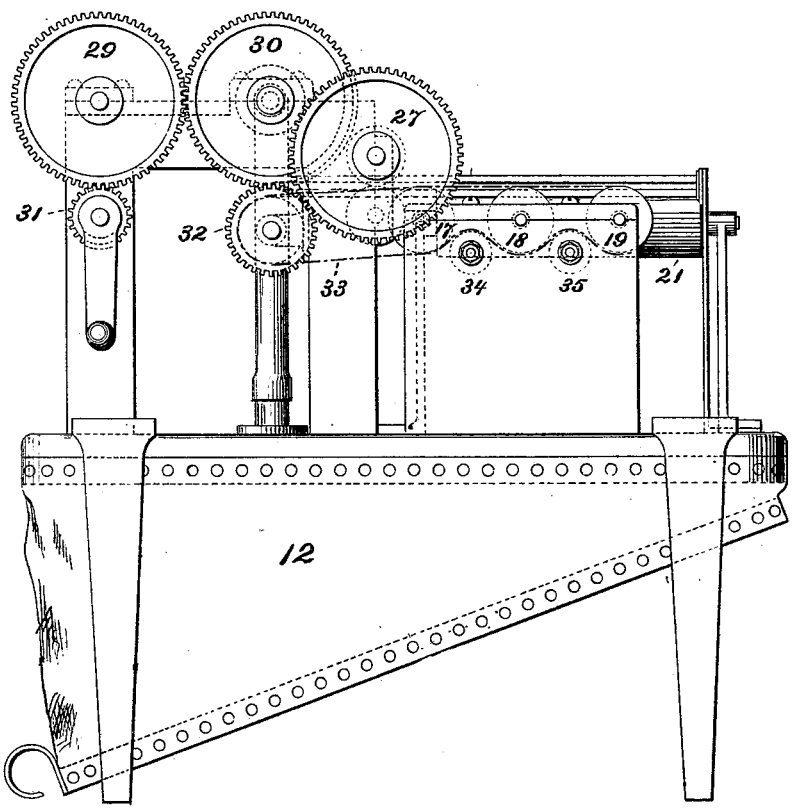
3 Sheets—Sheet 1.

S. D. TUCKER.

MACHINE FOR FOLDING PAPER.

No. 188,987. Patented March 27, 1877.

Fig. 1



Witnesses:
D. McSomers.
John F. Collins

Inventor:
Stephen D. Tucker,
by Munson & Philipp,
his Attorneys.

3 Sheets—Sheet 2.

S. D. TUCKER.

MACHINE FOR FOLDING PAPER.

No. 188,987. Patented March 27, 1877.

Fig. 1.

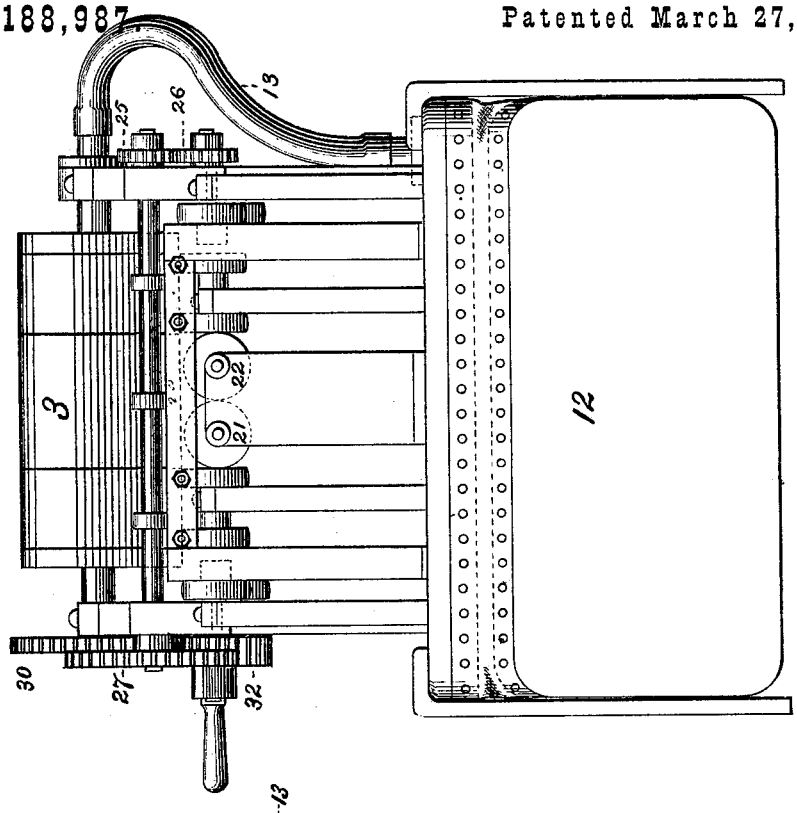
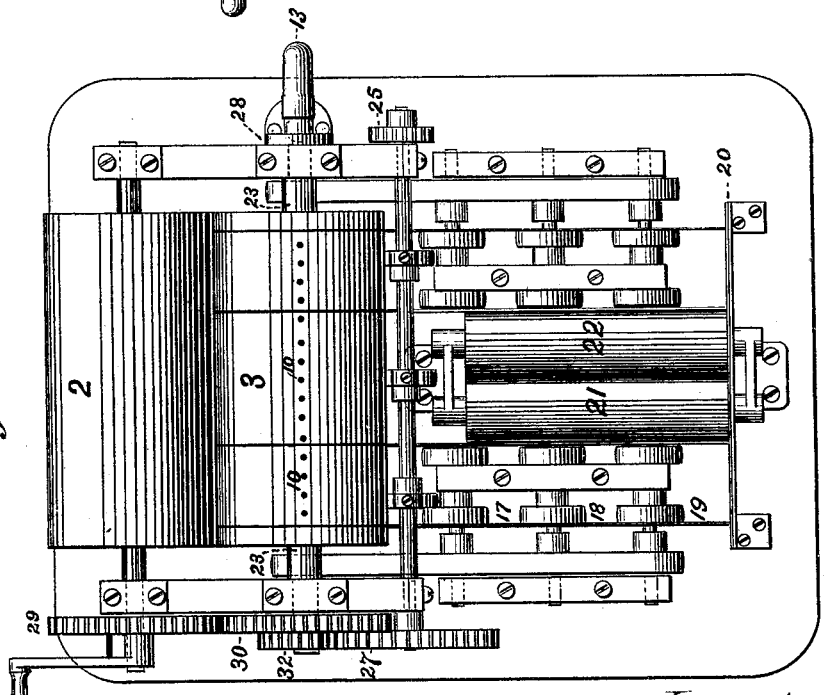


Fig. 2.



Witnesses
D. M. Somers
John F. Collins

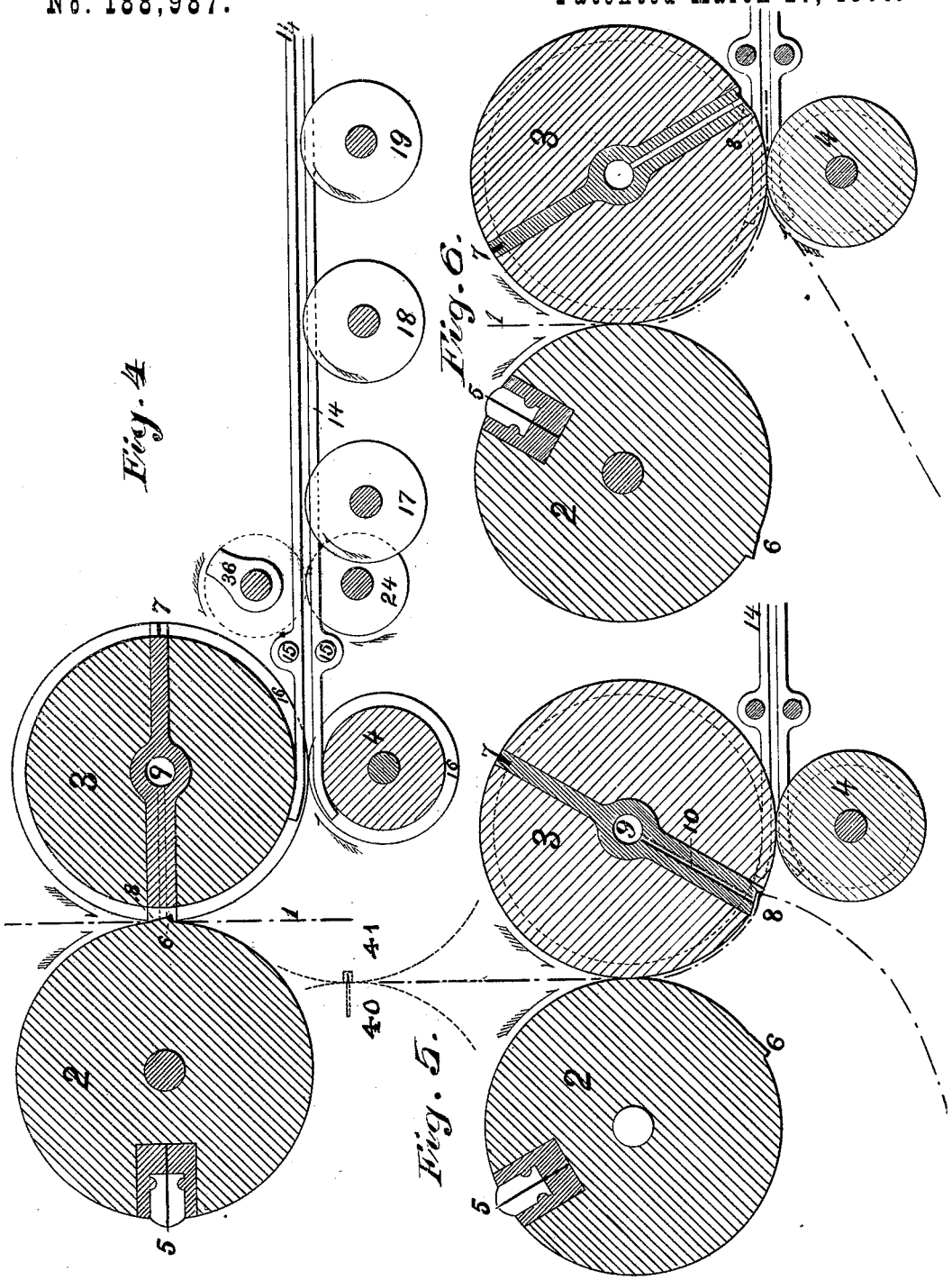
Inventor
Stephen D. Tucker,
by Munson & Philipp,
his Attorneys

3 Sheets—Sheet 3.

S. D. TUCKER.

MACHINE FOR FOLDING PAPER.

No. 188,987. Patented March 27, 1877.



Witnesses
D. McComus
John F. Collins.

Inventor
Stephen D. Tucker,
per Munson & Philipp
Attorneys.

UNITED STATES PATENT OFFICE.

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

IMPROVEMENT IN MACHINES FOR FOLDING PAPER.

Specification forming part of Letters Patent No. **188,987**, dated March 27, 1877; application filed March 18, 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 an Improvement in Machines for Folding Paper, of which the following is a specification:

In the accompanying drawings illustrating this invention is shown, in Figure 1, a side elevation, in Fig. 2 a top view, and in Fig. 3 an end view, of an apparatus embodying my improvements, while Figs. 4, 5, and 6 illustrate its details in sectional views.

Like characters indicate like parts in all of the figures.

This mechanism is designed for use in connection with a web-printing press, its function being to first fold a sheet of paper, and then sever it from the web or roll, it being one continuous progressive operation.

The printing-press is not illustrated, but may be of any of the known forms which operate upon a web of paper, and deliver it printed upon both its sides. Such a web is illustrated at 1, Figs. 4, 5, and 6, and is supposed to be emerging directly from the printing-press.

It is led through the bite of the cylinders 2 and 3, one of which, 2, is armed at one point of its periphery with a cutting blade or knife, 5, of any approved construction, (that described in my application filed November 27, 1875, being preferred,) and at a point of its periphery opposite to that occupied by the blade 5. This cylinder is armed with a creaser, 6. The other cylinder, 3, is provided with a female cutting device, 7, and a female creasing device, 8. The female cutter is adapted to the construction of cutting blade or knife used, and in this instance is simply a longitudinal slot cut into the periphery of the cylinder 3. The creaser 6 is formed by an angular rib projecting beyond the periphery of the cylinder, one face of which rib is so much shorter than the other, as to form an abrupt step, and the female creasing device is a recess in the periphery of the cylinder 3, formed to correspond in shape to that given to the creaser 6.

These creasing devices are so shaped that the paper is gradually pressed into the recess 8, until a firm hold upon it is secured at which time the highest part of the rib comes into operative contact with its female counterpart, and effects the doubling of the web at nearly right angles for a short distance, thus forming a preliminary crease upon which the web may be subsequently folded.

The creasing devices may be formed upon the face of metal plates let into the periphery of the cylinders, but in the present instance the female creaser is upon one edge of a casting, which, extending throughout the diameter of the cylinder, supports the female cutting device at its opposite end.

This casting is also extended at central points at its ends to form journals 23 upon which the cylinder 3 revolves. The cylinder 3 is bored centrally (in the construction shown through the casting and its journal) to form a pipe, 9, which constitutes a hollow axis resting in ordinary bearings in the frame-work.

One end of this hollow axis is closed by a plug or cap, and the other connects with a hollow extension-piece, 28, fixed to the side frame, and between the two an air-tight joint is maintained by packing.

A pipe, 13, connects the hollow axis through the extension-piece 28 with an air-exhaust apparatus, that shown being, for convenience of illustration, in the form of a bellows, 12.

In practice, however, a suitable air-pump, operated at proper intervals by connections made with some of the rotating shafts of the machine, will be employed, or the air may be exhausted from a suitable reservoir and the connection between it and the cylinder 3 controlled by valves, or the whole exhausting apparatus may be contained within the cylinder.

Numerous openings or small pipes, 10, communicating with the pipe 9, extend at right angles thereto, and terminate with their orifices in a straight line near the center of the female creaser, as is seen in Fig. 2.

During each revolution of the cylinder 3 an exhaust will be maintained through the pipe 9 and the small pipes 10 during the peried of time occupied by the cylinder in making a quarter revolution, the result of which will be to cause the paper web to be firmly held at the line of its contact with the row of pipe-orifices 10, to the exterior face of the female creasing device, and be carried with it

in its circular path, as will be presently explained.

Directly beneath the cylinder 3 is a roller, 4, which, like the other rotating parts of this mechanism, is properly hung in bearings in the frame-work.

The office of this roller is to complete the folding or doubling of the sheet, and from it several pairs of conducting rods, wires, or plates, 14, lead out in right lines. These conductors 14 are hung at one end on rods 15, and extend into grooves 16 in the cylinder 3 and roller 4, thus preventing the sheet from following the peripheries of either, and their outer ends are fixed to the gage 20 or to the frame-work. Another function of these conductors is to secure the proper delivery of the folded sheet, which, as it is carried out between them, is partially supported upon and carried forward by the pulleys 17, 18, and 19, and ultimately rests against a stop or gage, 20, and over a pair of folding-rollers, 21 22, through which it is doubled by a vibrating or other folder—such, for instance, as that described in Letters Patent granted to me December 14, 1875.

The sheet is propelled in its outward movement by the contact of the cylinder 3 with the roller 4, aided by the pulleys 17, 18, and 19, which latter, deriving motion from the shaft of roller 4, as a consequence move or feed the sheet with great speed.

When the sheet, especially if of low quality of paper, is allowed to abut against the fixed gage or stop 20 while running at high speed, the force of the blow is sufficient to either turn its folded edge upward, to break and distort the folded edge, or to cause the sheet to rebound from the gage by the force of the blow it receives, so that when the next fold is given it will be in a wrinkled condition and out of position.

In order to permit the sheet to be carried out and stopped easily and smoothly at the high speed with which this machine is adapted to run, and yet insure a correct register of it against the face of the gage 20, I have applied a slowly-moving brake mechanism, which seizes the tail end of the sheet as its head or folded edge approaches close to the gage 20, and causes the said sheet to travel slowly during the last part of its movement up to the gage.

This brake mechanism consists of segments 36 and bearing-pulleys 24, between which the sheet runs. They are geared together by toothed wheels 25 26, and are actuated by the toothed wheel 27, which is of the same size as the cylinder-wheel 30, and, like it, meshes with the toothed wheel 32. Thus their movements are so timed that they shall bite or clamp each sheet between them and the pulleys 24, and force it to travel, with a movement equal to that of their surface-speed, for a distance which shall cause the sheet to slowly approach and rest against the gage 20, the length of time during which the sheet is thus held being just sufficient to accomplish its perfect register, and yet to release the sheet, to permit it to move through the second folding-rollers 21 22, as it is doubled between them by the device, which makes its second fold.

This brake mechanism may be applied to any machine where a rapidly-moving sheet is required to register against a gage or stop.

The cylinders 2 3 are geared together by wheels 29 30, and are driven by a toothed wheel, 31, which may represent one of a train connecting with a shaft of the printing-machine.

The roller 4 receives motion through the wheel 32, meshing into the wheel 30, and, by an endless band, 33, moving over a pulley on the shaft of roller 4, which, pressed to duty by idlers 34 35, drives the sheet-carrying pulleys 17 18 19. The leading end of the printed web is passed between the cylinders 2 3, which are then set in operation.

When a portion, equal to one-half of the predetermined size of the sheet, has passed through the cylinders their creasing devices will have reached the position, and imparted the preliminary crease to the sheet, as shown in Fig. 4. At this time the vacuum created in the pipes 9 and 10 will cause the pressure of the atmosphere to hold the sheet upon the face of the female creasing device with a force sufficient to keep it there. As the rotation continues the first edge of the sheet will fall downward and rearward, as in Fig. 5, while its center, held at the point of creasing, will be carried into the bite of the cylinder 3 and roller 4 by means of the exhaust through the pipes 10, which is maintained until the sheet thus doubled has its folded edge fairly entered between said cylinder and roller. It is then driven onward by the surface-contact of these rotating carriers, and the carrying-pulleys 17 18 19, directed by the conductors 14, governed in its speed of travel by the brake mechanism, registered by the gage, and folded a second time, as before explained. When a length equal to a full sheet has passed through the cylinders 2 3 their rotation will have brought their cutting devices into operative position, when the sheet will be severed from the web, the tail of the folded sheet passing between the cylinder 3 and roller 4, and the head of the succeeding sheet descending, as in Fig. 4.

The cylinder 2 is not altogether indispensable, though its use in both the folding and cutting operation is desirable. When the creaser 6 is not used the sheet may be fed before or onto the cylinder 3 by various means, which will present the sheet with the line of the desired fold opposite or against the apertures of the vacuum apparatus, which apparatus, set in operation at the proper time, will draw the sheet onto the cylinder 3, and thus hold and double or fold the sheet between the folding rollers. When this mode of operation is employed the web may be severed by a cutting apparatus, such as is shown in Fig. 5

where the dotted cylinders 40 41 represent cutting devices which will sever the web into sheets. These cylinders may themselves constitute the web-guide, or several pairs of rollers, or guides like those marked 14, may be employed.

The cylinders 3 might be mounted with packed boxes upon a pipe fixed in the framework, and having one end closed, and the other connected with the pipe 13. In such a construction the pipe will be provided at proper points on one side with a row of perforations coinciding in position with the inner mouths of the pipes 10, and extending a distance equal to a little less than one-quarter of its circumference, by which arrangement the pipes 10 will be in communication with these perforations at a time and for a period which will apply and maintain the exhaust, so as to hold and fold the sheet, as before described.

The position of the segments 36 and rollers 24 may be reversed, or the shaft of roller 24 may be provided with segments coacting with the segments 36.

It is furthermore practicable to form the brake mechanism of two sets of slowly-moving rollers, one of which is moved into surface-contact with the other at the proper moment, and for a time sufficient to govern the movements of the sheet.

The cylinders 2 3 may be drums, or be composed of short cylinders or pulleys suitably mortised, to hold the cutter and creasing mechanism, or they may be simple heads connected by cross-bars, so as to form a carrier, supporting the cutting and creasing devices.

The roller 4 may be a grooved cylinder, or be made up of several pulleys on a shaft, as in the case of pulleys 17 18 19.

I do not herein claim the brake mechanism described and shown, as that forms a part of a separate application.

What is claimed, therefore, is—

1. The combination of a rotating sheet-carrier, provided with a vacuum sheet-holding device with a folding device, all substantially as described.

2. In combination with folding-rollers, a mechanism which creates a vacuum beneath a sheet along the line of the desired fold, and holds and carries the sheet into the nip of said folding-rollers, all substantially as described.

3. The combination of a mechanism for creasing a sheet along a given line, a mechanism which holds the sheet in position by creating a vacuum behind it, and carries it into folding devices, which double it, all substantially as described.

4. The combination of two rotating folding devices, (as 3 and 4,) one of which is provided with a means for creating a vacuum along the desired line of folding, and thus holds the sheet so as to carry it into the nip of said rotating folding devices, substantially as described.

5. The combination of the creasers 6 and 8 and vacuum apparatus with the cylinders or rotating carriers, substantially as described.

6. The combination of the creasers 6 and 8, vacuum apparatus, cylinders or rotating carriers 2 and 3, and the roller 4, substantially as described.

7. The combination of two cylinders or rotating carriers, each one of the pair being provided with one member of a cutting apparatus, and with one member of a creasing apparatus, with a sheet-doubling mechanism, all substantially as described.

8. The combination of a cylinder or rotating frame, carrying a cutting and a creasing device, with sheet-receiving devices co-operating therewith, to complete the folding or doubling of the sheet, all substantially as 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 V. PACE.