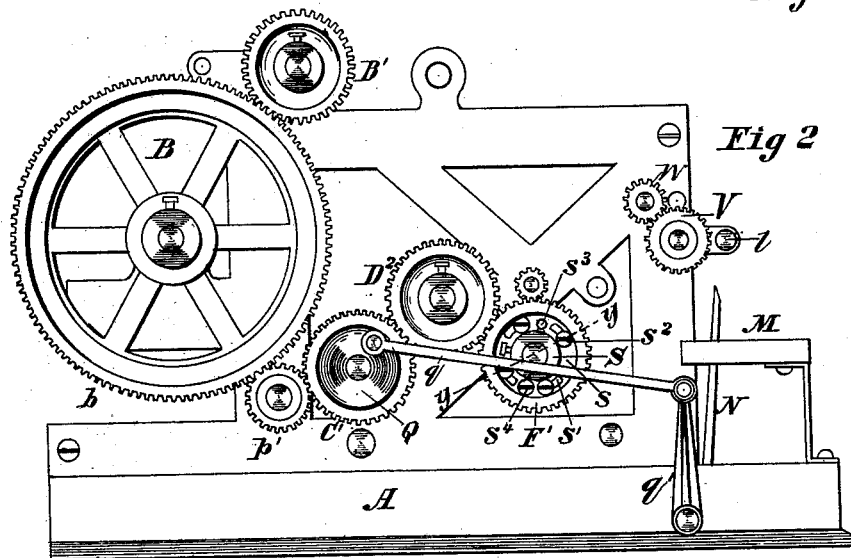
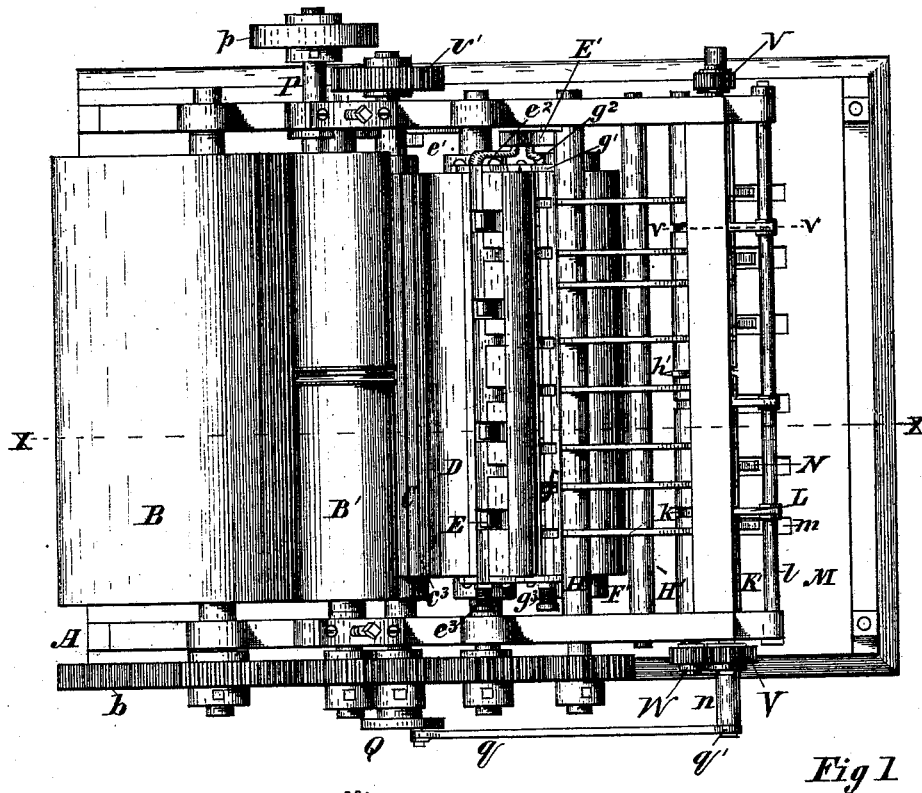
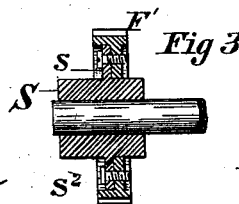


W. SCOTT.
Paper-Folding Machine.
No. 220,873. Patented Oct. 21, 1879.

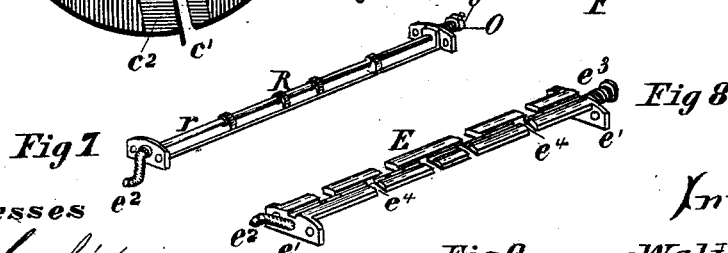
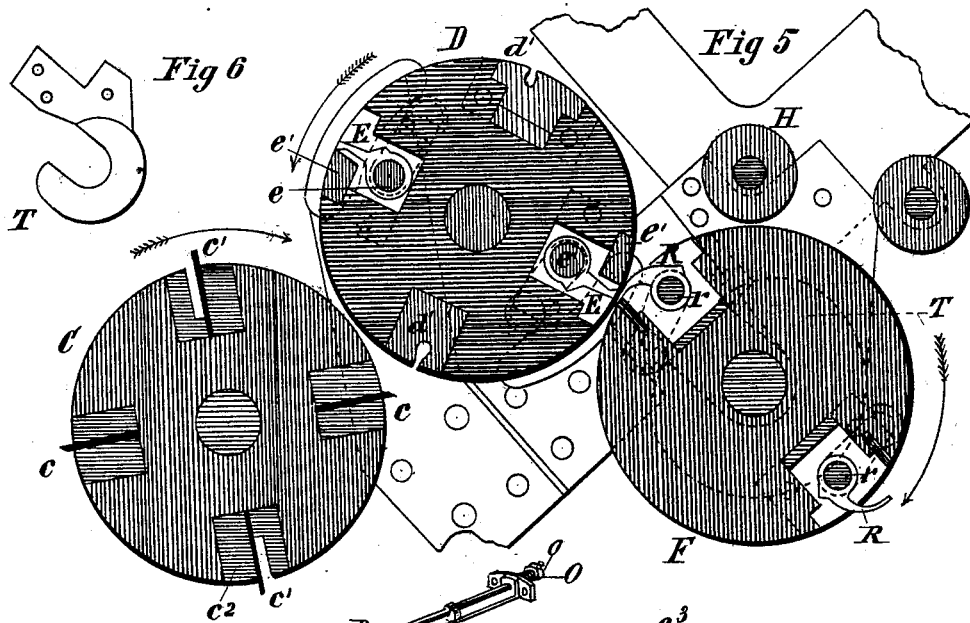
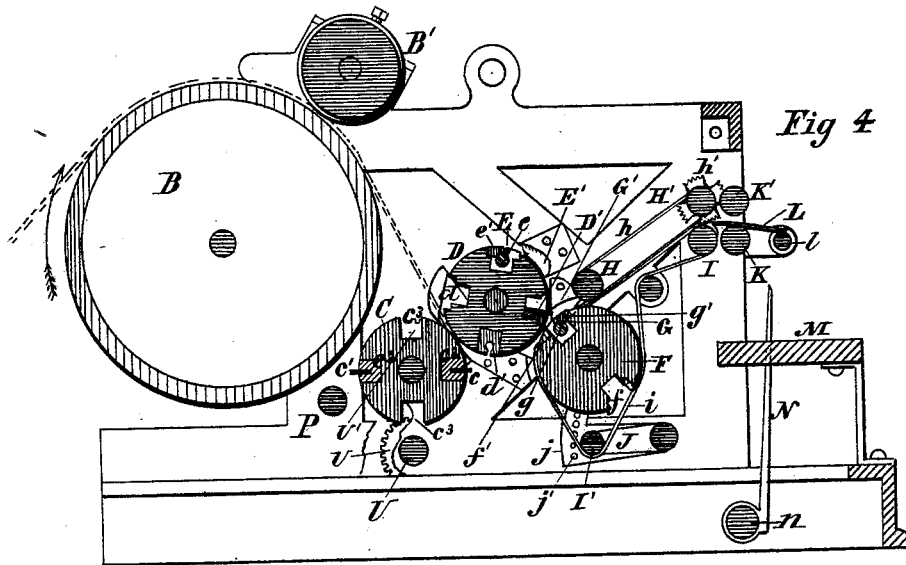


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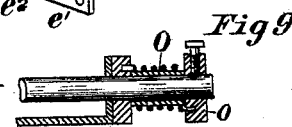


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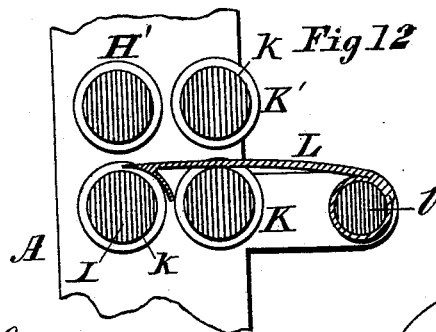
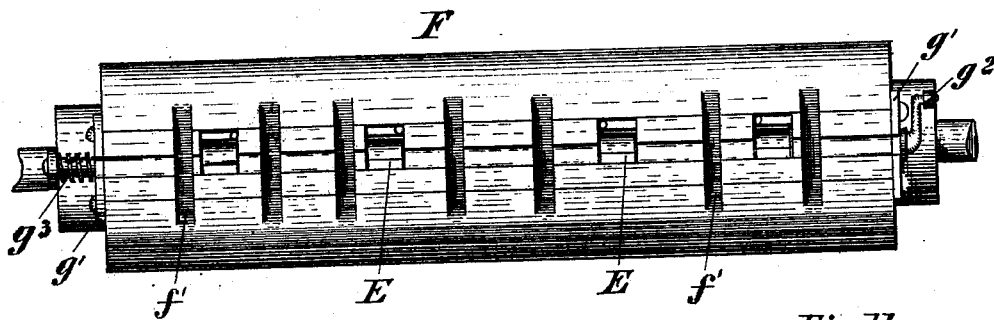
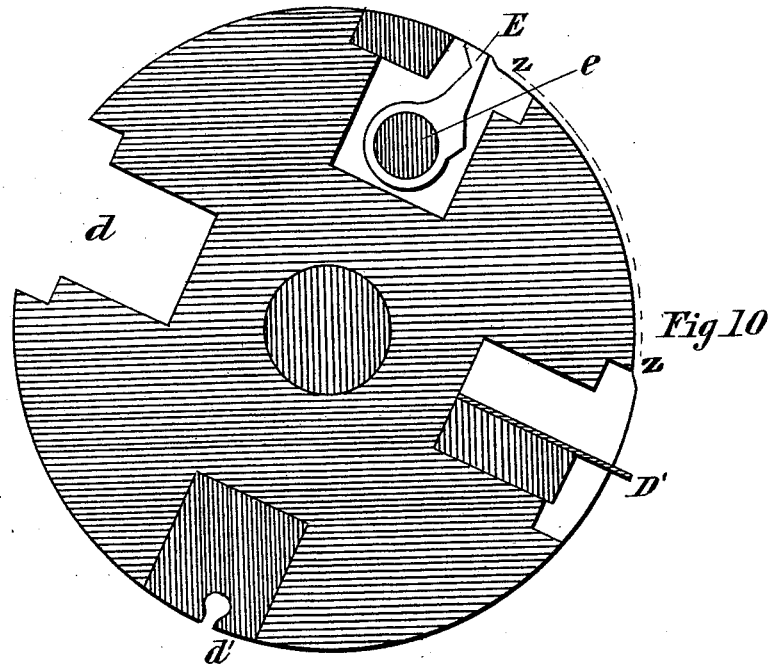


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UNITED STATES PATENT OFFICE.

WALTER SCOTT, OF CHICAGO, ILLINOIS.

IMPROVEMENT IN PAPER-FOLDING MACHINES.

Specification forming part of Letters Patent No. **220,873**, dated October 21, 1879; application filed May 21, 1879.

To all whom it may concern:

Be it known that I, WALTER SCOTT, of Chicago, county of Cook and State of Illinois, have invented certain new and useful Improvements in Paper-Folding Machines, which are fully described in the following specification, reference being had to the accompanying drawings, in which—

Figure 1 represents a plan view of a portion of a printing-press and a folding-machine embodying my improvements. Fig. 2 is a side elevation of the same; Fig. 3, a detail section taken on the line *y y*, Fig. 2 showing the attachment of the gear-wheel on one of the folding-cylinder shafts. Fig. 4 is a vertical section of the machine, taken on the line *x x*, Fig. 1. Fig. 5 is a similar section on an enlarged scale, showing only the folding-cylinders; Fig. 6, a view of a cam detached, which is employed when half-sheets are to be folded; Fig. 7, a perspective view of one of the griper-bars and grippers belonging to the griper-cylinders; Fig. 8, a similar view of a griper-bar and grippers belonging to the folding-cylinder, and used when half-sheets are folded; Fig. 9, a detail section on an enlarged scale of one of the bars shown in Fig. 7; Fig. 10, a transverse section of the folding-cylinder on an enlarged scale, showing the peculiar contour of the cylinder; Fig. 11, a side elevation of the griper-cylinder, and Fig. 12 a detail section taken on the line *v v*, Fig. 1, on an enlarged scale.

My invention relates to a paper-folding machine, designed to be attached directly to a printing-press, from which the sheets of paper are delivered, after being printed, directly to the folding mechanism.

The invention consists in various improvements in the folding devices and in combinations of devices, all of which will be hereinafter more fully set forth, and will be pointed out definitely in the claims.

In the drawings, A represents the main or supporting frame, and B B' the last printing-rollers of the press. A cylinder, C, is mounted in the frame A, just in the rear of the impression-cylinder B, as shown in Fig. 4 of the draw-

ings. This cylinder is provided with a cutter, *c*, and a folding-blade, *c'*, arranged on the sides of the cylinder opposite to each other. These cutting and folding blades are fastened in bars *c''*, which are fitted in suitable longitudinal grooves in the cylinder, from which they may be removed whenever desired.

Other grooves, *c'''*, are made in the cylinder for the purpose of adapting the latter to folding half-sheets, as will be hereinafter described.

A similar cylinder, D, is arranged in rear of and over the cylinder C. It is also provided with four longitudinal grooves, *d*, arranged at about a quarter of the circumference from each other. In one of these grooves is a bar containing a simple groove, *d'*, adapted to receive the cutting-blade in the cylinder C. In the channel on the opposite side of the cylinder a bar is fixed, which carries grippers E. These grippers are fixed on a rock-shaft, *e*, which has its bearing in the bar *e'*, that is fastened to the cylinder. One end of the shaft is provided with a crank, *e''*, and at the other end a spring, *e'''*, is coiled around the shaft and fastened to the bar, so as to render the latter yielding, but, at the same time, to hold the grippers up against the side of the groove in the bar in a well-known way.

In the recess or channel between the grippers E and the cutting-groove *d'* an ordinary folding-blade, D', is mounted. A cylinder, F, is also mounted in the same frame, and is arranged in rear of and below the cylinder D, and is provided with two grooves or channels, *f*, on opposite sides thereof, in one of which a bar is fixed, which is provided with grippers G, which are similar to the grippers E on the cylinder D, both of these grippers being holding-grippers in distinction from transferring-grippers.

The grippers G are mounted on a rock-shaft, *g*, having bearings in the bar *g'*, and provided with a crank, *g''*, at one end and a holding-spring, *g'''*, at the other, the same as the grippers E, described above. These cylinders C, D, and F are of the same size, and are geared to run at the same speed.

Immediately over the cylinder F is an ordinary tape-roller, H, the companion of which, H', is mounted in the rear end of the main frame, and higher than the roller H. Ordinary carrying-tapes *h* pass around and are driven by these rollers.

Immediately below the tape-roller H' is a similar roller, I, and immediately below the cylinder F is a tape-roller, I', and a series of carrying-tapes, *i*, pass around these rollers and the cylinder F, being carried up over a roller between the cylinder F and the roller I', as shown in Fig. 4 of the drawings.

The roller I' is mounted in a swinging or rocking frame, J, to which an arm, *j*, is attached, and is provided with a series of holes, *j'*, by means of which the frame may be set at any desired adjustment, for the purpose of giving greater tension to the carrying-tapes *i*.

Immediately in rear of the tape-rollers H' and I' is a pair of delivery-rollers, K K', and switches L, mounted on the rock-shaft *l*, are arranged in rear of these rollers, which are provided with grooves *k* for the reception of the switches.

If, as in the machine shown, the press is designed to print two copies at the same time, a perforator or a cutter, *h'*, is fixed on the tape-roller H' for dividing or perforating the sheet just as it is delivered from the tapes. The printed sheet passes down from the contact of the cylinders B B' and drops in between the cylinders C and D, as shown in dotted lines in Fig. 4 of the drawings. These two last-named cylinders are arranged relatively to each other, so that at every revolution the cutter *c* will enter the groove *d'*, and thereby sever the sheet. The end of the sheet is fed through between the cylinders until the opposite sides thereof are brought in contact, when the creasing-blade *c'* creases the sheet into the grippers E on the cylinder D, and the doubled sheet is then carried forward by the cylinder D and cut off at the proper moment by the cutter *c*, as already described. The sheet is then carried up past the cylinder F, and at the proper moment is creased centrally by the creasing-blade D' into the grippers G on the cylinder F, the grippers E at the same time releasing their hold on the sheet by the action of the cam E', against which the crank-arm on the griper-bar strikes. After this second fold it is evident that the sheets are carried upward by the cylinder F outside of the tapes *i*, and that the folded edge of the sheet will thereby be delivered between the tapes *h* and *i*. Just at the moment of delivery the grippers G release their hold upon the sheets by the action of a cam, G', against which the crank *g'* strikes at the proper moment. The sheets are now carried up between the tapes and delivered as desired. If the sheets are to be further acted upon the switches are thrown down, so as to deliver the sheets horizontally between the rollers K K'. In small-sized papers, however, where only two folds are desired, the twice-

folded sheets may be delivered downward between the lower rollers, I K, the switches being thrown up for this purpose, and the folded sheets then fall upon a table, M, below, where they are packed by vibrating arms N, mounted on a rock-shaft, *n*, and projecting up through slots *m* in the table.

If double copies are printed on the sheet, as above described, they will be divided by the revolving cutter *h'*, and will therefore be delivered on the table separately, or if perforated they are easily separated after delivery.

In this operation of my machine the leading end of the sheet, after being severed by the cutting-blade *c*, will not drop loosely, but will adhere to the surface of the cylinder C, the edge lying close to the cutting-blade. This I have found to be the fact in actual practice, and I attribute it to the circumstance that the sheet when cut is in close contact with the cylinder. The knife is perfectly straight and projects from the surface of the cylinder, which revolves with great rapidity, and will cause a slight current of air across its edge, which is sufficient to hold the end of the paper to the cylinder, which lies so close that the air does not pass under it.

This operation enables me to dispense with all contrivances for positively seizing and controlling the leading end of the sheet.

The above is a general description of the construction and operation of my machine; but there are some details in the construction of certain of the devices which I will now proceed to describe.

As the sheet of paper between the printing-cylinders and the cylinders C and D is taut, while the leading end of the sheet below the cylinders is loose, it is evident that if the cylinders C and D are perfectly true the creasing of the sheet into the grippers on the cylinder D would operate to draw back the leading end of the sheet, and consequently the latter would be unevenly folded—that is, one fold would be wider than the other. To obviate this the griper is set forward of the creaser-blade a little more than half the width of the sheet which is to be cut—about one-eighth of an inch will do—and the cutting-groove in the cylinder D is also arranged to correspond. It will be evident, therefore, that when the creaser comes into action there will be a greater width of sheet ahead of it than the width of paper which would be cut off behind it, and this will compensate for the drawing back of the leading end occasioned by the creasing of the sheet into the grippers and gives the folded sheet an even appearance. It will also be seen that the revolution of the cylinder D will direct the creaser thereon against the sheet of paper between the folding-cylinders and the printing-cylinders, and as the creaser projects from the surface this would produce a strain upon the sheet. To obviate this the cylinder D between the griper-bar and the creaser is cut away slightly, as shown at *zz* in Fig. 10 of

the drawings, thereby giving a little slack to the tension on the sheet, so as to counteract the additional strain of the projecting creaser. This creaser also passes the cylinder C at one of the empty grooves heretofore described, into which the creaser projects as it passes.

The rock-shafts on which the grippers are mounted, as described above, may be constructed and attached to their respective bars in the usual way. I prefer, however, to place a loose sleeve, O, on the spring end of the shaft, about which the spring is then wound, and the outer end thereof fastened to a collar, o, secured on the end of the shaft, while the inner end is attached to the bar, as usual, as shown in Fig. 9 of the drawings. This saves some friction and wear on the shaft.

It will be seen at once that as the tapes *i* pass around the cylinder F, and are in contact therewith at the point where the second fold is made, some provision must be made to permit the creaser-blade D' to press the sheet into the grippers G. For this purpose transverse grooves *f'* are made in the cylinder F, running across the griper-bar and receiving the tapes, thereby permitting the creaser to bend the paper into the grippers.

The machine, as shown in the drawings, is driven from a shaft, P, which is provided at one end with a pulley, *p*, and at the other with a gear-wheel, *p'*, which engages with gear-wheel *b* on the impression-cylinder and a gear-wheel, C', on the shaft of the cylinder C, which, in turn, engages with a similar wheel, D², on the shaft of the cylinder D, which also engages with a similar wheel, F', on the shaft of the cylinder F, these last three wheels being all of the same size, so as to give the same speed to the three cylinders.

The tape-roller H is geared to the wheel F'. The upper tape-roller, H', being driven from the former, is geared at one end to the lower delivering-roller, K, which, at the other end, is geared to its upper companion roller. On the end of the shaft of the cylinder C, outside of its gear-wheel, is a crank-wheel, Q, which is connected, by a pitman, *q*, to the crank-arm *q'* on the rock-shaft of the packer, whereby the latter is vibrated.

The machine constructed as explained is designed to cut and fold a full sheet. In order to adapt it to fold half-sheets some changes are necessary, which will now be described.

The cylinder C is provided with another cutter and creaser, the old creaser being moved around a quarter-circumference. In the cylinder D the folding-blade is removed and the grippers changed from their old position to the position of the folding-blade and another set of grippers mounted in the groove on the opposite side of the cylinder. The groove formerly occupied by the grippers is supplied with a bar having a cutter-groove like the one already existing on the opposite side of the cylinder.

In the cylinder F the folding-grippers are removed and transferring-grippers substituted

therefor. These transferring-grippers R are curved in the usual form and fastened to a rock-shaft, *r*, which is mounted in an independent bar, as already described for the other griper-bars, and is provided with crank-arm and spring, as shown in Fig. 7 of the drawings.

The extreme outer ends of the grippers rest on the edge of the cylinder or upper surface of the bar when closed down by their springs, as shown in Fig. 5 of the drawings, in the usual way. The griper-bar *e'* on the cylinder D must be provided with slots or recesses *e''* in its front or leading edge, as shown in Fig. 8 of the drawings.

It is evident that in order to permit the grippers R to take the sheet from the cylinder D at the proper time the griper-bar must be changed in position from that which it occupied in the former case, when full sheets were folded, for it is necessary that the point of contact between the two cylinders should be where the ends of the grippers will come together, as shown in Fig. 5 of the drawings, and, therefore, the griper-bar *r* should be set back somewhat from the position which it formerly occupied. To provide for this I mount a hub, S, on the outer end of the shaft of the cylinder F, to which it is secured by any suitable means. This hub is provided with a collar or flange, *s*, in which a series of segmental slots, *s'*, are made. The gear-wheel F' is mounted loosely on this hub, the web of the wheel being inside of the flange *s* and pierced with holes corresponding to the slots *s'*. The wheel is secured to the hub by means of screws *s²* passing through the slots and entering the holes on the annular body of the wheel. It is evident, therefore, that by loosening these screws the cylinder may be turned around in relation to its gear-wheel without changing the relation of the latter to the gear-wheels with which it engages, and this enables me to adjust the cylinder for the purpose above mentioned, so as to bring the griper-bar and shaft into a position in relation to the grippers E. (Shown in Fig. 5 of the drawings.)

The flange *s* is also provided with one or more holes, *s³*, which register with one or the other of several holes in the gear-wheels, so that by means of a set screw or screws, *s⁴*, the hub and gear-wheel may be securely fastened together in the position to which they may be adjusted.

A cam, T, of circular form, is attached to the frame in such position as to act upon the cranks of the griper-shaft *r* and open them before they reach the point of contact with the cylinder D, so that the ends of the grippers will pass behind the sheet, when they are immediately released from the action of the cam, and close upon the released sheet by the action of their springs, thereby transferring the sheet from one cylinder to the other in a well-known way. This cam is made of the form shown in Fig. 6 of the drawings, so that after passing a proper distance the crank is again

brought into contact with the cam, thereby opening the grippers to release the folded sheet at the desired point of delivery to the tapes.

It will be seen from the shape of the cam that in this instance the gripper, after being opened to deliver the sheet to the tapes, will be held open until the point is reached where they seize another sheet. The position of the cam and crank on the gripper-shaft are shown in dotted lines in Fig. 5 of the drawings.

When these changes are made it is evident that each half-sheet as it comes from the press will be folded once, and then taken by the cylinder F, which is now simply a transfer-cylinder, and delivered to the tapes.

It is evident that the sheets will be delivered to the table twice as rapidly as when full sheets are folded; hence the packer should be caused to vibrate twice as rapidly.

To accomplish this, the crank-wheel Q is removed from the shaft of the cylinder C and attached to the end of the shaft U just below, on the other end of which, on the other side of the machine, is a gear-wheel, *u*, half as large as a gear-wheel, *u'*, on the cylinder C, with which it engages, and which is the same size as the wheel C'. The crank-wheel will therefore be revolved twice as rapidly as before, and, consequently, increases the rapidity of the vibrations of the packer in the same ratio, causing it to take the half-sheets as they are delivered from the rollers.

In Fig. 2 of the drawings I have shown a gear-wheel, V, on the delivery-roller K, twice as large as the pinion W on the roller H', from which it is driven, while the pinions *v* on the other ends of the delivery-rollers are of the same size, so that these two rollers K K' will have the same motion.

From this arrangement of gearing it is evident that the delivery-rollers K K' will revolve at a much lower rate of speed than the tape-rollers, which deliver the sheets to the rollers K K', and this difference in speed will slacken the motion of the sheet, so that if it is delivered to other folding mechanism to produce additional folds, it will be carried against the usual stops so slowly that there will be no danger of wrinkling the sheets.

The shaft P, as already stated, which drives the folding mechanism, is also geared to the impression-cylinder, and from this gearing all of the printing machinery of the press is operated, so that both the press and the folding mechanism are operated by one and the same shaft, and can, therefore, be easily regulated as to speed, so as to run in proper relation to each other.

The construction and arrangement of the folding mechanism above described are exceedingly simple and compact, and by mounting it in the same frame with the printing-press and bringing the first cylinders into the relation described with the impression-cylinder there is no difficulty experienced in conducting the leading end of the sheet to the folder.

It falls directly upon the cutting and creasing cylinder below, by which it is carried directly into the folding mechanism automatically.

Some of the minor devices which are used in this machine (described above, and shown in the drawings) may be changed without materially modifying the general operation of the machine, and therefore I do not limit myself to the precise construction shown and described of all the devices named. Many of them are old and well known as independent devices, and there are other forms of them which can be substituted for those herein shown and described.

I am aware of English Patent No. 3,031 of 1870, and do not here claim any improvement therein shown and described; and I do not here claim the arrangement of the folding mechanism underneath the inking devices, as this improvement is contained and claimed in a separate application of mine.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The printing-cylinders B B', in combination with the folding-cylinders C D, arranged as described in relation to the former cylinders, whereby the leading end of the printed sheet will drop into the folding-cylinders, substantially as and for the purpose set forth.

2. The cylinder C, provided with a cutter and a creaser, in combination with the cylinder D, provided with a series of grippers and a creaser, and the cylinder F, provided with a series of grippers, arranged and operating to sever the sheets and make two parallel folds therein, substantially as described.

3. The cylinder C, provided with a cutter, *c*, and a creaser, *c'*, the former arranged a little more than half the width of the sheet ahead of the creaser, in combination with the cylinder D, provided with grippers E and a cutting-groove, *d'*, similarly arranged with reference to the grippers, substantially as and for the purpose set forth.

4. The method herein described of severing sheets and controlling the leading end of the web, which consists in severing the sheet and pressing the leading end of the web upon the surface of the cutting-cylinder immediately behind the knife, and carrying said leading end of the web around upon the surface of the cylinder by the simple rotation of the latter, substantially as described.

5. A gripper-shaft mounted in suitable bearings, so as to be oscillated therein, in combination with a sleeve, O, mounted loosely on one end of the shaft, and a retaining-spring wound about the sleeve, substantially as and for the purpose set forth.

6. The hub S on the shaft of the cylinder F, provided with flange *s*, having slots *s'* and holes *s''*, in combination with the gear-wheel F', mounted loosely on the hub and provided with a series of holes, the screws *s''*, which fasten the wheel to the hub-flange, and the

stop-screws s^4 , substantially as and for the purpose set forth.

7. The griper-bar e' , provided with recesses e^4 , in the front or leading edge of the bar, in combination with the cylinder F, provided with transferring-grippers R, substantially as described.

8. The rock-shaft n , which carries the packers, in combination with the crank-arm q' , at-

tached thereto, pitman g , removable crank-wheel Q, and two independent shafts geared to run at different rates of speed, and to either of which the crank-wheel may be attached, substantially as and for the purpose set forth.

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