No. 691,751. Patented Jan. 28, 1902.

H. H. CUMMINGS.

PAPER FOLDING MACHINE.

(Application filed Sept. 5, 1901.)

(No Model.) 3 Sheets—Sheet 1.

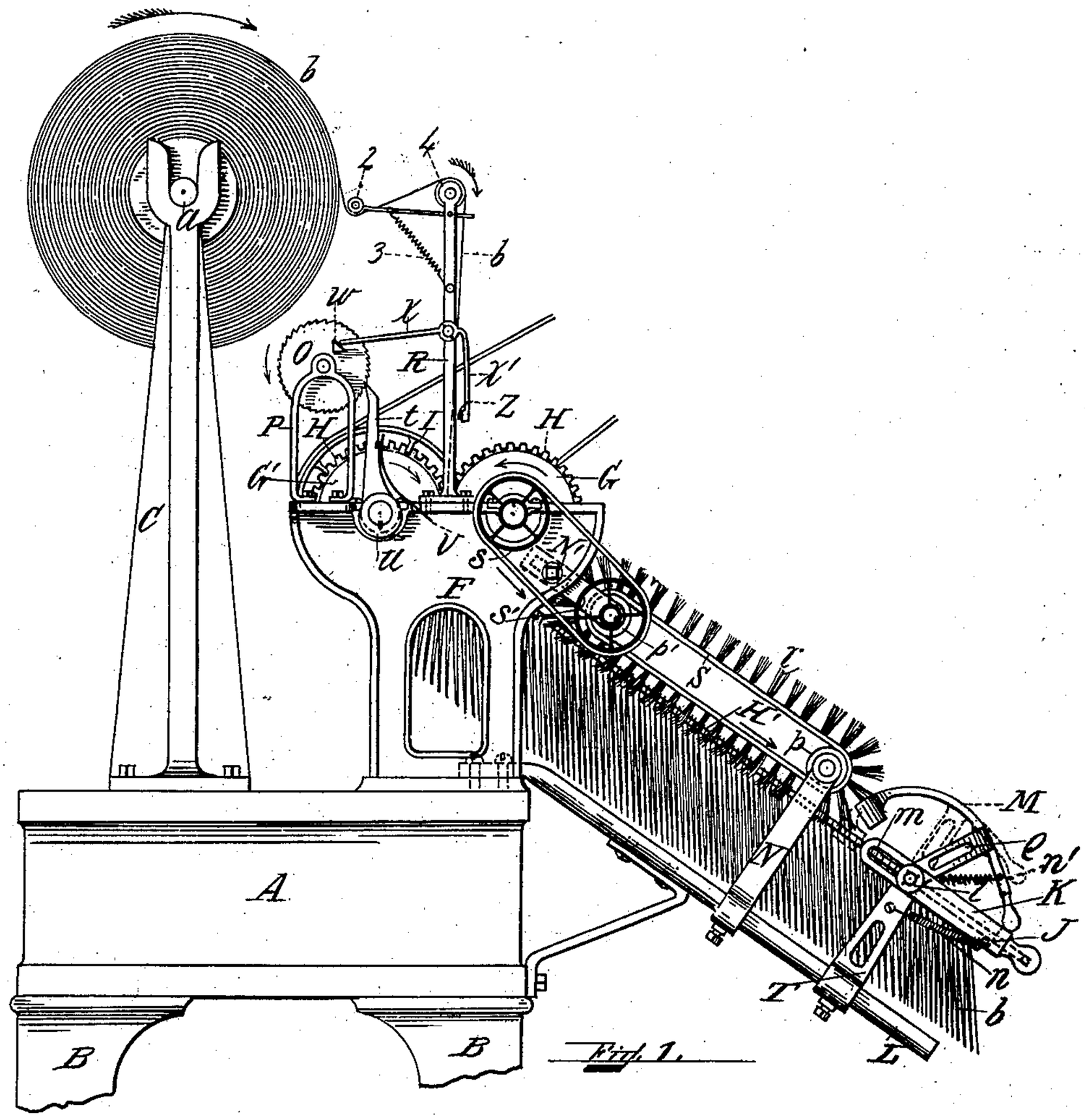

Fig. 1.

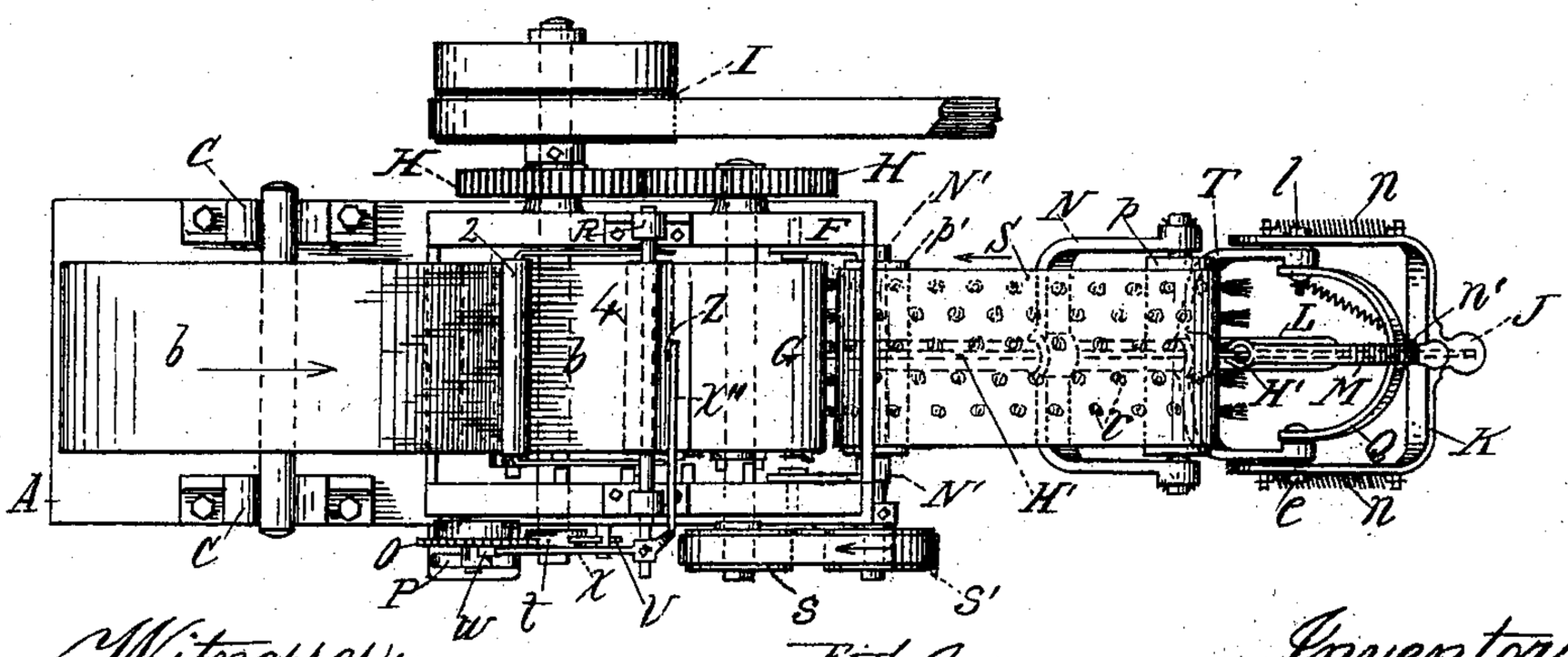

Fig. 4.

Witnesses:
Homer Rogers.
Clarence P. Moore

Inventor:
Henry H. Cummings
by Stephen Moore Atty.

No. 691,751. Patented Jan. 28, 1902.

H. H. CUMMINGS.

PAPER FOLDING MACHINE.

(Application filed Sept. 5, 1901.)

(No Model.) 3 Sheets—Sheet 2.

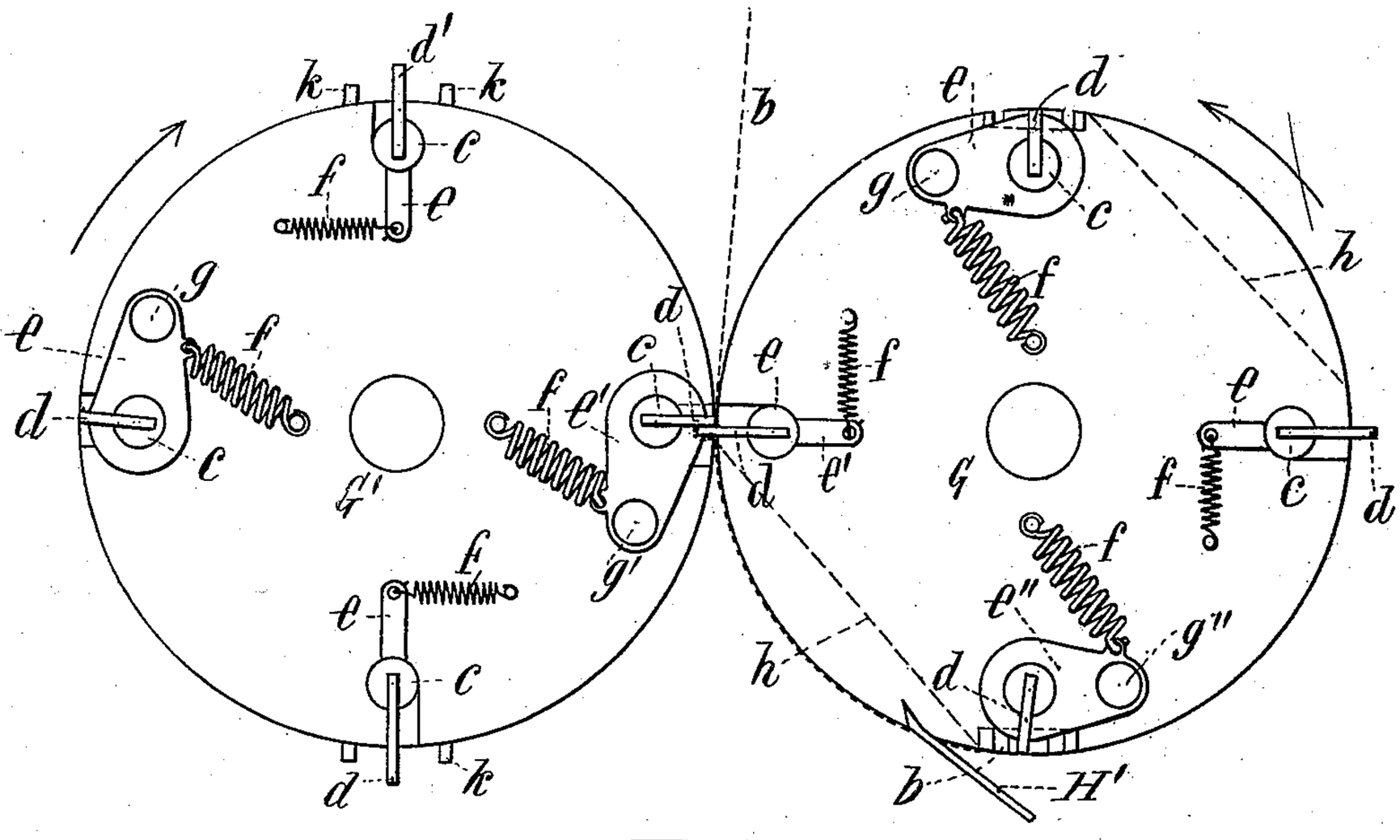

Fig. 2.

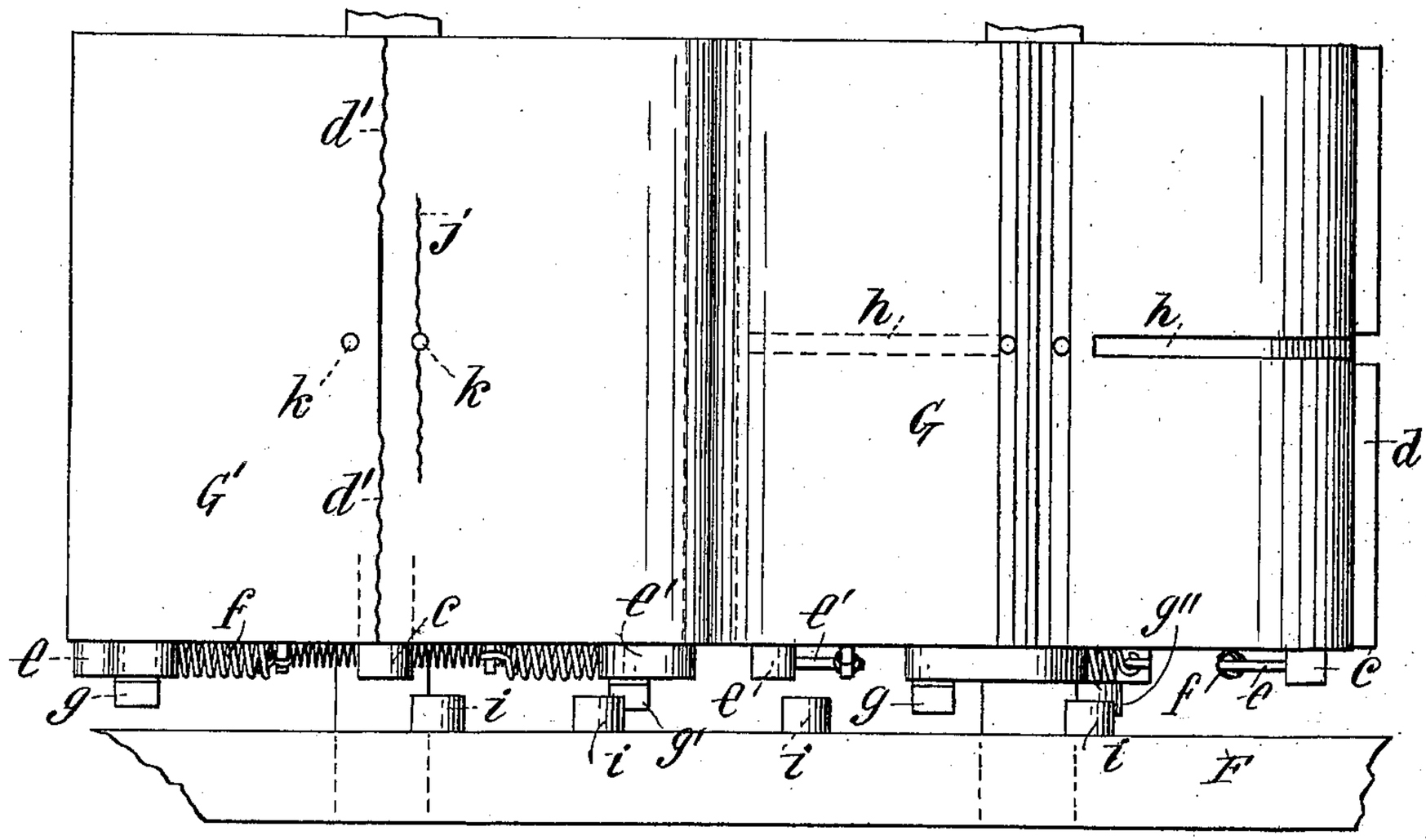

Fig. 3.

Witnesses:
Clarence P. Moore
James H. Williams.

Inventor:
Henry H. Cummings
by Stephen Moore atty

No. 691,751. Patented Jan. 28, 1902.

H. H. CUMMINGS.

PAPER FOLDING MACHINE.

(Application filed Sept. 5, 1901.)

(No Model.) 3 Sheets—Sheet 3.

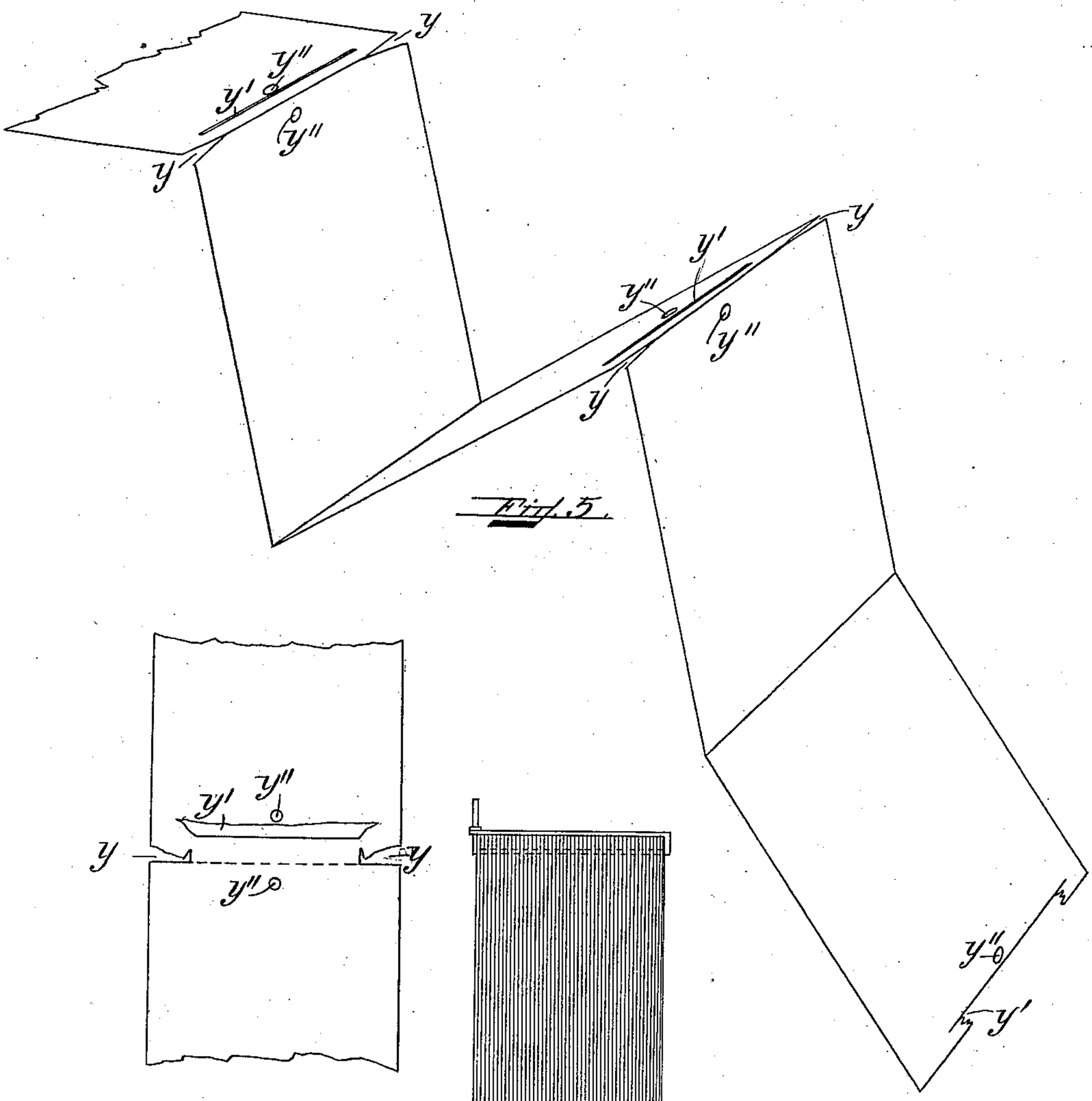

Fig. 5.

Fig. 6.

Fig. 7.

Witnesses:
Homer Rogers,
Clarence P. Moore.

Inventor:
Henry H. Cummings
by Stephen Moore Atty.

UNITED STATES PATENT OFFICE.

HENRY H. CUMMINGS, OF MALDEN, MASSACHUSETTS, ASSIGNOR TO THE NATIONAL FIBRE BOARD COMPANY, A CORPORATION OF MAINE.

PAPER-FOLDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 691,751, dated January 28, 1902.

Application filed September 5, 1901. Serial No. 74,360. (No model.)

To all whom it may concern:

Be it known that I, HENRY H. CUMMINGS, of Malden, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Paper-Folding Machines, of which the following is a specification.

My invention relates to paper-folding machines; and the object of my improvement is to provide a machine that will fold and cut toilet-paper so that it may be readily formed into packages such as are described in Letters Patent of the United States No. 598,315, granted to E. N. Cummings February 1, 1898.

My invention consists of a combination of devices whereby a strip of paper is delivered from a roll to a pair of rolls which are provided with means for folding, cross-cutting, and perforating said strip, then delivering the same onto a wire and automatically marking the number of sheets determined on to form a package and also providing for the removal of a completed package without stopping the machine. These devices are set forth in the following specification and the accompanying drawings, of which—

Figure 1 is a side elevation; Fig. 2, an end view of the rolls; Fig. 3, a plan of the same; Fig. 4, a plan of the machine as a whole; Fig. 5, a view of the paper, showing the folds and cuts made by the machine; Fig. 6, a detail showing the sheets partly torn apart, and Fig. 7 a package of the same.

Similar characters refer to similar parts in all the drawings.

The principal parts of the machine are mounted on a base A, supported on suitable legs B B. (Shown as cut away.)

A pair of standards C C, bolted to the base, carry in open bearings at their tops a mandrel *a*, on which is wound the paper to be folded. Supporting-frames F F, also bolted to said base, carry in suitable bearings the two rolls G G′. The shafts of these rolls are continued beyond the bearings and on one side carry the gears H H, whereby the rolls revolve in opposite directions at the same speed, being operated by a belt working on a pulley I on one of the roll-shafts projected beyond its gear. The rolls G and G′ revolve in the directions indicated by the arrows and draw the paper *b* between them, the projecting blades and recesses serving to fold and cut it as desired. In each roll near its circumference are drilled four holes from end to end, and a slot is cut from each hole to the circumference of the roll. In each hole is fitted a rod *c*, carrying a blade *d* or *d′*, that projects therefrom through the slot to or beyond the surface of the roll, two of these blades in each roll being flush with the surface of the roll and two projecting slightly beyond it, as shown. The rolls are so matched that in revolving the projecting blade in each roll as it meets the other roll enters the slot beside one of the flush blades on the other, so that the paper is alternately pressed into the slots of each roll, thus folding it in the desired zigzag form. These blades *d d′* have a slight vibratory motion in the said slots, the rods *c c*, to which they are attached, serving as pivots. Crank-arms *e e′ e″* are attached to the ends of the rods *c c*, and springs *f f*, attached to these arms, serve to press the blades normally against one face of the slots in which they lay. Two of the arms on each roll carry projecting studs *g g g′ g″*, which as the rolls revolve strike against studs *i i′* on the frame F, so as to move the blades against the pressure of the springs and away from the adjacent face of the slots, and thus to loosen at the proper time the paper clamped therein.

In the position shown in Fig. 2 the roll G has one of its projecting blades *d* entered into the adjacent slot in the roll G′, carrying the strip of paper, (indicated by dotted lines *b*,) which is thus folded about the edge of the blade. Just as this blade begins to withdraw from the slot in roll G′ (by the continued revolution of the rolls) the stud *g′* on the crank-arm attached to the blade *d* in G′, holding the paper, strikes against the stud *i* on the frame F and loosens the grip on the paper and allows the fold to drop free. This is the lower fold, as seen in Fig. 1. Referring again to Fig. 2, the paper is shown as still held in the slot at the bottom of roll G and about to be released by the stud *g″* on the crank-arm *e″* striking against the stud *i′*, on the frame F. Before this fold of the paper drops, however, it is thrust upon a needle or wire H′, which enters a perforation which has previously

been made in the paper, and thus it is hung upon the needle by every alternate fold. This needle has an upturned point lying against the roll G and it enters a circumferential groove *h h*, extending partly around said roll on opposite sides thereof. It will be readily seen that as the two rolls each have the slots and blades on their opposite sides alike each revolution forms two folds in the paper in each direction. This method of folding the paper is old and not of my invention, but the reception of the paper from the rolls upon a needle is an important feature thereof. Fig. 5 shows that the paper has cross-cuts *y y* from each edge inward, and a central cut *y'* and a hole for the wire *y''* at and near each of the alternate folds. In Fig. 3 it will be seen that the blade *d'* is made for a portion of its length from each end (indicated by a waved line) with a sharp saw-tooth edge, which cuts the paper in the act of folding. A similar cutting-blade *j* is inserted in the same roll in a proper position to make the central cut *y'*, (seen in Figs. 5 and 6,) and it also has punches *k k* to make the required perforation for the wire. This cutter *j* and the punches *k k* enter corresponding apertures in the roll G. Duplicates of the cutters and punches are on the opposite side of the roll G'.

The needle H', of which the upper end is seen in Fig. 2, is a long steel wire upon which the successive folds of paper (see Fig. 1) are strung, as above described. It is held at its lower end by being inserted loosely in a socket in the handle J, which is attached to and forms a part of a bifurcated frame K. (See Fig. 4.) This frame is supported on studs *l l*, which are attached to a supporting-frame T, which is held by a rod L, bolted to the base A and braced, as shown in Fig. 1. The frame K, carrying the needle-holder J, is not rigidly attached to the studs *l l*, but has a slot *m*, as shown, (see Fig. 1,) which allows it to be drawn back away from the needle, to which it is normally held by the springs *n n*, which also serve by their strain in a diagonal direction to press the point of the needle firmly against the roll G.

Above the frame K and attached to the same studs *l l* on their inner ends is the curved yoke Q, carrying the curved needle-holder M, which may be swung forward to the position shown by the dotted lines, Fig. 1, being pivoted on the studs *l l*. The upper end of this curved holder is bifurcated, so as to form a spring-clamp that will when thrown forward embrace and firmly hold the needle H'. A spring *n'* is attached to this handle and to the inner end of stud *l*, which by its tension holds the needle-point against the roll G when the needle is supported by this holder M.

In the operation of the machine the handle J normally holds the needle in place, the holder M being thrown back in the position seen in Fig. 1. When a sufficient quantity of paper to form a package has been collected on the needle, as indicated by a telltale hereinafter described, the paper is slid down the needle beyond the point where the curved holder M may grip it, and then, this holder M being thrown forward to the position shown by the dotted line, the needle is supported by it and the handle J is drawn away from the needle and the package is slipped off the needle onto the wire on which it is to remain. A small hole drilled in the butt of the needle allows the end of the wire to be inserted therein; so the package is readily slipped from the needle to the wire.

In order to assist the folds of paper in sliding along the needle as the folds are formed and caught on its upper end, an endless apron S, carrying bristles or wires *r*, is used. This is carried on two rolls, the lower one, *p*, being hung in bearings in a frame N, attached to the rod L, and the upper one, *p'*, hung in brackets N', projecting from the frame F. The shaft of the upper roll *p'* projects beyond its bearing, so as to carry a pulley *s'*, which is driven by a belt from a pulley *s*, mounted on the projecting end of the shaft of the roll G.

The numbering of the folds is automatically done by a ratchet-wheel O, which is supported on a stud in a frame P, bolted to a projecting shelf of the base F. This ratchet is operated by a pawl *t*, which is reciprocated by an eccentric *u* on the projecting end of the shaft of roll G'. A spring *v* serves to hold the pawl against the ratchet-wheel O. Attached to one side of this wheel is a stud *w*, which at each revolution of the wheel lifts the arm of the bell-crank lever *x*, which is fulcrumed on a stud in the upright standard R, which is bolted to the frame F. This bell-crank lever, in addition to the horizontal and perpendicular portions *x* and *x'*, (shown in Fig. 1,) has a horizontal arm *x''*, (see Fig. 4,) extending toward the central line of the strip of paper as it is fed to the rolls. Upon the extreme lower end of this arm is an inked pad *z*, which is pressed against the descending strip of paper by the action of the stud *w* upon the other end of the lever. Thus a mark is made at each revolution of the ratchet-wheel, which is moved one notch at each revolution of the rolls G and G'. As each revolution places two folds upon the needle H', it is evident that if the ratchet has two hundred and fifty teeth each five hundred folds will be indicated by the ink-mark made by contact of the pad *z* with the strip of paper. Any of the usual devices for counting may be used in connection with the lever *x*.

In order to prevent breakage of the paper from the inertia of the roll upon the mandrel *a*, the strip of paper is led to the machine under a small roll 2, mounted on vibratory arms pivoted to the upright R and pressed downward by a small spring 3.

In the operation of the machine the paper is led from the roll on mandrel *a*, under the spring-roll 2, over the roll 4, (mounted upon the upper ends of the upright R R,) thence downward to the folding-rolls G G', being

marked on its way at the proper intervals by the pad *z*. It is delivered by the rolls in folds to the needle H′ and thence removed by hand onto the wires which are to permanently carry it, as has been fully explained.

I do not claim, broadly, a pair of folding-rolls with blades and cutters for the purposes of this machine. Neither do I claim in connection with such rolls a spring-tension roller, as 2, these devices being old; but

I do claim—

1. In a machine of the character described, the combination with a pair of rolls provided with appliances for folding a continuous strip of paper in alternate directions and perforating the same near each alternate fold, of a needle-rod, adapted to enter the said perforations and receive the folds of paper thrust upon it by the action of said rolls, arranged and to operate substantially as set forth.

2. In a machine of the character described, the combination with a pair of folding and perforating rolls such as herein shown, of a needle-rod adapted to receive the folded paper thereon and two holders for said needle-rod, either one of which may be disconnected from it while the other holds it, substantially as and for the purpose described.

3. In a machine of the character described the following elements: a pair of rolls arranged with appliances for folding and perforating a continuous strip of paper, a needle-rod adapted to receive such paper by the perforations therein, and means for automatically carrying said folds of paper along said rod and away from said rolls substantially as specified.

4. In a machine of the character described, the combination of a pair of folding and perforating rolls, a needle-rod adapted to receive the paper by the perforations therein and means for automatically marking the sheets at regular intervals substantially as herein set forth.

5. The combination of the folding and perforating rolls G G′, the needle H′ arranged to receive the folds of paper from said rolls, the needle-holder J and the supplementary holder M, all arranged and to operate substantially as shown and described.

6. The combination of the folding and perforating rolls G G′, the needle H′, adapted to receive the folds of paper from said rolls and the apron S, provided with wires or bristles as shown, and means for moving said apron parallel with said needle substantially as and for the purpose specified.

In testimony whereof I have affixed my signature in presence of two witnesses.

HENRY H. CUMMINGS.

Witnesses:
STEPHEN MOORE,
HOMER ROGERS.