6 Sheets—Sheet 1.

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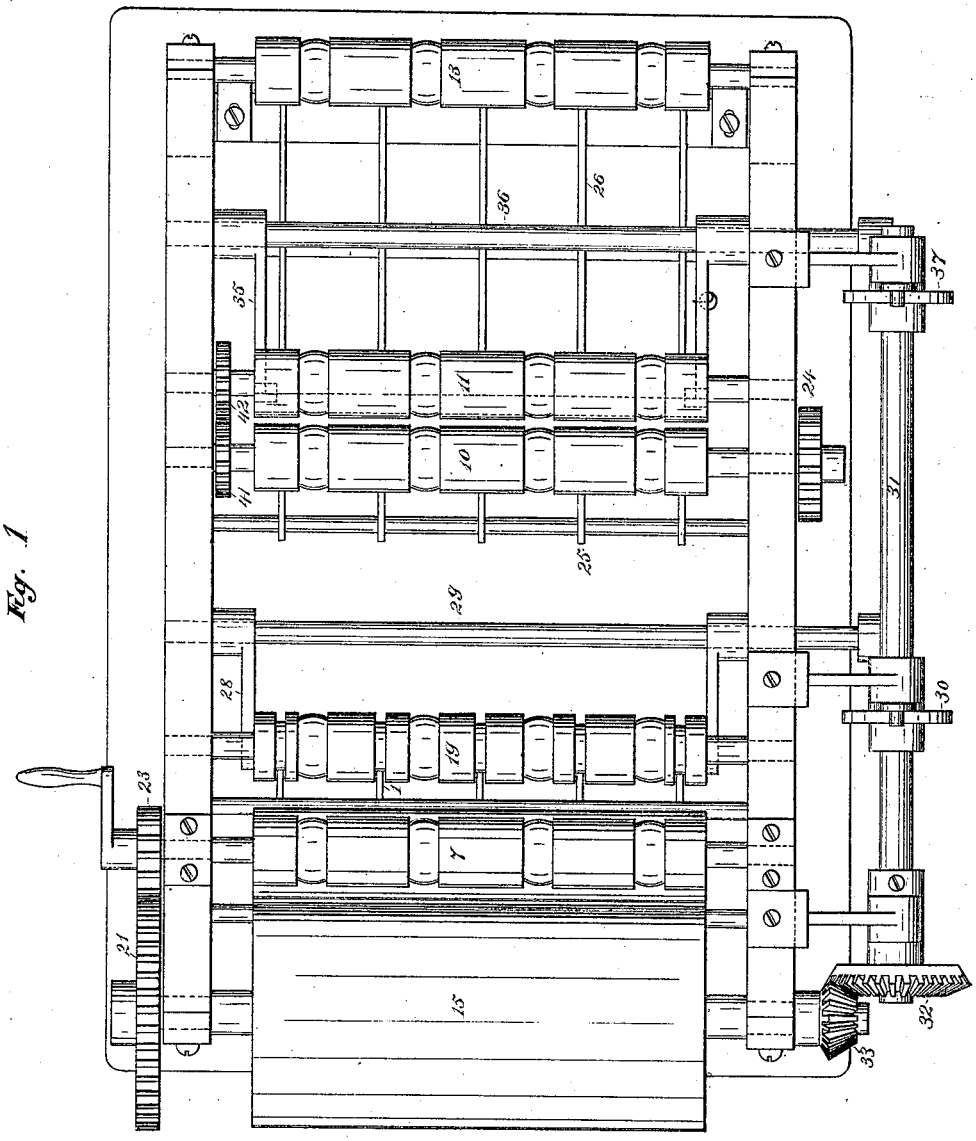
Paper-Folding Machine.

No. 212,466. Patented Feb. 18, 1879.

Fig. 1



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6 Sheets—Sheet 2.

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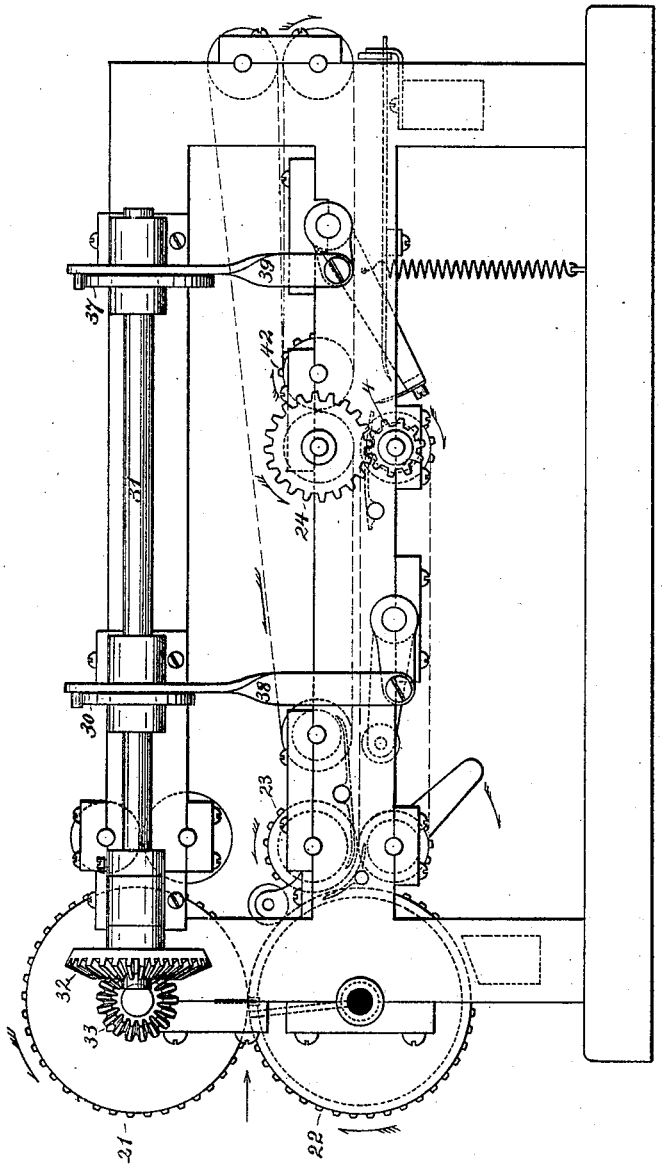
Paper-Folding Machine.

No. 212,466. Patented Feb. 18, 1879.

Fig. 2.



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6 Sheets—Sheet 3.

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Paper-Folding Machine.

No. 212,466. **Patented Feb. 18, 1879.**

Fig. 3

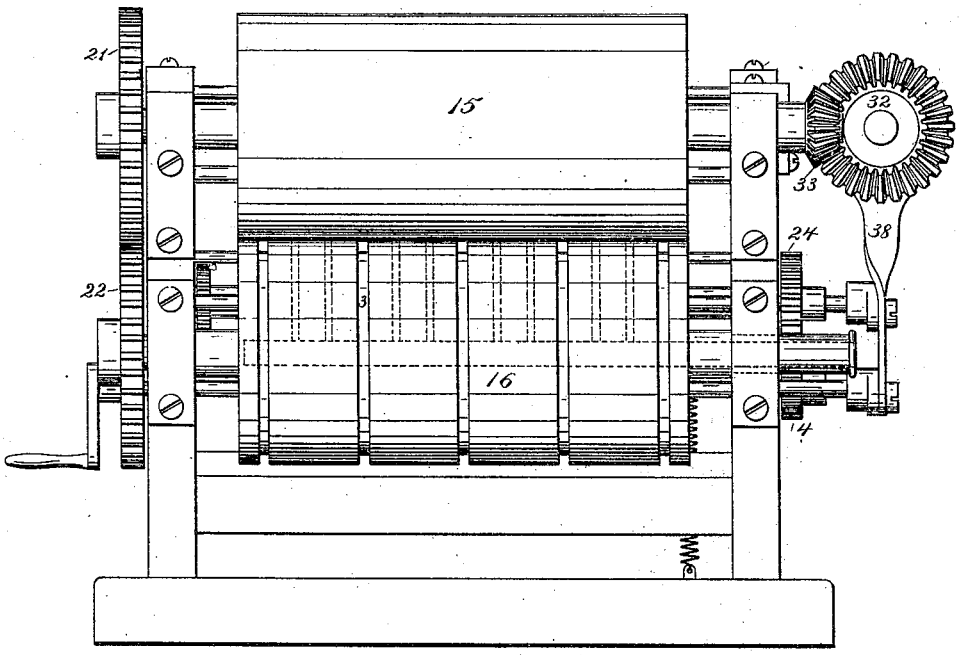
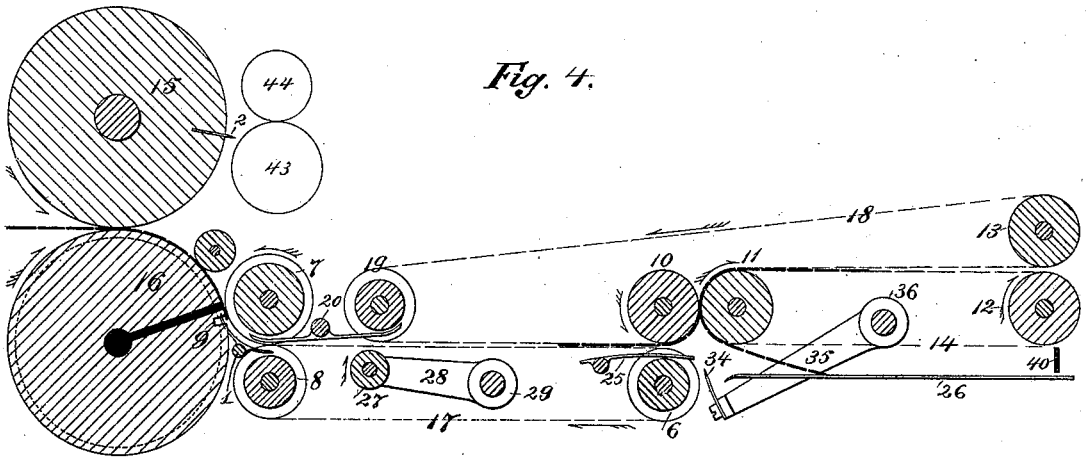


Fig. 4.



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6 Sheets—Sheet 4.

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Paper-Folding Machine.

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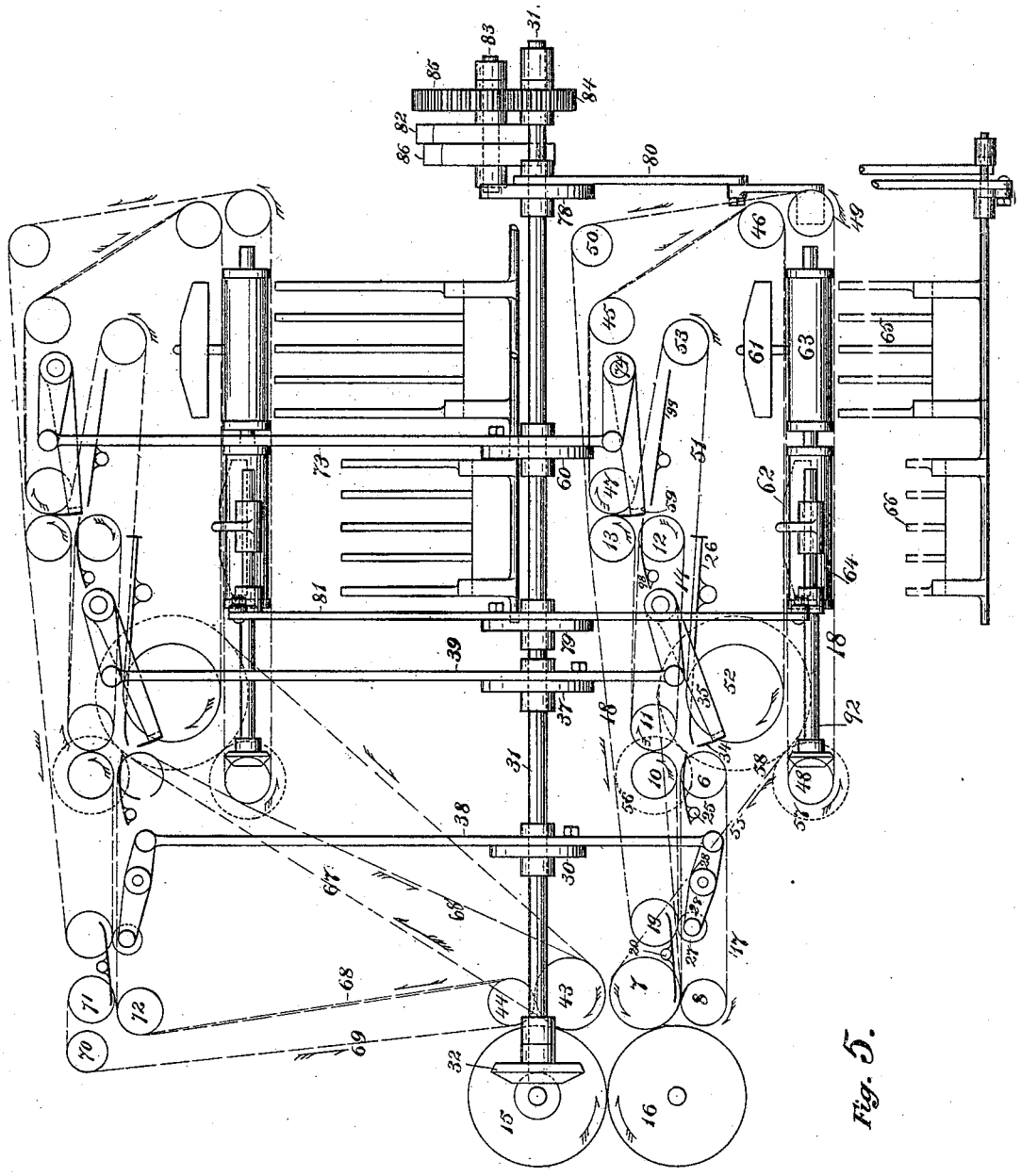

Fig. 5.

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6 Sheets—Sheet 5.

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Paper-Folding Machine.

No. 212,466. Patented Feb. 18, 1879.

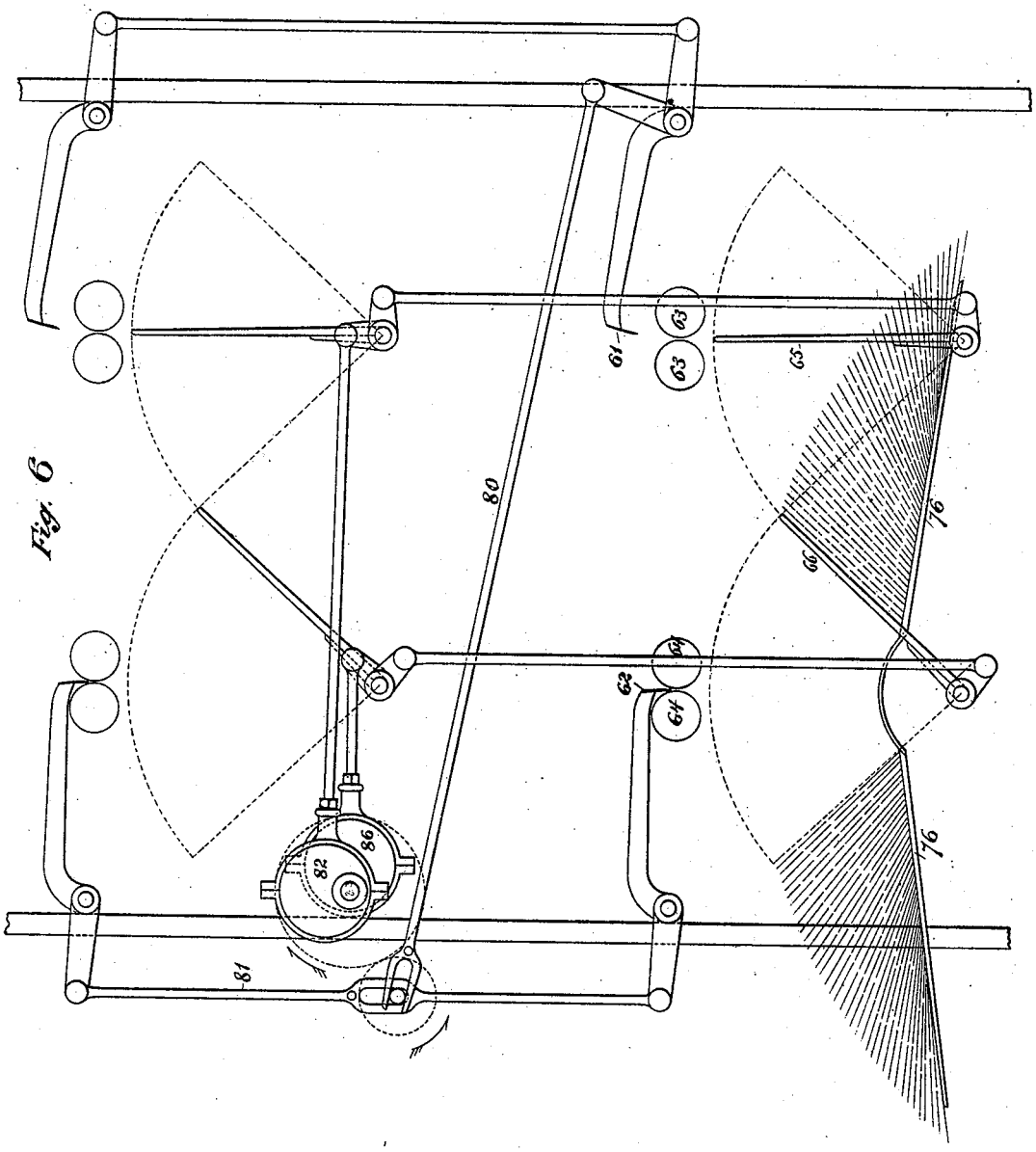

Fig. 6

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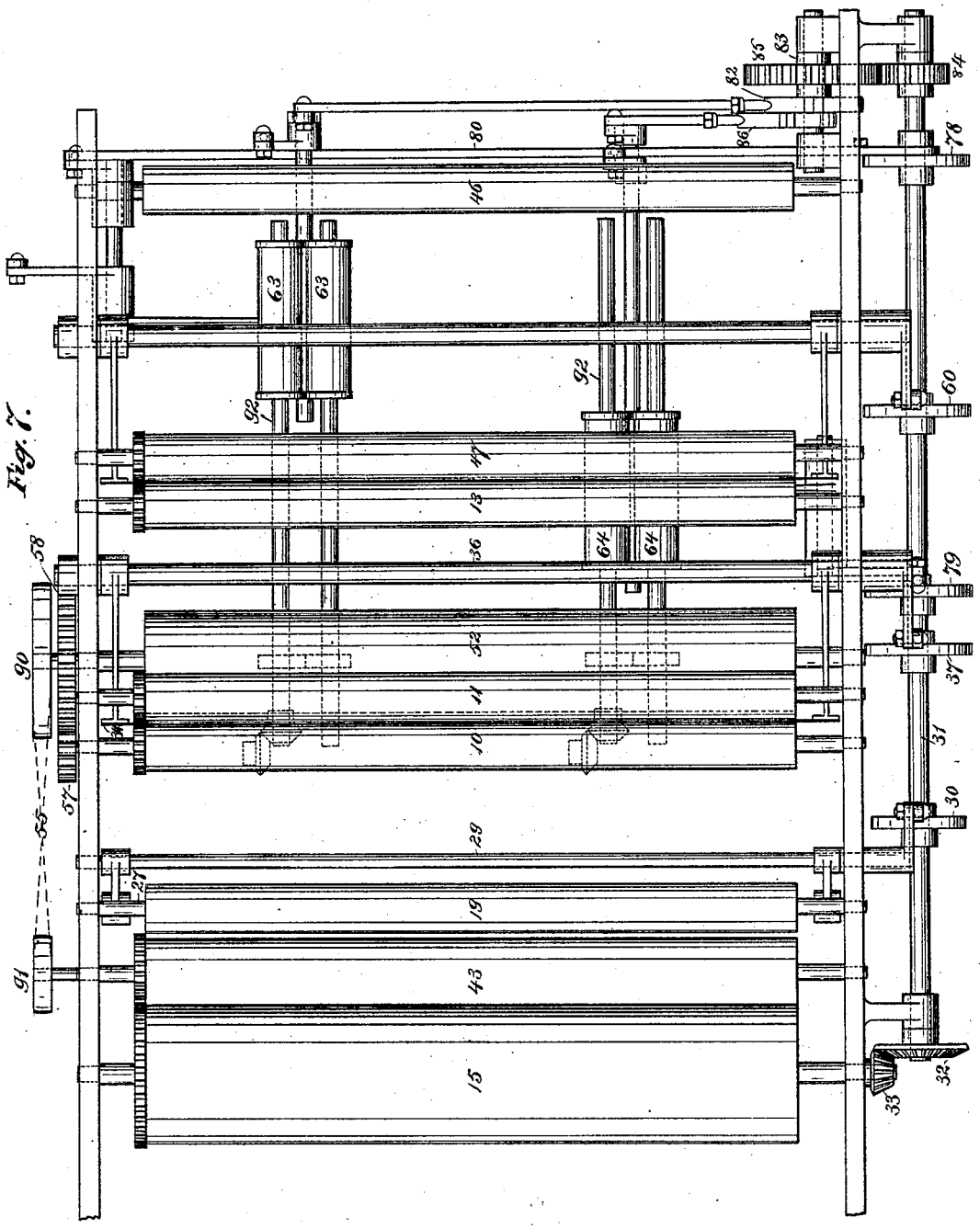
6 Sheets—Sheet 6.

R. M. HOE.

Paper-Folding Machine.

No. 212,466. Patented Feb. 18, 1879.

Fig. 7.



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UNITED STATES PATENT OFFICE.

RICHARD M. HOE, OF NEW YORK, N. Y.

IMPROVEMENT IN PAPER-FOLDING MACHINES.

Specification forming part of Letters Patent No. **212,466**, dated February 18, 1879; application filed December 2, 1876; patented in England, August 28, 1872.

To all whom it may concern:

Be it known that I, RICHARD M. HOE, of the city, county, and State of New York, have invented a certain new and useful Improvement in Paper-Folding Machines, of which the following is a specification:

In the accompanying drawings, Figure 1 is a plan view. Fig. 2 is a side elevation. Fig. 3 is an end elevation, and Fig. 4 a sectional elevation, of a single-acting machine embodying this invention. Fig. 5 is a side elevation of a double machine, with the frame-work removed to show the cutting-tape and folding-rollers in end or sectional view. Fig. 6 is a similar end elevation of some of the working parts of the mechanism. Fig. 7 is a plan view of the lower set of tape and folding rollers.

This invention is an improvement upon that contained in Letters Patent No. 211,848, granted to me February 4, 1879, and relates to folding-machines into which the paper-sheets are delivered by a rotating mechanism, whereby they are fed at a high rate of speed into a folding-machine, and particularly to that class of folding-machines which are adapted to work in conjunction with a perfecting printing-press.

As is well known, such presses operate to print a web of paper, cut it into proper-sized sheets, and deliver the same with great rapidity; and in order that the folding mechanism shall have a capacity to dispose of the sheets as rapidly as they are delivered to it from the printing-press, it is necessary that the said sheets shall pass into the folding-machine with great speed; and inasmuch as the sheet, traveling at the high velocity with which it leaves the delivering-rolls of such a press, cannot be arrested in proper relation to the folding mechanism with that accuracy which is requisite to its being folded upon a central or other determined line, it is essential that some provision shall be made for governing its movements with respect to said folding mechanism.

This invention therefore consists in the sheet controlling or checking mechanism, hereinafter described and claimed, by which the movement of the sheet with respect to the folding mechanism is so governed as to secure its accurate position in relation to the folding mechanism at the time when said folding mechanism operates to double it.

Other features of invention are fully hereinafter set forth, and need no preliminary description here.

The printed sheets, as they emerge from the printing-press, may be separated into two or more paths, and each stream of sheets conducted to separate folding devices; or the sheets may all be folded by one set of mechanisms; but in this latter case the cutting-cylinders and the sheet-receiving rollers 7 8 of the folding mechanism should be separated a distance apart and connected by accelerated tapes, by which the sheets will be separated a suitable distance apart.

This invention will be first described as applied to a machine acting upon a single stream of sheets, and then the construction necessary for its application to the folding of a double stream of sheets will be pointed out.

The cylinders 15 16, as illustrated, represent cutting and carrying cylinders. They might, however, be plain rollers, which regularly feed forward the sheets between them and deliver the same to the folding apparatus. If, however, they are constructed as represented in Fig. 4, and are employed in connection with a web-perfecting printing-press, they may perform the function of severing the printed web into sheets and delivering the same to the folding mechanism. In that case at each revolution of the cylinder 15 the knife 2, which it carries, will enter the slot 9 in the cylinder 16 and sever the web, the forward end of which will be held down by atmospheric pressure upon the cylinder 16 by the aid of openings extending from the center to the periphery of said cylinder, as shown in black in Fig. 4, and connected with any suitable exhaust apparatus. This pneumatic apparatus will be intermittent in its operation, and will act upon the sheet at the point of contact with the two cylinders, and will relieve the sheet from its action at a point near the receiving tape-rollers 7 8, at which point conductors 1, extending into grooves 3 in the cylinder 16, will direct the sheet between the

said rollers 7 8. The lower of these rollers, 8, has endless tapes 17, leading from it to the pulleys 6, which are situated directly under the first of a pair of folding-rollers, 10 11.

The folding-roller 11 has endless tapes 14 extending from it to one of a pair of delivering-rollers, 12 13. Another set of tapes, 18, extend from the delivering-roller 13, over the folding-roller 11, under the folding-roller 10, and around rollers 19, situated near the upper receiving-roller, 7, and return back to the roller 13. Fixed guards 20, extending into slight grooves in the roller 19 and roller 7, bridge the space between them, and serve to guide the sheet onward as it emerges from the receiving-rollers 7 8.

The cylinders 15 16 are geared together by toothed wheels 21 22, and are driven by means of a toothed wheel, 23, on the shaft of roller 7. (See Fig. 1.) The rollers 7 8 are geared together, so as to revolve in unison, and thus drive the tapes 17 at a high velocity, which gives to the sheet a motion equal to that of the surface-speed of the cylinders 15 16. These tapes impart motion to the shaft of pulleys 6, upon which is a toothed wheel, 4, meshing into a similar wheel, 24, on the shaft of the folding-roller 10, which folding-roller 10 is geared to its companion roller 11 by gear-wheels 41 42, so that the two revolve in unison. The wheel 4 has one tooth to two upon the wheel 24, whereby the folding-rollers and the tapes 18 are caused to move at a less surface-speed than that of the tapes 17.

As the sheet is carried out by the receiving-rollers 7 8 it rests upon the tapes 17, and travels with great speed underneath the folding-rollers 10 11, its leading end being supported by guards 25 26. When its tail end has cleared the receiving-rollers and is free from their action, a brake mechanism is brought into action upon it, and reduces its speed of travel to such an extent that it may be carried slowly during its last movement under the folding-rollers, or while it approaches the requisite position with relation thereto for it to be properly folded. This mechanism consists of a shaft carrying roller or rollers, 27, which shaft is supported upon arms 28, which are fast upon a shaft, 29, intermittingly rocked through a connecting-rod, 38, by a cam, 30, carried by a shaft, 31, actuated through miter-gears 32 33 from the shaft of cylinder 15. The movement of the cam 30 is so timed as to raise the brake-rollers 27 into contact with the sheet overlying it, and press the same against the surface of the rollers 19 at the moment when the end of the sheet has left the rollers 7 8, thus forcing it to partake of the speed of said rollers 19, which, it will be observed, is considerably less than the speed—viz., one half—with which the sheet travels under the action of the rollers 7 8. If the sheet were carried out with the great speed at which the tapes 17 run, it could not be accurately doubled at the proper point into the nip of the folding-rollers by the vibrating folding-blade, which latter must, from its mode of operation, move slowly; or, if its forward end is registered against a gage, as 40, the sheet could not be carried against said gage without buckling up or overriding it; but when made to travel at a low rate of speed at the time when it approaches the position which it must reach at the moment of folding, perfect accuracy in doubling it at its center or at any predetermined point is attained.

When the sheet has reached its proper position under the folding-rollers 10 11 its tail end will either have passed beyond the brake-rollers 27, or the latter will have been dropped out of operative contact therewith, and the vibrating folding-blade will come into operation to double the sheet, which is thus free, between the said folding-rollers. This vibrating folding-blade 34 is hung upon arms 35, fast upon a shaft, 36, which is vibrated through a connecting-rod, 39, by a cam, 37, carried by the shaft 31.

It is apparent that, in order to prevent the freshly-printed sheets from being smeared by the tapes 17, the brake-roller 27 should be grooved, so as to pass by the said tapes 17; but short rollers, fixed upon the shaft at suitable distances apart, will serve the purpose as well.

It is obvious from the foregoing description that the rollers 19, which form a part of the sheet controlling or checking mechanism, must be actuated at a speed much less than that of the receiving-rollers 7 8, or the cylinders 15 16, which deliver the sheet into the folding apparatus; and that either the roller 27 or that of 19 must have a positive action in order to affect the travel of the sheet.

In the present instance the roller 27 is an idler, and the roller 19 is driven by the tapes 18; and, though this is an advantageous mode of actuating it, because the tapes afford a guard above the sheet, the roller 19 might be actuated by a motion derived from any of the moving shafts through suitable gearing, and its feeding-movement will be governed by its position relative to the folding-rollers, so that it will feed the sheet into proper position thereunder at a slow speed, which permits it to be accurately folded at the predetermined point. The once-folded sheet is delivered by the rollers 12 13, and may pass from thence to the delivering-table or to successive folding apparatus, by which either folds parallel with or at right angles to the first fold may be imparted to it, as is obvious.

In constructing this machine to operate upon a double stream of sheets, the mechanisms operating upon a single stream of sheets, as hereinbefore described, are preserved, as is shown in Fig. 5, where they are marked with the same reference characters as in the preceding figures. A second set of receiving tape-rollers, 43 44, precisely similar to those 7 8, are provided, which rollers occupy the same position

relative to the cylinder 15 as do the said rollers 7 8 with respect to cylinder 16. The tapes 18, instead of terminating at the roller 13, pass under it and over the roller 47, which, with the roller 13, constitute a second pair of folding-rollers; thence over supporting-rollers 45, under similar rollers 46, horizontally out over sets of folding-rollers for producing a third fold, and are returned over rollers 48, 49, and 50 to the said rollers 19, and a set of tapes, 51, operating in connection with said tapes 18, run from a roller, 52, over the roller 53, folding-roller 47, rollers 45 46, and return to the roller 52. The guards 25 26 are duplicated under the second set of folding-rollers, where they are marked, respectively, 98 99. The roller 52 is driven by a crossed band, 55, from the roller 7, suitable pulleys 90 91, Fig. 7, being applied to their shafts for this purpose; and the tapes 18 are driven by spur-gears 56 57, meshing with a toothed wheel, 58, on the shaft of roller 52, the speed of said tapes being reduced below that of the tapes 17, as hereinbefore described. The second folding-blade, 59, is driven from a cam, 60, on the shaft 31, and the third folding blades, 61 62, derive their motion from the same shaft 31, as will be hereinafter explained.

A sheet doubled through the folding-rollers 10 11, and once folded thereby, as hereinbefore explained with respect to the single machine, is carried onward underneath the folding-rollers 13 47, through which it is doubled on a line parallel with its first fold by the folding-blades 59. The sheet thus folded twice is carried between the tapes 18 51, out over the folding-rollers 63 64, through which it is again doubled and delivered before the fly-frames 65 66, which lay it upon the piling-table. In its passage over the rollers 45 or 46, either of which may be grooved and be provided with a rotary saw, so that in passing over them the twice-folded double-width sheet may be divided transversely into two separate sheets, one of which will be arrested under the folding-blade 61 by a suitable gage, and the other in like manner under a folding-blade, 62, which separate sheets are respectively folded into the nip of the rollers 63 64, and by them delivered before fly-frames 65 66, which deposit them upon the piling-table.

As before remarked, the second or upper set of folding mechanisms are counterparts of the first, or that just described, the actuating-band 67 corresponding to that 55, and the tapes 68 corresponding with those 17, and, in conjunction with tapes 69 and rollers 70 71 72, transfer the sheet from the receiving-rollers 43 44 to the tapes which carry the sheet within the range of action of the controlling or checking mechanism and to the second folding apparatus.

The cylinder 15 in this double machine is supplied with an exhaust apparatus similar to that applied to the cylinder 16, but operating alternately therewith, so as to cause the sheets to alternately adhere to the periphery of the cylinder 15 and the cylinder 16.

In the practical operation of this double machine the sheet first emerging from the cylinders 15 16 will be delivered to the receiving tape-rollers 43 44, and be carried by the tapes 68 69 into the upper folding apparatus, where, since it has a considerable distance to travel, it will arrive at a corresponding point therein simultaneously with the second sheet from the cylinders 15 16, which, having a much shorter travel, enters directly into the carrying devices of the lower folding mechanism. The two sheets will thus be simultaneously acted upon by the two sets of folding mechanisms, and will arrive at and be folded by the last folding mechanisms at the same time, being delivered at the same moment upon the piling-tables. By thus timing the entrance of the two sheets to the folding apparatus the several sets of folding-blades and delivering devices may be actuated simultaneously by motions derived from the same shaft. Thus the action of the whole mechanism by which both streams of sheets are folded proceed simultaneously, and will fold the two streams of sheets, pile, and deliver them out of the machine at four places, as will be better understood by reference to Fig. 6.

The folding-rollers 63 64, arranged at right angles to the previous folding-rollers, are geared together in pairs, and are revolved by means of shafts 92, deriving motion through bevel-gears from the rollers 48.

The vibrating folding-blades 61 62 are actuated from cams 78 79 on shaft 31 through the connecting-rods 80 81.

The double-acting fliers 65 66 are operated by the eccentrics 86 82, mounted on a short shaft, 83, which is driven at one-half the revolution of the cam 31 by the spur-gearing 84 85.

The folding or tape rollers may have continuous surfaces, or be formed by short pulleys, arranged upon a common shaft, and the conductors 1, supplied to guide the sheet to the upper folding mechanism, will extend into grooves into the cylinder 15 and roller 44, and the cutting-blade in the cylinder 15 will be cut away, so as not to interfere.

Supporting-tapes might be substituted for the guards 26 99, as is obvious.

What, therefore, is claimed is—

1. In combination with sheet-delivering rolls geared to revolve at high speed, a roller, 19, geared to revolve at low speed, and an intermittingly-acting roller, 27, for controlling the movements of the sheet, substantially as described.

2. The combination of constantly-revolving roller 19, intermittingly-acting brake-roller 27, folding-rollers 10 11, and folding-blade 34, substantially as described.

3. A single pair of delivering-rollers, provided with devices for conveying sheets alter-

nately into separate paths of travel, in combination with two sets of receiving-rollers, hung in stationary bearings, for directing the same to separate folding mechanisms, substantially as described.

4. The combination, with a single revolving sheet-delivering apparatus, of two sets of receiving-rollers and two sets of folding apparatus, receiving alternate sheets, all substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

RICHD. M. HOE.

Witnesses:
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CHAS. W. CARPENTER.