(No Model.) 3 Sheets—Sheet 1.

J. CARNES.

PAPER FOLDING MACHINE.

No. 484,295. Patented Oct. 11, 1892.

Fig. 1.

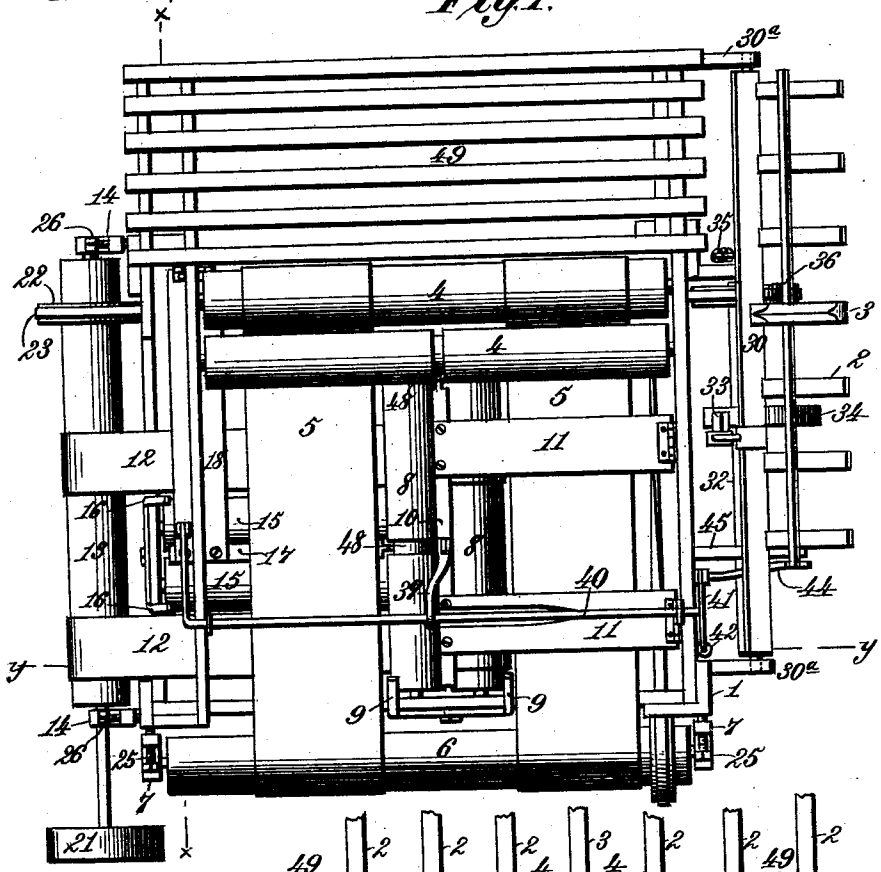
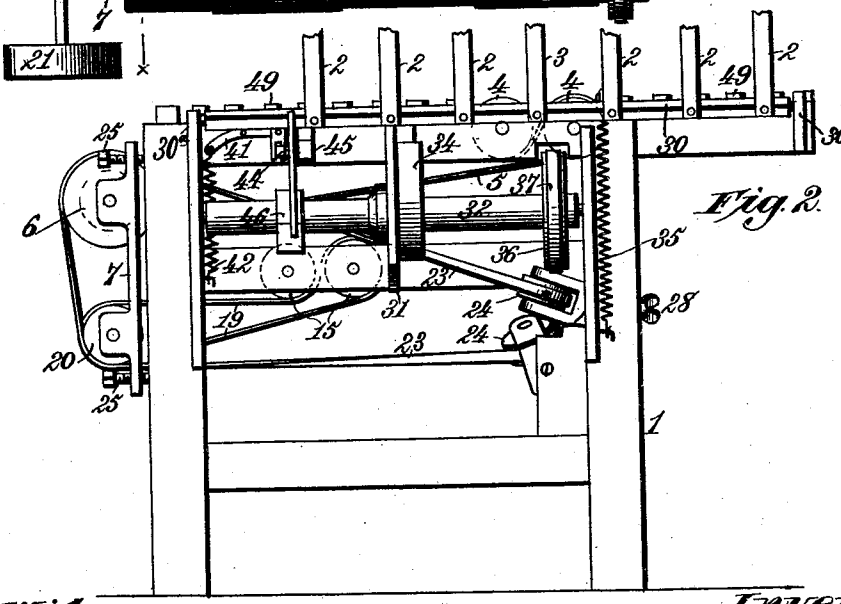


Fig. 2.



Witnesses.
Robt. Everett.
J. A. Rutherford.

Inventor
John Carnes.
By Munn & Co. Norris.
Atty.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 3 Sheets—Sheet 2.

J. CARNES.

PAPER FOLDING MACHINE.

No. 484,295. Patented Oct. 11, 1892.

Fig. 3.

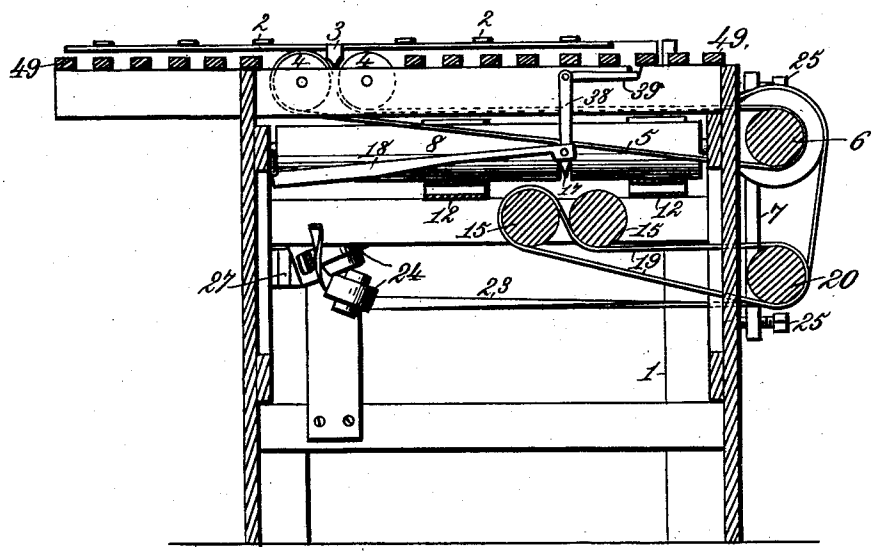
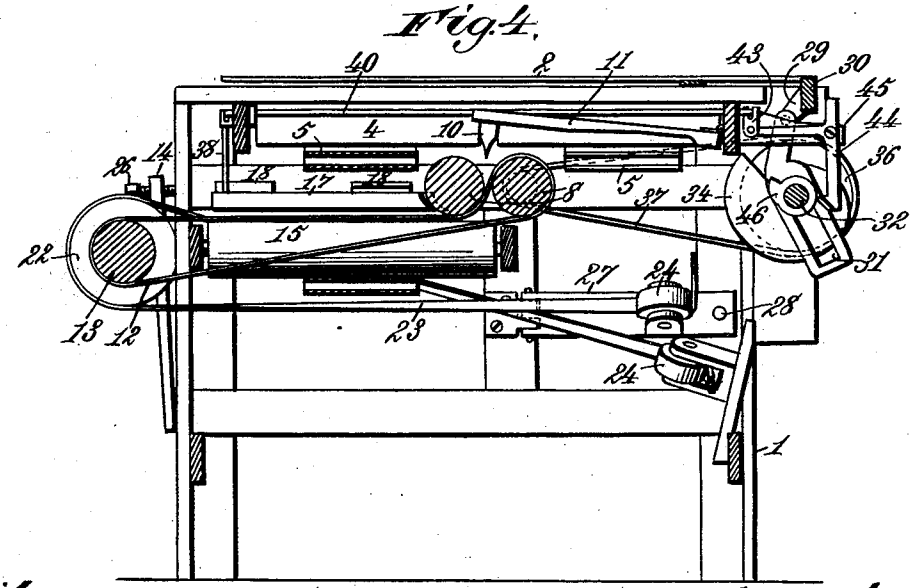


Fig. 4.



Witnesses.
Robt. Gwatt.
J. A. Rutherford.

Inventor.
John Carnes.
By James A. Norris. Atty.

THE MORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 3 Sheets—Sheet 3.

J. CARNES.

PAPER FOLDING MACHINE.

No. 484,295. Patented Oct. 11, 1892.

Fig. 5.

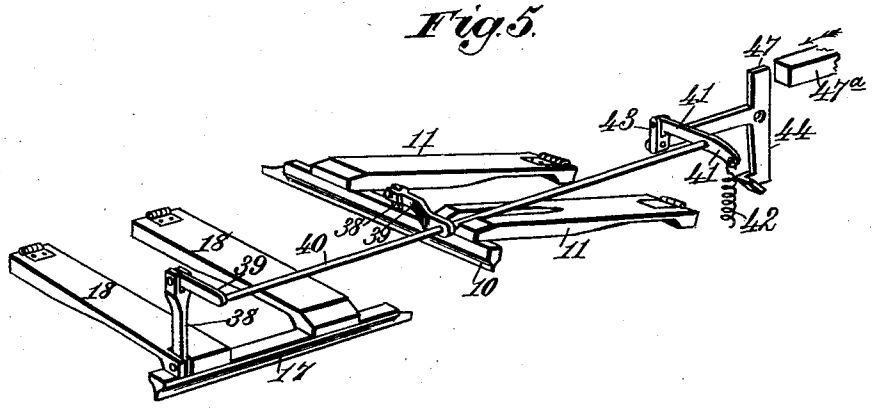


Fig. 6.

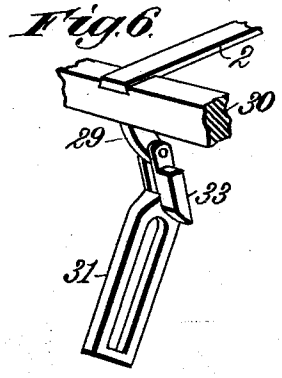


Fig. 7.

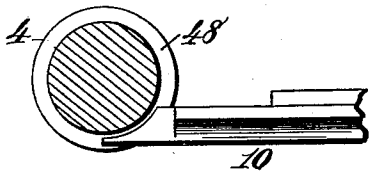
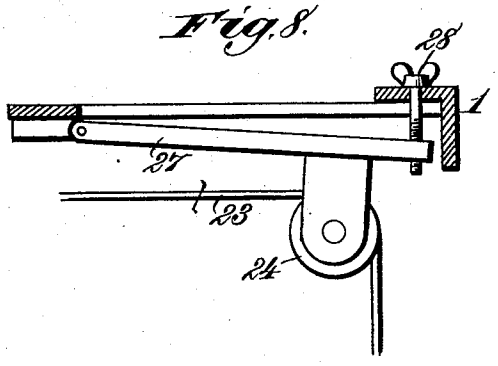


Fig. 8.



Witnesses.
Robert Quett.
J. A. Rutherford.

Inventor.
John Carnes.
By James L. Norris,
Atty.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOHN CARNES, OF LIMA, OHIO.

PAPER-FOLDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 484,295, dated October 11, 1892.

Application filed March 11, 1892. Serial No. 424,585. (No model.)

To all whom it may concern:

Be it known that I, JOHN CARNES, a citizen of the United States, residing at Lima, in the county of Allen and State of Ohio, have invented new and useful Improvements in Paper-Folding Machines, of which the following is a specification.

This invention relate to that class of paper-folding machines which comprises a series of folding-rolls and suitable shafts on which are mounted endless bands or tapes for conveying the paper through the machine, a series of oscillatory or vibratory folding blades or creasers for determining the several lines of fold and to hold the paper to the drawing action of the folding-rolls, and fenders or stops to arrest the feed of the paper sheets at intervals when they are in position to be folded or refolded.

My invention consists in certain features of construction and novel combinations of devices in a paper-folding machine, as hereinafter more particularly described and claimed.

In the annexed drawings, illustrating the invention, Figure 1 is a plan of my improved paper-folding machine with a portion of the slatted top or table removed. Fig. 2 is an elevation of the rear end of the machine or that end which will be adjacent to a printing-press when the folder and a printing-machine are employed conjointly. Fig. 3 is a vertical transverse section through the front end of the machine on the line $x\ x$ of Fig. 1. Fig. 4 is a vertical longitudinal section on the line y y of Fig. 1. Fig. 5 is a perspective of the second and third folding-blades and their operating mechanism. Fig. 6 is a detail view of a portion of the operating mechanism of the fly. Fig. 7 is a transverse section of a folding-roll, together with an elevation of a portion of an adjacent folding-blade. Fig. 8 is a detail view of a belt-tightener for the main driving-belt.

Referring to the drawings, the numeral 1 designates the machine-frame, which comprises suitable uprights or corner-posts and connecting cross-bars. At the rear of the machine is pivotally supported a fly 2, which is provided with a centrally-arranged folding-blade 3, that is rigidly secured to or integral with said fly and oscillates or vibrates therewith. In one side of the machine-frame, at its top, is journaled the first pair of folding-rolls 4, that coact with the folding-blade 3 in imparting the first fold to the paper. The folding-rolls 4 are arranged at right angles with the pivotal axis of the fly 2, and are in line with the folding-blade 3, which when lowered coincides with and enters the space between the tops of said rolls to crease the paper, and thereby determine the line of fold to be imparted by said rolls. On the outermost roll 4 of the first pair of folding-rolls are mounted endless bands or carrying-tapes 5, that pass beneath the innermost roll and then across the machine and around a shaft 6, that is journaled in adjustable bearings 7, attached to the outside of the machine-frame. By means of these endless bands or tapes 5 the once-folded sheet of paper is conveyed from the rolls 4 to a second pair of folding-rolls 8, that are journaled below the rolls 4 and extended at right angles thereto across the machine. When the paper has been carried by the traveling bands or tapes 5 into proper position on the rolls 8, a further progress of the paper in that direction is prevented by a stop or stops 9, located between the tapes 5 in proximity to the ends of the rolls. The stops 9 preferably consist of a continuous bent wire having its central portion secured to one of the cross-bars of the machine-frame and its ends bent upward and across said cross-bar toward the folding-rolls 8 and in position to arrest the horizontal movement of the paper. While the once-folded sheet of paper is thus made to rest across the rolls 8, a second crease at right angles to the first one is imparted to the paper by means of a second folding-blade 10, carried by arms 11, that are hinged or pivoted to the machine-frame. On the rearmost roll 8 are mounted endless bands or carrying-tapes 12, that are extended beneath the front one of these rolls and around a shaft 13, journaled in adjustable bearings 14 on the front of the machine. By means of the second folding-blade 10 the sheet of paper is creased and forced down into the space between the rolls 8 and onto the traveling tapes 12. In passing between the rolls 8 the paper is folded a second time, and is then conveyed by the tapes 12 to a third pair of folding-rolls 15, journaled below and at right angles to the second pair of rolls. The rolls 15 are arranged between the two paral-

lel tapes 12 in the same manner that the rolls 8 are arranged between the two parallel tapes 5, and at the other end of the third pair of folding-rolls 15 are arranged stops 16, preferably of the same construction as the stops 9, provided at the outer end of the second pair of folding-rolls. The movement of the paper above the rolls 15 having been arrested by the stops 16, a third crease will be imparted to the folded sheet of paper by means of a third folding-blade 17, carried by arms 18, that are hinged or pivoted to the frame of the machine. Mounted on one of the third pair of folding-rolls 15 and extended beneath the other roll of said pair is an endless belt or tape 19, that is passed around a shaft 20, journaled in the lower part of the adjustable bearings 7 at the side of the machine. After the paper has been creased and folded for the third time by the joint action of the folding-blade 17 and folding-rolls 15 it will be conveyed by the endless traveling band or tape 19 out of the machine.

Power for operating the machine may be applied by belting to a wheel or pulley 21 on the shaft 13, which is provided near one end with a pulley 22 for attachment of a belt 23, that is crossed between said pulley 22 and two guide-pulleys 24, supported in suitable bearings at the rear of the machine. From the guide-pulleys 24 the belt 23 is turned at right angles and extended across the rear of the machine-frame to and around the shafts 6 and 20, or pulleys mounted thereon. The endless bands or traveling tapes 5, 12, and 19 transmit motion from the shafts 6, 13, and 20, respectively, to the first, second, and third pairs of folding-rolls, one roll in each pair having a tape or tapes passed around it, while the other roll is actuated by the friction of the tape or tapes on its under side. In order to provide for tightening the several belts and tapes, the shafts 6 and 20 are mounted in adjustable bearings 7, having at their upper and lower ends set-screws 25, engaged in adjacent parts of the machine-frame, by which set-screws the bearings 7 and shafts mounted therein can be adjusted to tighten or slacken the belts and tapes, as required. The shaft 13 is mounted in adjustable bearings 14, having set-screws 26 in their upper ends for the same purpose. For the purpose of enabling the belt 23 to be tightened or loosened independent of the carrying-tapes one of the guide-pulleys 24 may be made to serve as a belt-tightener by being mounted in bearings secured to one end of an adjustable arm 27, having its other end hinged or pivoted to the frame of the machine. By means of a thumb-screw 28, supported in the machine-frame and engaged in said arm, the position of the belt-tightening pulley can be adjusted as required.

To a lug 29 on the pivotal bar 30 of the fly 2 is pivotally connected the upper end of a slotted cross-head or lever 31, that loosely embraces a rotary cam-shaft 32, mounted in suitable bearings at the rear of the machine. This slotted lever or cross-head 31 is provided on one side at its upper end with a lug or bearing 33, for contact with a cam 34 on the shaft 32, by which the fly is raised at intervals, the pivotal bar 30 of said fly being journaled at its ends in bearings 30^a at the rear of the machine. When the rotation of the cam 34, after raising the fly, has progressed far enough to release the lug 33 on the lever 31, the fly will be thrown or drawn onto the top of the machine by the tension of a spring 35 provided for that purpose. The cam-shaft 32 has mounted thereon a pulley 36 for attachment of a belt 37, by which the cam-shaft can be actuated from one of the second pair of folding-rolls.

The first folding-blade 3 is carried and actuated by the fly 2, as before described. The second and third folding-blades 10 and 17 are provided with levers 38, that connect with arms 39 on a rock-shaft 40, mounted in the upper part of the machine-frame. On the rear end of this rock-shaft 40 are two arms 41, to one of which is connected a spring 42, that acts on the rock-shaft 40 in such a manner as to normally hold the folding-blades 10 and 17 in an elevated position until the proper time for them to be forced down to crease the paper. To the other one of the rock-shaft arms 41 is pivoted a link 43, that connects with one arm of a bell-crank lever 44, pivoted to a bracket 45 on the rear of the machine. This bell-crank may be actuated at proper intervals to rock the shaft 40 and depress the folding-blades 10 and 17 by means of a cam 46, mounted on the shaft 32 in position to engage the depending arm of said bell-crank, and thereby oscillate the same for actuating the said second and third folding-blades. Instead of actuating the bell-crank 44 by means of the cam 46, the said bell-crank may have an upward-projecting arm 47 to be struck by a trip or lever 47^a, Fig. 5, that may be carried on a moving part of a printing-press.

The forward roll in the first and second pairs of folding-rolls 4 and 8 is preferably provided at or about the center with an annular or circumferential groove 48 to afford a clearance for the adjacent ends of the second and third folding-blades 10 and 17, which should be arranged to operate as close as possible to the preceding folding-rolls, so that the paper will be creased entirely across. The entering of the end of the folding-blade into the circumferential groove 48 also prevents the paper from being carried around the roll. Each of the folding-blades 3, 10, and 17 is formed with concavely-beveled sides to correspond with the curvature of the several pairs of folding-rolls and prevent wedging of the folding-blades between said rolls.

The top of the machine, onto which the paper is first thrown by the fly, preferably consists of a slatted frame 49, that may be formed in two or more sections for convenience in handling. A section of this slatted frame is to be placed on each side of the first pair of

folding-rolls 4 and substantially flush with the top thereof to assist in supporting the paper in readiness to receive the first crease and fold. By removal of this sectional top or slatted frame 49 ready access is given to the folding-rolls when required.

It will be observed that by arranging and operating the several devices in the manner described all cog-gearing is dispensed with and the various parts of the machine will act in successive time movements with proper relation to each other, as required, for folding and refolding the paper the desired number of times.

What I claim as my invention is—

1. In a paper-folding machine, the combination of several pairs of folding-rolls, each succeeding pair of rolls being below and at right angles to a preceding pair of rolls, endless belts or tapes for transmitting power to said rolls and conveying the paper from one pair of rolls to the next, and a number of oscillatory folding-blades each of which is adapted to enter the paper between a pair of rolls, the second and third folding-blades being arranged, respectively, at right angles to the first and second pairs of folding-rolls and the forward rolls of said first and second pairs of rolls being each provided with a central circumferential groove to receive one end of an adjacent folding-blade and enable it to make a crease entirely across the paper, substantially as described.

2. In a paper-folding machine, the combination, with the pairs of folding-rolls 4, 8, and 15, each succeeding pair of rolls being arranged below and at right angles to a preceding pair, and the forward roll in the first and second pairs being each provided with a central circumferential groove 48, of the folding-blades 3, 10, and 17, having concavely-beveled sides and adapted to crease the paper and enter it between the folding-rolls, the grooves 48 in the forward rolls of the first and second pairs of rolls being each arranged to receive one end of an adjacent folding-blade to enable it to make a crease entirely across the paper and prevent the paper from being carried around the rolls, substantially as described.

3. In a paper-folding machine, the combination of the folding-rolls 4, 8, and 15, arranged in three pairs, each succeeding pair below and at right angles to the preceding pair of rolls, the shafts 6 and 20, mounted in adjustable bearings 7, endless belts or tapes 5 and 19, connecting the first and third pairs of folding-rolls with said shafts, the driving-shaft 13, mounted at right angles to the shafts 6 and 20 in adjustable bearings 14, the endless belts or tapes 12, that connect said driving-shaft with the second pair of folding-rolls, the belt 23, by which the shafts 6 and 20 are driven from the shaft 13, and the guide-pulleys 24, that turn said belt at right angles to its shafts, one of said pulleys being mounted in adjustable bearings to serve as a belt-tightener, substantially as described.

4. In a paper-folding machine, the combination of a series of folding-rolls 4, 8, and 15, arranged in pairs, a fly 2, having a folding-blade 3 integral therewith and arranged at right angles to the pivotal bar or axis 30 of said fly, the second and third folding-blades 10 and 17, mounted on pivoted arms, the rock-shaft 40, connected with said folding-blades and provided at one end with arms 41, the spring 42, connected with one of said arms, and the bell-crank 44, connected with the other arm for operating the second and third folding-blades, the cam-shaft 32, having a cam 34 mounted thereon, and the slotted lever 31, loosely mounted on the cam-shaft and having its upper end pivotally connected with the fly, said lever provided with a lug or bearing 33 for the cam 34 to act on to raise the fly and attached folding-blade, substantially as described.

In testimony whereof I have hereunto set my hand and affixed my seal in presence of two subscribing witnesses.

JOHN CARNES. [L. S.]

Witnesses:
WM. MCCAMP, Jr.,
G. W. JAMES.