(No Model.)

# C. M. HARDING.

## PAPER CUTTING MACHINE.

No. 371,579. Patented Oct. 18, 1887.

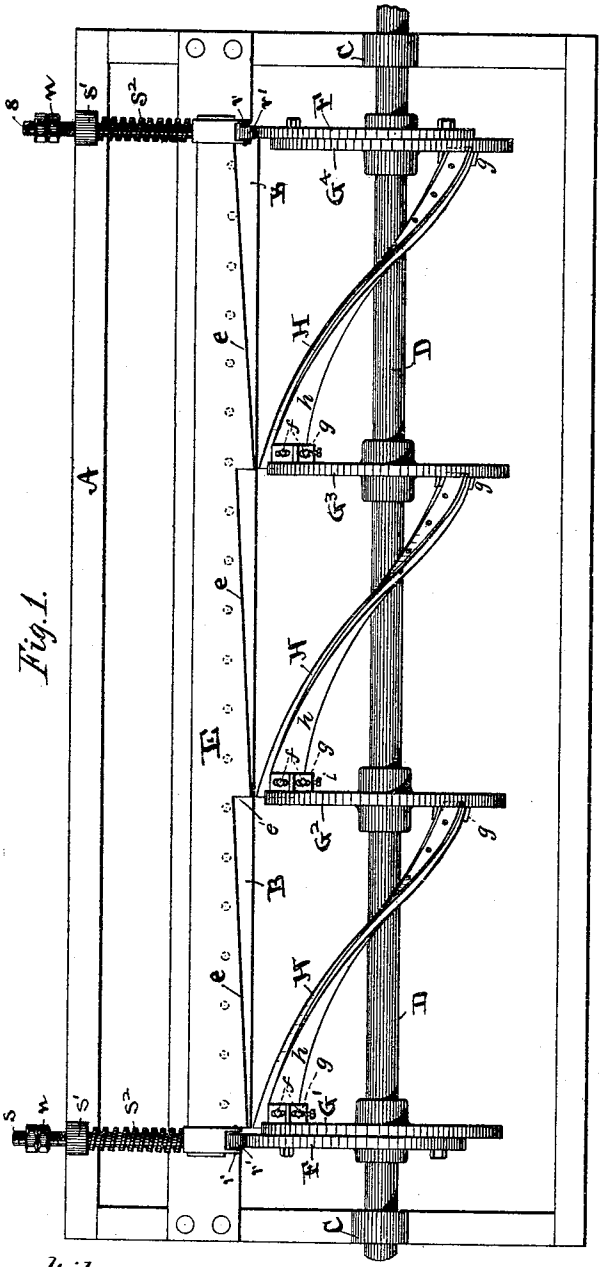

Fig. 1.

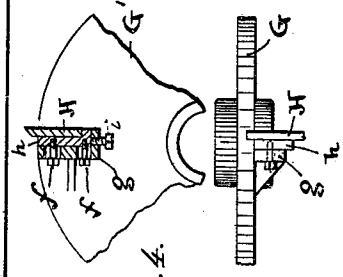

Fig. 4.

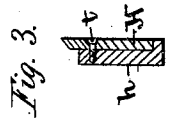

Fig. 3.

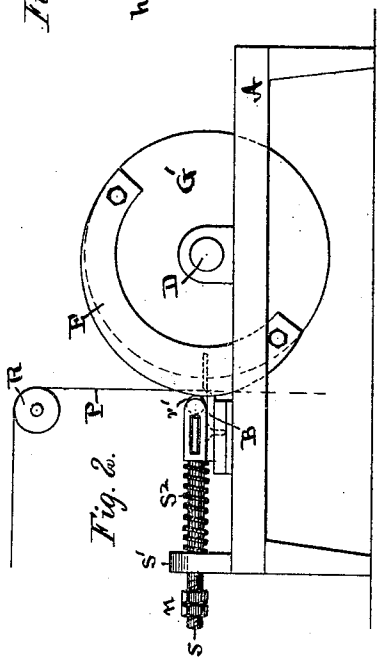

Fig. 2.

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# UNITED STATES PATENT OFFICE.

CHARLES M. HARDING, OF FRANKLIN, OHIO.

## PAPER-CUTTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 371,579, dated October 18, 1887.

Application filed December 16, 1885. Serial No. 185,785. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES M. HARDING, a citizen of the United States, residing at Franklin, Butler county, Ohio, have invented new and useful Improvements in Paper-Cutting Machines, of which the following is a specification.

My invention relates to paper-cutting machines, its object being to provide a practicable and efficient mechanism for cutting diagonal sections from continuously-fed strips; and it consists in mechanism embodying a fixed horizontal bed-knife and one or more spiral cutting-blades upon a rotating frame or cylinder acting in conjunction with said bed-knife, and a clearing-bar moving upon said bed-knife to clear the paper strip from the same, all as hereinafter more fully described, and illustrated in the drawings.

Mechanism embodying my invention is illustrated in the accompanying drawings, in which—

Fig. 1 is a plan view of my invention complete, embodying three cutting-knives arranged to operate simultaneously upon three strips of paper fed continuously. Fig. 2 is a vertical section taken through one of the cutting-blades and through the bed-knife and clearing-bar; Figs. 3 and 4, detail views showing sections of the cutting-blade and its backing-piece and exhibiting the mode of attachment to the shaft.

Referring now more particularly to the drawings, A designates the supporting-frame, on which are mounted the bed-knife B, the clearing-bar E, and its reactuating mechanism, and upon which, in journal-bearings C, is mounted the shaft D, carrying the cutting-blades, as hereinafter set forth.

The bed-knife B is substantially the same in construction and individual arrangement as is used in other paper-cutting machinery of this nature, and presents a cutting-edge in a horizontal plane and in the vertical plane of the paper strip P.

The clearing-bar E is a flat bar, which I prefer to construct of wood faced beneath at its forward edge with metal having an exact sliding contact throughout upon the upper face of the bed-knife, (for reasons presently to be explained,) and is provided at each end with studs $r$, projecting longitudinally beyond the coinciding end limits of the bed-knife and clearing-bar, which studs may be provided with friction-rollers $r'$. Projecting rearward at each end of the clearing-bar, preferably in the cross-line of the studs $r$, are arms $s$ $s$, projecting loosely through loops $s'$ upon the frame A, beyond which loops the arms are threaded and provided with adjustable nuts $n$, which may be set forward or backward to limit the horizontal movement of the clearing-bar. A coiled spring, $s^2$, placed around each arm between the loops $s'$ and the clearing-bar, hold the bar normally forward to the limit allowed by the nuts $n$. The exact construction of these parts, as shown by the drawings, is as follows: Each arm $s$ is formed into a rectangular loop near its forward end, which receives the projecting end of the clearing-bar E and forms a shoulder for the action of the spring $s^2$, and terminates at its forward end in two jaws, between which the roller $r'$ is pivoted upon the stud $r$.

In the present case the clearing-bar has its forward vertical edge formed as three separate inclines, $e$, to correspond with the three cutting-knives and accommodate and act upon three strips fed simultaneously. These surfaces are inclined correspondingly at fixed angles with the vertical outer edge of the bed-knife, the inner end or bottom of each incline being joined to the outer end or top of each incline by a surface, $e'$, perpendicular to the edge of the bed-knife and coinciding with the line of thrust of the clearing-bar.

The clearing-bar is moved backward by two cam-wheels or eccentrics, F F, secured upon the shaft D, arranged opposite the friction-rollers $r'$. The eccentricity of the cam is proportioned so as to move the clearing-bar backward a distance equal to or a little in excess of the length of the vertical line $e'$, at proper intervals, against the force of the springs $s^2$, actuating it forward. The parts are arranged and proportioned so that the outer angles of the clearing-bar shall be moved outward from a position just within the edge of the bed-knife to one overlapping the same sufficiently to allow the inner angles to just clear such edge. The object of this movement will be more fully understood in connection with the functions of the cutting-blades.

The cutting mechanism is constructed as fol-

lows: Upon the shaft D are centered four disks, G, which for convenience we may refer to in relative order, when required, as G' $G^2$ $G^3$ $G^4$, provided with hubs and keyed or otherwise secured to the shaft rigidly. Between each two consecutive disks is secured a spirally-curved cutting-blade, H, having a cutting-edge in a cylindrical plane and the cutting-edges of all being in a common cylindrical plane extended concentric with the axis of the shaft. The shaft D is arranged parallel with the edge of the bed-knife B, and the latter's edge is arranged approximately in the cutting-plane of the knives. The knives H are arranged in corresponding radial positions upon the disks, their cutting-edges corresponding in length, each to each and with the inclined surfaces *e* of the clearing-bar; and, further, the adjacent ends of consecutive knives upon each disk are brought to the same central plane of the disk. It will be obvious, therefore, that the cutting operation as the shaft D is rotated will begin at the end of the spiral blade first in approximate contact with the bed-knife and extend thence across the bed-knife until the opposite end of the cutting-blade passes the bed-knife. This action will be more clearly understood by referring to Fig. 1, in which the left-hand end of each spiral blade is shown in cutting contact with the bed-knife. Supposing the shaft to be revolving over from the observer, it will be obvious that the point of cutting contact will shift continuously from left to right across the edge of the bed-knife. If it be now further understood that the sheet of paper is passing vertically downward between the bed-knife and the spiral cutting-edges and is continuously in motion, it will be obvious that the line of severance will be diagonal.

The action of the clearing-bar, it may now be explained, is so adjusted that as it moves forward the crossing-point of the edge *e* over the forward edge of the base-knife moves simultaneously with and just behind the point of cut, and the paper is thus cleared from the bed-knife and directed properly in its descent.

It remains to describe the mode of connecting the knives H to the disks. Each disk G is provided with a lug, *g*, cast upon its side and extending radially inward from its periphery and outward from the face of the disk, as indicated in Fig. 4, and the lug has a foot, which gives it an L form in cross-section, and may be strengthened behind by a bracket, as shown. The knife H is seated in and against a backing-piece, *h*, which is also L-shaped in cross-section, having a foot extending forward under the heel of the knife, as indicated in Fig. 3. The backing-piece may be of cast-iron, and is extended longitudinally into a bar fitting between adjacent faces of two disks G, and conformed to the curvature of the knife H, which is secured thereto by screws *t* at suitable intervals.

The knife H, with its backing-piece *h*, when secured together, constitute one structure, which is placed in position between two adjacent disks seating in the angle of the lugs *g*, as indicated in Fig. 4. The knife H extends longitudinally beyond its backing-piece at each end to the central plane of the supporting-disk, a suitable recess being formed in the face of the disk to receive it. The backing-piece is secured to the lugs by set-bolts *f f*, passing through suitable perforations in the lugs and threaded into the backing-piece. I prefer to elongate the perforations of the lugs in a radial line from the shaft-axis, and introduce a set-screw, *i*, from beneath through the foot of the lug *g*, thus obtaining an adjustment of the knife outward to take up any loss of radial dimension occurring through grinding or sharpening the spiral knives or the bed-knife. This is more important in a machine embodying a number of knives operating, as in the present case, with a single bed-knife, since the wear in grinding may be unequal in different knives; but in a machine with a single knife a similar adjustment may be effected by moving the bed-knife forward.

The cams F are most conveniently mounted on the shaft D by securing the same against the outer side of the outer disks, G.

To secure the most perfect operation of the machine, the parts should be proportioned and actuated so that the vertical travel of the paper and the horizontal travel of the cutting-edges across the bed-knife shall exactly conform, and the radial angle, as projected upon a common circle, between the radial positions of the knife H, at opposite ends, should equal the angle of the diagonal cut with the horizontal plane of the bed-knife. The machine will operate, however, by proportioning the rates of lineal travel of the paper and of the cutting-knives so as to compensate for any inequalities in the above particulars, and the angle of cut may be regulated by the same means within limits; but the first construction is to be preferred.

In this description I have omitted mention of the mechanism for feeding the paper forward, as the same is ordinarily part of the system of drying and pressing rolls of the paper-making machine, and forms no part of my invention, excepting in so far as some means of feeding the paper forward is to be understood as operating in connection with the same. It will be understood, however, that the apparatus here shown is to be attached to or placed in juxtaposition with the ordinary paper-machine to receive and cut the paper strip as it comes from the rolls over an idler or feed-roll, R, placed to deliver it vertically to the cutters.

If the clearing-bar were omitted altogether, especially if the feed-roller R is placed a little farther forward to drop the paper a little beyond the edge of the bed-knife, the machine would still be operative, since when the projecting corner of the sheet at the beginning of the cut passes beyond the bed-knife as it travels downward the paper itself, by reason of its severed edge crossing the edge of the bed-knife diagonally, would tend to clear the

edge and continue in motion downward without buckling, especially if the stock is dry enough to possess any inherent elasticity; but the clearing-bar obviously tends to insure this result, and is especially useful with damp and limp stock in the condition in which it is usually cut. It will be obvious, also, that the clearance of the paper in such case would be enhanced by giving the edge of the bed-knife a slight inclination to the cutting-line of the rotating knife and giving it a slight withdrawing movement, similar to that at present described for the clearing-bar, the inclination of the bed-knife in such case being opposite to that now given the clearing-bar. It is also obvious that two of the three cutting-knives H shown and described may be omitted, and the machine thus limited to operation upon a single sheet; also, that any number may be added upon the same shaft within constructive limits to cut additional sheets; also, that by increasing the diameter of the disks additional cutting-knives could be added between the same disks (and the actuating-cam modified accordingly) to cut more than once at each revolution of the shaft, all of which modifications are obviously within the spirit of my invention.

I claim as my invention and desire to secure by Letters Patent of the United States—

1. In a continuous-feed paper-cutting machine, the combination of a horizontal stationary bed-knife, a movable cutting-blade engaging the edge of the bed-knife at a continuously-shifting point, and a horizontal reciprocating clearing-bar inclined to the vertical edge of the bed-knife and operating substantially as set forth.

2. In a continuous-feed paper-cutting machine, the combination of a spiral cutting-blade arranged upon a rotating shaft, a fixed horizontal bed-knife, and a horizontally-reciprocating clearing-bar arranged upon the surface of the bed-knife and operating substantially as and for the purpose set forth.

3. The combination, in a paper-cutting machine, of the shaft carrying the duplicated spiral cutters, the fixed horizontal bed-knife having its edge approximately in the cutting-plane of the cutters, and the reciprocating clearing-bar having its outer edge formed as a series of consecutive inclines corresponding with the limits of the several cutters, respectively, substantially as and for the purpose set forth.

4. The combination, in a continuous-feed paper-cutting machine, of the shaft D, two disks, G, provided with lugs *g*, spiral cutting-blade H, and a backing-piece, *h*, constructed and arranged substantially as and for the purpose set forth.

5. The combination, in a paper-cutting machine, of the disks G, provided with lugs *g*, formed with a foot, as shown, the backing-piece *h*, cutting-blade H, adjusting-screws *i*, and holding-screws *f*, substantially as and for the purpose set forth.

6. The combination, with the rotary cutters and a fixed bed-knife, of the clearing-bar E, arms *s s*, shaft D, cams F F, and springs $s^2$ $s^2$, substantially as and for the purpose set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CHARLES M. HARDING.

Witnesses:

L. M. HOSEA,

C. D. KERR.