bar is moved backward and forward in a positive manner, and with great rapidity when the machine is driven at full speed, there is a liability that the bar will strike the catches as they are being moved upward or downward past the same. To avoid the breakage of the parts which would result in such case, I pivot the catches to the finger-keys and apply spiral springs *s* to urge them forward, the forward motion being limited, however, by stop-pins *t*. Owing to this yielding action, it follows that in the event of the bar striking the catch, the latter will yield and permit the key to continue its upward or downward movement until the catch is carried clear of the bar.

The action of the locking devices is as follows: The operator having depressed the forward ends of two, three, or more keys, their rear ends will be elevated, thereby lifting the ends of the catches above the bar. The bar advancing immediately after will engage beneath the catches and lock the keys in position, so that they will actuate their respective slides in due time. Previous to the action of these keys, the operator may remove his hands therefrom and actuate other keys. After the keys have actuated the slides, they will be released by the forward motion of the locking-bar, and its consequent disengagement from the catches will occur. The feeding of the paper or other material through the machine will be effected by the combined action of the type and the rotary pressure-wheel, the adjacent surfaces of which urge the paper forward between them. The distance which the paper is moved for the printing of the different letters may be regulated to correspond with the width of the letters by giving the rear edges of the slides against which the cam acts different widths—that is to say, by giving each bar on the rear edge a width corresponding with the width of its letter or character, so that the cam will retain the bar in contact with the paper for a longer or shorter period.

In the drawings I have represented a supplemental feeding mechanism actuated by studs or projections on the rear edges of the slides. This mechanism, which is shown in Figs. 6 and 7, constitutes no part of my invention. It consists of a wheel, L, to actuate the feed devices of any suitable character, operated by means of a pawl, M, carried by an arm, N, on a rock-shaft, O, the opposite end of which is provided with an arm, P, having its extremity extended upward into the cam-groove *o*, before alluded to. Whenever a slide is advanced to the printing position, its stud *p*, being carried into the cam-groove *o*, will

encounter the arm P, and by depressing the same transmit motion through the intermediate parts to the ratchet-wheel. By making the studs of the respective slides of different lengths corresponding to the widths of the letters borne by the studs, the latter may be caused to move the feed devices different distances. Letters of narrow width—such as *i* and *j*, for example—will have short studs and impart but a slight motion to the feed mechanism, while extended letters—such as *m* and *w*—having longer studs, will impart a greater motion to the feed.

It will be perceived that the feed devices are actuated only by the studs of those slides which are advanced to the printing position, and that consequently the feed mechanism remains at rest when the machine is not printing.

At the end each of the printing slides may be made in one continuous piece from end to end; but it is preferred, as shown in the drawings, to construct each slide in two sections or lengths, having their ends notched and hooked together, as shown in Fig. 1. This construction is advantageous in that it permits the outer end of the slide bearing the type to be readily disconnected and removed for the purpose of cleaning or repairing the same, or replacing it by a new slide in the event of its being broken.

In the modifications shown in Fig. 9, the hooks or catches K are secured rigidly one to each key, and arranged to engage over a horizontal bar, I, which extends across the entire key-board, and which is connected by springs *s* to collars J on the eccentrics of the cylinder. The bar advances and retracts once at each vibration of the cylinder, and engaging the hooks K locks the individual keys up or down, as the case may be.

Having thus described my invention, what I claim is—

1. The combination of the revolving cylinder, the longitudinal slides having type on their sides, the finger-keys to effect the end motion of the individual slides, means, substantially as described, for returning the slides to their normal position, and a pressure device, substantially such as described and shown, to force the paper or equivalent material into contact with the slides.

2. In a printing-machine, a revolving cylinder provided with longitudinal slides each having a type or die, and each adapted to move radially as well as longitudinally.

3. The revolving cylinder, the longitudinally and radially moving slides having type or dies thereon, a device, substantially as described, to sustain the paper against the action of the type, and a pressure device, substantially as described, to urge the slides radially against the paper.

4. The grooved cylinder, in combination with the longitudinal type-bearing slides having projections on their inner sides, and the stationary cam arranged to encounter

the projections of those slides which are moved endwise from the normal position and force the same radially outward, substantially as described and shown.

- 5 5. The revolving cylinder and the type-bearing slides thereon, in combination with the pressure-roll E, and gearing, substantially as described, to effect the positive rotation of  
10 said roll at a surface-speed corresponding with that of the type.
6. In combination with the cylinder, the radially and longitudinally moving type-bearing slides, and the pressure-spring acting against the outer edges of said slides.
- 15 7. The combination of the revolving cylinder, the longitudinally and radially movable type-bearing slides, the cam to urge said slides outward, and means, substantially as described, for adjusting said cam, whereby it may be  
20 caused to move the type a greater or less distance.
8. The combination of the revolving cylinder, the pressure device, substantially as described, to force the slides outward, and the  
25 series of type bearing slides having their edges which are acted upon by the pressure device made, respectively, of different widths corresponding to the different characters or letters.
9. In combination with the pressure-roll,  
30 the revolving cylinder, the stationary cam or pressure device, substantially as described, acting within said cylinder, and the type-bearing slides having their inner edges arranged to be acted upon by the pressure device and  
35 constructed of different widths, whereby each slide is held in its outer or projecting position

for a longer or shorter period, according to the width of the letter or type borne upon its face.

10. The combination of the rotary cylinder, the type-bearing slides movable endwise therein, and the bearing provided with a cam groove or incline to retract the slides. 40

11. In combination with the revolving cylinder and the type-bearing slides therein, the pressure-roll E, the swinging frame to sustain said roll, and means, substantially as described, for securing and releasing said frame. 45

12. The combination of the rotary grooved cylinder, the type-bearing slides mounted therein, and provided with projections disposed in a spiral line about the cylinder, and the finger-keys provided with inclined or beveled faces to act upon said projections and effect the longitudinal movement of the slides. 50

13. In combination with the cylinder and the longitudinal movable slides therein, the finger-keys, the locking-bar, and mechanism, substantially as described, for moving the same to and fro in a positive manner, and the yielding hooks or catches connecting the keys with the locking-bar. 55 60

14. In a printing-machine, the combination of the finger-keys, the revolving cylinder, the longitudinal slides to effect the printing of the selected characters, a locking-bar common to the series of keys, eccentrics to actuate said bar, and a yielding connection whereby breakage is prevented. 65

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