J. S. IVES.

PAPER-PERFORATING MACHINE.

No. 169,548. Patented Nov. 2, 1875.

Fig. 1.

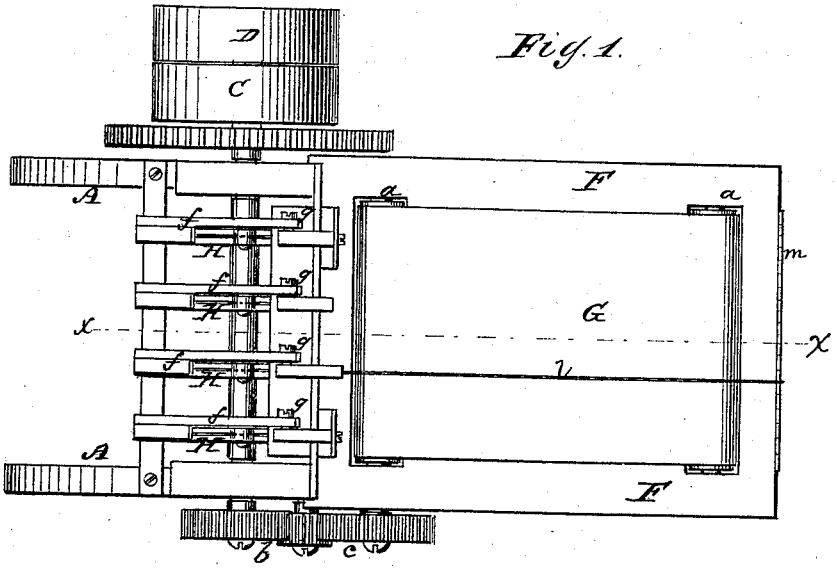



Fig. 2.

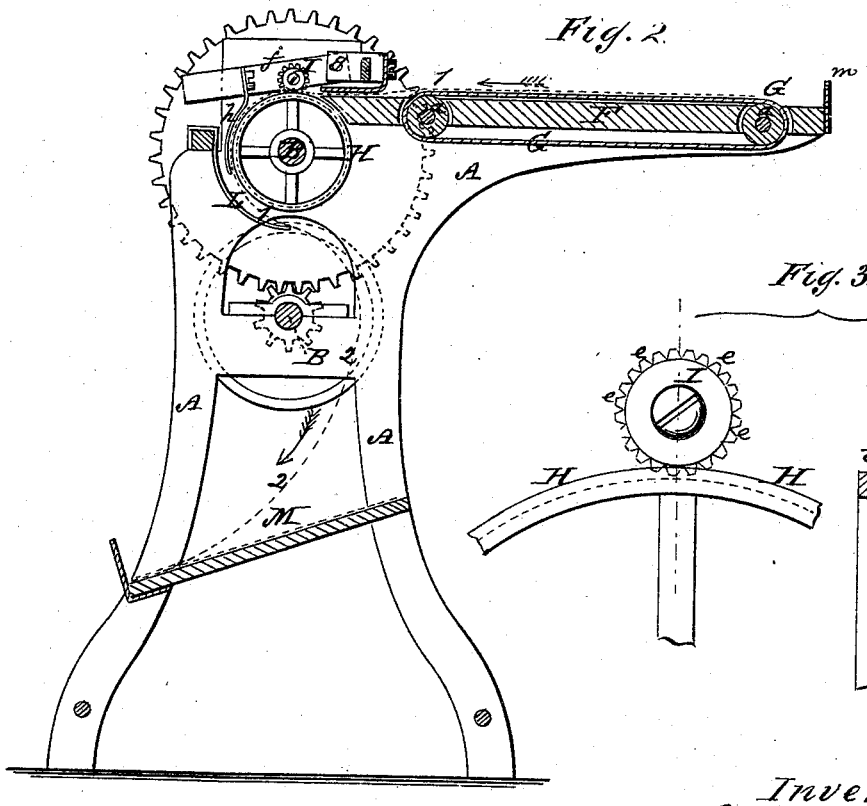
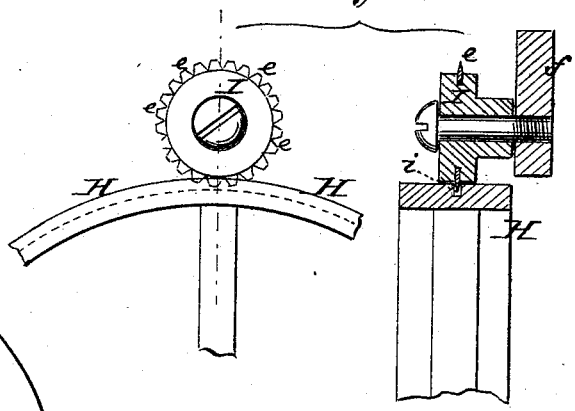



Fig. 3.

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## IMPROVEMENT IN PAPER-PERFORATING MACHINES.

Specification forming part of Letters Patent No. **169,548**, dated November 2, 1875; application filed June 3, 1875.

*To all whom it may concern:*

Be it known that I, JOSEPH S. IVES, of New York city, in the county of New York, in the State of New York, have invented an Improvement in Perforating-Machines; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings and to the letters of reference marked thereon.

A variety of machines and contrivances have heretofore been suggested and made for the purpose of perforating paper, card-board, &c., for numerous purposes; but in all such machines and devices with which I am familiar, the construction and mode of operation have been such that the perforations or holes in the stock were formed by cutting out, or punching clean out, a blank or particle of the stock at each hole. Sometimes the holes thus formed have been circular in contour, and sometimes of rectangular or other shape.

In the use of all the machines or devices heretofore used to thus perforate paper these serious objections occur, viz: The mechanism must be costly and complicated in construction, and difficult to keep in working order; provision must be made for the discharge from the machine of the blanks cut out; the finished work must be carried off at one side of the table, thus making the machine occupy considerable space, because, otherwise, the chips or litter would be mixed with the finished work, and the dirt made by the discharge of the stock cut out is a great inconvenience. Besides these objections to the mechanism, the product of the machine or the finished work is, in consequence of the stock being cut out, very undesirable for many purposes for which perforated paper sheets are made—as, for instance, for sheets of bank-bills and other certificates of monetary value which have to be handled frequently and counted.

My invention has for its object to avoid all the objections heretofore existent in perforating machines or devices, and, at the same time, afford for use a machine with which perforated sheets can be made better adapted for many purposes than sheets as heretofore made; and to these ends and objects my invention consists in a perforating-machine in which cutting-tools are employed, that make rows of clean cuts in and through the stock without removing any particles thereof, or leaving any objectionable burr, as will be hereinafter more fully explained; and, further, it consists in certain combinations of devices, as hereinafter more fully set forth.

To enable those skilled to make and use my invention I will proceed to more fully explain the construction and operation of a machine embracing my improvements, referring by letters to the accompanying drawings, in which—

Figure 1 is a top view; Fig. 2, a vertical section at the line line *x x*, Fig. 1; and Fig. 3, detail views of the perforating-tools detached.

In the several figures the same part is designated by the same letter of reference.

A is the main frame or frame-work of the machine, in which is mounted, in suitable bearings, a shaft, B, provided at one end with a fast and loose pulley, C and D, to which may be belted, by a band, E, in the usual manner, the driving-power to run the machine. F is the feed-table, in which is arranged the usual feed-apron G, moved by its rolls *a a*, which derive the proper motion from the main shaft through gears *b c*, as illustrated. On the rotatory shaft B are securely mounted four (more or less) wheels, H, each of which has cut in its face or periphery a groove or channel, *i*, and immediately over each of said wheels H is mounted, so as to run in contact therewith, a smaller wheel, I, which carries on or in its periphery the cutters or knife edges *e*. Each of the cutter-wheels I is mounted to turn freely on an arm or lever, *f*, which is hinged at *g* to a cross-bar, J, of the frame-work of the machine, and the weights of the levers or hinged arms *f* keep the cutter-wheels I down to their work and in contact with the peripheries of the grooved wheels H. Each of said levers *f* is provided with a spring-guide, *h*, which serves to guide and hold toward the wheel H the piece of paper being operated upon, and in rear of and under the series of wheels H is located the deflector or guide-board L, which, by preference, is formed, as shown, of a curved sheet of metal. This guide-board or deflector L is properly secured in the position illustrated, and its function is

to deflect and induce to the proper discharge of the finished work onto a receiving-table or receptacle, M, located immediately beneath the working parts and near the base of the machine. The dotted lines at 1 and 2 in Fig. 2 illustrate a sheet of paper during its passage into and discharge from the machine. The usual guide-springs *l* and gage *m*, or their equivalents, are employed to enable the operator to properly register or set the sheets fed in to be operated upon.

In the operation of the machine the sheets to be perforated are set on the feed-apron G and carried into the wheels, as usual in power-perforators. As the forward edge of the sheet comes between the peripheries of the wheels H and I the latter take hold of and carry through the sheet, which is passed along in the direction indicated by the arrows at Fig. 2, and has the perforation made in it by the cutters *e* running in the grooves of the wheels H. As the perforated sheet passes out it slides or tumbles over in an inverted position and falls flat in the receiver or receptacle M.

The weight or force with which the cutter-wheel I is held down onto the periphery of wheel H, and the extent of the plain surfaces of the two, should be such as to create the proper friction between the two and the interposed sheet of paper to effect the proper driving or rotation of the cutter-wheels I by the rotation of the driving-wheels H, and the cutters or knife-edges *e* of the wheels I should be made as thin as possible to insure certainty of action, and of the proper lengths and distances apart to effect the desired perforation, with clean cuts, without forming any objectionable burr, and with only just enough stock left between the cuts to hold the paper together till a severance is desirable.

The groove *i* in wheel H should be made just wide and deep enough to permit the passage of the knife-edge cutters *e* through the paper, and permit the periphery of wheel H to bear on the sheet close up to each side of the cutting-edge *e*. In lieu of the heavy or weighted levers or arms *f* to hold the cutter-wheels I down to their work and in proper position to be driven, the same end may be accomplished by the action of springs.

In the construction of the machine the form and size of many parts, as well as their arrangement, may of course be varied without departing from my invention.

It will be seen that in a machine made as shown and described the perforations will consist of clean cuts in the sheet, and that, therefore, no chips or dirt will be made, and that therefore I am enabled to carry and discharge the sheets beneath the cutting mechanism, and thus economize space and make the machine less cumbersome than those heretofore made.

By the employment of cutting knife-edge tools, working as described in the grooved bearing-wheels, I am enabled to make the cuts without the formation of any objectionable burr or roughness on the back side of the sheet, and can make the perforations so narrow that when the stock is torn apart the edges of the pieces will be comparatively smooth, instead of very ragged, as usual with work done on machines made in the ordinary manner.

By the combination of the cutter-wheels I with the wheels H in the manner described, so that the latter act as drivers to rotate the former through the friction on each of said rolls by the interposed sheet of paper, I am enabled to make the machine very simple, durable, and not liable to get out of order, while at the same time, by the described mode of operation, it follows that the cutter-tools will operate alike and with certainty of action on all parts of the sheet, though variable in thickness and embodying imperfections of surface.

Having so fully explained the construction and operation of my improved machine that any one skilled in the art can make and use it, what I claim therein as new, and desire to secure by Letters Patent, is—

1. The combination, with a suitably-grooved rotatory surface, on which the sheet is supported, of a cutter-wheel driven therefrom, and formed or provided with knife-edge cutters, the whole so constructed and operating that the sheet passed between said two wheels will have a row of clean cuts made in it, as and for the purpose described.

2. The combination, with a grooved driving-wheel, of a cutter-wheel and a means for pressing and holding the cutter-wheel toward the driving-wheel, the whole arranged and operating together as and for the purposes described.

3. In combination with the means for perforating the paper, a receptacle for the finished sheets, arranged immediately under the perforating mechanism.

4. In combination with the perforating mechanism and a suitable receptacle for the finished sheets, arranged beneath said mechanism, a deflector or guide-board, the whole arranged and operating as and for the purposes set forth.

In witness whereof I have hereunto set my hand and seal this 11th day of May, 1875.

JOS. S. IVES. [L. S.]

In presence of—

J. N. McINTIRE,

JACOB FELBEL.