

F. G. CREED.
 PRINTING APPARATUS CONTROLLED BY PERFORATED TAPE.

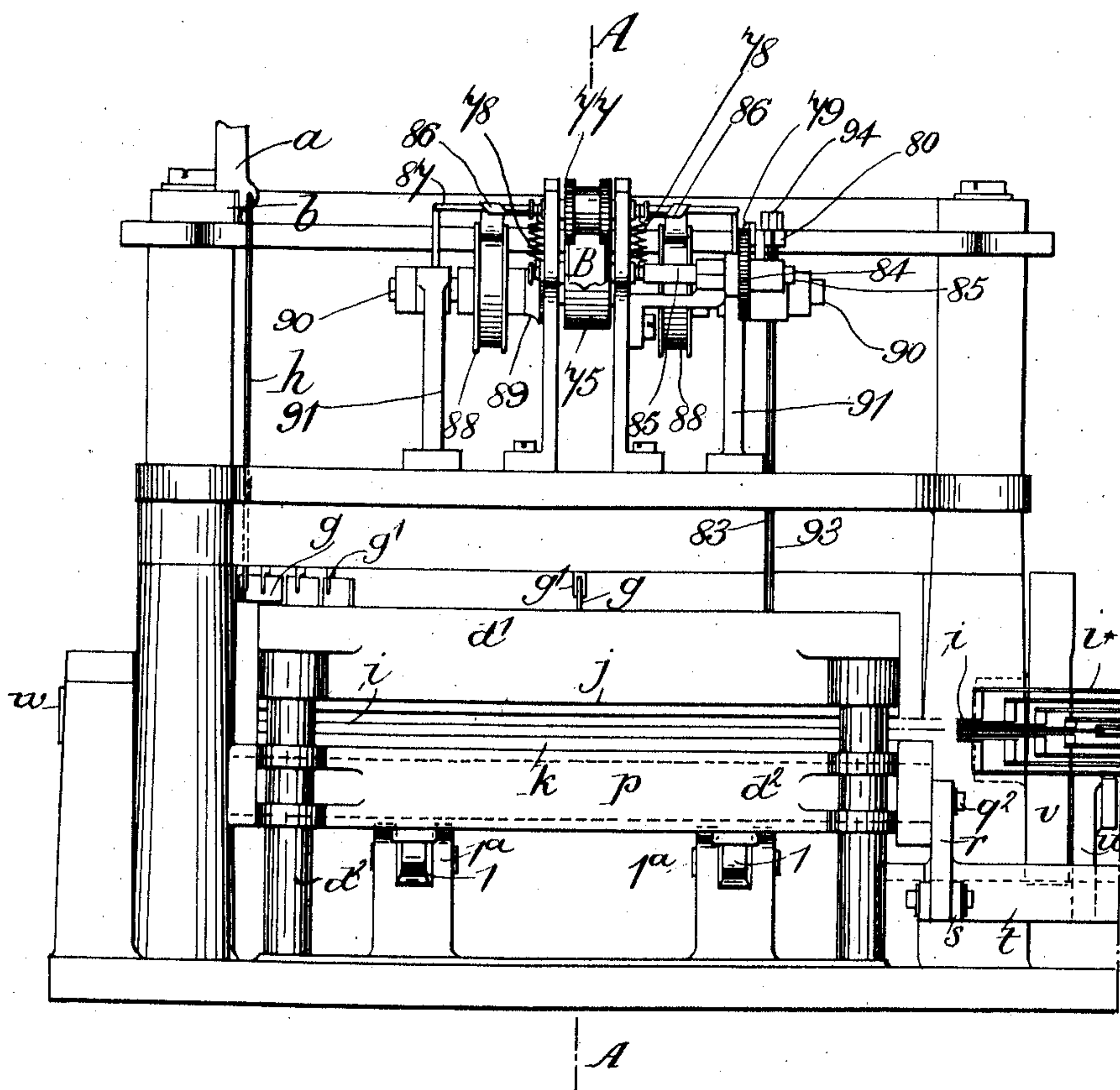
985,402.

APPLICATION FILED APR. 6, 1908.

Patented Feb. 28, 1911.

6 SHEETS—SHEET 1.

Fig. 1.



Witness
 E. R. Peck
 S. L. Buckner

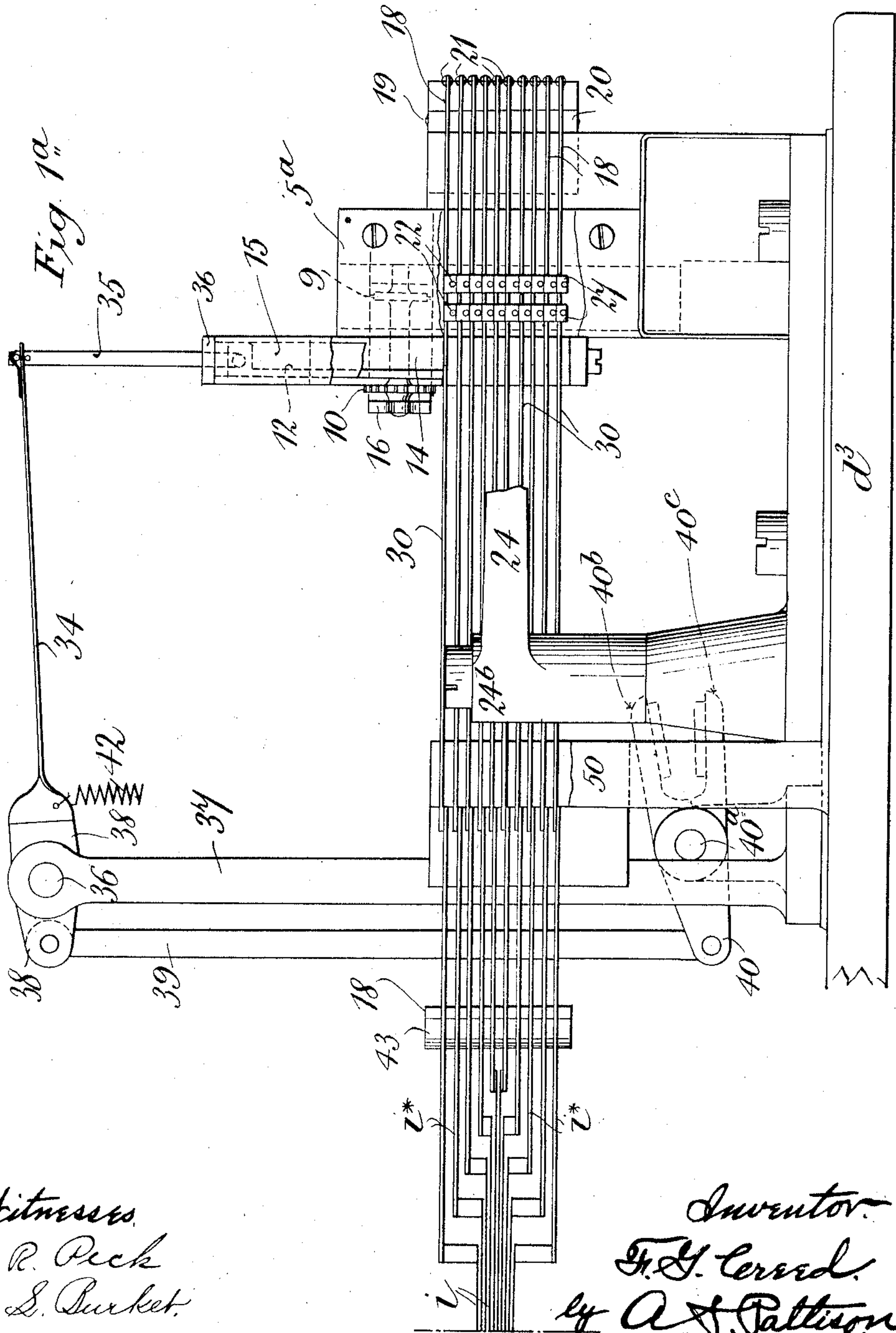
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6 SHEETS—SHEET 2.



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6 SHEETS—SHEET 3.

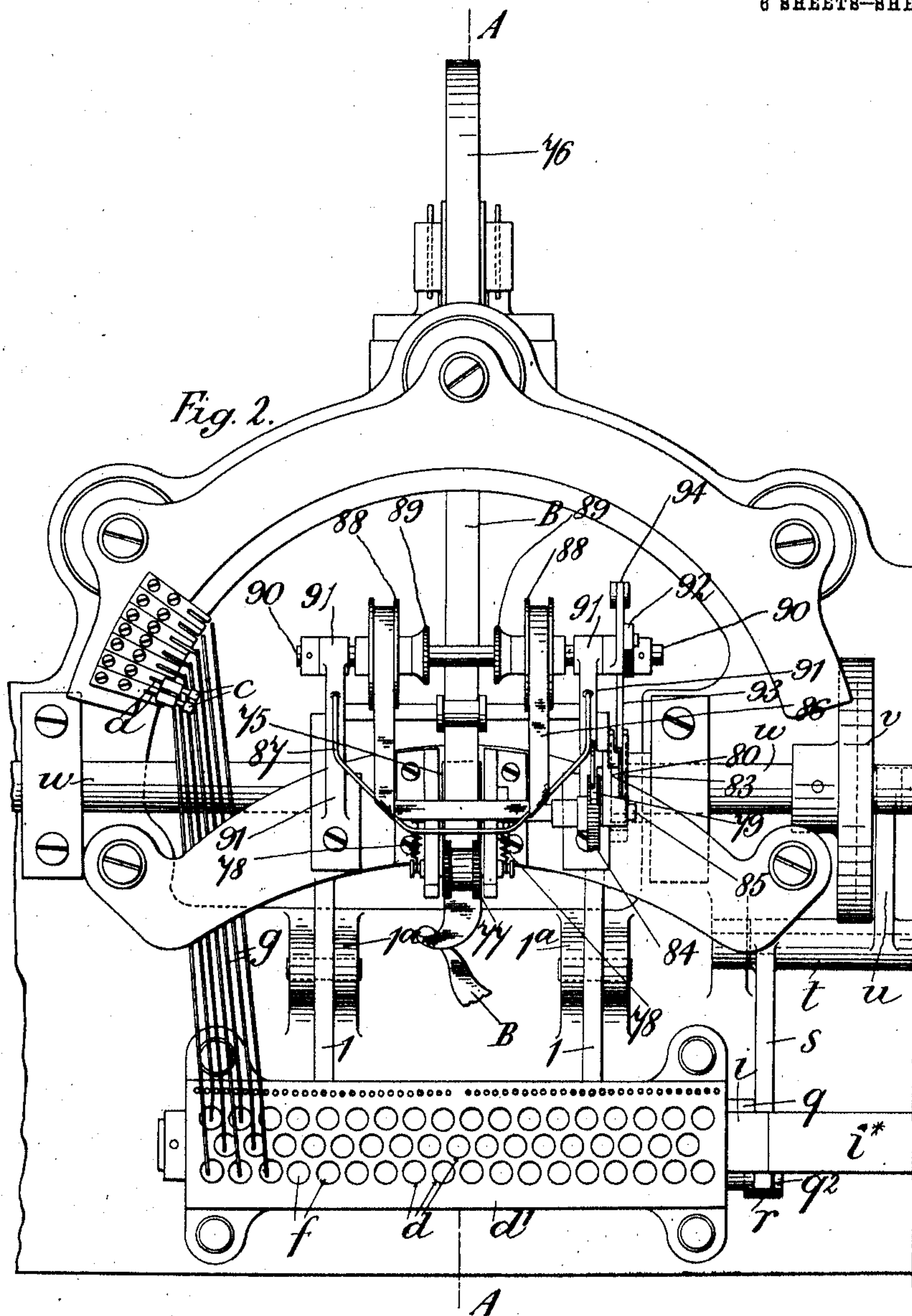


Fig. 4.

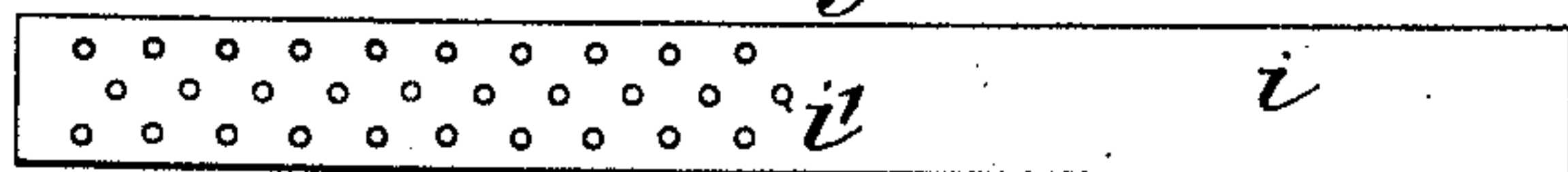


Fig. 5.



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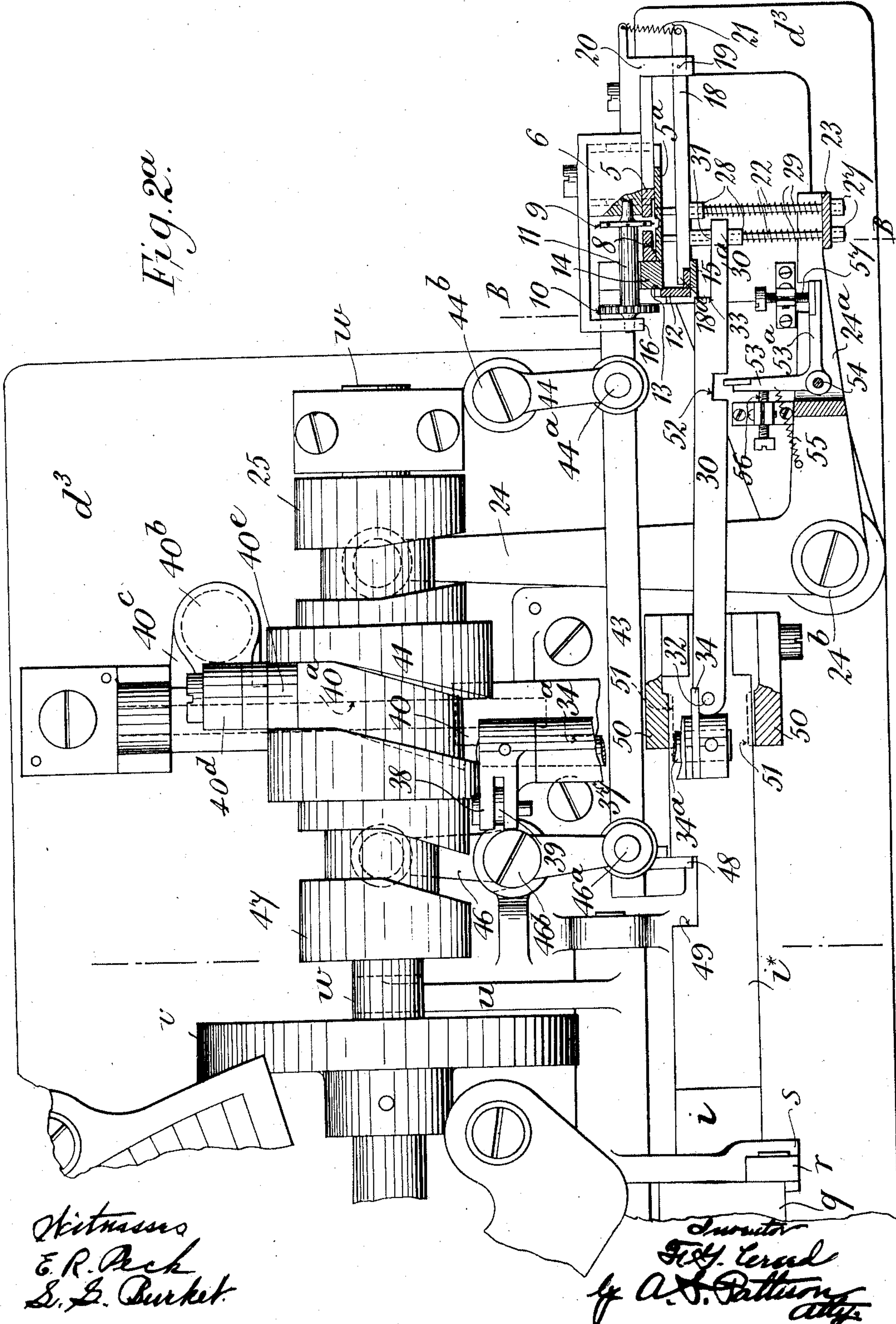
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6 SHEETS—SHEET 4.

985,402.

Fig. 2a.



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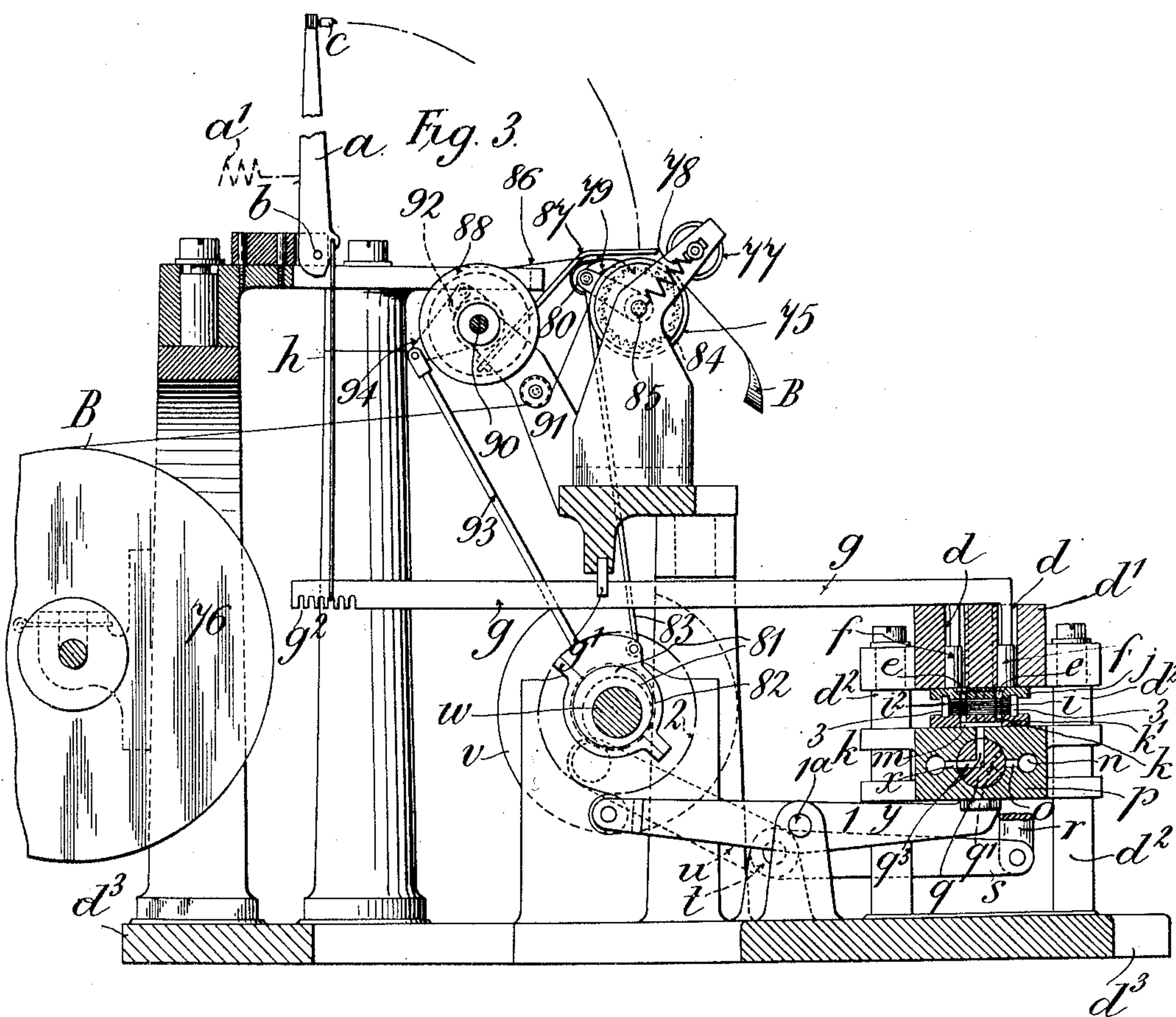
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6 SHEETS—SHEET 5.



Witness
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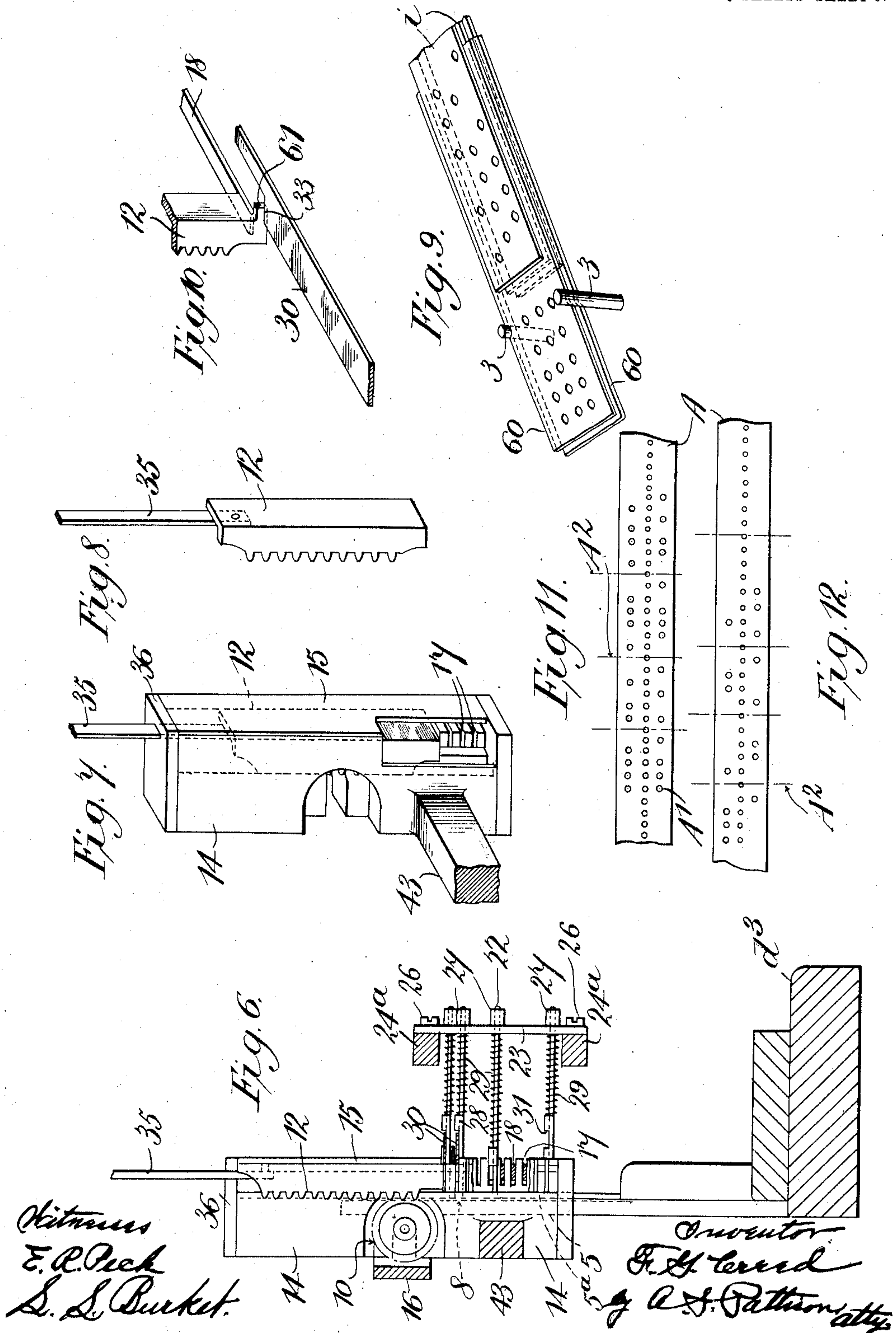
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6 SHEETS—SHEET 6.



UNITED STATES PATENT OFFICE.

FREDERICK GEORGE CREED, OF GLASGOW, SCOTLAND, ASSIGNOR OF ONE-THIRD TO
WILLIAM ARTHUR COULSON, OF GLASGOW, SCOTLAND.

PRINTING APPARATUS CONTROLLED BY PERFORATED TAPE.

985,402.

Specification of Letters Patent.

Patented Feb. 28, 1911.

Application filed April 6, 1908. Serial No. 425,501.

To all whom it may concern:

Be it known that I, FREDERICK GEORGE CREED, a subject of the King of Great Britain and Ireland, residing at Glasgow, in the county of Lanark, Scotland, have invented Improvements in Printing Apparatus Controlled by Perforated Tape, of which the following is a specification.

This invention has reference to apparatus of the kind whereby telegraphic or other messages, or intelligence, in the form of perforations in a tape, can be reproduced in the form of ordinary printed characters, the perforated tape being automatically moved forward, in an intermittent manner, by feeding mechanism to an extent dependent upon the length of each letter or other character (hereinafter referred to as a letter) to be reproduced, whether the lengths of successive letters be variable or not.

Examples of apparatus of the kind referred to, are described in the specifications of former British Patent No. 22,653 of 1902 and No. 25,861 of 1905. In those examples however, the apparatus is adapted only to actuate keyboard-operated typewriting machines, whereas by the present invention it is possible to simplify the apparatus by dispensing with a separate typewriting machine and to combine those parts thereof, such as type carriers, paper cylinder or equivalent paper support, inking device and feed mechanism, that are actually necessary to the process of printing a telegraphic message, with the controlling and actuating mechanism, thereby enabling a simple and efficient telegraphic printing machine, complete in itself, to be produced.

In printing apparatus according to the present invention, the printing mechanism is operated by a series of pneumatic devices under the control of a series of adjustable valve devices which are adapted to be brought into proper position, relatively to each other, through the agency of selective mechanism operated by or under the control of the perforated tape in such a manner that for each operation of the apparatus, the valve devices will be automatically arranged or set to form a particular combination, depending upon the nature of the particular set of perforations in the tape representing the letter about to be reproduced as an ordi-

nary character, and thereby enable fluid under pressure (hereinafter referred to as compressed air) to flow to the pneumatic device designed to operate the particular printing device (hereinafter referred to for brevity as the type-bar) that is to reproduce the letter as an ordinary printed character. The spacing movement of the paper cylinder or equivalent paper support or platen, upon which the printing device strikes, can be effected mechanically from the main driving spindle.

The printing mechanism, the pneumatic devices for operating the same, the valve devices for controlling the supply of compressed air to the pneumatic devices, the selective mechanism for bringing about the rearrangement of the valve devices to suit the particular letter to be reproduced, and the tape feeding mechanism, can be variously constructed to enable the characters represented by perforations in a tape to be reproduced as ordinary characters, but it is preferred to construct such parts in the improved manner hereinafter described with reference to the accompanying drawings, as such improved constructions possess valuable practical advantages.

In the accompanying illustrative drawings, Figures 1 and 1^a together show, partly in rear elevation and partly in vertical section, and Figs. 2 and 2^a together, partly in plan and partly in horizontal section, so much of the main portions of one construction of apparatus according to the present invention as is necessary to a clear understanding thereof. Fig. 3 is a cross section of the apparatus corresponding to the line A A of Figs. 1 and 2. Fig. 4 shows one of the valve devices in plan. Fig. 5 shows an air control valve. Fig. 6 is a vertical section corresponding to the line B B of Fig. 2^a. Figs. 7, 8, and 9 are detail views to a larger scale. Fig. 10 is a detail view showing a modification. Fig. 11 shows a piece of Wheatstone-Morse punched tape, and Fig. 12 shows a piece of punched cable tape.

In the example shown, the printing is effected by type-bars formed as bell crank levers *a* pivoted at *b* and having arms of unequal length, the longer arms carrying printing type *c* and the short arms being arranged to be operated by pneumatic devices.

Each pneumatic device comprises a vertical cylinder d having a compressed air inlet and outlet e and fitted with a plunger f whose upper end acts, as for example through a lever g pivoted at g^1 , and a link h , upon the short arm of the corresponding type bar a . Each type bar has connected to it a spring a^1 that serves to return it and the attached parts, and also the corresponding plunger f , to their normal positions after each printing operation. The plungers f may be made of different diameters, corresponding to the amount of force required to print the corresponding characters. It is however preferred to use levers g and links h , and to form the levers with a series of notches g^2 so that the length of the lever arm of each lever g connected to a link h can be readily varied to suit requirement. The cylinders d are formed by holes bored in a block d^1 fixed to pillars d^2 on a base plate d^3 .

The valve devices (hereinafter called the air controlling valves) comprise a series of closely fitting plates i arranged horizontally one above the other between two stationary perforated plates j , k and each formed with a series of holes i^1 (Fig. 4). These holes are so relatively arranged in the several plates i that upon movement of one or more of the plates under the control, or by the action of perforated tape, as hereinafter described, one hole i^1 in each plate i will be brought opposite a similar hole in all the other plates so as to form a passage i^2 (Fig. 3) through which compressed air can flow from a supply chamber m . Compressed air is admitted to the chamber m from a compressed air passage n and a port o in a block p and a right angled passage q^1 in a cylindrical air control valve q (Figs. 3 and 5) which is mounted to rock in the block p and is actuated, at the proper moment, as for example through a crank pin q^2 on the end of the valve, a link r , a lever arm s on a sleeve t and a second lever arm u on the sleeve, from a face cam v , or equivalent, on the main driving shaft w . From the chamber m the compressed air passes through one of the holes k^1 in the plate k , through the passage i^2 in the valves i , and the corresponding hole j^1 in the plate j to the cylinder d of the corresponding pneumatic device so as to operate the corresponding type bar a . After the operation of the type bar, the control valve q is operated by the mechanism hereinbefore described to return it to the normal or inoperative position shown and allow the air to exhaust from the cylinder d through the holes e and k^1 , the passage i^2 in the valves i and chamber m by means of right angled passages q^3 in the valve q and a port x and passage y in the block p . The air controlling valves i are arranged to slide freely upon one another while being rearranged and to be afterward forced tightly one

against the other by suitable means, such as a pair of pressure or clamping levers 1, pivoted at 1^a , and operated by cams 2 from the driving shaft w , so as to lift the block p on the pillars d^2 and clamp the valves between the plates j , k and prevent compressed air escaping between them. It is while the valves are so clamped between the plates j and k that the control valve q is moved into its operative position for admitting compressed air to one or other of the cylinders d . The valves i , which are made of thin straight strips of steel or other hard metal, are arranged to work endwise in a corresponding race or guideway formed in the example by pins 3 fixed in the plate k and entering clearance spaces in the plate j .

The means used for actuating and resetting the valves i under the control or by the action of perforated tape, and also the tape feeding mechanism for moving the tape forward in an intermittent manner, may be of any known or suitable construction. It is however advantageous to use with the air controlling valves i hereinbefore described, the improved valve-selecting and actuating mechanism and tape feeding mechanism shown in Figs. 1^a, 2^a and 6 to 10 inclusive of the drawings. In this mechanism, 5 and 5^a are two perforated vertical guide plates fixed to a standard 6 on the base plate d^3 and arranged to form a vertical guide-way 8 (Fig. 2^a) for the perforated tape A (Figs. 11 and 12) to be dealt with. 9 is a feed wheel the teeth of which engage in the central row of feed holes in the tape. 10 is a toothed wheel fixed to the same spindle 11 as the feed wheel and having its teeth adapted to gear with the teeth on a feed rack 12 (Figs. 6 and 8) which is mounted to slide in a guideway 13 formed partly in a laterally movable block 14 (Fig. 7) and partly by a cover plate 15. The adjacent edges of the teeth on the rack 12 and wheel 10 are rounded off in a known manner to enable these parts to engage smoothly with each other. One end of spindle 11 is journaled in the standard 6 and the other end in an arm 16 fixed to the said standard. The feed rack 12 is of angular shape in cross-section, the guideway 13 being of corresponding shape. The block 14 has a series of horizontal slots 17 arranged one above the other to receive, on the side next the tape guideway 8, a series of levers 18 (hereinafter called stop plates) which are pivoted at 19 to a fixed support 20 and each of which is provided with a spring 21 to cause its free end 18^a to be moved into contact with and be normally held against, the cover plate 15. Each stop plate 18 is of such length that when engaged by the lower end of the feed rack 12, the latter will not pass out of contact therewith during its lateral movement. 22 are horizontal pairs of selector pins arranged one

above the other, the pins in each pair being arranged to act endwise upon and displace the corresponding stop plate 18 in a direction toward the tape guide-way 8. In the arrangement now being described, which is designed for use with Wheatstone-Morse punched tape (Fig. 11), there are ten stop plates 18, ten pairs of selector pins 22, and ten horizontal pairs of holes in the perforated plates 5, 5^a as heretofore. Each of the stop plates, except the uppermost one, extends between a pair of selector pins 22, the uppermost stop plate being above the uppermost pair of selector pins as shown in Fig. 1^a. The free ends 18^a of the stop plates normally project across the guide-way 13, each stop plate 18 being adapted, when pressed toward the tape guide-way by the action of one, or other, or both, of the corresponding pair of selecting pins 22, to move out of the path of the feed rack 12 and allow such rack to move downward until it is arrested by an undisplaced stop plate. The forward end of each selector pin 22 is loosely supported in the perforated tape guide plate 5^a, while its rear end is loosely supported in a plate 23 fixed across the forked end 24^a of one arm of a bell crank lever 24 pivoted at 24^b and the other arm of which is adapted to be operated by a cam 25 on the driving shaft *w*. The plate 23 is fixed to the lever arm 24^a by screws 26, by removing which the plate can be readily removed together with the selector pins 22. Each selector pin is provided at its rear end with a fixed head 27 adapted to abut against the said plate 23 and also to act as a guide to prevent the pin turning around in working, and near its forward end is provided with a fixed collet 28 of square or rectangular section, arranged to abut against the corresponding stop plate 18. A coiled compression spring 29 surrounds each selector pin 22 between the plate 23 and the collet 28 for the purpose of pressing the pin forward as far as the head 27 thereon will allow it to go and keep the said head normally in contact with the plate. 30 are selecting devices that are controlled by the selector pins 22 and serve to actuate the valves *i*. These selecting devices, which in the example are shown as plates and are hereinafter called selector plates, may advantageously be made equal in number to the pairs of movable selector pins 22, and each of them be adapted to be brought into the operative position by one only of such selector pins so that only perforations A¹ at one side of the perforated tape A (Fig. 11) need be utilized for bringing about that primary movement of the selector plates 30 which brings them into a position to be actuated by the feed rack 12 during its lateral movement in one direction, the length of the group of selector plates so actuated,

measured vertically (Fig. 1^a), depending upon the length of the group of perforations included in the letter, and the number and arrangement of the plates in such group being dependent upon the number and arrangement of the perforations at the said side of the tape corresponding to the said letter. This utilization of the perforations at one side only, namely the lower side, of the central row of feed holes in the tape, is rendered possible by the fact that where a blank space occurs in the lower line of perforations in a letter in Wheatstone-Morse punched tape, for land telegraphy, it distinguishes the perforation next following as a dash, whereas perforations not so distinguished represent dots. For thus utilizing the perforations at one side only of the tape, the collets 28 on the left hand vertical set of selecting pins 22 (Fig. 1^a) are each formed with a slot or recess 31 adapted to receive the notched free end of one of the series of selector plates 30 which are arranged one above the other, and of which there are ten in the example now being described. Each selector plate 30 is pivoted at one end, as at 32, in an extension *i*^{*} of one of the air controlling valves *i*, of which, in this case, there are also only ten. Each selector plate 30 is formed with a shoulder 33 arranged, when the plate is moved toward the tape, as hereinafter described, to come opposite the left hand side of the feed rack 12.

34 is a feed lever for moving the feed rack 12, to which it is connected by a link 35, up and down, as heretofore, the upward movement of the rack being limited by a stop 36 fixed to the block 14. The feed lever is fixed to a spindle 34^a that is journaled in a standard 37 and has fixed to it a lever arm 38 connected by a link 39 to lever mechanism comprising a lever arm 40 fixed upon one end of a shaft 40^a on the other end of which is fixed a second lever arm 40^b arranged above the arm 40^c of a bell crank lever that is journaled on the shaft 40^a and has its other arm 40^d engaged through a roller 40^e with a cam 41 on the driving shaft *w*. The arrangement is such that the feed rack 12 can be forced downward to different extents by the feed lever 34, under the action of a spring 42, independently of the lever mechanism which will, however, act, at the required times, to raise the feed rack to its initial position, limited by the said stop 36, substantially in the manner described in the former British specification No. 25861 of 1905 hereinbefore referred to.

The block 14 is attached to and carried by a lever frame comprising a link 43 that is pivoted near one end to and supported in the bifurcated end 44^a of a lever arm 44, pivoted at 44^b to the base plate *d*³ and at the other end, is similarly mounted in the free

end 46^a of a two-armed lever 46 also pivoted to the base plate at 46^b. The latter lever is arranged to be moved sidewise by a cam 47 on the driving shaft *w* for the purpose of moving the link 43, block 14 and attached parts, including the feed rack 12, sidewise at the proper time. 48 is a projection or bar carried by the link 43 and extending into a notch 49 in the extension *i*^{*} of each controlling valve *i* for the purpose of returning displaced valves, and selector plates 30 to their original positions, determined by a stop or abutment 50, after each printing operation. The said stop 50 is provided with guides 51 for the valve extensions *i*^{*}.

Means are provided for preventing those selector plates 30 and attached valves *i* that are not concerned in the reproduction of the letter being dealt with, from moving forward when the remaining selector plates and valves are moved forward by the feed rack 12. For this purpose, when the said valves *i* are in the form of plates arranged one upon another as described, so that positive movement of one plate may move another or others by friction, each selector plate 30 may, as shown in Fig. 2^a, be formed at its rear side with a notch 52 into which extends one arm 53 of a bell crank lever 53, 53^a that is pivoted at 54 to the forked end 24^a of the lever 24 and is normally held by a spring 55 against an adjustable stop 56 carried by the base plate. The other arm 53^a of the lever is arranged opposite another adjustable stop 57 that is carried by the base plate and which, upon the lever 24 being operated to move the selector pins 22 toward the tape, acts upon the said arm 53^a and turns the lever 53, 53^a sufficiently to bring the other arm 53 thereof against the right hand end of the notches 52 of those selector plates 30 which are in their normal or undisplaced position and prevent them being moved forward. Or, as shown in Fig. 9, a thin partition plate 60, similar to the valves *i* and formed with holes or ports to correspond with the holes *e* and *k*¹ (Fig. 3) in the perforated plates *j* and *k* between which the valves *i* slide, can be inserted between adjacent pairs of such valves, these partitions being mounted so that they are free to move vertically with the valves to a small extent but not to slide longitudinally therewith, being retained endwise, for example, by the guide pins 3. By these means, friction between adjacent valves will be avoided.

The action of the tape feeding, selecting and actuating mechanism is as follows:—Assuming that the feed lever 34 is in its uppermost position, holding the feed rack 12 against its stop 36, that a length of perforated tape has been raised in the tape guideway 8 by the feed wheel 9, and that the laterally movable block 14 has been moved to the right by means of its operating cam 47

acting through the corresponding lever 46 and link 43 and disengaged the feed rack 12 from the toothed wheel 10 and returned, to their normal position, determined by the stop 50, those air controlling valves *i* that may have been displaced in the last operation of the machine, then, upon the next rotation of the driving shaft *w*, the lever 24, 24^a will be rocked by its cam 25 so as to cause the plate 23 attached to the said lever to move toward the tape guideway 8 and permit the selector pins 22, under the control of their springs 29, to also move forward to a greater or less extent. Where holes, representing a letter, are presented in the tape to the selector pins, the points of the pins will move through them, but where there is blank tape, the further movement of the pins will be arrested, their springs 29 yielding to allow of the plate 23 moving away from the heads 27 of the stationary pins. When any one, or both, of the selector pins 22 in a horizontal pair of such pins is or are permitted to move forward through a hole or holes in the tape, it, or they, press forward the corresponding stop plate 18 so as to move it out of the path of the feed rack 12 which is afterward caused to descend by the feed lever 34 until arrested by the stop plate 18 corresponding to the pair of selector pins 22 that are opposite the double blank portion of tape, indicated at each of the lines A² in Fig. 11, at the end of the letter in the tape being dealt with. By reason of the notched end portion 30^a of each selector plate 30 taking into the slot or recess 31 in the collet 28 of the corresponding selector pin 22 in the left hand vertical set of such selector pins, which correspond to the possible holes A¹ in the lower half of the perforated tape A (Fig. 11), the selector plate or plates, corresponding to the selector pin or pins that is or are opposite to and enter a hole or holes in the said portion of tape, will be moved forward to bring its or their shoulder or shoulders 33 opposite to the left hand side of the feed rack 12 so that upon the laterally movable block 14 being again moved to the left by its cam 47 and intermediate connecting means, the selector plate or plates 30 that corresponds or correspond to the letter being dealt with, will be moved to the left so as to cause the corresponding air controlling valve or valves *i* to be displaced in order to bring about the operation of the corresponding pneumatic device and printing device, as hereinbefore described. The selector plates 30 that are not displaced by the selector pins 22, are prevented from moving forward with the displaced selector plates, by the bell crank lever 53, 53^a or the equivalent means, hereinbefore described. The movement of the block 14 to the left also reengages the feed rack 12 with the toothed wheel 10. The le-

ver 24, 24^a is then operated by its cam 25 to return all the selector pins 22 to their normal position, whereupon the feed lever 34 is operated through the lever mechanism from the cam 41 to raise the feed rack 12 to its normal position limited by the stop 36 and thereby rotate the toothed wheel 10 and feed wheel 9 to again raise the tape A so as to bring the next letter therein into position to be dealt with. Immediately after the valves have been moved to the left as aforesaid, the clamping device is operated to clamp the valves in the rearranged position. Compressed air is then admitted by the valve *q* being moved into its operative position and the letter is printed as hereinbefore described after which the valve *q* and the clamping lever are returned to their normal or inoperative positions, and the controlling valves *i* moved again to the right in readiness for a new selection. The movement of the valves to the right of course coincides with the disengagement of the feed rack 12 (which has by this time reached its uppermost position) from the toothed wheel 10, and also with the movement toward the tape of the lever 24 and the selector pins 22. An important saving in time in the cycle of operations is thus secured. The operations above described are then repeated for the next letter. When dealing with Wheatstone-Morse punched tape, at the end of each word, double blank tape is brought opposite the upper pair of selector pins 22 so that the upper stop plate 18 is not displaced, no selector plates 30 and valves *i* are moved forward, and no printing is effected, the paper upon which the printing is done being simply moved forward a step by the spacing mechanism of the machine.

In the case of cable tape, perforated according to the system employed for transmission over the Atlantic cables, all perforations in the lower side of the tape, in a letter, represent dashes, and all blank spaces at such side in a letter, except that included in the double blank space at the end thereof, indicate dots formed by perforations in the upper side of the tape. Since in the said cable tape a letter may be represented by dots only, or may have a dot as its last element, and since the said dot or dots will have blank spaces opposite them on the underside of the tape, it will be evident, on consideration, that when such cable tape is employed, some factor must be introduced into the rearrangement of the valves for the purpose of indicating in such rearrangement, not merely the arrangement of the perforations, but also the total length of the set of perforations in the letter being dealt with. This result can conveniently be obtained by causing the valve and selector plate corresponding to the double blank space at the end of the said letter to be

moved to the left at the same time as the other valve or valves if any, concerned in the rearrangement. Therefore, to adapt the apparatus hereinbefore described for dealing with perforated cable tape, such as referred to, the feed rack 12 (Fig. 8) used when dealing with Wheatstone-Morse punched tape, is replaced by a feed rack provided with a lateral projection 61 (see Fig. 10) adapted to engage the shoulder 33 of the selector plate 30 corresponding to the left hand selector pin 22 of the pair of selector pins that is prevented by double blank portion of tape at the end of the letter being dealt with, from moving forward, so that when the feed rack 12 is moved to the left as hereinbefore described, such selector plate 30 will be moved forward together with any other selector plate or plates 30 that may have been displaced by endwise movement of another selector pin 22, or other selector pins, located above the one mentioned, for effecting a printing operation. In this case, means other than the bell crank lever 53, 53^a (Fig. 2^a), must be provided to prevent displaced selector plates 30, other than the one to be engaged by the said finger or projection 61, being moved forward with the last mentioned selector plate and any displaced selector plate or plates above the same. For this purpose, the air controlling valves *i* may conveniently be separated from each other by plates 60 that are prevented from moving endwise as hereinbefore described with reference to Fig. 9 and the movement of the lever 24 in withdrawing the pins from the tape is enlarged so as to cause the shoulders 33 of the selector plates 30 to clear the projection 61 in the upward movement of the feed rack 12.

As will be obvious, the selector plates 30 instead of operating air controlling valves as hereinbefore described, can be used to operate other devices for controlling printing mechanism in apparatus of the kind herein referred to.

In the machine shown in Figs. 1 to 3 inclusive, the type bars *a* with type *c* are arranged to reproduce ordinary characters in succession upon a paper tape B. This tape is led over an impression wheel 75 from a reel 76 and is held in driving contact with the wheel 75 by a pressure roller 77 acted upon by springs 78. The impression wheel is rotated in a forward direction in an intermittent or step by step manner by a pawl 79 carried by an arm 80 that is oscillated from the eccentric 81 on the shaft *w* through an eccentric strap 82 and a link 83, the pawl engaging a ratchet wheel 84 fast on the same shaft 85 as the impression wheel 75.

The characters are printed by the aid of an inked ribbon 86 that is passed under a wire guide 87 and wound on two spools 88 either of which can be fixed by a clamp 89 to

a shaft 90. This shaft is carried in fixed bearings 91 and rotated in a step by step manner by pawl and ratchet mechanism 92 worked from the strap 82 of the eccentric 81 through a rod 93 and a lever arm 94.

The reproduction of the ordinary characters may however, if desired, take place in successive lines upon a sheet of paper supported by a cylinder, as in a type writer, the cylinder being caused to move endwise in a step by step manner to form a line of characters and in a rotary manner to form successive lines of characters by any suitable means and in a manner now well understood.

As will be obvious the details of construction can be variously modified without departing from the essential features of the invention. Also, the actuating pistons *f* of the pneumatic devices under the control of the air controlling valves *i* may be attached directly or indirectly to the keys of an ordinary or separate typewriting machine for the purpose of operating the same.

What I claim is:—

1. In printing apparatus controlled by perforated tape, the combination with printing mechanism and means for imparting motion thereto, of a stationary perforated guideway for the tape, mechanism adapted to feed the tape through said guideway to varying extents and selector pins adapted to be moved through the perforations in said guideway in different orders under the control of said tape to determine the extent of movement of the tape feed mechanism.

2. In printing apparatus controlled by perforated tape, the combination with a series of printing devices and means for imparting motion thereto, of a stationary perforated guideway for the tape, mechanism for feeding the tape therethrough to different extents, selector devices adapted to be moved to control the means for imparting motion to the printing devices and a series of selector pins adapted to be moved through the perforations in the guideway in different orders under the control of said tape, all of the said pins being adapted to determine the extent of movement of the feed mechanism and certain of the pins being further adapted to move the selector devices.

3. In printing apparatus controlled by perforated tape, the combination with a series of printing devices and means for imparting motion thereto, of a stationary perforated guideway for the tape, intermittently movable mechanism for feeding the tape through said guideway, selector devices adapted to be moved into a position to be operated by the tape feed mechanism and to control the operation of the printing device, and a series of selector pins adapted to be moved through the perforations in the guideway in different orders under the con-

trol of said tape and move the selector devices into position to be operated by the tape feeding mechanism in corresponding orders.

4. In printing apparatus controlled by perforated tape, the combination with a series of printing devices and means for imparting motion thereto, of a stationary perforated guideway for the tape, gear for feeding the tape through the guideway, a series of selector plates adapted to be moved from an inoperative position to a position in which they can be operated to determine which printing device shall be operated, and a rack adapted to be moved to a position to engage the tape feeding gear and in so moving to operate such selector plates as may be in position to be operated.

5. In printing apparatus controlled by perforated tape, the combination with a series of printing devices and means for imparting motion thereto, of a stationary perforated guideway for the tape, gear for feeding the tape through the guideway, a series of selector plates adapted to be moved from an inoperative position to a position in which they form a link in the system of motion imparting means referred to, a rack adapted to be moved to a position to engage the tape feeding gear and in so doing to operate such selector plates as may be in position to be operated, and selector pins adapted to be moved through the perforations in the guideway in different orders under the control of the tape and to move the selector plates into the path of the said rack in corresponding orders.

6. In printing apparatus controlled by perforated tape, the combination with a series of printing devices and means for imparting motion thereto, of a stationary perforated guideway for the tape, gear for feeding the tape through the guideway, a series of selector plates adapted to be moved from an inoperative position to a position in which they form a link in the system of motion imparting means referred to, an endwise movable rack adapted to be moved also laterally to a position to engage the tape feeding gear and in so doing operate such selector plates as may be in position to be operated, a series of selector pins adapted to be moved through certain of the perforations in the guideway in different orders under the control of the tape to move the selector plates into the path of the said rack in corresponding orders, a series of selector pins adapted to be moved through certain other of the perforations in the guideway, also under the control of the tape, and means movable with any selector pin of either series to permit the rack to move endwise to an extent commensurate with the length of tape representative of the character to be printed.

7. In printing apparatus controlled by

tape having perforations at both sides of a central row of feed holes, a stationary perforated guideway for the tape, a series of selector pins adapted to be moved through the perforations in the guideway corresponding to the perforations at one side of the tape, a series of selector pins adapted to be moved through the perforations in the guideway corresponding to the perforations at the other side of the tape, selector plates each movable by a corresponding selector pin of one series of selector pins, printing mechanism controlled by such selector plates, tape feeding mechanism comprising an endwise movable rack and a series of stop plates movable with both series of selector pins for limiting endwise movement of the rack in one direction prior to feeding the tape.

8. In printing apparatus controlled by Wheatstone-Morse punched type, a stationary guideway for said tape, a series of selector pins movable through the perforations in the guideway, tape feeding mechanism comprising a rack movable endwise to different extents under the control of said selector pins in conjunction with the perforations at both sides of the tape and printing elements individually movable under the control of selector pins in conjunction with the perforations at one side of the tape.

9. In printing apparatus controlled by perforated tape, mechanism for controlling the motion of the printing devices comprising selector plates adapted to be displaced about independently movable axes, means for displacing said plates without moving the pivots, means for operating the displaced plates with simultaneous movement of the pivots and means for positively preventing operation of the remaining plates and movement of the pivots.

10. In printing apparatus controlled by perforated tape, mechanism for controlling the motion of the printing devices, comprising notched selector plates adapted to be displaced about independently movable axes, a stationary perforated tape guideway, selector pins movable through the perforations in the guideway in different orders under the control of the tape, means upon said pins for displacing the selected selector plates, a tape feed rack adapted to be moved laterally to operate the displaced selector plates, a bell crank lever movable with the selector pins and stationary stops co-acting with the said bell crank lever, one of such stops being adapted to move an arm of the lever into contact with one end of the notch of each of the non-displaced selector plates from an intermediate position in such notch and the other stop being adapted to return the end of the lever to said intermediate position.

11. In printing apparatus controlled by perforated tape, printing elements, a separate pneumatic device for the operation of

each printing element, a block having a compressed air chamber common to all the pneumatic devices, valve devices coöperating with the air chamber and comprising a series of longitudinally movable perforated plates common to the pneumatic devices and arranged to slide one upon the other to produce alinement between a single perforation of each plate and form a passage establishing communication between the air chamber and one of the pneumatic devices at a time, dependent upon their position, means for automatically altering the position of the valve devices so as to arrange the perforations in different combination depending upon the nature of the particular set of perforations in the tape representing the character to be reproduced, and means for supplying air to the air chamber after each alteration in position of the valve devices.

12. In printing apparatus controlled by perforated tape, printing elements, a series of cylinders, plungers in said cylinders and connections from said plungers to the corresponding printing elements, valve devices comprising a series of longitudinally movable perforated plates arranged side by side, two main perforated plates between which the valve plates are movable, selector plates for arranging the longitudinally movable plates with their perforations in different combinations under the control of the tape, a block through which compressed air is introduced to and exhausted from the valve devices as each character is printed and means for moving the block to clamp the perforated plates together while air is being supplied to the valve devices.

13. In printing apparatus controlled by perforated tape, printing elements, a series of cylinders formed in a stationary block and fitted with plungers for operating said printing elements, a stationary perforated plate corresponding to the said cylinders and secured to the underside of the block, a movable block arranged beneath the stationary block, guides for said movable block, a plate carried by the movable block having perforations corresponding to the perforations in the stationary perforated plate and a chamber adjacent to the movable block, a valve in the movable block having ports and passages for supplying compressed air to and exhausting air from said chamber, a series of longitudinally movable perforated plates arranged between the stationary and chambered plates, selector plates for arranging the longitudinally movable plates with their perforations in different combinations under the control of the tape, and means for advancing the movable perforated block toward the stationary block and clamping all the perforated plates together while air is being supplied to the selected cylinder.

14. In printing apparatus controlled by perforated tape, printing elements, a separate pneumatic device for the operation of each printing element, valve devices controlling the supply of compressed air to each of the pneumatic devices, selector plates each pivoted to a separate valve device, a stationary guideway for the perforated tape, means controlled by said tape for imparting a primary movement in a lateral direction to the selector plates and means for imparting a secondary movement in a longitudinal direction to such plates.

15. In printing apparatus controlled by perforated tape, printing elements, a separate pneumatic device for the operation of each printing element, valve devices for controlling the supply of compressed air to each of the pneumatic devices, selector plates each pivoted to a separate valve device, a stationary guideway for perforated tape, means controlled by said tape for imparting a primary movement in a lateral direction to the selector plates, tape feeding means adapted to impart a secondary movement in a longitudinal direction to such plates, and means also controlled by the tape for causing the feed mechanism to alter the extent of feed in accordance with the length of tape representative of the character to be printed.

16. In printing apparatus controlled by perforated tape, printing elements, a separate pneumatic device for the operation of each printing element, valve devices controlling the supply of compressed air to each of the pneumatic devices, selector plates each pivoted to a separate valve device, a stationary guideway for perforated tape, selector pins adapted to be moved through perforations in the guideway and tape to impart a primary movement to the selector plates in a lateral direction, tape feeding gear and a rack movable in one direction to engage the tape feeding gear and in so doing impart a secondary movement in a longitudinal direction to the selector plates and movable at a later instant in another direction to operate the tape feeding gear.

17. In printing apparatus controlled by perforated tape, printing elements, a separate pneumatic device for the operation of each printing element, valve devices for controlling the supply of compressed air to each of the pneumatic devices, selector plates each pivoted to a separate valve device, a stationary guideway for perforated tape, selector pins adapted to be moved through perforations in the guideway and tape to impart a primary movement to the selector plates in a lateral direction, tape feeding gear, a rack, means for moving said rack in one direction to engage the tape feeding gear and in so doing impart a secondary movement in a longitudinal direction to the

selector plates, means for moving the rack at a later instant in a direction to operate the tape feeding gear and selector pins adapted to be moved through other perforations in the guideway and tape for causing the rack to produce varying extents of feed of the tape.

18. In printing apparatus controlled by perforated tape, printing elements, a separate pneumatic device for the operation of each printing element, valve devices controlling the supply of compressed air to each of the pneumatic devices, selector plates each pivoted to a separate valve device, a stationary guideway for perforated tape, selector pins adapted to be moved through perforations in the guideway and tape to impart a primary movement to the selector plates in a lateral direction, tape feeding gear, a rack, means for moving said rack in one direction to engage the tape feeding gear and in so doing impart a secondary movement in a longitudinal direction to the selector plates, means for moving the rack at a later instant in a direction to operate the tape feeding gear, a series of stop plates for altering the starting position of the rack prior to initiating the feed movement, and selector pins movable through perforations in the stationary guideway and tape for displacing said stop plates to determine the starting position of the said feed rack.

19. In printing apparatus controlled by tape having perforations at both sides of a central row of feed holes, printing elements, a separate pneumatic device for the operation of each printing element, valve devices for controlling the supply of compressed air to each of the pneumatic devices, selector plates each pivoted to a separate valve device, a stationary guideway for the perforated tape, a series of selector pins adapted to be moved through the perforations in the guideway corresponding to the perforations at one side of the tape for imparting a primary movement in a lateral direction to the selector plates, a series of selector pins adapted to be moved through the perforations in the guideway corresponding to the perforations at the other side of the tape, tape feeding gear, a rack, means for alternately moving said rack in opposite directions in an endwise direction, means for moving the rack intermediate of the alternate movements aforesaid in a lateral direction to engage the tape feeding gear and in so doing impart a secondary movement in a longitudinal direction to the selector plates, and a series of stop plates movable with both series of selector pins for limiting endwise movement of the rack in one direction.

20. In printing apparatus controlled by tape having perforations at both sides of a central row of feed holes, printing elements, a separate pneumatic device for the opera-

tion of each printing element, longitudinally movable valve devices for controlling the supply of compressed air to each of the pneumatic devices, notched selector plates
 5 each pivoted to a separate valve device, a stationary guideway for the perforated tape, a series of selector pins adapted to be moved through the perforations in the guideway corresponding to the perforations at one
 10 side of the tape for imparting a primary movement in a lateral direction to the selector plates, a series of selector pins adapted to be moved through the perforations in the guideway corresponding to the perforations
 15 at the other side of the tape, tape feeding gear, a rack, means for alternately moving said rack in opposite directions in an endwise direction, means for moving the rack, intermediate of the said alternate move-
 20 ments, in a lateral direction to engage the tape feeding gear and in so doing impart a secondary movement in a longitudinal direction to the selector plates, a series of stop plates movable with both series of selector
 25 pins for limiting endwise movement of the rack in one direction, a bell crank lever movable with the selector pins and stationary stops co-acting with said bell crank, one stop being adapted to move an arm of the
 30 lever into contact with one end of the notch of any selector plate not primarily moved, from an intermediate position in such notch, and the other stop being adapted to return the end of the lever to said intermediate
 35 position.

21. In printing apparatus controlled by tape having perforations at both sides of a central row of feed holes, printing elements, a series of cylinders, plungers in said cyl-
 40 inders and connections from said plungers to the corresponding printing elements, valve devices comprising a series of longitudinally movable perforated plates arranged one above the other, two main perforated plates
 45 between which the valve plates are movable, notched selector plates pivoted to the valve plates for arranging them with their perforations in different combinations, a block through which compressed air is introduced
 50 to and exhausted from the valve devices as each character is printed, a stationary guideway for the perforated tape, a series of selector pins adapted to be moved through the perforations in the guideway corre-
 55 sponding to the perforations at one side of the tape for imparting a primary movement in a lateral direction to the selector plates, a series of selector pins adapted to be moved through the perforations in the guideway
 60 corresponding to the perforations at the other side of the tape, tape feeding gear, a rack, means for alternately moving said rack in opposite directions in an endwise direction, means for moving the rack, inter-
 65 mediate of the said alternate movements, in

a lateral direction to engage the tape feed-
 ing gear and in so doing impart a secondary movement in a longitudinal direction to the selector plates, a series of stop plates mov-
 70 able with both series of selector pins for limiting endwise movement of the rack in one direction, a bell crank lever movable with the selector pins and stationary stops co-acting with said bell crank, one stop be-
 75 ing adapted to move an arm of the lever into contact with one end of the notch of any selector plate not primarily moved from an intermediate position in such notch, and the other stop being adapted to return the end of the lever to said intermediate position. 80

22. In printing apparatus controlled by tape having perforations at both sides of a central row of feed holes, printing elements, a series of cylinders formed in a stationary
 85 block and fitted with plungers for operating said printing elements, a stationary perforated plate corresponding to the said cylinders and secured to the underside of the block, a movable block arranged beneath the stationary block, guides for said mov-
 90 able block, a plate carried by the movable block having perforations corresponding to the perforations in the stationary perforated plate and a chamber adjacent to the movable block, a valve in the movable block having
 95 ports and passages for supplying compressed air to and exhausting air from said chamber, a series of longitudinally movable perforated plates arranged between the stationary and chambered plates, means for advancing
 100 the movable perforated block toward the stationary block and clamping all the perforated plates together previous to compressed air being supplied to the selected cylinder, notched selector plates each pivoted
 105 to a separate valve plate, a stationary guideway for the perforated tape, a series of selector pins adapted to be moved through the perforations in the guideway corresponding to the perforations at one side of the tape
 110 for imparting a primary movement in a lateral direction to the selector plates, a series of selector pins adapted to be moved through the perforations in the guideway corresponding to the perforations at the other side of
 115 the tape, tape feeding gear, a rack, means for alternately moving said rack in opposite directions in an endwise direction, means for moving the rack, intermediate of the said alternate movements, in a lateral direction
 120 to engage the tape feeding gear and in so doing impart a secondary movement in a longitudinal direction to the selector plates, a series of stop plates movable with both series of selector pins for limiting endwise
 125 movement of the rack in one direction, a bell crank lever movable with the selector pins and stationary stops co-acting with said bell crank, one stop being adapted to move an arm of the lever into contact with one end of
 130

the notch of any selector plate not primarily moved, from an intermediate position in such notch, and the other stop being adapted to return the end of the lever to said intermediate position.

23. Printing apparatus controlled by perforated tape, comprising a stationary guideway for the perforated tape, a series of printing elements, devices for operating said elements, selector plates for arranging said operating device in different operative orders, a series of selector pins movable through the perforations in the guideway and controlling tape, means actuated by said selector pins for imparting a primary movement to the selector plates, gear for feeding the tape, a rack adapted to be idly moved endwise in one direction to an extent commensurate with the length of tape representative of the character to be printed, a series of stop plates adapted to be moved

with movement of each selector plate, a series of selector pins movable through the guideway and perforated tape for moving said stop plates independently of the selector plates, means for moving the rack laterally into engagement with the tape feed gear and in so doing impart a secondary movement to the selector plates which have been primarily moved, and means upon the rack for imparting to a selector plate not primarily moved a movement corresponding to the secondary movement of a primarily moved selector plate, for the purpose set forth.

Signed at Glasgow, in the county of Lanark, Scotland this 27th day of March 1908.

FREDERICK GEORGE CREED.

Witnesses:

GEORGE BROWN SERVICE,
HENRY DRON DRYDALE.