(No Model.) 3 Sheets—Sheet 1.

J. T. HAWKINS.

PAPER FOLDING MACHINE.

No. 332,520. Patented Dec. 15, 1885.

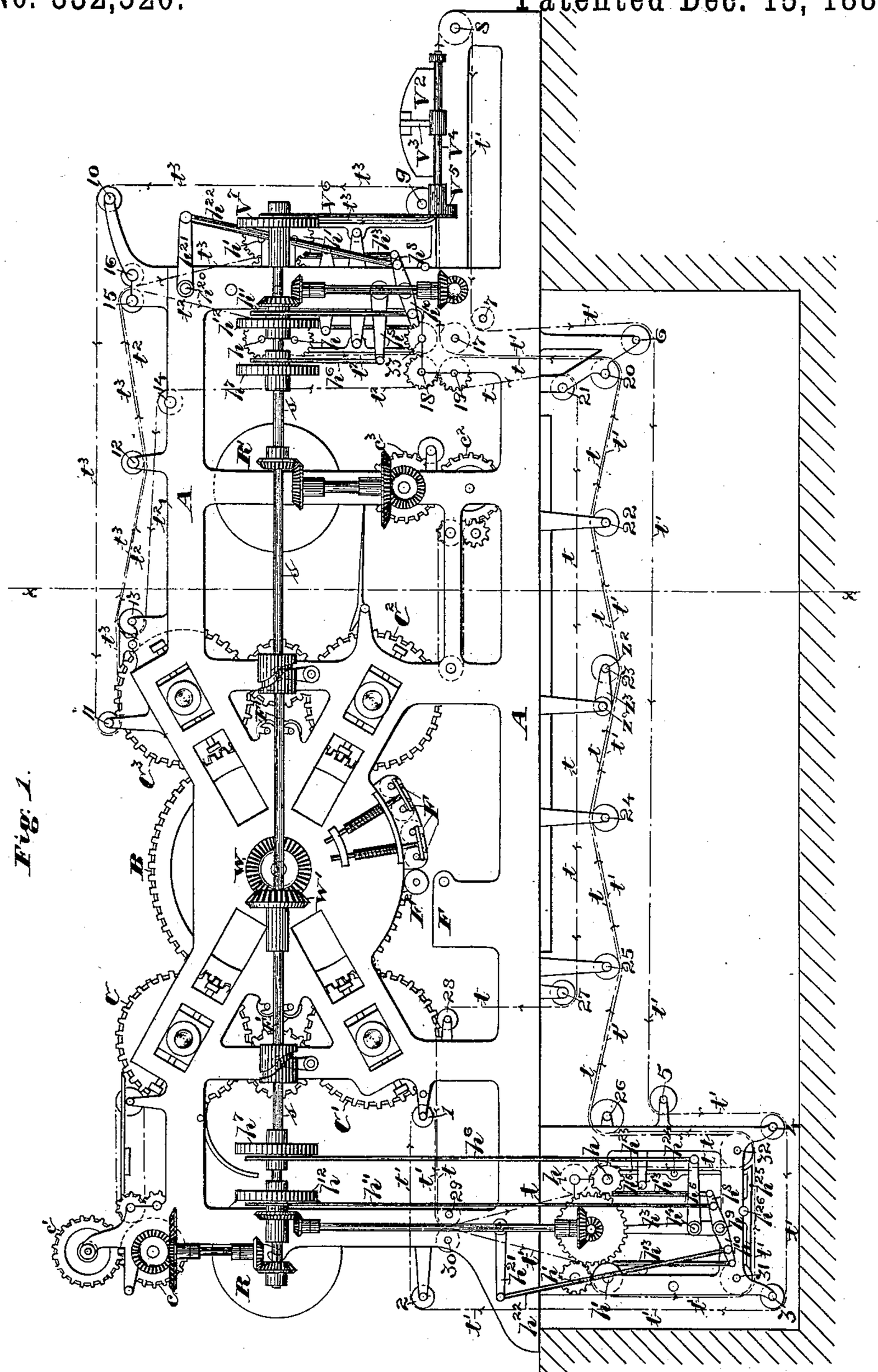

Fig: 1.

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(No Model.) 3 Sheets—Sheet 2.

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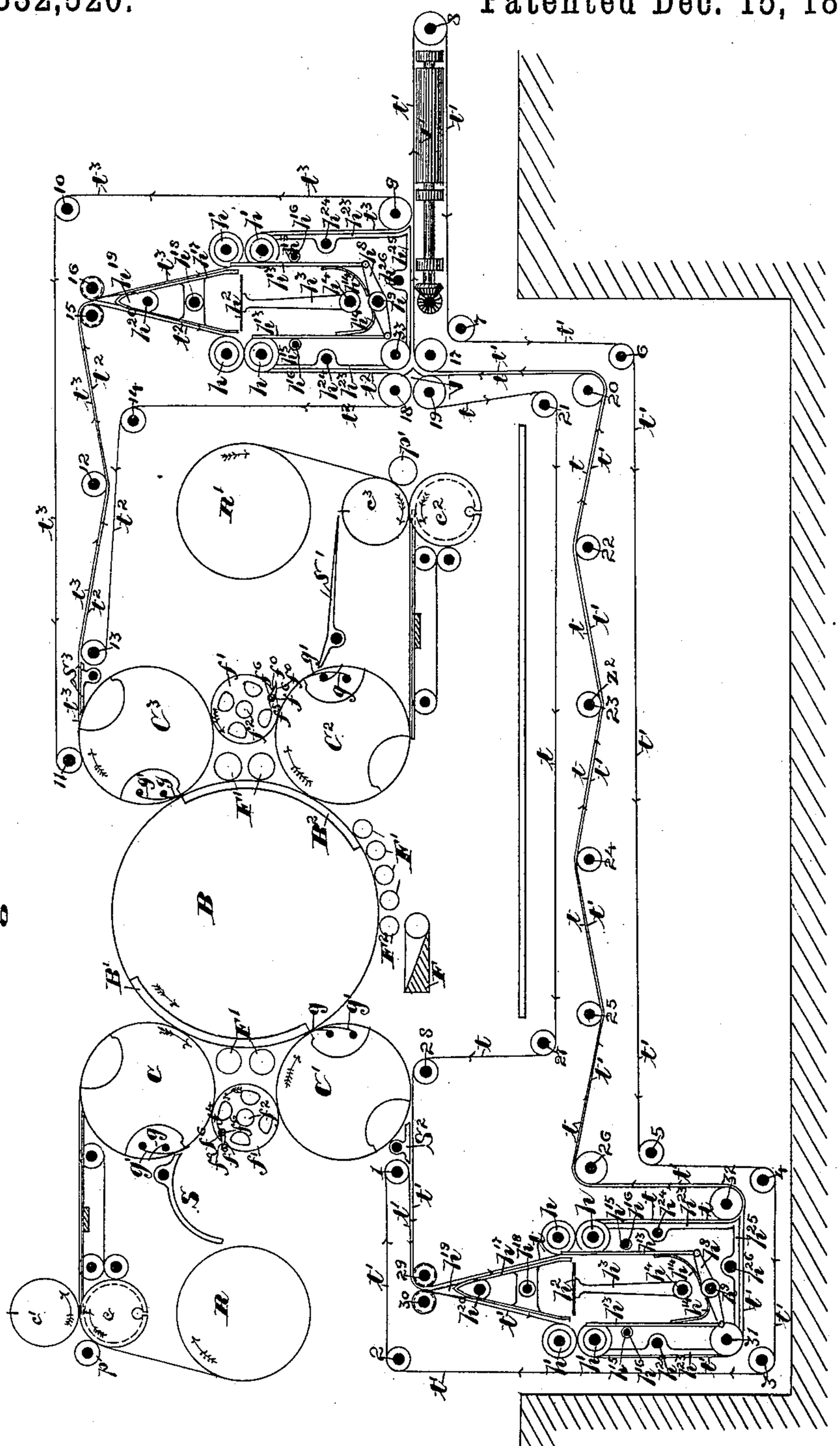

Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

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Fig. 3.

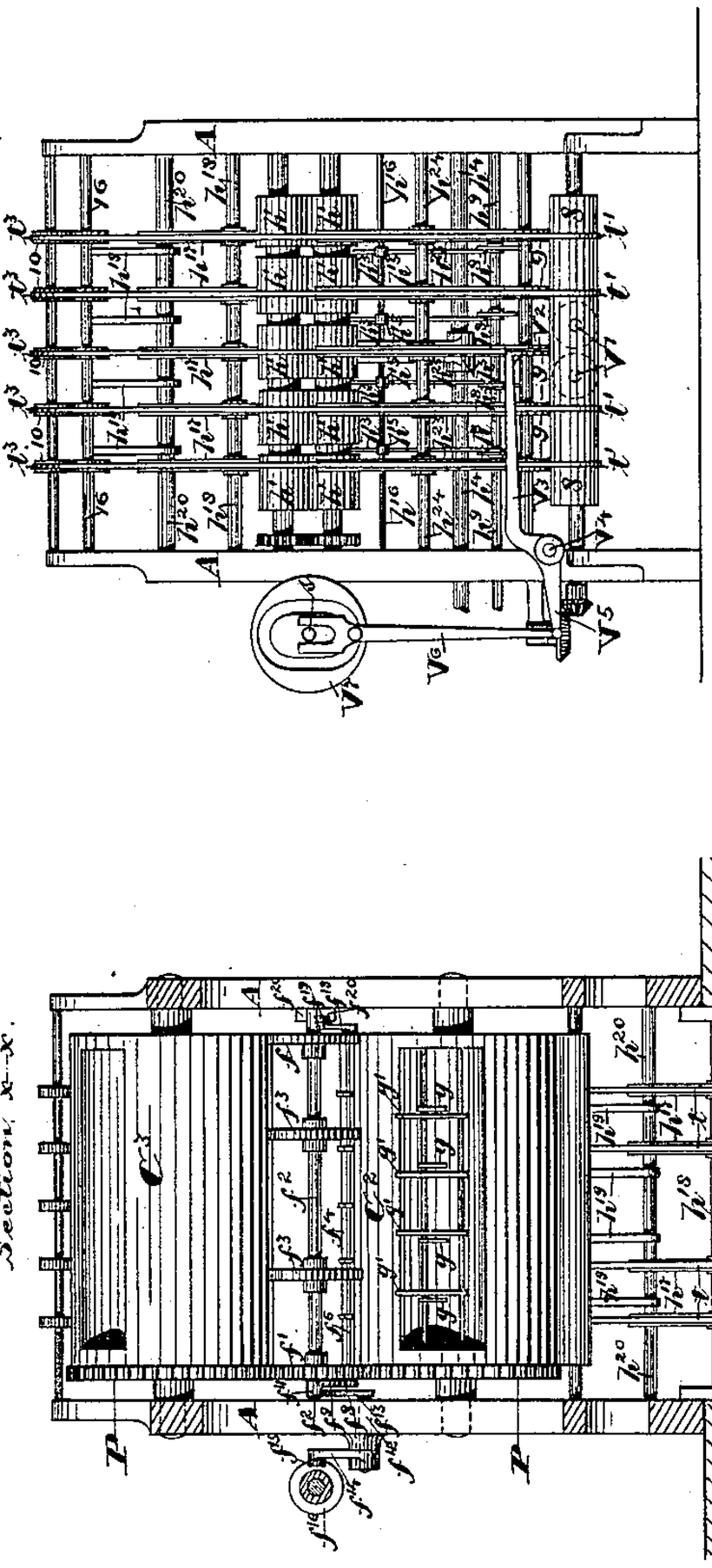
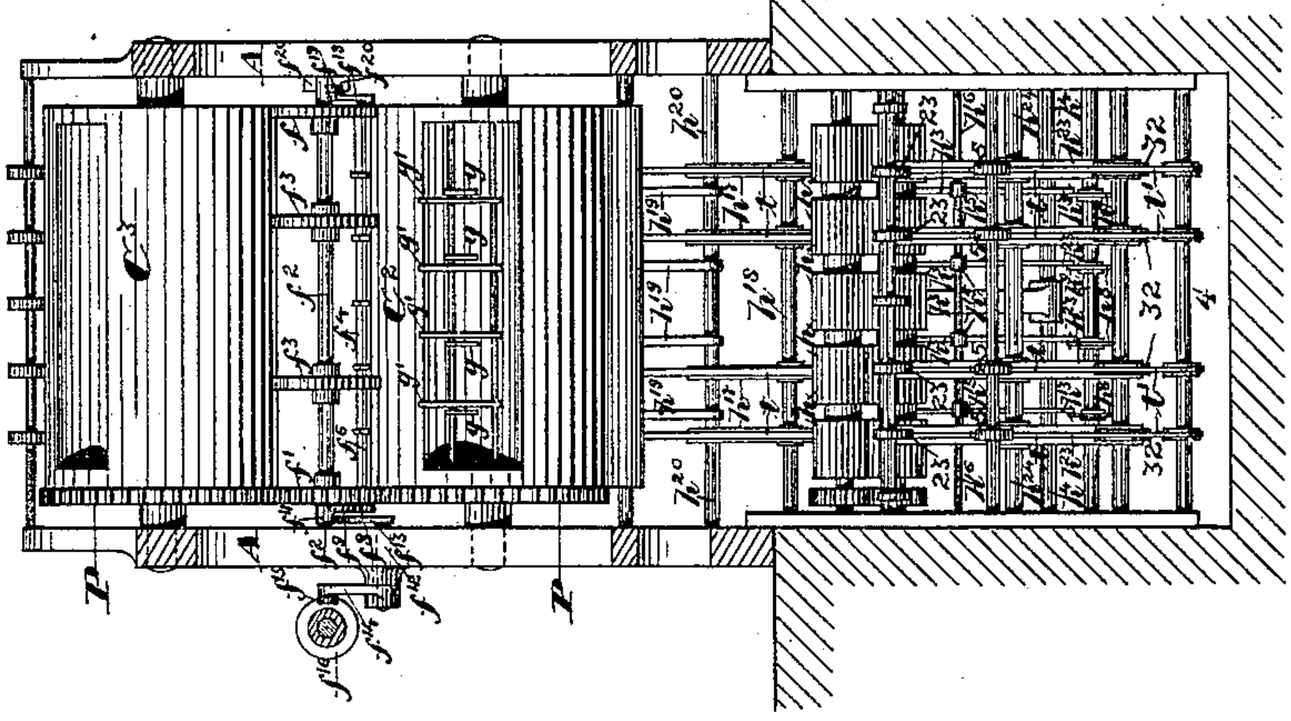


Fig. 4.

Section, x—x.



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UNITED STATES PATENT OFFICE.

JOHN T. HAWKINS, OF TAUNTON, MASSACHUSETTS.

PAPER-FOLDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 332,520, dated December 15, 1885.

Application filed November 8, 1884. Serial No. 147,459. (No model.)

To all whom it may concern:

Be it known that I, JOHN T. HAWKINS, of Taunton, in the county of Bristol and State of Massachusetts, have invented a new and useful Folding-Machine, more particularly adapted for a folding attachment to perfecting printing-presses, which invention is fully set forth and illustrated in the following specification and accompanying drawings.

The object of this invention is to so make the first respective folds in the sheets as delivered to the folding-machine, with alternate sides uppermost, that they will arrive at the point for imparting their second respective folds with the same side uppermost, and be delivered from the machine at one place in uniform positions.

In the accompanying drawings, Figure 1 is a side elevation, Fig. 2 a longitudinal vertical outline section, and Fig. 3 an end elevation, of the delivery end of the machine, showing a perfecting-press in combination with or connected to the folding apparatus forming the subject of this invention. Fig. 4 is a transverse vertical section through X X, Fig. 1, looking toward the type or form cylinder.

In Figs. 3 and 4 several parts are omitted for the purpose of clearness in illustrating the parts shown.

In said drawings the letters A indicate the main frames of the machine. B indicates the type or form cylinder, carrying the two forms B′ B^2, one for each side of the sheets to be printed, and C C′ C^2 C^3 indicate impression-cylinders. R R′ indicate the rolls from which the webs of paper are fed to the machine, and *c c′* c^2 c^3 two pairs of sheet-cutting cylinders for severing the sheets as they are fed to the grippers of the impression-cylinders C and C^2, respectively. F indicates the ink-fountain; F′, form-inking rollers, and F^2 an ink ductor-roller.

The mechanism for operating the inking apparatus is omitted as not essential to this invention.

For each pair of the said impression-cylinders is a folding apparatus for making the first fold in the sheets, and, as they are duplicates of each other in all that relates to the making of the said first fold, a description of that apparatus receiving the sheets from the cylinders C^2 and C^3 will suffice for both until the description is reached of the mode of transferring the sheets from all four impression-cylinders to a common point to perfect their folding.

The letters *h* and *h′* indicate each a pair of folding-rollers; and h^2 indicates a double oscillating folding-blade secured to an arm, h^3, oscillating upon a rock-shaft, h^4, to which an arm, h^5, is secured, which in turn is operated by a rod, h^6, carrying on its upper end a roller (not shown) engaging a grooved cam, h^7, upon the shaft *s*. The folding-blade h^2 is thus made to alternately enter the bite of the pairs of folding-rollers *h h′*.

The letter h^8 indicates a series of double equal-armed levers attached to a rock-shaft, h^9. To rock-shaft h^9 is secured at one end a double equal-armed lever, h^{10}. To one end of this arm h^{10} is articulated a rod, h^{11}, carrying on its upper end a roller (not shown) engaging a grooved cam, h^{12}, on the shaft *s*.

The letter h^{13} indicates a series of guide wires or rods pivoted at their lower ends to the levers h^8, and h^{14} indicates a series of springs operating to keep the guide-rods h^{13} pressed outward against a series of rollers, h^{15}, carried on shafts h^{16}. The upper ends of the guide-rods h^{13} pass into grooves in the rollers *h* and *h′*, so that their surfaces are just above the peripheries of these rollers.

The letter h^{17} indicates a series of stationary guide-rods supported upon a stationary shaft, h^{18}, and extended downward till their lower ends just clear the folding-blade h^2. Their upper ends pass below the surface of a series of switches, h^{19}, secured to a rock-shaft, h^{20}. On the outer end of the rock-shaft h^{20} is secured an arm, h^{21}, which is connected by a rod, h^{22}, to one end of the double lever h^{10}, and therefore the switches h^{19} are operated through the lever h^{10} by the cam h^{12}.

The letter h^{23} indicates a series of guide-rods secured to stationary shafts h^{24}, the upper ends of which rods enter grooves in the lower roll of each pair of folding-rollers *h* and *h′*.

The letter h^{25} indicates a series of guide-rods secured to stationary shafts h^{26}.

The following numbered parts are each a series of tape-pulleys secured to their respective shafts—that is to say, from No. 1 to No. 33, inclusive.

The letter *t* indicates a series of tapes whose respective directions of motion are indicated by the arrow-heads.

The letter *t'* indicates another series of tapes whose directions of motion are similarly indicated by arrow-heads.

To indicate, now, the paths of tapes *t'*, commencing at pulleys 1, said tapes pass under 1, thence in contact with tapes *t* over 29, (where they separate from the tapes *t*,) thence downward in contact with the left-hand guide-rods h^{17}, thence under the upper of the folding-rollers *h'*, over the lower folding-roller *h'*, thence downward in contact with guides h^{23}, under 31, thence horizontally in contact with guides h^{25}, under 32, (from this point in contact with tapes *t*,) over 26, under 25, over 24, under 23, over 22, under 20, thence vertically and over 17, (at this point separating from tapes t^3,) thence horizontally in contact with guides h^{25}, over and under 8, returning over 7, under 6, over 5, under 4, under 3, and over 2 to point of starting.

To indicate, now, the path of tapes *t*, commencing at the same point, said tapes are in contact there with tapes *t'* and pass over 29, (separating from tapes *t'*,) thence downward in contact with the right-hand guides h^{17}, under the upper folding-roller *h*, over the lower roller, *h*, thence downward in contact with guides h^{23}, under 32, (from this point in contact with tapes *t'*,) over 26, under 25, over 24, under 23, over 22, under 20, upward over 19, (at this point separating from tapes *t'*,) downward under 21, under 27, upward over 28 to the point of starting.

The letters t^2 and t^3 also indicate two other series of tapes, whose directions of motion are also indicated by arrow-heads. Tracing the path of tapes t^3, commencing at 11, said tapes pass over the stripper-fingers S^3 and pulleys 13, (coming in contact with tapes t^2,) pass under 12, over 15, (at this point separating from tapes t^2,) downward in contact with the right-hand guides h^{17}, under the upper folding-roller *h'*, over the lower roller *h'*, downward in contact with guides h^{23}, under 9 vertically, and over 10, over and returning under 11 to place of starting. Commencing with tapes t^2 at the top of 13, said tapes pass (in contact with tapes t^3) under 12, over 15, (where they separate from tapes t^3,) downward in contact with the left-hand guides h^{17}, under the upper folding-roller *h*, and over the under roller *h*, downward in contact with the guides h^{23}, under 18, upward over 14, and under and over 13 to place of starting. Motion is given to all these tapes by the folding-rollers *h* and *h'*, as driven from the shaft *s* by the several bevel and spur gears. (Plainly shown in Fig. 1, and not necessary to indicate by letter or number.) The switches h^{19} pass between the tapes at their points. The pulleys 33 have no tapes running upon them, and only serve to guide the sheets brought downward by tapes t^2 under said pulley 33, and thence on top of tapes *t'* to the rollers, for making the second fold. A series of stationary switches, V, deflect the sheets coming from the left-hand side of the right-hand folding apparatus and the sheets coming from both sides of the left-hand folding apparatus under pulleys 33 and over 17, respectively, into the common horizontal path to the rollers, for making the second fold.

V' indicates a pair of folding-rollers for making the second fold, and V^2 a folding-blade attached to an arm, V^3, which in turn is secured to a rock-shaft, V^4. To V^4 is secured a lever, V^5, connecting to a rod, V^6, carrying on its upper end a roller (not shown) engaging a grooved cam, V^7, having a groove of proper shape, as shown in Fig. 3, to give two motions to the folding-blade V^2 for each revolution of the shaft *s* or type-cylinder B. The shaft *s* is driven from the shaft of the type-cylinder B by the miter-wheels W and W'.

The method of imparting motion to the cutting-cylinders and other rotary members is so plainly shown in Fig. 1 as not to require further indication by letters or figures.

It will be observed that the sheets are fed to and taken by the grippers of cylinder C at its top and delivered perfected from the bottom of cylinder C', whereas the sheets are fed to and taken by the grippers of the cylinders C^2 at its bottom and delivered perfected from the top of cylinder C^3. As the impression-cylinders take a sheet at every revolution, and make an impression at the meeting of each form as it passes, the sheets printed by any one impression-cylinder will be printed on alternate sides—that is to say, if the outside of the paper is first printed by cylinder C its next sheet will receive its impression on the form for the inside, and when cylinder C prints the outside of a sheet cylinder C' prints the inside of the same sheet, and conversely, when cylinder C prints the inside cylinder C' prints the outside of the same sheet. In this way each perfected sheet when delivered from cylinder C' by the operation of opening its grippers *g* (and its sheet-lifter fingers *g'* depressing the sheet to pass under the stripper-fingers S^2) will issue at this point with an alternate side uppermost, and if carried directly in this position to a single pair of folding-rollers would be folded alternately right and wrong side out. To avoid this and make the first fold in every sheet in the same direction as to its inside or outside, the sheets pass between the tapes *t* and *t'* to the switches h^{19}, which are so operated by the cam h^{12} as to pass the sheets alternately to the right and left of themselves. The double folding-blade h^2 is, as heretofore described, moved so as to alternately tuck the sheets into the bite of the rollers *h* and *h'*, the blade h^2 meeting in each case the inside of the sheet. The vibrating or sliding guides h^{13} are for the purpose of keeping the descending sheets from coming in contact with the lower roller of each pair of rollers *h* and *h'*. Said rollers running in a direction the reverse of the motion of the

sheet would be liable to obstruct its free passage downward unless the sheet was protected from contact with them. The guides h^{13} provide a smooth path for the head of the sheet down into the space between the arm h^3 and said vibrating guides h^{13}. Such motion is given to these guides by the cam h^{12} as to be isochronous with the motion of the folding-blade h^2, and so that when the blade is about to enter between the rollers h the guides h^{13} cover the lower roller of the rollers h', down which a sheet will be passing, and vice versa.

Following the course of the four series of tapes, as above described, it will be seen that the sheets (the several distances of travel of the sheets being properly adjusted) will be presented to the second fold-rollers alternately from each pair of impression-cylinders with the first fold made in them, and all with the same side up. From this point the sheets may be given as many additional folds by the usual well-known means as may be desired. The rock-shaft Z carries the series of tape-wheels 23, running on studs Z^2 in the arm Z^3, for the double purpose of tightening the tapes t and t' and varying the distance between the tape-wheels 26, and 20 in order to nicely adjust the time of arrival of the sheets from the left-hand folder at the common point of receiving the second fold.

The construction here shown is for a folio sheet making the first fold parallel with the column-rules; but it will be understood that it may be adapted to a quarto sheet, which requires the first fold to be made transversely to the column-rules by placing the fold-rollers h and h' and the double oscillating folder-blade at right angles to the position shown, and replacing the vibratory guides h^{13} with stationary guides, and running the tapes in proper directions to suit this arrangement. It will also be obvious that instead of delivering the sheets all at one end of the machine the arrangement of the folding apparatus and tapes t^2 and t^3 may be the same for both ends of the machine, as is shown for cylinders C^2 and C^3, with separate apparatus for completing the further folding at each end of the machine. It will also be clear that this machine may be constructed with but one pair of impression-cylinders and one complete folding apparatus as a cheaper construction for papers with a circulation smaller than such as would require the four-cylinder machine, as drawn and described.

I do not herein claim any of the printing apparatus herein shown, the same being claimed in another application now pending bearing the serial No. 121,083, filed February 18, 1884.

Having thus fully described my said folding apparatus as of my invention, I claim—

1. In a paper-folding machine, an apparatus for making the first fold, consisting of a series of switches, as h^{19}, to deflect the sheets into alternate separate paths, a series of inclined guides, as h^{17}, to guide the sheets alternately to each of two pairs of folding-rollers, as $h\,h'$, and a double oscillating folder-blade, as h^2, said rollers and blade co-operating to tuck the sheets alternately into each of the two pairs of folding-rollers, two sets of sliding or vibrating guides, as h^{13}, to protect the sheets from one roller of each pair of folding-rollers, (which runs in a contrary direction to that of the sheet,) and suitable tapes, as t^2 t^3, and guides, as h^{23} h^{26}, for conveying the sheets after receiving the first fold, all with the same side uppermost, to a common point to receive the second and succeeding folds, substantially as and for the purposes set forth.

2. In a paper-folding machine, in combination with two separate folding apparatuses, a series of tapes, as t t' t^2 t^3, respectively leading, as described, from over and under pulleys numbered from 1 to 33, inclusive, and in contact with the respective guides, guide-rods, rollers, and strippers described, whereby the sheets respectively received by each of said folding apparatuses have therein imparted to them a first fold, and are thence conveyed to a common point to receive their second or succeeding folds, substantially as and for the purposes set forth.

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