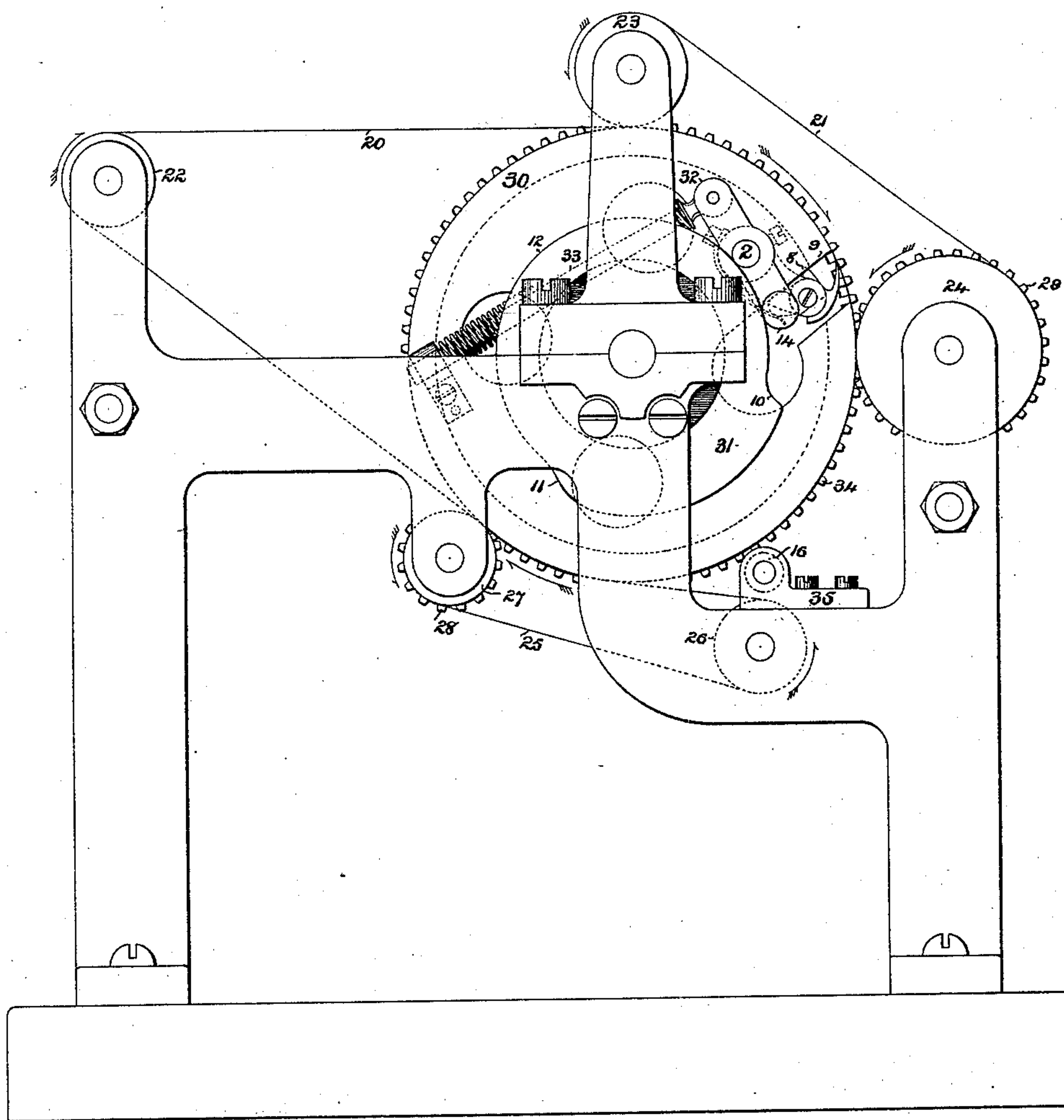


W. SPALCKHAVER.
Paper-Folding Machine.

No. 223,457.

Patented Jan. 13, 1880.

Fig. 1.



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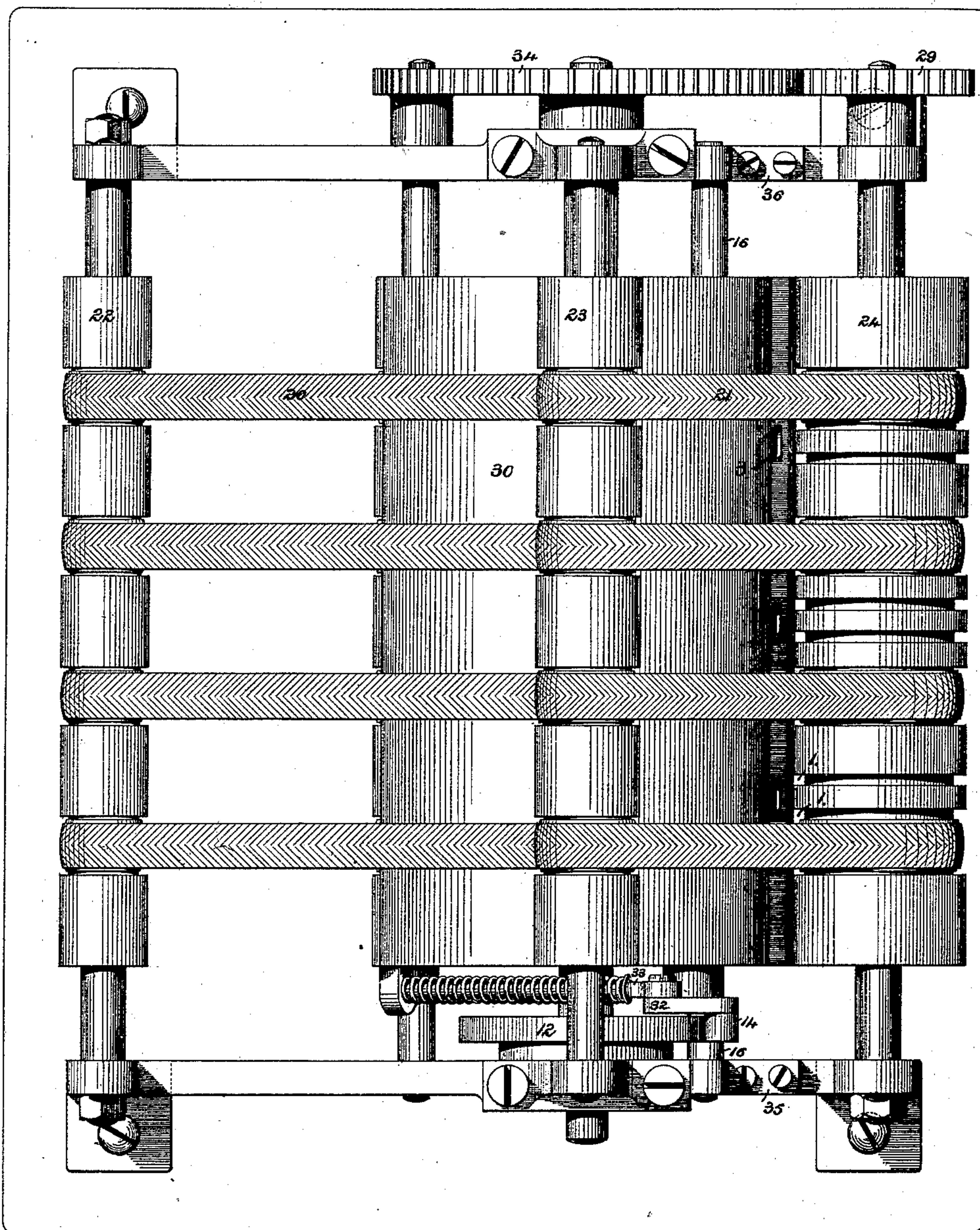
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Fig. 2.



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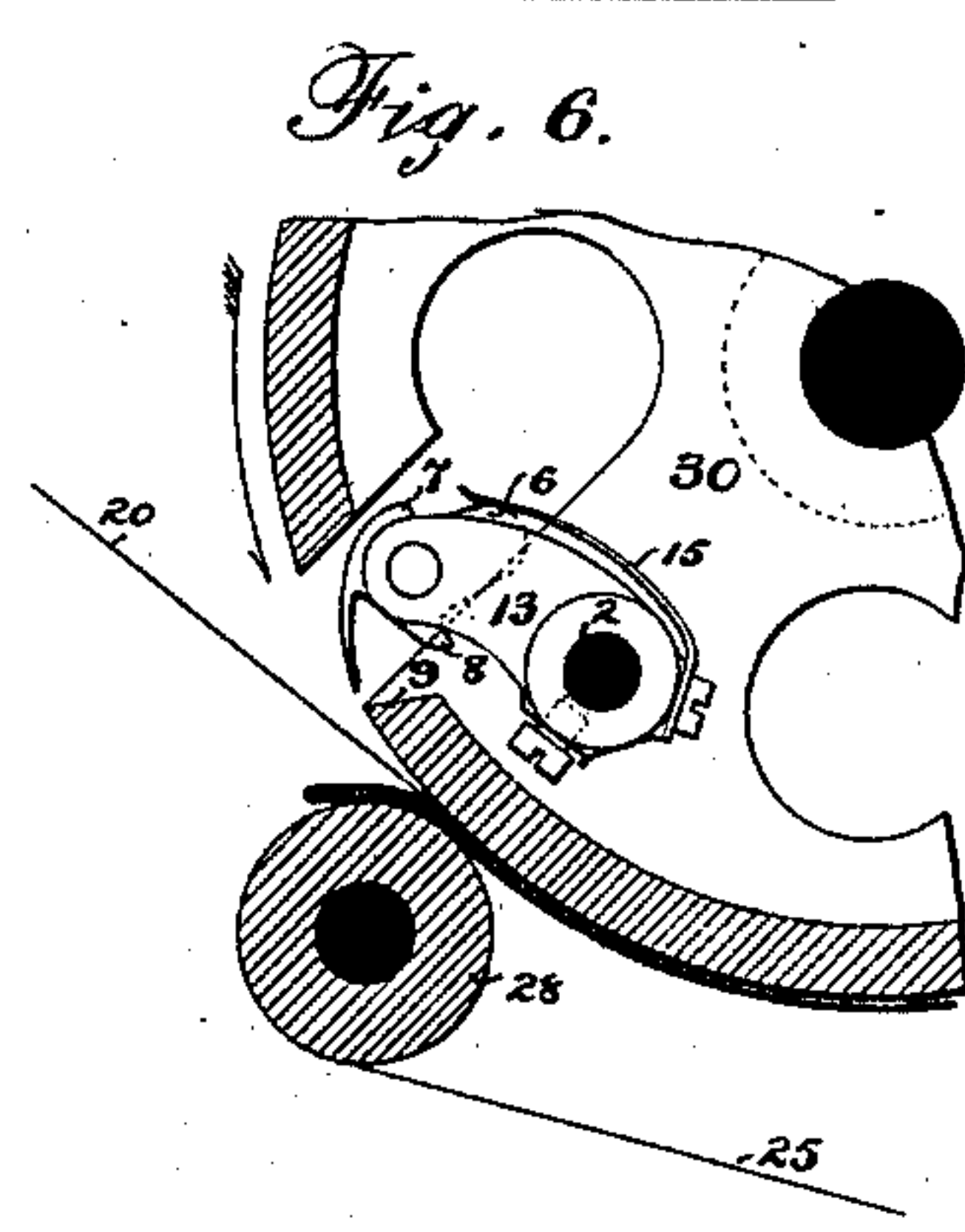
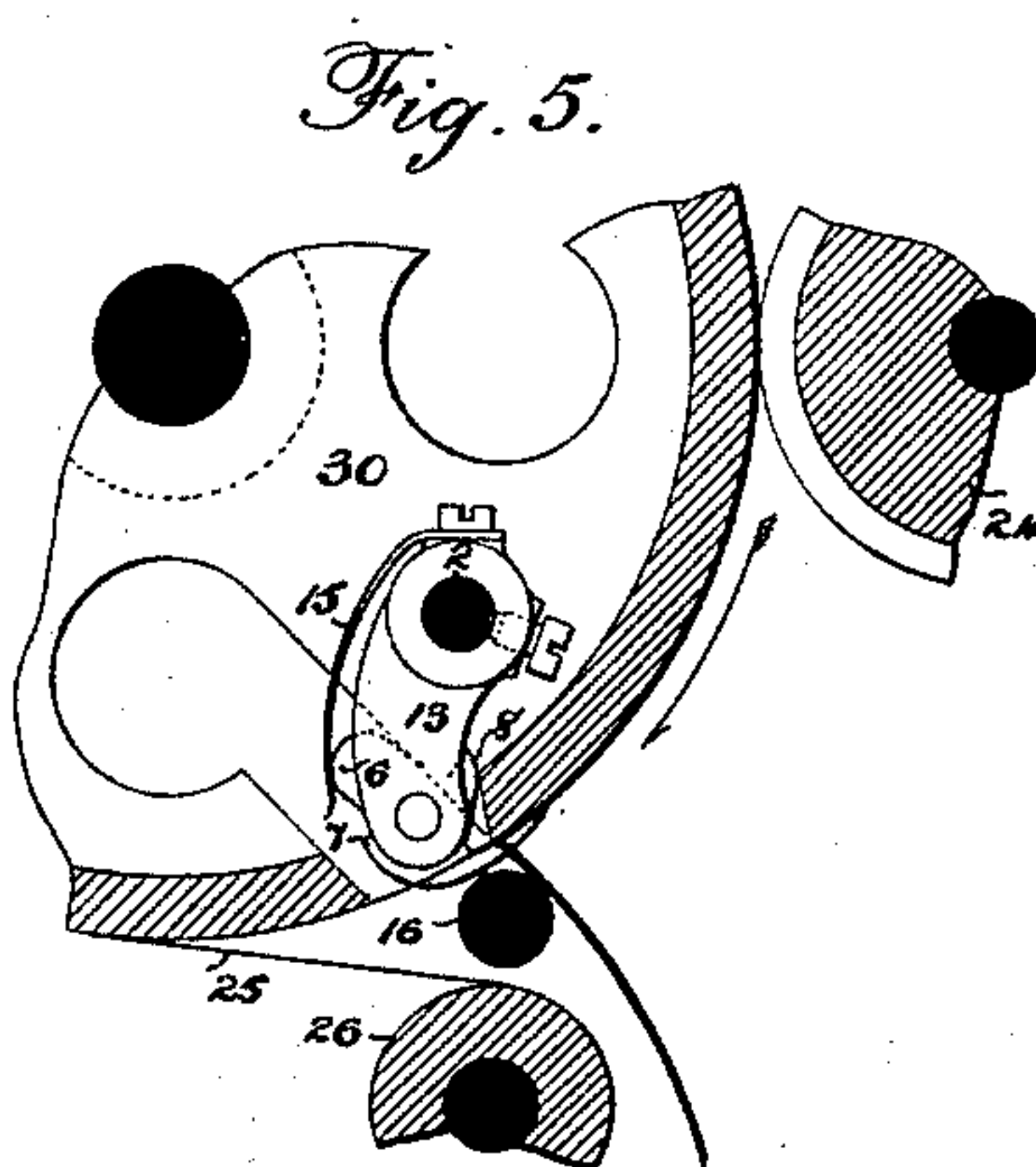
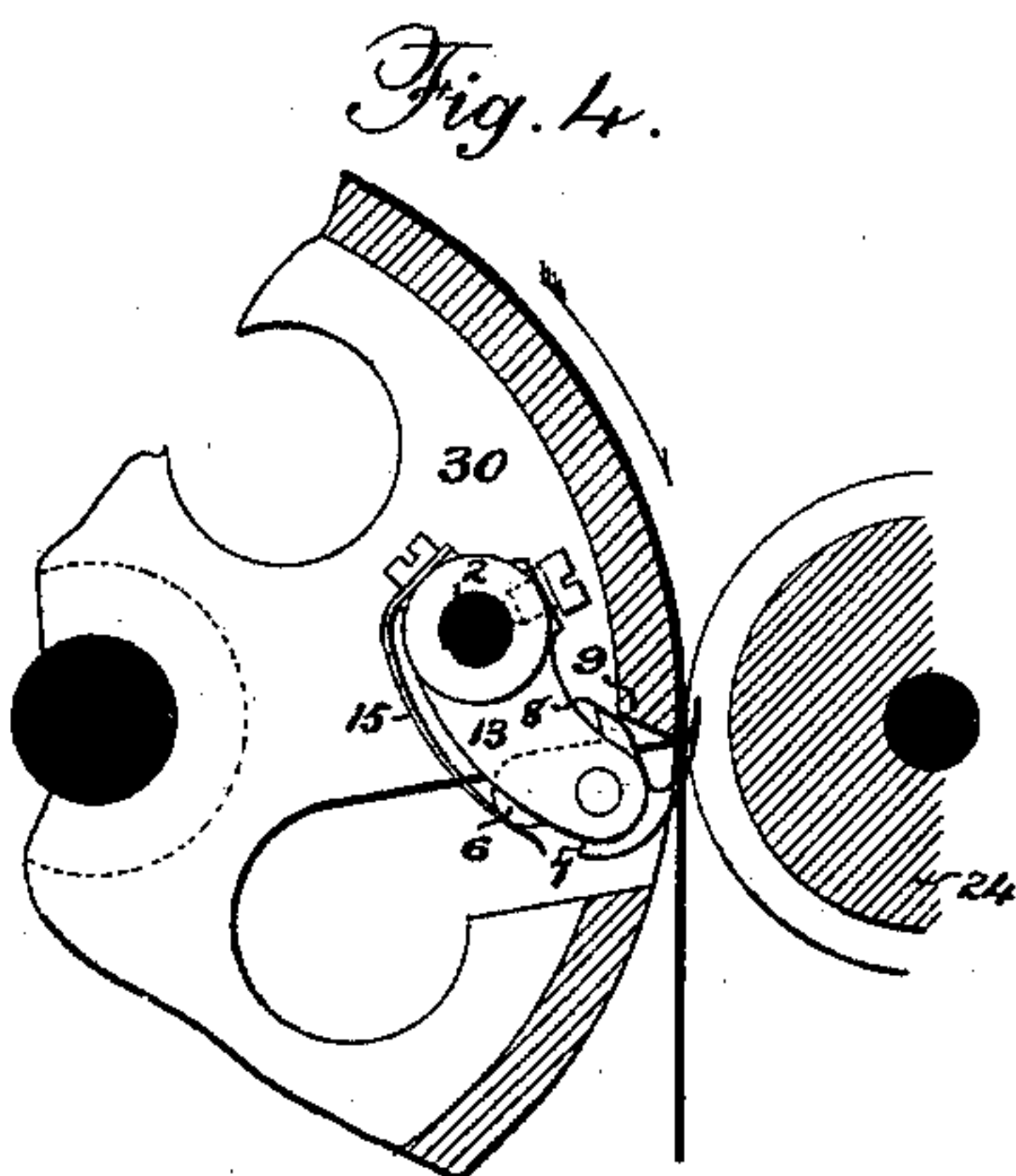
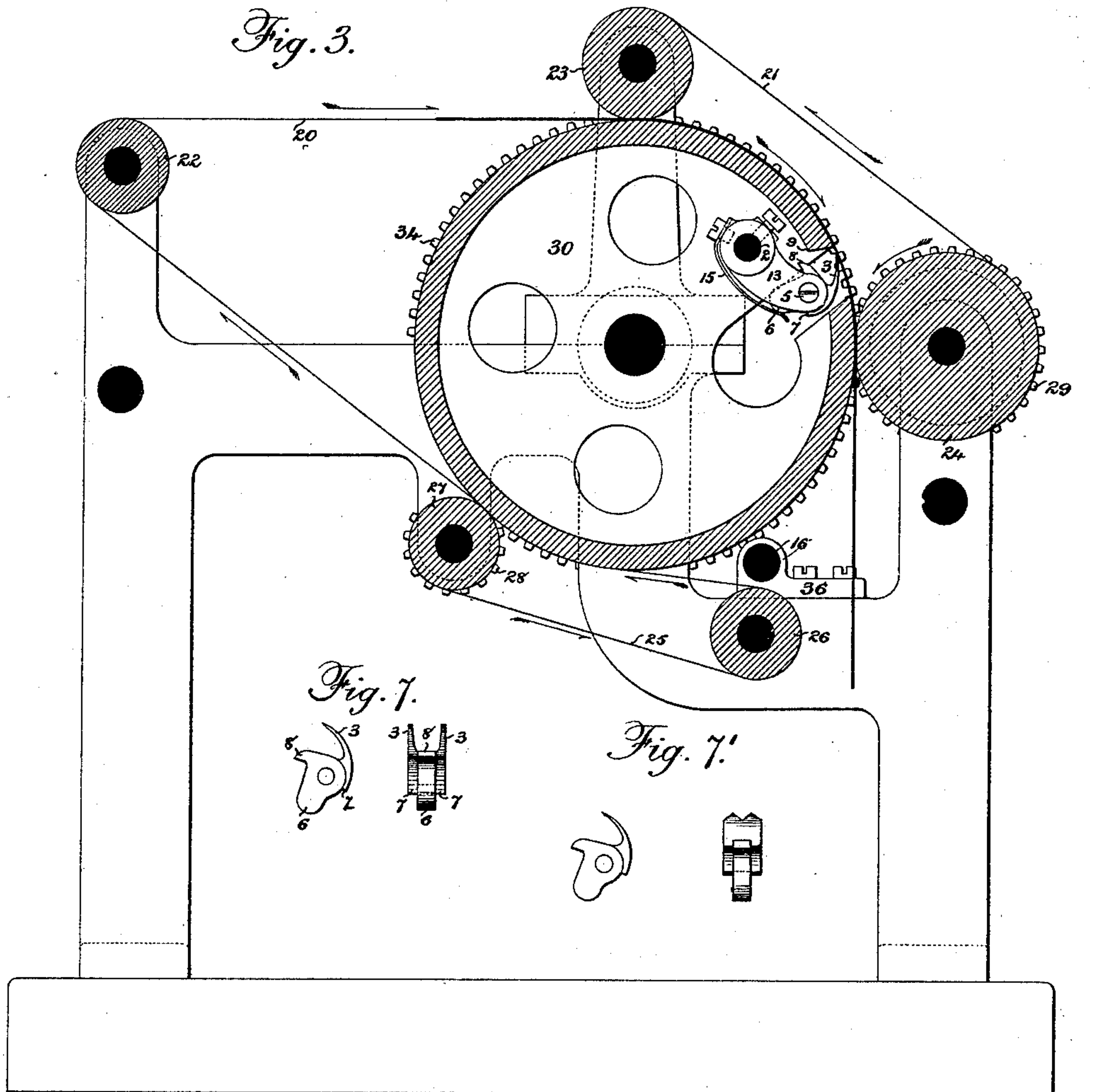
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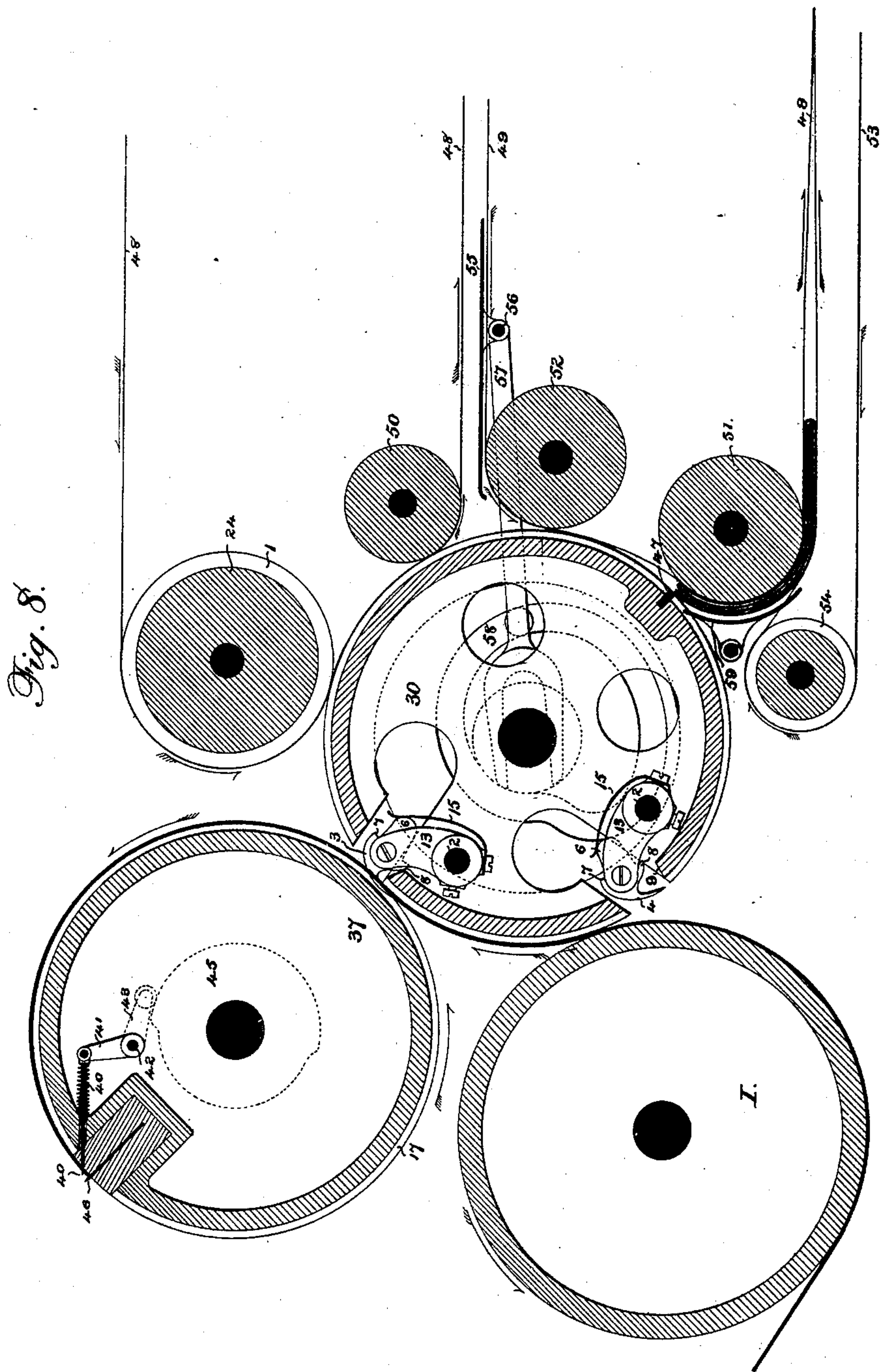
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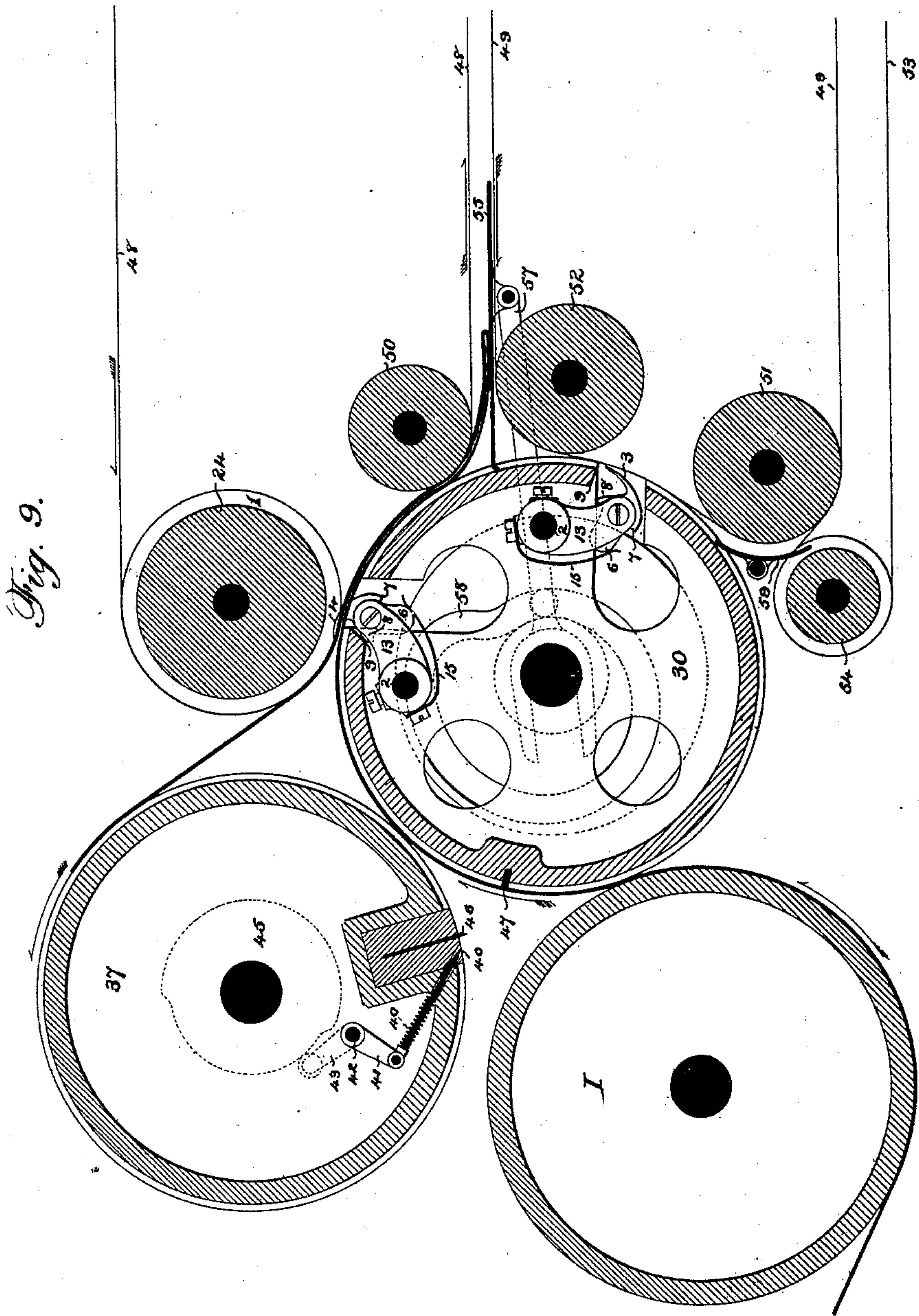
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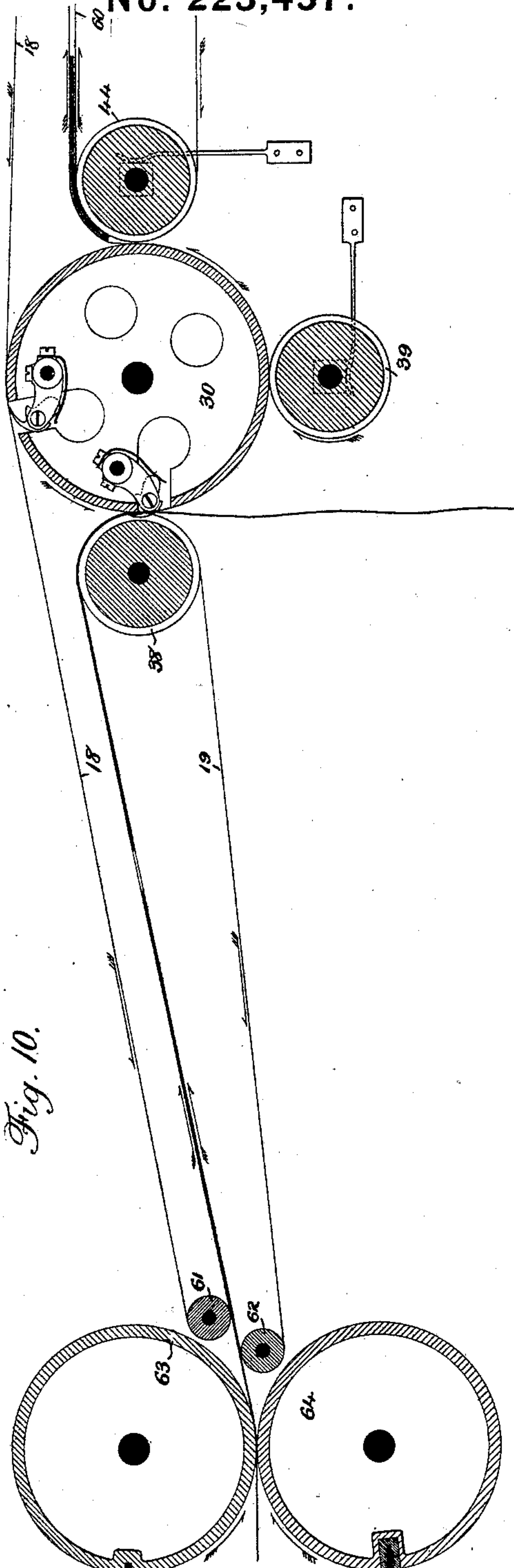


Fig. 10.

WITNESSES.

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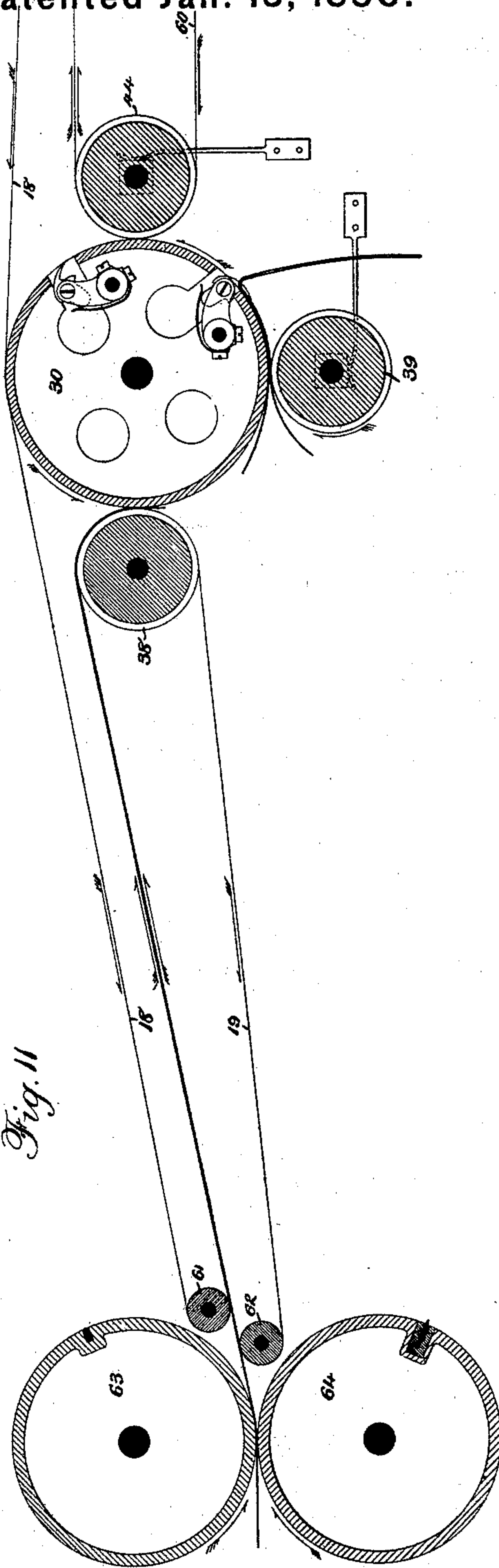


Fig. 11

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UNITED STATES PATENT OFFICE.

WILLIAM SPALCKHAVER, OF BROOKLYN, ASSIGNOR TO R. HOE & CO., OF
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PAPER-FOLDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 223,457, dated January 13, 1880.

Application filed October 14, 1879.

To all whom it may concern :

Be it known that I, WILLIAM SPALCKHAVER, of the city of Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Machines for Folding Paper; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification.

This invention relates to that class of paper-folding machines known as "rotary"—that is, such whose instrumentality for determining the line of folding is supported in a rotating carrier, whereby the machine is adapted to operate at a high rate of speed, and, when connected with a web-perfecting printing-machine, is capacitated to receive, fold, and deliver the product thereof; and it relates more particularly to that kind of such rotating paper-folding machines in which the folding is accomplished by an instrumentality supported by the rotating carrier that seizes the paper at the folding-line and carries it thereby between the surface of the carrier and a doubling-surface.

The invention consists, mainly, in rocking fold-determining forks that automatically pierce, seize, and hold the paper along the line of its ultimate folding, and thus carry that portion of the paper between two adjacent surfaces, whereby the paper is doubled, the said forks then withdrawing to release the paper and permit its further folding or delivery from the machine.

The invention also embodies various combinations of said fold-determining forks with other co-operating devices, an arrangement of them for accomplishing two parallel folds, and constructions and combinations of parts too fully hereinafter pointed out to need further preliminary description.

In the drawings illustrating these improvements, Figure 1 represents a right-side elevation. Fig. 2 represents a plan or top view, and Fig. 3 represents a longitudinal sectional elevation, of a folding mechanism embodying my improvements as constructed to impart single transverse folds to the paper. Figs. 4, 5, and 6 illustrate details of the rotating car-

rier, showing particularly the operation of the fold-determining forks, of which latter Fig. 7 shows detail views and Fig. 7' a modification. Figs. 8 and 9 illustrate an arrangement of folding mechanism embodying my improvements as constructed to impart two parallel folds to each sheet. Figs. 10 and 11 show the folder connected with a web-press by fast tapes.

The construction of the machine illustrated in Figs. 1 to 6 as embodying these improvements will first be explained.

A rotating carrier, 30, mounted in a proper framing, is provided with a series of fold-determining forks, 3, that are carried at the ends of rock-arms 13, which are mounted fast upon a rock-shaft, 2. This rock-shaft is journaled in the heads of said carrier at such points that the forks may protrude from and be withdrawn into a recess in the periphery of the carrier as the rock-arms are vibrated by the movements of the said rock-shaft, which are imparted at proper times during each rotation of the carrier 30 by means of a rock-arm, 14, which the rock-shaft carries at one end, and a cam, 31, fixed to one side frame. This cam might be a slotted cam imparting the movements in both directions to the rock-arm 14, or, as shown, it may be a face-cam throwing the rock-arm in one direction, its contrary movement being accomplished by means of an arm, 32, and a spring-seated rod, 33, in like manner as the grippers of cylinder printing-machines are commonly operated.

The fold-determining forks are each made double, as shown in Fig. 7, though they might obviously be single. Whether double or single, they are preferably provided with a stud, 5, whereby they are pivoted in the ends of their rock-arms 13, and each have tail pieces depending from them, which tail-pieces are provided with a projection, 6, a shoulder, 7, and a cam-face, 8.

A spring, 15, fast to the rock-arms 13, bears upon the projection 6, and thus forces the fork into its most extended position with reference to said arm, as in Figs. 3 and 6, the shoulder 7 then seating itself upon a suitable stop provided upon the rock-arm, which position of the fork is that assumed when it is being protruded

through the opening in the carrier and caused to pierce the paper, as in Fig. 4. When, however, said fork has passed through the paper the cam-face 8 of its tail-piece will engage the surface 9 of the shell of the carrier at the rear side of its opening, and in consequence of the continued outward movement of the fork this cam-surface will cause the tail-piece to so rock as to move said fork down onto the periphery of the carrier, thus impinging upon the paper and clamping it upon the surface of the carrier, as in Fig. 5. The forks having completed their movements through and onto the paper, which is accomplished while the rock-arm 14 is passing over the rise 10 of the cam 31, will then remain stationary in that position until the face 11 of the cam is reached, passing down which the reverse movement will be accomplished and the forks withdrawn to release the paper.

A doubling-bar, 16, fixed in brackets 35 36, extends across the machine and stands in close proximity to the periphery of the carrier at a suitable point to aid the fold-determining forks in doubling the paper.

The carrier 30 is furnished with steel conducting-tapes 20 21, the former running from a roller, 22, and partially around the carrier, while the latter runs from a roller, 23, in contact with a portion of the surface of said carrier and returns over a sheet-sustaining cylinder, 24. A third set of tapes, 25, runs from a roller, 26, in contact with a portion of the periphery of the carrier and returns over a pressing-roller, 27. This roller 27 carries a pinion, 28, and the cylinder 24 a pinion, 29, by which they are driven from a toothed wheel, 34, that is fast on the shaft of the carrier 30, whereby a uniform motion is given to all the rollers and tapes.

The paper in the form of sheets may be fed from a table to the carrier 30 in like manner as a cylinder printing-machine is fed, whereupon the same will be conducted by the tapes 20 21 and properly operated upon; but in practice this folding-machine will be connected with a web-perfecting printing-machine in which a web of paper is printed upon opposite sides and cut into proper-sized sheets, this folding-machine being driven in proper time from the printing-machine by means of gearing that connects the shaft of the carrier 30 with one of the rotating shafts of the printing-machine. If the tapes 20 21 are used, they will then be extended and caused to run around pulleys or rollers set just in rear of the cutting-cylinders of the printing-machine, so that the sheets emerging from said cutting-cylinders will be properly conveyed to the carrier 30, all of which is fully illustrated in Figs. 10 and 11.

When the machine is in operation a sheet carried onto the cylinder 30 in proper time will be held thereon by the tapes 21 and carried between the surface of the carrier 30 and that of the sustaining-cylinder 24, the center of said sheet, or that point of it where the fold

is to be made, overlying the fold-determining forks 3.

During that part of the rotation of the carrier 30 when the rock-arm 14 of said forks is traversing the low part of the cam 31 said forks will be retained within the opening in the carrier; but when the sheet of paper has so far passed between the carrier and cylinder 24 that that portion of it where the fold is to be made is passing between said carrier and cylinder, the rock-arm 14 will have reached the rise 10 in the cam 31, in passing up which the fork-carrying rock-arms 13 will be rocked rearward, thereby moving the forks outward and causing them to pierce the sheet while it is sustained by the cylinder 24, said forks at that time, while extended by the spring 15, passing into recesses 1 provided in said cylinder for their reception. (See Fig. 2.) So soon as the forks have passed through the sheet their cam-faces 8 impinge against the surface 9 and cause said forks to draw down onto the sheet while completing their rearward movement, by which operation they bear upon the sheet and clamp the same onto the surface of the carrier. The leading portion of the sheet having been allowed to droop down from between the carrier and cylinder 24, and the folding-line of said sheet now being securely held by the forks, it follows that as the carrier continues its rotation said leading end will continue to move downwardly, and that portion of the sheet clamped by the forks will be held on and compelled to move with the carrier. It will thus be carried between the surface of the carrier and the face of the doubling-bar 16, as in Fig. 5, and as it passes the latter it will draw the leading end of the sheet after it, and thus double the sheet along the line held by the forks, and thus lay the two parts or front and rear portions of the sheet together, whereby the doubling or folding of said sheet will be accomplished.

As the head of the folded sheet passes beyond the doubling-bar 16 it enters between the tapes 25 and the surface of the carrier, and will thus be held onto said carrier so as to move onward with it. When the sheet reaches this point the rock-arm 14 will pass down the face 11 of the cam 31, and the forks will thereby be withdrawn from the paper and into the opening in the carrier, as in Fig. 6. The folded sheet then freed from the forks will be carried onward by the tapes 25, and, passing between the pressing-roller 27 and the carrier, will have its fold pressed flat, and said sheet will be stripped from the carrier by the tapes 20, and, passing over the roller 27, will be delivered from the machine. From this roller the folded sheet may be deposited upon a piling-table, or be disposed of by any of the well-known delivery apparatuses; or it may be conveyed to a folding mechanism of this or any of the well known constructions, and receive one or more additional folds at right angles or parallel to its first fold, as may be desired.

One mode of connecting this folding-machine with a web-press is shown in Figs. 8 and 9, which also show a duplication of the folding mechanisms with such auxiliary devices as are requisite in imparting two parallel folds to the same sheet while it is passing once through the machine.

The carrier 30 is constructed to act as one of the cutting-cylinders of the web-perfecting printing-machine, and is so related to the companion cutting-cylinder 37 and the last impression-cylinder I of such printing-machine as to receive the web from said impression-cylinder and conduct it between itself and the cutting-cylinder 37 without the intervention of tapes.

The cutting-cylinder 37 is furnished with a series of holding-pins, 40, that are arranged to reciprocate in sockets formed in the cylinder-shell, being thus protruded at proper times just in the rear of the cutting-blade, so as to impale and hold the detached leading end of the web of paper. These pins are pivoted to rock-arms 41, that extend from a rock-shaft, 42, journaled in the heads of the cylinder and provided with an actuating-arm, 43, that rides upon the surface of a cam, 45, that is fast to the framing.

The carrier 30 is furnished with a cutting-slot, 47, with which the blade 46 co-operates in severing the paper web, and it is provided with fold-determining forks 3, that are carried by arms 13 on a rock-shaft, 2, that is actuated by an arm, as 14, and a cam, as 31, (as the reference-characters in part indicate,) which forks 3 are constructed and operate as hereinafter described with reference to the single-fold-producing mechanism, said forks, in this instance, co-operating in aiding the production of the first fold with the cutting-cylinder 37 as their sheet-sustaining cylinder, which latter is provided with circumferential grooves 17 for that purpose. This carrier 30 is further recessed at a proper distance rearwardly from the recess occupied by the forks 3 with a series of forks, 4, which are constructed and operate with the grooved sheet-sustaining cylinder 24 in aiding the production of the second fold in precisely the same manner as do the forks 3 in the single-folding machine, being, like them, spring-seated and constructed to swing in arms 13 that project from a rock-shaft, as 2, which rock-shaft has a rock-arm, as 14, that rides upon a cam, as 31, said cam 31 being fixed to the frame opposite to that end of the carrier 30 where the cam 31 is placed, and these forks 4 are provided with tail-pieces having a projection, 6, a shoulder, 7, a cam-face, 8, and a spring, 15, constructed and operating as do those parts of the forks 3.

The carrier 30 is provided with a set of tapes, 48, that run over the cylinder 24, pass a short distance in contact with the carrier, and are then led off under a roller, 50, said tapes extending outwardly, being returned over suitable pulleys or rollers. A set of tapes, 49, run over a roller, 52, pass a short distance in con-

tact with the carrier, and are then led off under a roller, 51, and returned over suitable pulleys or a roller, said tapes extending outwardly so as to run parallel with the tapes 48, and with them to form a delivery-channel for once-folded sheets. A third set of tapes, 53, run over a roller, 54, under the roller 51 and return over suitable pulleys or a roller, said tapes extending outwardly so as to run parallel with the tapes 49, and with them form a second delivery-channel for twice-folded sheets.

The cylinder 24 and rollers 50, 52, and 51 will be geared with and driven from a toothed wheel on the carrier 30, and the roller 54 will be similarly driven from the wheel on the roller 51, by which arrangement all the tapes will be positively driven at appropriate speed.

A set of reciprocating guides or bars, 55, the shaft 56 of which runs in appropriate ways, are so located that they may move to and fro between the tapes 48 49 and have their forward ends entered into and temporarily held in grooves found in the carrier 30, as in Fig. 9, or be removed therefrom, as in Fig. 8, the means for accomplishing which are a connecting-rod, 57, and an appropriately slotted cam, 58, that is fast on the shaft of the carrier 30, said rod having a stud entering the grooves of the cam 58.

A set of curved conductors, 59, held by a rod, are placed so that their ends may extend into grooves in the carrier 30 and roller 54 and their faces stand coincident with the periphery of the roller 51.

It being understood that the cutting-cylinder 37 and the impression-cylinder I are provided with toothed wheels, gearing with the toothed wheel on the carrier 30, and that the remaining complement of printing-cylinders, constituting the principal part of a web-press, are similarly geared to the cylinder I, a printed web passing over said cylinder I will be operated upon as follows: Said web will come from the cylinder I and pass between the cylinders 37 30 where the pins 40, which are withdrawn while their rock-arm 43 rides upon the low part of the cam 45, engage its surface, and are forced through it as their rock-arm 43 rides up onto the high part of the cam 45. This impalement is effected just before the cutting-blade 46 operates with the slot 47 to sever the web, so that when the severing is accomplished the leading end of the web will be held upon the pins and retained thereby upon the cylinder 37, so as to be carried onward with it, as in Fig. 8. As the carrier 30 rotates and its forks 3 are passing the point of contact between the carrier and the cylinder 37, said forks are protruded through the paper web and closed down thereon to clamp the web upon the carrier 30 along the line of the first fold, and the paper web thus seized and held is then carried onward toward the cylinder 24, the cam 45 operating the rock-arm 43 to withdraw the pins 40 and release the leading end of the web at the precise moment to avoid any buckling

or straining of the same. As the folding-line of the web passes under the cylinder 24 it acts as a doubling-roller, completing the first fold, and also to press the doubled edge thereof together. After the head of the folded paper has entered under the tapes 48, and before the forks 3 pass the roller 50, their rock-arm 14 will have passed down the face 11 in the cam 31, thus causing said forks to be withdrawn from the paper. As the folded sheet is carried onward and its head passes the roller 50 it engages the guides 55, which have been moved forward by means of the cam 58, and it is thereby intercepted and guided outwardly over said guides and between the tapes 48 49, as in Fig. 9.

While the two plies of the folded paper are passing under the cylinder 24, and the forks 4 reach that point, the rock-arm 14 of said forks is actuated by their cam 31 to protrude them through the two plies of paper and clamp the same down onto the surface of the carrier, whereby said plies of paper are seized along the line of their second fold and carried forward.

When the carrier has so far rotated as to bring the cutting-blade and slot again into co-operation the web will be again severed, thus detaching the forward doubled portion and constituting it a folded sheet, while the pins 40 have again impaled the leading end of the web and will carry it around with the cylinder 37, as before described.

When the second line of fold passes the guides 55, which have meanwhile been moved outwardly by the action of the cam 58, as in Fig. 8, the sheet will be drawn downward and doubled on said folding-line between the carrier and the roller 52, which now acts as a doubling-roller. As the sheet is thus folded and its doubled head enters between the tapes 49 and the carrier its forward once-doubled end is drawn backward over the guides 55, and passing over the roller 50 is laid upon the rearward plies of such sheet. While such twice-folded sheet is passing between the tapes 49 and carrier, and before its doubled head passes the roller 51, the rock-arm 14 of the forks 4 rides down the face of its cam 31 and withdraws said forks within the carrier, thus releasing the sheet, which, intercepted by the conductors 59, is stripped from the carrier and directed around the roller 51 and into the nip of the tapes 49 53, by which it is carried out of the machine.

If it is desired to readjust this apparatus so as to impart a single fold to the sheet, this may be done by throwing the forks 4 out of operation, so that they will remain within the periphery of the carrier, and by adjusting the devices actuating the guides 55 so that they will stand in the position shown in Fig. 9. The once-folded sheet will then be carried out by the tapes 48 and guides 55, and may, as well as the twice-folded sheets conducted by the tapes 49 53, be conveyed to an ordinary

delivery apparatus or to folding mechanisms, as has been described with reference to the machine shown in Figs. 1 to 7; but if a machine is to have this adjustment to deliver sheets once folded, a set of auxiliary tapes running in the same direction as the tapes 48 will be mounted under them so as to receive the sheets from the guides 55, the tapes 49 being lowered out of the plane in which such tapes will travel.

Another mode of arranging this folding mechanism in connection with a web-printing machine is illustrated in Figs. 10 and 11. The cutting-cylinders 63 64 there shown represent the web-severing mechanism common in such printing-machines, from which cylinders the severed or partially-severed web is conducted to the cylinder or carrier 30 and its mechanisms by means of fast tapes 18 19, that are arranged as follows: The upper set run from a roller, 61, over the sheet-sustaining cylinder 38, under the cylinder 30, and pass off over a pressing-cylinder, 44, to the sheet-delivering apparatus, from whence they return over a roller to the roller 61. The lower set run from a roller, 62, and return around the cylinder 38. A third set of tapes, 60, run from the cylinder 44 to the delivery apparatus, and are returned over a suitable pulley or roller. The tapes 18 19 are slightly separated near the rollers 61 62, and of course press together as they pass over the cylinder 38; and as these tapes move independently of the cutting-cylinders 63 64, and are given the speed of the cylinder 30, (their driver,) they will, since the cylinder 30 is of greater size than the cylinders 63 64, be caused to move at a higher relative speed than the latter, and thus accelerate the movement of the paper and detach sheet from sheet and provide a working space between successive sheets. The tapes 60 run parallel with the extended portion of the tapes 18 and at a like speed; but these tapes 18 might return over the cylinder 30 and their extended portion have substituted for it an independent set of tapes working with the tapes 60.

The fold-determining forks supported by the cylinder 30 and their operating mechanisms do not differ from those already described, as will be readily apparent; but a different arrangement of co-operating devices is shown. Thus the forks aiding the production of the first fold coact with the sheet-sustaining cylinder 38 in piercing the paper, and with the cylinder 39 in doubling, laying, or pressing the sheet, while the forks aiding the production of the second fold coact with the cylinder 39 (which then acts as a sheet-sustaining cylinder) in piercing the paper, and with the pressing-cylinder 44 in doubling, laying, or pressing the sheet, the latter cylinder also acting as a means for directing the sheet toward the delivering apparatus. These cylinders 39 and 44 are here shown as spring-seated; and it is apparent that the cylinders and rollers 38, 23, 24, 27, 50, 52, and 51 might be similarly mounted.

It is apparent that the doubling-bar 16 may be a roller and still perform the doubling function, as do the cylinder 24 and the roller 52 in Figs. 8 and 9 and the cylinders 39 44 in Figs. 10 and 11, in which case the tapes 25 might run over said roller.

The fold-determining forks might have substituted for them pointed flat chisels, as Fig. 7', and in either form these fold-determining forks 3 might project rigidly from their arms 13, and be so shaped as to pierce the paper and then clamp it down upon the surface of the carrier; but the pivoted form of them is the best and more effective form of construction.

The fold-determining forks or the thin pointed flat chisels may be placed near enough together as to so far perforate the sheet upon its line of folding that that folded line, when it becomes the head of the folded paper, may be readily separated to form detached leaves.

The function of the sheet-supporting cylinders might be accomplished by tapes.

What is claimed is—

1. The combination, with a rotating carrier over the surface of which the paper is carried, of fold-determining forks which are protruded beyond the surface of the carrier to pierce and hold the paper, substantially as described.

2. The combination, with the rotating carrier and the fold-determining forks, of a paper-sustaining cylinder coacting therewith, substantially as described.

3. The combination, with the rotating carrier and fold-determining forks, of a doubling bar or roller, substantially as described.

4. The combination, with the rotating carrier and fold-determining forks, of the doubling bar or roller and a pressing-roller, substantially as described.

5. The combination, with the rotating carrier and fold-determining forks, of the tapes 20, 21, and 25, substantially as described.

6. The combination, with the rotating carrier, of the rock-arms, as 13, and the fold-determining forks, as 3, pivoted therein, substantially as described.

7. The combination, with the rotating carrier and its surface 9, of the rock-arms, as 13, the pivoted spring-seated fold-determining forks, as 3, and their cam-face 8 and shoulder 7, substantially as described.

8. The combination, with the rotating carrier having two sets of fold-determining forks, of the reciprocating guides or bars, substantially as described.

9. The combination, with the carrier 30, its two sets of fold-determining forks, cylinders 37 24, reciprocating guides or bars 55, and the cutting mechanism, substantially as described.

10. The combination, with the carrier 30, its two sets of fold-determining forks, cylinders 37 24, reciprocating guides or bars 55, cutters 46 47, tapes 48 49 53, their carrying-rollers, and the conductors 59, substantially as described.

11. The combination, with a rotating carrier, of fold-determining forks or chisels which are moved to pierce and clamp the paper at the line of fold, substantially as described.

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

WILLIAM SPALCKHAVER.

Witnesses:

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C. M. HUNTER.