3 Sheets—Sheet 1.

S. D. TUCKER.

PAPER-FOLDING MACHINE.

No. 186,384. Patented Jan. 16, 1877.

FIG. 2.

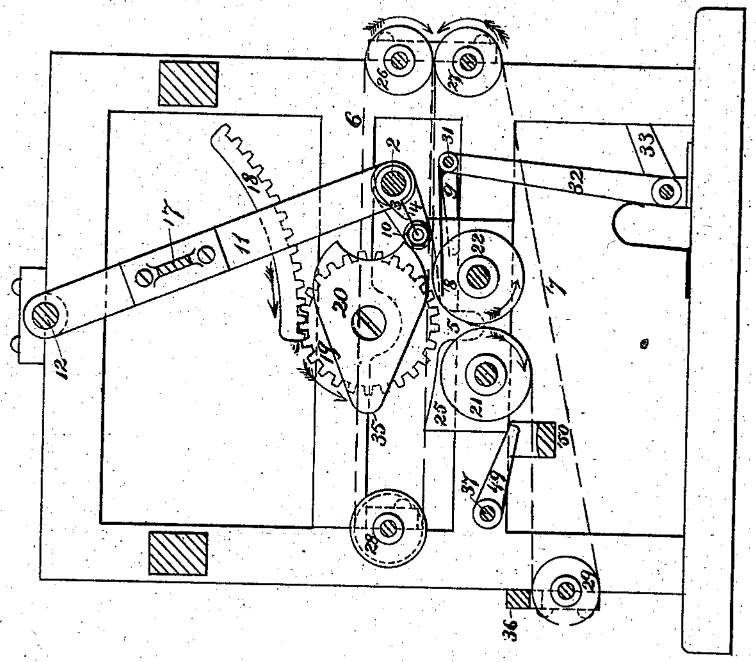
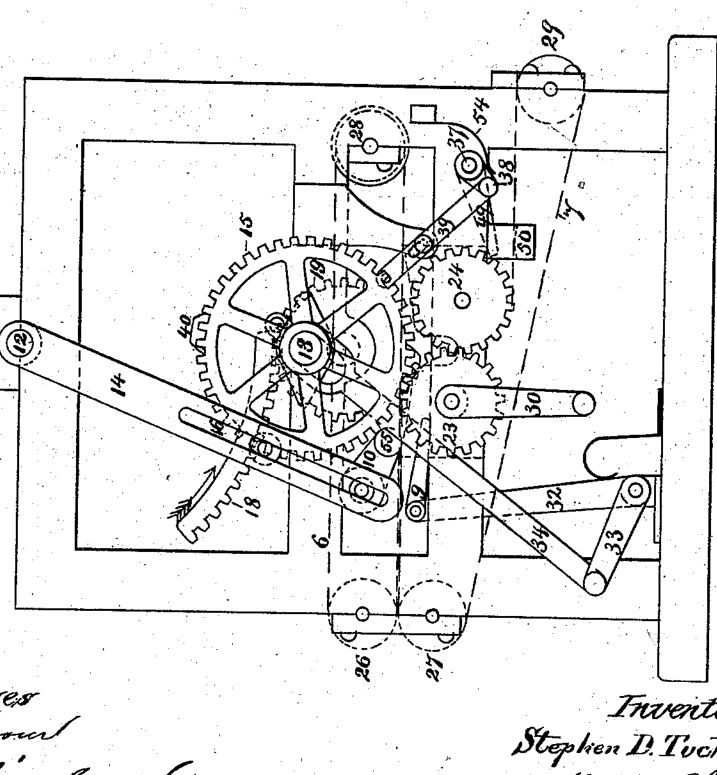


FIG. 1.



Witnesses
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L. A. Grissabaugh

Inventor:
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by Munson & Philipp, att'ys.

N. PETERS, PHOTO-LITHOGRAPHER WASHINGTON, D. C.

3 Sheets—Sheet 2.

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FIG. 7.

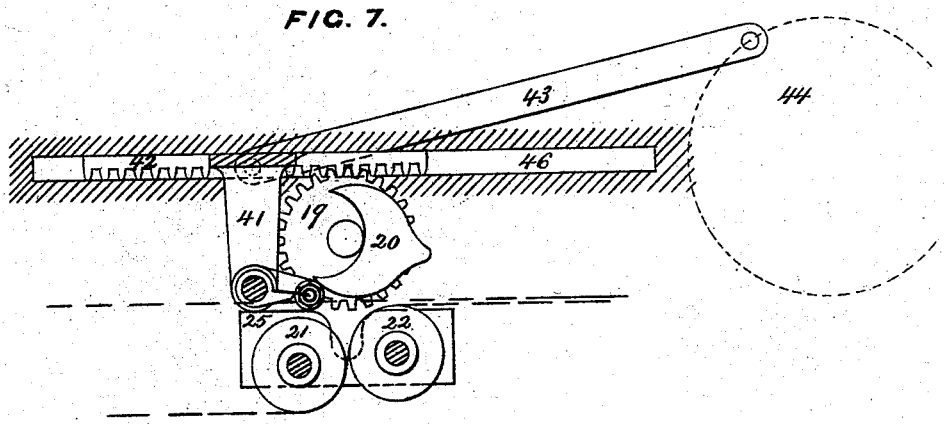

FIG. 5.

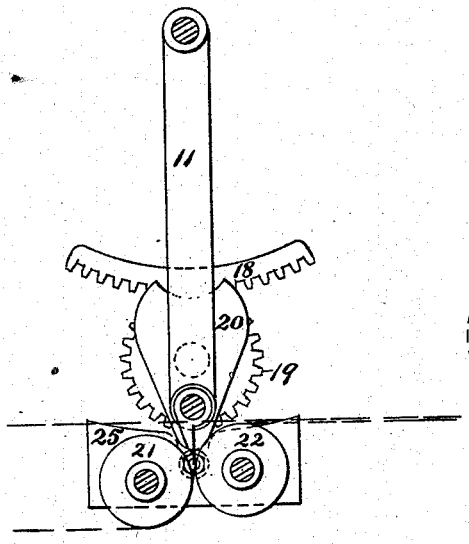

FIG. 6.

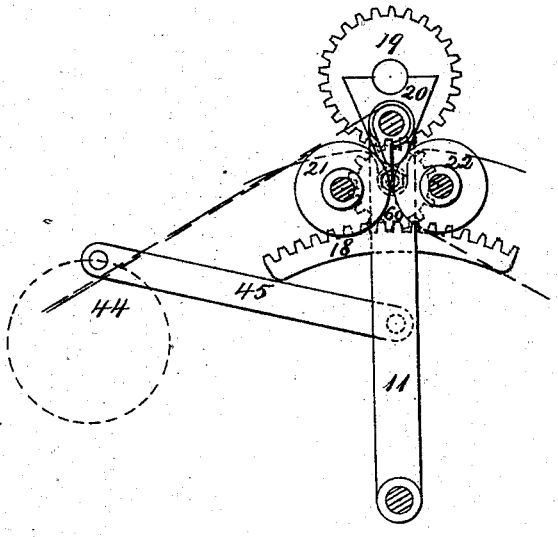

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FIG. 3.

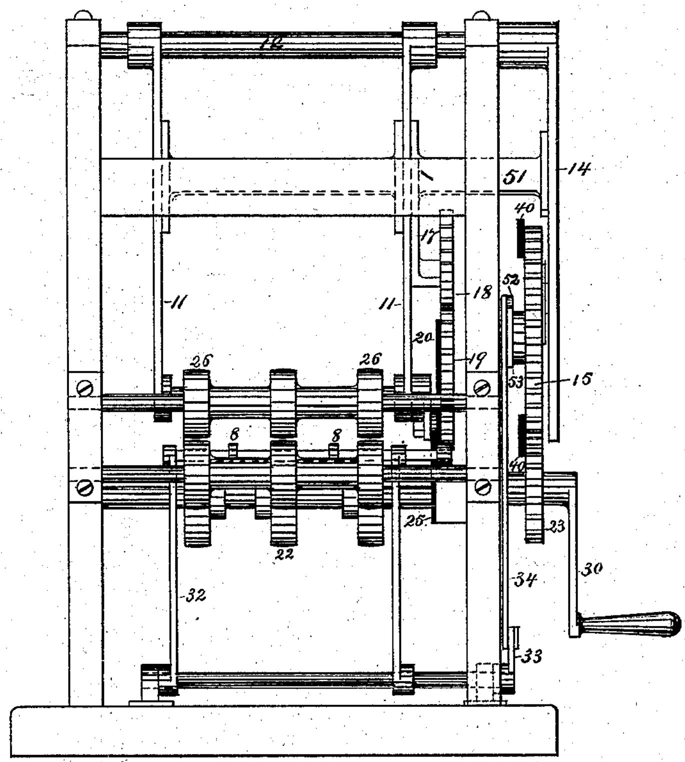
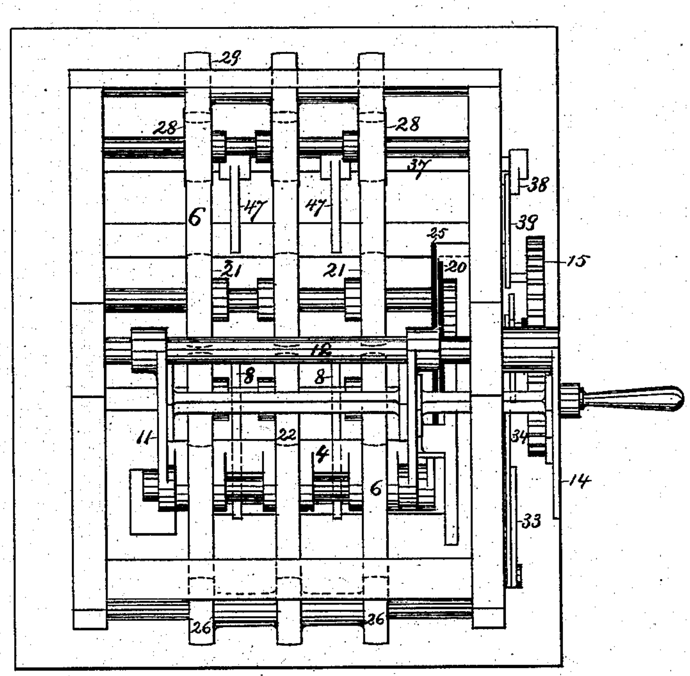


FIG. 4.



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UNITED STATES PATENT OFFICE.

STEPHEN D. TUCKER, OF NEW YORK, N. Y.

IMPROVEMENT IN PAPER-FOLDING MACHINES.

Specification forming part of Letters Patent No. **186,384**, dated January 16, 1877; application filed April 20, 1876.

To all whom it may concern:

Be it known that I, STEPHEN D. TUCKER, of the city, county, and State of New York, have invented certain new and useful Improvements in Partially-Rotating Folding-Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, in which—

Figure 1 is a right-hand side elevation; Fig. 2, a sectional view as seen from the left-hand side; Fig. 3, an end view; Fig. 4, a top view; Fig. 5, the folding-blade in the act of doubling the sheet into the folding-rollers; Fig. 6, a modification in which the folding-blade carrier vibrates on a center placed below the folding-rollers, and Fig. 7 a modification in which the folding-blade carrier is reciprocated in a right line.

This invention relates to that class of fabric-folding mechanisms in which the folding-blade turns on a center, and is supported in a carrier which moves it to and from the folding-rollers, the combined effect of which motions is to cause the folding-blade to enter the folding-rollers in the operation of folding the sheet, and to retreat therefrom and repeat the operation.

This invention consists in a carrier moving to and fro, and supporting a partially-rotating folding-blade adapted to operate with folding-rollers, or other sheet-receiving device, as well as in modifications and details fully hereinafter described.

The folding-blade carrier consists of two or more arms, 11, depending from a shaft, 12, which is journaled in the frame-work. The folding-blade shaft 2 is hung in the lower ends of these arms, and to it the folding-blade 4 is secured by means of two or more collared arms, 3, Fig. 2. This folding-blade carrier is vibrated or reciprocated by means of a pin attached to the rim of a toothed wheel, 15, which pin runs in a slot, 16, on a lever, 14, which lever, fastened upon the shaft 12, is tied to the arms 11 by a brace or rod, 51, and extends downward outside of the frame-work. One of the arms 11 carries a toothed segment, 18, which is consequently vibrated with the folding-blade carrier by means of the lever 14. The toothed segment 18 gears with a toothed wheel, 19, hung on a short shaft fixed in the side frame, which wheel 19 has secured to its inner face a triangular flying cam, 20. A partial rotation is thus imparted to the wheel 19, and a partial rotation of the cam 20 results. Folding-rollers 21 and 22 turn in bearings in the side frames, and are rotated by toothed wheels 23 and 24 meshing together, one of which, 23, drives the toothed wheel 15.

A stationary or female cam, 25, is fixed to the side frame, but at such a distance from it as to be out of the vertical plane occupied by the vibrating or flying cam 20. The bearing-surface of this female cam is inclined from its outer ends toward its center, where it takes quick turns and forms a curved recess or seat, 5, for a purpose to be explained. These devices form the folding mechanism proper.

The sheet feeding and controlling devices, though they form no part of the present invention, and are therefore not herein claimed, will be described in connection with the operation of the machine, which is as follows: The sheets of paper are introduced between the feeding-rollers 26 and 27, which direct each sheet between endless tapes 6 and 7, of which tapes the former are stretched around the roller 26, to and around a roller, 28, on the opposite side of the machine, while the tapes 7 run from the roller 27, over the folding-roller 22, under the folding-roller 21, around a roller, 29, and are returned to the roller 27. The tapes 7 are driven by the folding-rollers, and the tapes 6 by the contact of the roller 26 with the roller 27, though the rollers 26 and 27 may be geared together for this purpose.

Each sheet is delivered to the feeding-rollers 26 and 27 at the proper time to bring its middle portion, or that point at which the desired fold is to be made, over the folding-rollers at the moment when the folding-blade is carried to and projected between said rollers, and will ultimately fold said sheet, as will be presently explained.

As the sheet moves forward toward the folding-rollers, it is apparent, since it is supported on the lower tapes 7, that its leading end will be liable to follow and be carried by them between said folding-rollers. To prevent this and insure its being carried over the top of the folding-roller 21, a series of reciprocating guide-rods, 8, are provided. These rods project

from a shaft, 31, which is supported in the ends of levers 32, and vibrated by an arm, 33, and connecting-rod 34, which latter is bifurcated at one end, to straddle the shaft 13 and receive a reciprocating movement from a cam, 53, on the shaft 13, which bears upon a friction-roller, 52, carried by the rod 34. This motion is timed to advance the guide-rods 8, so as to form a bridge upon which the leading end of the sheet passes over the opening between the folding-rollers, and to withdraw the said rods to permit the folding-blade and the sheet it doubles to pass between the folding-rollers. These guide-rods are supported in the proper plane, during all of their movements, by an arm, 9, which rests upon the frame-work or a horizontal way.

As the folding-blade carrier and toothed segments 18 move forward, driven, as before described, by the toothed wheel 15, the pin or friction-roll 55, Fig. 1, on the arm 10 of the folding-blade shaft, will engage one face of the flying-cam 20, as in Fig. 2; and as the said flying-cam is actuated through the toothed segment 18 and the toothed wheel 19 from the same toothed wheel 15, it is rotated in unison with the folding-blade carrier, but in a contrary direction, and thus presents to the pin or roll 55 on the advancing arm 10 constantly-varying portions of its surface. This flying-cam is so shaped as to form a passage or guideway between its face and that of the fixed or female cam 25 at the points successively occupied by the pin or friction-roll 55 on the arm 10, equal to the diameter of said pin or friction-roll. This pin or friction-roll is thus forced to follow the curved surface of the fixed cam 25, and carries with it the folding-blade 14, which it projects between the folding-rollers.

When the arm 10 reaches the curved seat 5, as in Fig. 5, the point 35 of the flying-cam will pass by the pin or roller on the arm 10, which will then follow the guideway formed between the opposite side of the flying-cam 20 and the fixed cam 25, the effect of which will be to withdraw the blade from the folding rollers by a movement precisely the reverse of that which entered it between them.

During this movement the middle or folding point of the sheet will have reached the proper position over the folding-rollers, and been doubled by the folding-blade into the bite of the folding-rollers, between which it is rapidly carried by their rotation, and, guided by the tapes 7, is delivered out of the machine for further folds.

While the doubled sheet is going through the folding-rollers, the folding-blade carrier continues to move forward to the extent of its vibration, is reversed, and returned to repeat the operation, a new sheet being entered at the rollers 26 and 27, to be operated upon as just described.

As illustrated, the machine is arranged to be double-acting—that is, it may fold a sheet at each vibration of the folding-blade carrier—one during its forward throw and one during its backward throw. But it is requisite that the folding-blade should always force the sheet into the folding-rollers at about the same speed that the sheet travels forward, so that there shall be no accumulation of paper behind it through the stoppage of the paper at the point of folding. In the forward motion, when the paper and folding-blade move in the same direction, this is done by feeding the paper at the same speed at which the folding-blade moves; but on the return or rearward stroke of the folding-blade, in which it travels in a direction contrary to that in which the sheet is moving, the motion of the folding-blade must be accelerated, so as to force the paper quickly into the bite of the folding-rollers, and thus compensate for the forward motion of the sheet and prevent its accumulation. This is accomplished by the arrangement of the crank-pin working in the slot of the lever 14, which, by its varying position in the lever, causes the blade in its forward movement to travel at the same speed as the sheet moves, but on the return stroke causes the blade to travel at about double that speed. This may be done also by a cam. It is always requisite that the blade should remain exactly the same length of time each side of the folding-rollers.

When the folded sheet emerges from the folding-rollers, it may be guided by the tapes 7, or by any other means—such as rods—to a mechanism for producing a second fold, and this duplication of folds may be repeated at will, as is commonly done in folding-machines. In thus directing the sheet from one to another set of folding-rollers, especially from the first to the second set, when it is required to be moved with great velocity over a short distance, it has been found difficult to stop it against a fixed gage—as 36—so that it shall not recoil or buckle up, but lie in proper position or register for the new fold. This is accomplished by a brake mechanism, which is automatically brought into contact with the surface of the sheet in such a manner as to retard its motion, so that its movement shall be slow at the time when it reaches the said gage, thus enabling it to gently abut against the gage and adjust itself in contact with the face of the gage without danger of misplacement. The brake consists of arms 49, fast on a shaft, 37, rocked at the proper time by a crank-arm, 38, and connecting-rod 39, which latter is reciprocated by tappets 40, fixed on the wheel 15. These arms 49 are thus vibrated as often as is required by the number of sheets fed—that is, according as the machine is double or single acting, as before explained. These arms 49 are carried down quickly, and momentarily press the rear end of the sheet onto stationary blocks 50, thus momentarily stopping its movement at a time when its leading or folded edge is nearly up to the gage 36. These arms 49 are quickly raised by the spring 54, and the sheet thus released recovers its motion from the tapes 7, but so gradually that

it is moving slowly onward when it strikes the gage 36, against which it is stopped and rests in register for the next fold. These arms 49 may be arranged to press upon the sheet by their own weight, which may be augmented by springs, as the practical operation may require. They will thus so press the sheet onto the blocks 50 as to create a frictional contact sufficient to retard the motion of the sheet and accomplish its proper register against the gage 36, and yet permit it to move over the greater part of the distance it travels with a speed which will permit one sheet to be kept from interfering with that which follows it.

As has been described, this machine may be double or single acting. When made to fold when the folding-blade carrier moves in one direction only, but half the number of sheets will be supplied at the rollers 26 and 27, and the blade, in returning, will enter the folding-rollers through the space between two succeeding sheets, but will touch neither. In this mode of operation the blade may be vibrated at the same speed in both directions by a crank and connecting-rod, as shown in Fig. 6, where the folding-blade carrier is represented as vibrating from a center placed below the folding-rollers. In this modification an idler, 60, between the segment 18 and wheel 19, transmits the motion from one to the other.

In Fig. 7, a right-line movement of the folding-blade carrier is shown. In this modification a rack, 42, fixed to the carrier 41, and guided in a way, 46, imparts the motion to the wheel 19 and cam 20, which arrangement gives the proper movement to the folding-blade.

This whole folding mechanism, though it is capable of operating as an independent machine, is intended to form part of one machine with a printing-press.

As an independent machine, it may have the sheets fed to the rollers 26 and 27 by hand from a feed-table, or by any automatic apparatus.

When joined to a printing-press of that type known as "web-perfecting," such as print the web upon both sides and cut it into sheets, the folding-rollers may be driven by a train of wheels and the folding-blade vibrated by a crank-motion taken from some part of the printing-press.

In Figs. 6 and 7 the dotted circle 44 illustrates such a crank-motion.

The printing and cutting mechanism will, of course, be timed to perfectly co-operate with the folding mechanism, and to present the sheets in succession at proper intervals of time, according as the machine is working as a double or single acting mechanism. A quick return or rearward movement of the folding-blade carrier, as hereinbefore described, is preferable in the former case, and may be employed when the mechanism is single-acting. In either case the folding-blade carrier may be vibrated by properly-shaped cams in place of a crank. The tapes are not essential, as guide-rods may direct the sheets. The folding-blade and folding-rollers, which are cut away, so as not to interfere with the tapes, might be continuous, when the latter might be slightly grooved to accommodate the reciprocating guide-bars 8; but if the devices be arranged so that the folding-blade carrier vibrates or reciprocates in a vertical plane, even these bars 8 might be omitted, as the sheet would then descend past the rollers by its gravity.

Having thus set forth the nature and operation of my improvements, what I claim is—

1. A folding-blade moved over the coacting folding devices, and partially rotated to enter between the same by mechanism, substantially as described.

2. A folding-blade partially rotated, combined with, and moved to and fro over folding-rollers, so as to co-operate therewith, substantially as described.

3. A folding-blade partially rotated and moved to and fro over folding-rollers, so as to co-operate therewith, in combination with sheet-feeding devices, substantially as described.

4. The combination of a folding-blade carrier having a to-and-fro movement over the coacting folding devices, a partially-rotating folding-blade carried thereby, and sheet-receiving devices, substantially as described.

5. The combination of a folding-blade carrier having a to-and-fro movement, a partially-rotating folding-blade carried thereby, and folding-rollers, substantially as described.

6. The combination of a folding-blade carrier having a to-and-fro movement with a crank or cam-actuating motion, a partially-rotating folding-blade, flying-cam, and stationary cam, substantially as described.

7. A folding-blade partially rotated and moved to and fro over coacting folding devices, in combination with a flying-cam and stationary cam, substantially as described.

8. The combination of a folding-blade carrier having a to-and-fro movement, a partially-rotating folding-blade carried thereby, a flying-cam, and stationary cam, all substantially as described.

9. The combination of a folding-blade carrier having a to-and-fro movement, toothed segment, toothed wheel, and flying-cam, substantially as described.

10. The combination of a folding-blade carrier having a to-and-fro movement, toothed segment, toothed wheel, flying-cam, stationary cam, and partially-rotating folding-blade, substantially as described.

11. The combination of a folding-blade carrier having a to-and-fro movement, toothed segment, toothed wheel, flying-cam, stationary cam, partially-rotating folding-blade, and folding-rollers, substantially as described.

12. The combination of toothed wheel 15, lever 14, toothed segment 18, toothed wheel 19, and flying-cam, substantially as described.

13. The combination of toothed wheel 15, lever 14, toothed segment 18, toothed wheel 19, flying-cam, and stationary cam, substantially as described.

14. The combination of toothed wheel 15, lever 14, toothed segment 18, toothed wheel 19, flying-cam, stationary cam, and folding-roller, substantially as described.

15. The combination of the folding-blade and the crank 15, or a cam with the slotted lever 12, for giving a slow forward motion and a quicker return to the folding-blade, for the purpose described.

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

STEPHEN D. TUCKER.

Witnesses:

CHAS. W. CARPENTER,

CHARLES VERNON PACE.