



(No Model.)

3 Sheets—Sheet 2.

H. HOLLERITH.

MACHINE FOR COMPILING OR TABULATING STATISTICS.

No. 526,129.

Patented Sept. 18, 1894.

Fig. 2.

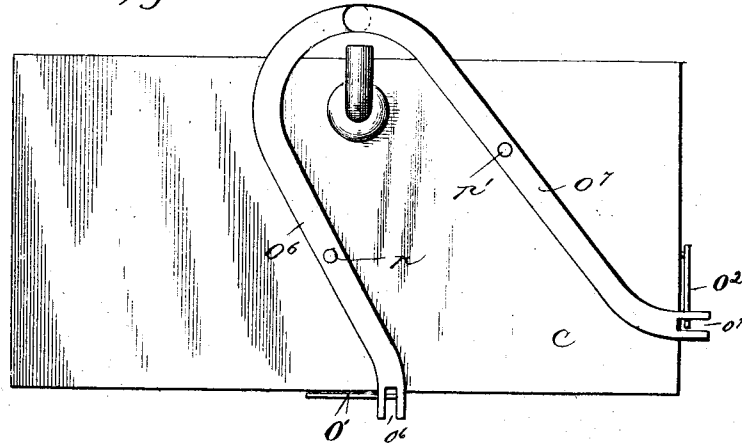


Fig. 3.

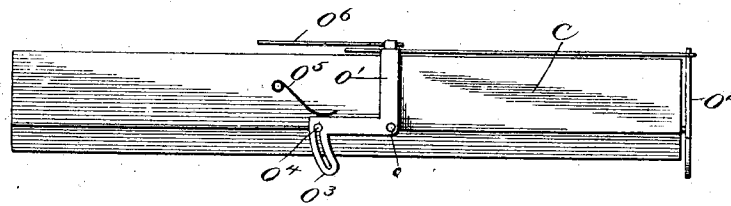
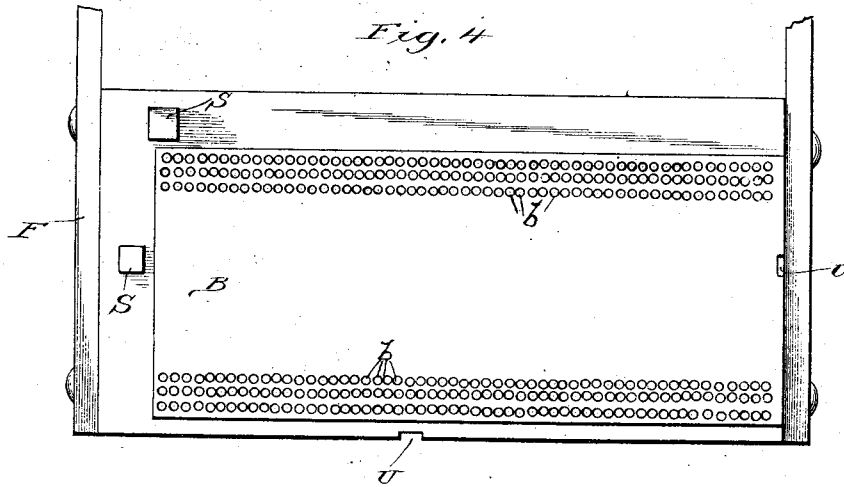


Fig. 4.



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His Attorneys.

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Fig. 5.

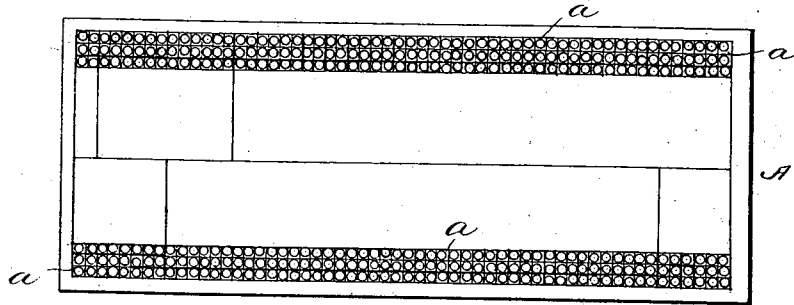


Fig. 6.

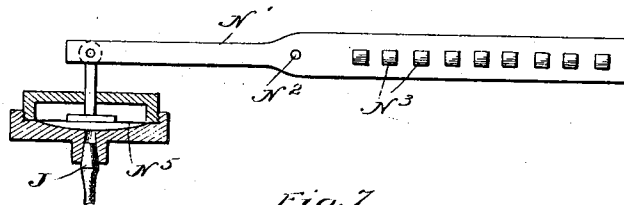


Fig. 7.

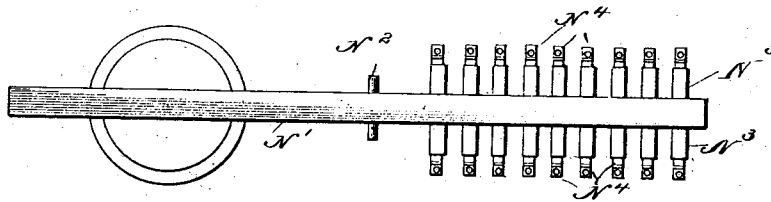


Fig. 8.

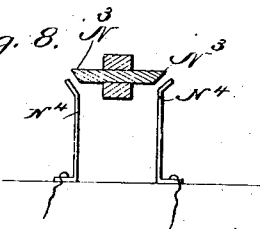
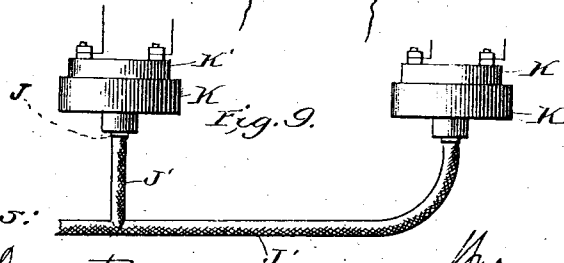


Fig. 9.



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# UNITED STATES PATENT OFFICE.

HERMAN HOLLERITH, OF WASHINGTON, DISTRICT OF COLUMBIA.

MACHINE FOR COMPILING OR TABULATING STATISTICS.

SPECIFICATION forming part of Letters Patent No. 526,129, dated September 18, 1894.

Application filed December 22, 1892. Serial No. 456,066. (No model.)

*To all whom it may concern:*

Be it known that I, HERMAN HOLLERITH, of Washington, in the District of Columbia, have invented certain new and useful Improvements in Machines for Compiling or Tabulating Statistics; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the letters of reference marked thereon.

On the 8th day of January, 1889, I obtained Letters Patent of the United States, No. 395,781, for certain improvements in the art of compiling statistics, said improvements involving, among other things, the use of record cards or strips having perforations punched in each to represent the items or characteristics of the individual or subject designated by that particular card or strip, an electric circuit closing device consisting of a bed plate provided with a series of contacts forming the terminals of a system of electric circuits and a reciprocating platen carrying a series of spring contact points or pins corresponding in number and arrangement to contacts in the bed plate and adapted to pass through the perforations in the cards or strips registering with them and to make connection with the bed plate contacts; a series of electro-mechanical counters and a series of electro-mechanically operated sorting boxes connected to the aforesaid system of electric circuits and adapted to count and to facilitate the distribution of the cards acted upon by the circuit closing device. Subsequently, to wit, on or about the 20th of August, 1892, I filed in the United States Patent Office an application for patent (Serial No. 443,652), covering an adaptation or modification of my aforesaid original invention in which adaptation or modification the cards or strips were caused to control pneumatic or other fluid pressure apparatus in such manner as to actuate suitable counters, sorting boxes, &c., by fluid pressure, without the use of any electrical appliances whatever. I have found that the best features of both the former apparatuses can be practically and successfully combined and embodied in a single improved apparatus, and this improved apparatus I will now proceed to describe.

In the accompanying drawings: Figure 1, represents a side elevation (partly in section) of my said improved apparatus; Fig. 2, a top plan view of the movable platen; Fig. 3, a front elevation of the same. Fig. 4, is a top plan view of the bed plate. Fig. 5, is a plan view of one of the record cards; and Figs. 6, 7, and 8 are, respectively, a side elevation, a top plan view, and a cross sectional view of multiple contact device. Fig 9 is a view of a modification in which a number of circuit closers are operated from a single air tube.

Similar letters of reference in the several figures indicate the same parts.

A indicates one of the record cards used in my system, the same being made, preferably, of paper and divided or marked off into spaces *a*, as shown, each space indicating some statistical item, which may appertain to the person or subject of which the card is the exponent.

B indicates the bed plate and C the movable platen of what is termed the "press." The bed plate is provided with ducts or passages *b* and the platen with ducts or passages *c'*, corresponding in number and position to the spaces designated on the record card and adapted to register, when the card is placed in position upon said bed plate, with as many perforations as may be punched in said card spaces. To aid the operator in properly positioning the cards upon the bed plate, the latter is provided with stops or projections S, (see Fig. 4) so located that when the rear edge and the left hand end or edge of the card are brought up against them, the holes in the card will properly register with the appropriate corresponding ducts or passages in the platen and bed plate respectively and thus insure the proper working of the machine. The ducts or passages *c'*, in the platen all communicate with a common air chamber *c*, which in turn communicates, through a passage *c<sup>2</sup>*, valve chamber *c<sup>4</sup>* and flexible tube *T'*, with a reservoir D in which a supply of compressed air is constantly maintained. The platen is preferably swung upon links F, G to insure its even descent upon the bed plate and the outer end of the link F is provided with an operating handle F', while its inner end has connected to it a spring F<sup>2</sup>, whose function is to keep the platen normally elevated.

$c^5$  is a downwardly seating spring pressed valve arranged within valve chamber  $c^4$  and having a stem  $c^7$  which extends downward, as shown. This valve is intended to be automatically raised to admit air to the chamber  $c$ , when a record card is properly placed upon the bed plate and the platen is brought down upon the card, but it is not intended to be disturbed when an improperly positioned card is upon the bed plate. The mechanism for thus controlling the valve I will now describe. Upon the platen are arranged two bell crank levers  $O^1$   $O^2$ , one at the side and the other at the end of the platen. Each of these levers is pivoted at its angle, as shown at  $o$ , and its lower arm is provided with a slotted finger  $O^3$  which is guided by a pin  $O^4$  and is kept normally pressed down by a light spring  $O^5$  so as to project the finger  $O^3$  below the lower edge or face of the platen, as shown; while its upper arm is preferably reduced and enters a slot  $o^6$  or  $o^7$  in the end of a pivoted lever  $O^6$  or  $O^7$ , arranged on the top of the platen. The top lever  $O^6$  is pivoted at  $p$  to co-operate with the side lever  $O^1$ , while the top lever  $O^7$  is pivoted at  $p'$  and co-operates with the end lever  $O^2$ . When these several levers are all in their normal positions as shown in Figs. 2 and 3 the free end of the top lever  $O^6$  overlaps the free end of the top lever  $O^7$  at a point immediately beneath the stem  $c^7$  of the valve  $c^5$ , and, if, while this position of the levers is maintained, the platen is brought down upon a properly positioned record card resting upon the bed plate, the downwardly projecting fingers of the levers  $O^1$   $O^2$  will enter suitable slots or recesses  $U$ ,  $U$  (Fig. 4) in the bed plate provided for their reception and the ends of the overlapped levers  $O^6$ ,  $O^7$  will strike a stationary projection  $H$ . (consisting preferably of an adjustable screw shown in Fig. 1) just before the platen reaches the limit of its downward movement and will be raised or sprung up by said stationary projection sufficiently to cause them to bear upward against the valve stem  $c^7$  and lift the valve  $c^5$  from its seat, thereby permitting the passage of compressed air into the ducts or passages of the platen, thence down through the perforations in the record card and finally into the corresponding ducts or passages in the bed plate. Should, however, the record card, through the carelessness of the operator, have been improperly placed upon the bed plate, that is to say, so as to leave it projecting either out at the front side or at the right end, or at both these points, such projecting portions will arrest and raise one or both of the fingers  $O^3$  upon the descent of the platen and cause one or both of the levers  $O^1$   $O^2$  to be tilted and one or both of the top levers  $O^6$   $O^7$  to be turned so as to throw the outer end of one or both said last mentioned levers out of line with the valve stem  $c^7$ , and thus prevent the lifting of said stem and the opening of the valve. The failure of the apparatus to operate will be noticed by

the attendant who will at once properly adjust the card and proceed with his work.

The levers  $O^1$ ,  $O^2$ ,  $O^6$ , and  $O^7$  together with the stationary projection  $H$ , constitute what may be termed a valve actuator, and embody a principle of operation which may obviously find expression in various embodiments, though the embodiment shown is preferred because of its simplicity. Those ducts or passages  $b$  in the bed plate which are not required to be used with a given series of punched cards, are closed by means of conical plugs  $I$ , such as shown in Fig. 1, while in each of such ducts or passages as are to be used is inserted a hollow plug  $J$  which is connected by a suitable flexible tube  $J'$  to an electric circuit closing device consisting preferably of a two-part casing  $K$   $K'$ , a flexible diaphragm  $K^2$  clamped at its edges between the two parts of said casing, and spring contact arms  $K^3$ ,  $K^4$ , whose fixed ends, are secured to the part  $K'$  of the casing, but whose free ends  $k$   $k'$  are overlapped and stand in such relation to the middle of the diaphragm as that when pressure is brought to bear upon the inner surface of the diaphragm, as by the flow of compressed air into the tube  $J'$ , said free ends will be forced together, thus completing an electric circuit  $L$  of which said contact arms form parts and operating an electromechanical counter  $L^3$  interposed in said circuit, thus indicating upon the dial of the counter the fact that the particular statistical item of the card designated by the perforation that has admitted air to that particular tube  $J'$  has been duly counted and registered.

By providing a tube  $J'$  and circuit closer for each of the ducts or passages on the bed plate of the press, connecting up the circuit closers to the other electric circuits provided also with operating magnets and counters, all the items indicated by the perforations of any given card are at the same time counted and registered, as will be readily understood.

It is sometimes desirable to have the circuit closing device operate to close a series of circuits instead of a single circuit as shown in Fig. 1, and to accomplish this I make use of a multiple contact arrangement, such as shown in Figs. 6, 7, and 8, the same consisting of a bar  $N'$  pivoted at  $N^2$  and bearing a number of contact strips  $N^3$ , &c., which are adapted to co-operate with a series of pairs of spring contacts  $N^4$ ,  $N^4$ , interposed in the several circuits to be manipulated. This bar  $N'$  is connected at one end to a pin or projection secured to the diaphragm  $N^5$  and its outer end bearing the contact strips is caused to rise or fall accordingly as said pressure is applied to or withdrawn from the diaphragm, as will be readily understood. The same result can be effected by connecting a number of the single circuit closing devices to one air tube, as shown in Fig. 9. Of course it is understood that where the multiple contact arrangement shown in Figs. 6, 7, and 8 is used the diaphragm  $N^5$  and its casing of Fig. 6, is

to be used in substitution for the diaphragm K<sup>2</sup>, and its casing of Fig. 1.

Where it is desired to sort the cards into groups so that the latter may be again passed through the machine and counted, it is only necessary that the circuit closer connected to the tube which makes connection with the duct or passage in the bed plate registering with such group-perforation in the cards be interposed in a circuit whose operating magnet instead of actuating the prime mover of a counter is arranged to operate the lid of one of the sorting boxes used in my system. This is also illustrated in Fig. 1, where M' indicates the particular operating magnet referred to M<sup>2</sup>; a pivoted arm or catch adapted to be attracted by the magnet when the circuit is closed M<sup>3</sup>; an arm connected to the lid M<sup>4</sup> of a sorting box M<sup>5</sup>; and normally engaged by the arm or catch M<sup>2</sup>, and M<sup>6</sup> a spring adapted to throw up the lid M<sup>4</sup> when the arm or catch M<sup>2</sup> is released by the closing of the circuit.

The raising of a sorting box lid not only uncovers a receptacle in which to place each card as it is removed from the press, but visually indicates to the operator just where such receptacle is. I do not, however, broadly claim herein the use of the sorting boxes as they are made the subject of claims in my former patent and application herein above referred to.

By this improved apparatus I am enabled to gain the advantage of having the perforated cards co-operate with a fluid pressure apparatus instead of with an electric circuit closer and its many contacts as in my former patent and, at the same time, I am enabled to connect up and operate my counters and sorting boxes electrically, which effects a very material saving in point of space as well as in cost of plant, since wires can be run and connected up more economically and more compactly than air tubes as proposed in my former pending application.

Having thus described my invention, what I claim as new is—

1. In a system, such as described, the combination with record cards or strips provided with perforations representing items or characteristics of the individual or unit, of a fluid pressure controlling apparatus having ducts or passages leading therefrom, a circuit closer connected to one of said ducts or passages and operated by pressure therein, an electric circuit controlled by said circuit-closer, and an electro-mechanical counter operated from said electric circuit; substantially as described.

2. In a system, such as described, the combination with record cards or strips provided with perforations representing items or characteristics of the individual or unit, of a fluid pressure apparatus having ducts or passages leading therefrom, a series of circuit closers connected to and operated by pressure therein, a series of electric circuits controlled by

said circuit closers, and a series of electro-mechanical counters operated from said electric circuits; substantially as described.

3. In a system, such as described, the combination with separate record cards provided with perforations representing items or characteristics of the individual or unit, a fluid pressure apparatus having ducts or passages leading therefrom, a series of circuit closers connected to said ducts or passages and operated by pressure therein, a series of electric circuits controlled by said circuit closers, and a series of sorting boxes and electro mechanical devices for operating the same from said electric circuits; substantially as described.

4. In a system, such as described, the combination with a record card having perforations and the fluid pressure controlling apparatus having ducts or passages leading therefrom, as described, of an electric circuit, and electro mechanical devices operated therefrom, and a circuit closer consisting of a chamber provided with a diaphragm-exposed to fluid pressure from one of said ducts or passages and contacts constituting the terminals of the electric circuit closed and opened by the movements of said diaphragm, as set forth.

5. The combination with a record card having perforations, as described, of cooperating plates or surfaces between which the record card is placed, ducts or passages opening at said plates or surfaces and adapted to cooperate with the perforations in the card, a source of fluid pressure, a fluid pressure controlling valve, and a valve actuator rendered inoperative when the record card is misplaced; substantially as described.

6. The combination of the platen with its air passages and valve, the bed plate, and a valve actuator arranged to be thrown out of operative position by an improperly positioned record card; substantially as described.

7. The combination of the platen with its air passages and valve, the bed plate, and a movable valve actuator having one of its members arranged in a plane intersected by a misplaced card; substantially as described.

8. The combination of the platen with its air passages and valve, the bed plate and a movable valve actuator having members projecting in planes intersected by the end or side of a misplaced record card; substantially as described.

9. The combination of the platen with its air passages and valve, the bed plate, a valve actuator having its movable members carried by the platen, one of said members projecting in a plane intersected by a misplaced record card; substantially as described.

10. The combination of the platen with its air passages and valve, the bed plate, a valve actuator having its movable members carried by the platen and having one of said members projected beyond the edge or face of the platen at the side of the latter so as to strike any

card that projects sidewise from its proper place on the bed plate; substantially as described.

11. The combination of the platen with its  
5 air passages and valve, the bed plate, a valve actuator having its movable member carried by the platen a portion of said movable member projecting beyond the lower edge or face of the platen at both side and end; substantially  
10 as described.

12. The combination of the platen with its air passages and valve, the bed plate, the

pivoted top levers and the cooperating side and end levers carried by the platen; and the fixed projection; substantially as described. 15

13. The combination of the platen with its air passages and valve, the bed plate, the pivoted top levers, the cooperating pivoted side and end levers and their springs and the fixed projection; substantially as described. 20

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