(No Model.) 2 Sheets—Sheet 1.

S. WHEELER.

METHOD OF MAKING PERFORATIONS IN PAPER.

No. 404,581. Patented June 4, 1889.

Fig. 1.

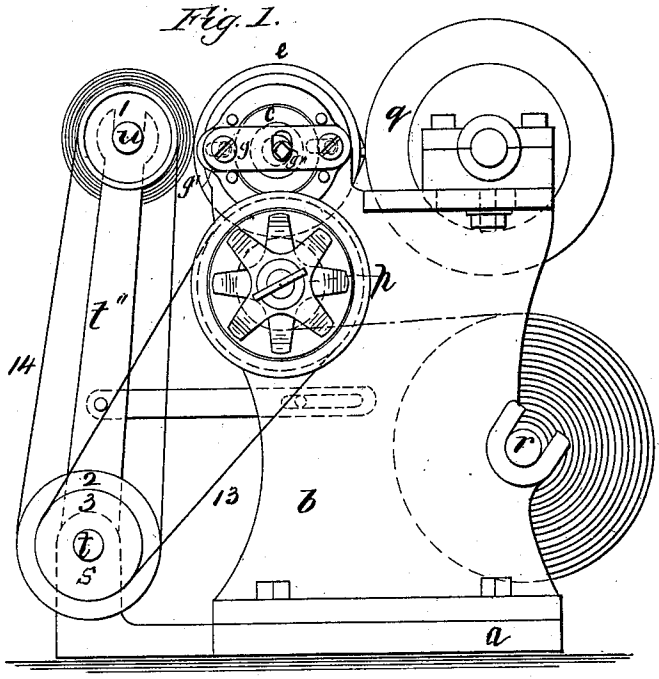
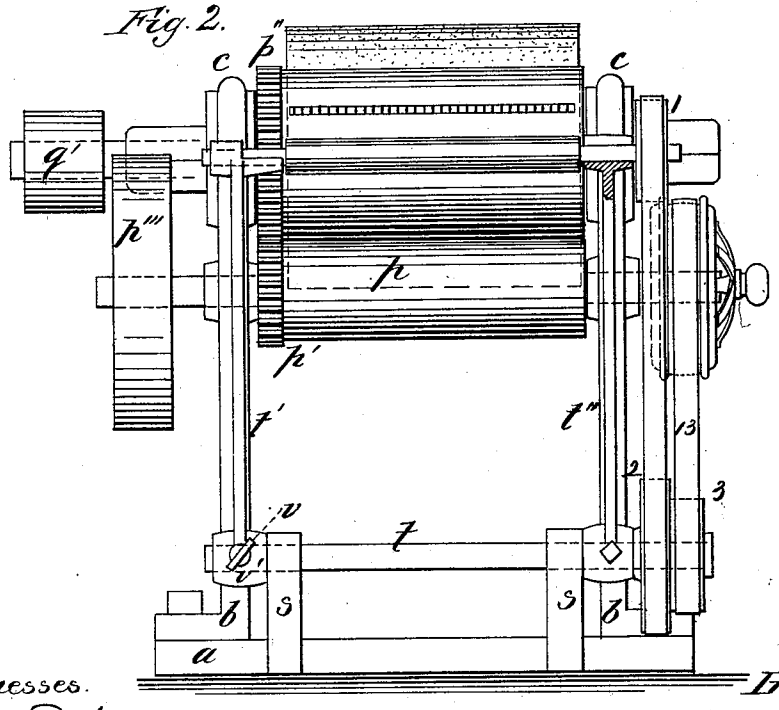


Fig. 2.



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Fig. 3.

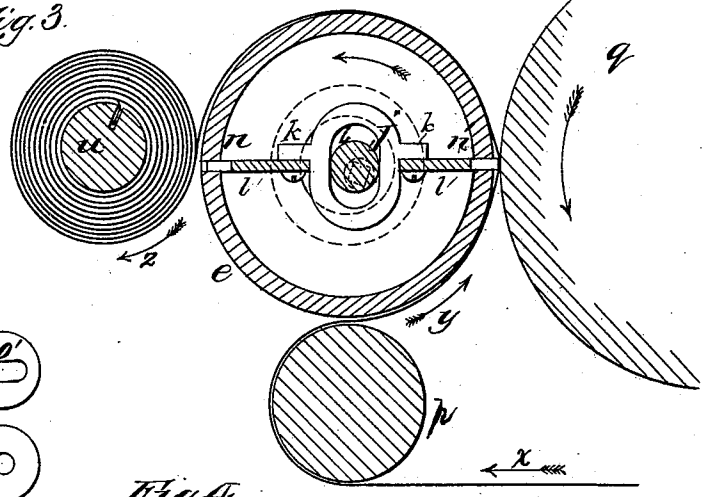


Fig. 5.

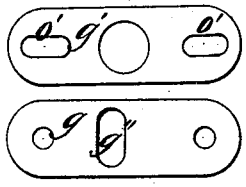


Fig. 4.

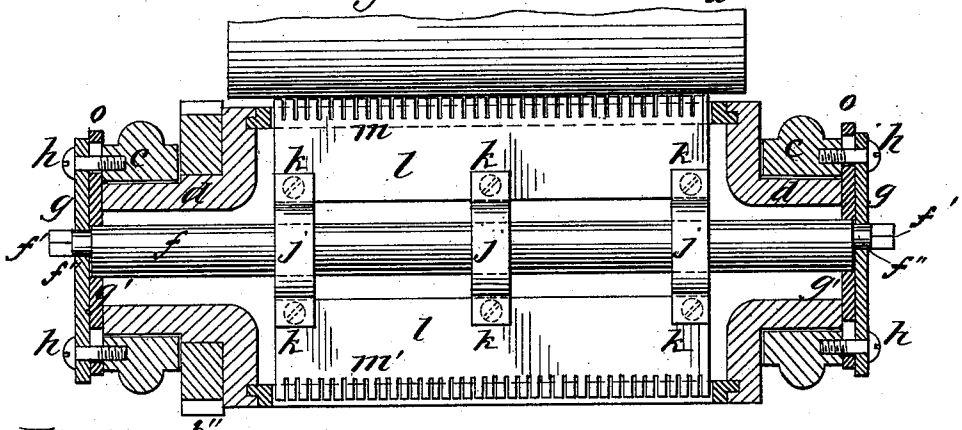


Fig. 6.

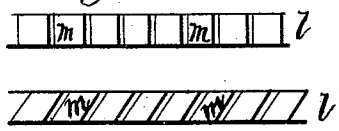


Fig. 7.

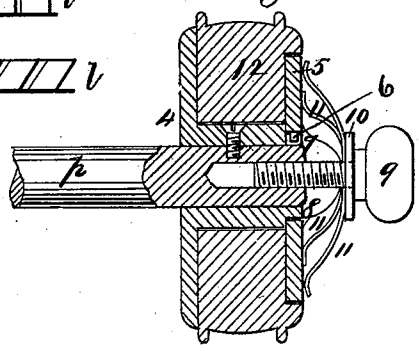
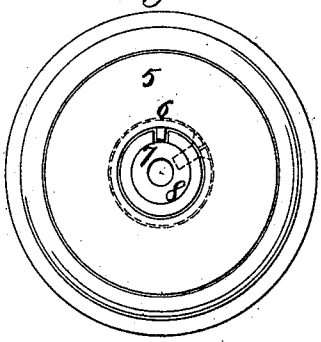


Fig. 8.



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UNITED STATES PATENT OFFICE.

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METHOD OF MAKING PERFORATIONS IN PAPER.

SPECIFICATION forming part of Letters Patent No. 404,581, dated June 4, 1889.

Application filed May 2, 1885. Serial No. 164,196. (No model.)

To all whom it may concern:

Be it known that I, SETH WHEELER, of the city of Albany, in the county of Albany and State of New York, have invented a new and useful Improvement in the Method of Making Perforations in Paper, of which the following is a specification, reference being had to the accompanying drawings forming part thereof.

My invention relates to a new and improved method of making lines of small perforations in paper, so that such paper can be easily separated into small pieces; and it consists in the method of removing portions of the surface of the paper—namely, by abrasion—in order to produce such perforations.

Heretofore perforations have been made in paper by punching them out with the aid of dies and punches. This process is slow and expensive, because of the thinness of the material—the paper operated upon.

In the drawings is represented a machine by means of which my method may be carried out.

Figure 1 is a side elevation of such a machine. Fig. 2 is an end elevation thereof. Fig. 3 is a transverse vertical section taken through the rolls. Fig. 4 is a longitudinal section of the cylinder over which the paper passes in being abraded. Fig. 5 is a sectional view of the plates attached to the machine at each end of the said cylinder. Fig. 6 is an enlarged view of the ends of the teeth against which the paper is held to be abraded. Fig. 7 is a sectional view of the friction-clutch. Fig. 8 is a front view of such friction-clutch with the spring-arms removed.

a is the bed-plate of the machine, to which are bolted two standards *b b*. In the top of each of these standards is a circular hollow casting *c*. In these circular hollow castings *c c* are placed the journals *d d* of the cylinder *e*.

f is a shaft extending through the cylinder *e*, having its journals in four plates *g g g' g'*, rigidly secured by set-screws *h h h h* to the circular castings *c c*, two plates at each side of the standards *b b*, such shaft also passing through oblong openings *i* in each of the three yokes *j j j* in order that such shaft may be set eccentric to the cylinder *e*. On the sides of each of these yokes at *k k* are flanges, in order to have bolted thereto plates *l l* at opposite sides of the shaft *f*, in one and the same plane, and extending lengthwise along the interior of the cylinder *e*. These plates *l l* contain a series of teeth *m m'* on their outer edges, which project through two slots *n n'*, constructed lengthwise in the surface of the cylinder *e* and at opposite sides of such cylinder. The two plates *g' g'* are placed one on each end of the cylinder *e* inside of the plates *g g*, and have circular openings for surrounding the larger diameter of shaft *f* a short distance at each end. Each of these plates has motion because of the openings or slots *o' o'*, through which the set-screws *h h* pass, so that by releasing the set-screws and turning the shaft *f* by means of a square *f'* at the end of the bearing or smaller diameter *f''*, placed eccentric to the larger diameter of the shaft *f*, the plate *g*, being vertically slotted at *g''*, permits the bearing *f''* to change its position up or down in the making of the adjustment sidewise of the plates *g' g'*, in order to get the shaft *f* more or less eccentric to the cylinder *e*, and thus carry the teeth *m m'* more or less beyond the periphery of the surface of the cylinder *e* at intervals during its revolution, as hereinafter described.

The plates *g' g'* are to be shifted in order to get the extent to which the tooth-plates *l l* shall project through the slotted openings *n n'* and beyond the periphery of the cylinder *e* at certain positions of the cylinder *e* when rotating relative to the abrading-roll for the purpose of effecting the proper abrasion of the paper.

p is a feed-roll having its bearings in the standards *b b*, over which the paper to be perforated is fed on its way to the cylinder *e*. This roll is geared to the end of the periphery of the cylinder *e* by the gearing *p' p''*. The shaft of the feed-roll extends out on one side, and on it is placed a belt-wheel *p'''*, so as to communicate motion to the feed-roll *p* and cylinder *e* from the prime motor.

q is an abrading-roll journaled in the standards *b b*, opposite the cylinder *e*. Its body should be composed of emery or other abrading-surface. The shaft of the roll also extends out at one side, and on such end is placed a belt-wheel *q'*, to which power is to be

applied from a prime motor independent of the power supplied from the prime motor through the belt-wheel p^3.

r is a roll journaled quite low down in the standards b b for holding the roll of paper to be perforated.

s s are two posts on the front of the machine, through journals in which passes a shaft t. To this shaft t are attached two vertical arms t' t''. In the upper ends of these arms are bearings for the winding or receiving roll u.

The roll u is driven by a system of belts and pulleys in manner as follows: At the end of the shaft of the roll u is a pulley 1. At the end of the shaft t are two pulleys 2 3, rigidly connected together, and at the end of the shaft of the feed-roll is a friction-pulley. This friction-pulley is constructed as follows:

4 is a spool rigidly connected to the end of the shaft of the feed-roll p. In place of an outer wall to this spool there is substituted a disk 5. This disk has its center cut away, so as to rest on a shoulder made in the end of the shaft of the feed-roll p, and contains a teat or projection 6, which takes into the opening 7 of shoulder 8.

9 is a set-screw, which passes into the threaded end of the shaft of the feed-roll p, the neck of which presses against a flange 10, from which project a number of radial spring-arms 11 11, the ends of which impinge against the outer surface of the disk 5.

12 is a pulley-block running freely on the spool 4.

13 is a belt passing over the periphery of the pulley-block 12 and pulley 3, so as to give motion to the pulley-blocks 2 3, running loosely on the shaft t, when the shaft p is in motion and the set-screw 9 turned inward, so that the radial spring-arms 11 11 will press the disk 5 up against the loose pulley-block 12, and thus cause frictional contact with it of the wall of the spool 4 and the inner surface of the disk 5.

14 is a belt running from the pulley-block 2 to the pulley-block 1, so that the motion given by the shaft p to the pulley-block 3 through the belt 13 will be transferred to the receiving-roll u through the pulley-blocks 1 2 and the belt 14.

The object of the friction-pulley is that in case the power which is applied to the shaft of the feed-roll p through the medium of the belt on the pulley p^3 shall so increase as to unduly strain the paper while it is being taken up by the receiving-roll, and thereby endanger the tearing of the paper as it is running thereon from cylinder e, the loose pulley-block 12 will slip before the limit is reached at which the strain will tear the paper by causing a slipping of the loose pulley-block 12 and the relaxation of the winding of the paper upon the receiving-roll u through the operation of the belts 13 14 and the pulleys 1 2 3 4. This adjustment to counteract such strain is made by set-screw 9. (See Fig. 7.)

The operation of the receiving-roll u is such that it will yield by reason of the movement outward of the standards t' t'' as it fills up with the perforated paper delivered to it from the cylinder e. The standard t' may be removed from the shaft t by unscrewing the set-screw v, passing through the sleeve v' into the shaft t. The receiving-roll u may thereby be removed, when full, from its bearings in the standards t' t'', so as to insert another roll for receiving the perforated paper.

The operation of the machine in abrading the surface of the paper so as to make lines of perforations therein is as follows, having reference more particularly to the manufacture of paper for toilet use, although the invention is not limited to the treatment of such paper, as postage-stamps, bank-note, check, and other descriptions of paper can be perforated with but slight modifications in the mechanism shown.

The paper intended for toilet use is placed upon the roll r. Its end is then drawn around the feed-roll p and on up between the cylinder e and the abrading-roll q. It then passes on after it has been perforated by the abrading process to the take-up or receiving roll u. (See the three arrows x y z in Fig. 3.) On motion being given to the pulley p''' the cylinder e will be rotated in the direction of the arrows shown thereon, (see Fig. 3,) and by reason of the shaft f being set eccentric to such cylinder e, through the adjustment of the plates g g g' g', the yokes j j will cause the teeth m m', attached to plate l l, to alternately project through the slots n n' in the cylinder e and beyond its periphery, as such slots are respectively opposite the surface of the abrading-roll q. The abrading-roll q is run by means of a belt over a pulley q' on its shaft and to be operated by a pulley on the prime motor, which abrading-roll has a greater speed given to it than the cylinder e receives from the rotation of the shaft of the feed-roll through a belt on the pulley p''', thus causing the surface of the abrading-roll to abrade the surface of the paper as it is forced out against the periphery of such abrading-roll by means of the ends of the teeth m m'. As the cylinder e passes out of the position shown in Figs. 1 and 3 the teeth m m' are gradually withdrawn within the slots n n', so that the paper will run freely over the periphery of the cylinder and onto the receiving-roll u. This withdrawal of the teeth m m' is due to the movement of the shaft f within the yokes j j j, its axial line and that of the cylinder e not being coincident, due to the adjustment of the plates g' g' to attain such eccentricity. The teeth m m' are so adjusted before the commencement of the operation that they will just touch the surface of the periphery of the abrading-roll q while passing it. It follows that when the paper is run in between the ends of the teeth and the abrading-roll it will be abraded, thus giving lines of perforations across its surface. The ends of the teeth m m' may be sharpened before run-

ning in the paper by the adjustment of the shaft *f* and the plates *g g g' g'*, the cylinder *e* and the abrading-roll *q* being run at different speeds, as before stated.

I am aware that in the manufacture of lace-paper the design has been first struck up or embossed in the paper by dies, and then while supported on one of the dies or a counterpart thereof the projecting parts of the design were ground off. In my invention no embossing or previous preparation of the paper is employed; but the plain paper is presented to the action of the abrading-surface.

The mechanism by which I herein illustrate the invention claimed in this application is the subject-matter of a companion application filed by me of even date herewith, having Serial No. 164,197.

I claim—

1. The method of making perforated tearing-lines in paper, consisting of presenting plain paper to an abrading-surface and thereby grinding away portions of the paper in the lines desired, substantially as described.

2. The method of making perforated tearing-lines in paper, consisting of projecting plain paper by a series of teeth against a rotating abrading-surface and thereby grinding away the paper on said teeth, substantially as described.

3. The method of making perforated transverse tearing-lines in a web of paper, consisting of continuously moving the web and intermittingly projecting it by a series of teeth against a rapidly-moving abrading-surface and thereby grinding away the paper on said teeth, substantially as described.

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