4 Sheets—Sheet 1.

W. SPALCKHAVER.

Paper-Folding Machine.

No. 212,998. Patented Mar. 4, 1879.

Fig. 2.

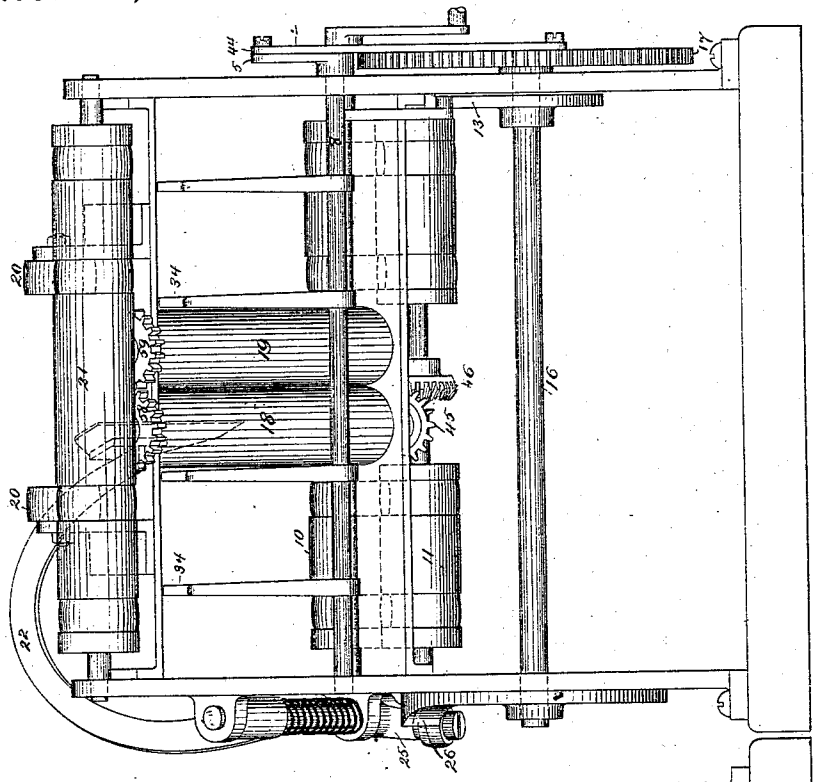
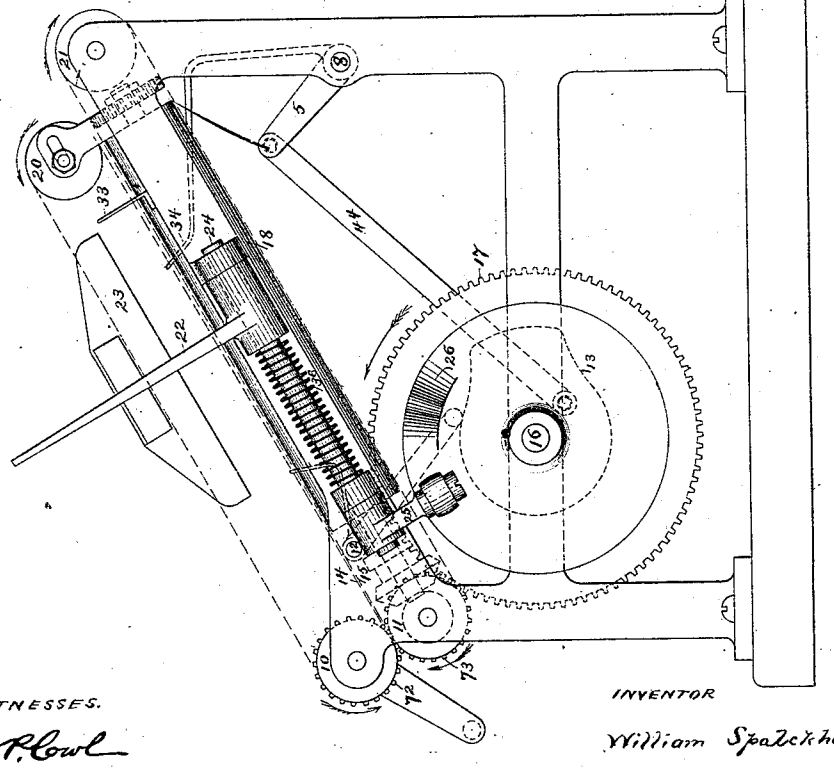


Fig. 1.



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4 Sheets—Sheet 2.

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Fig. 3.

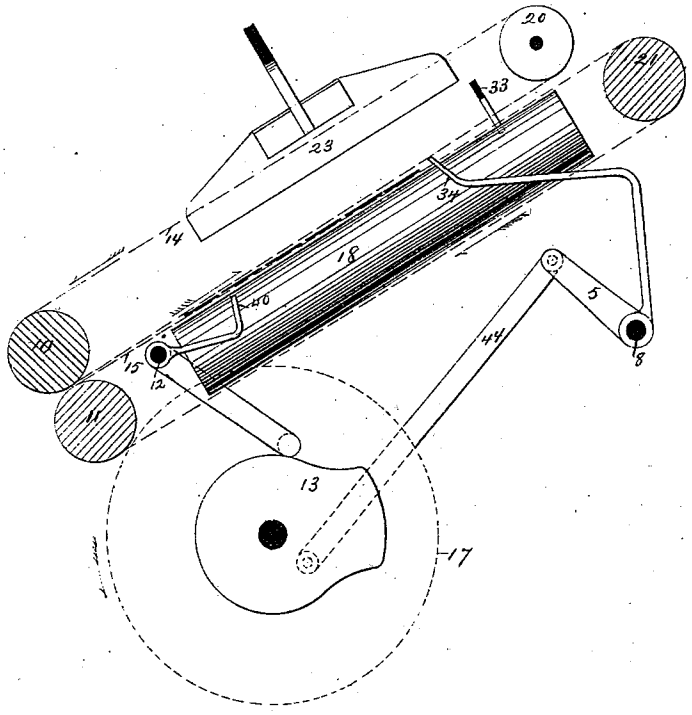
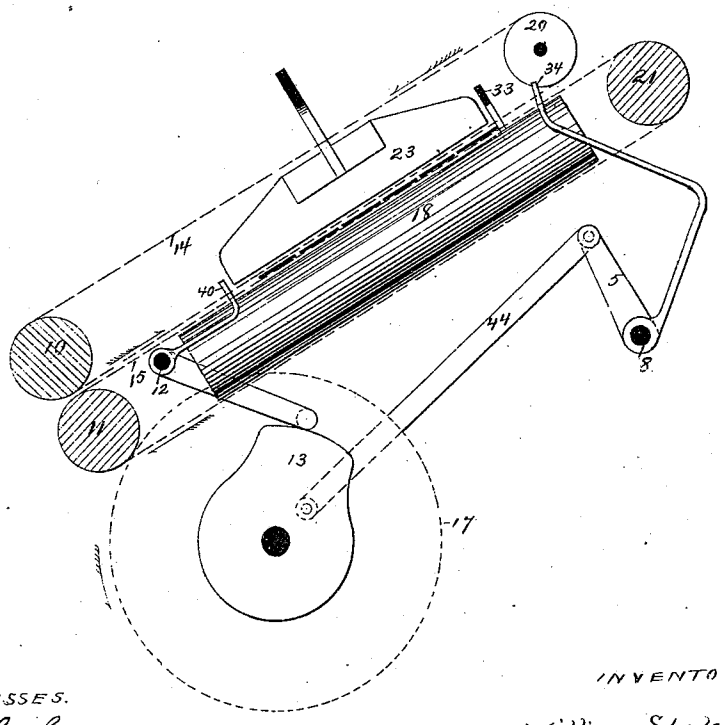


Fig. 4.



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4 Sheets—Sheet 3.

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Paper-Folding Machine.

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Fig 5

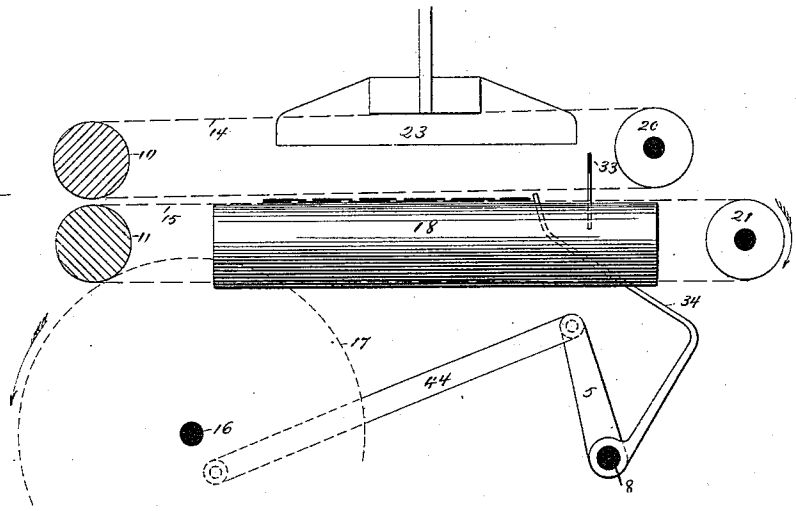


Fig 6.

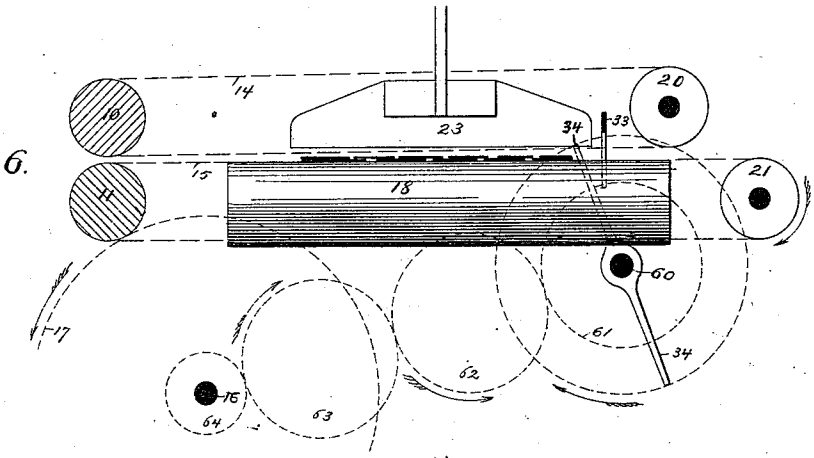
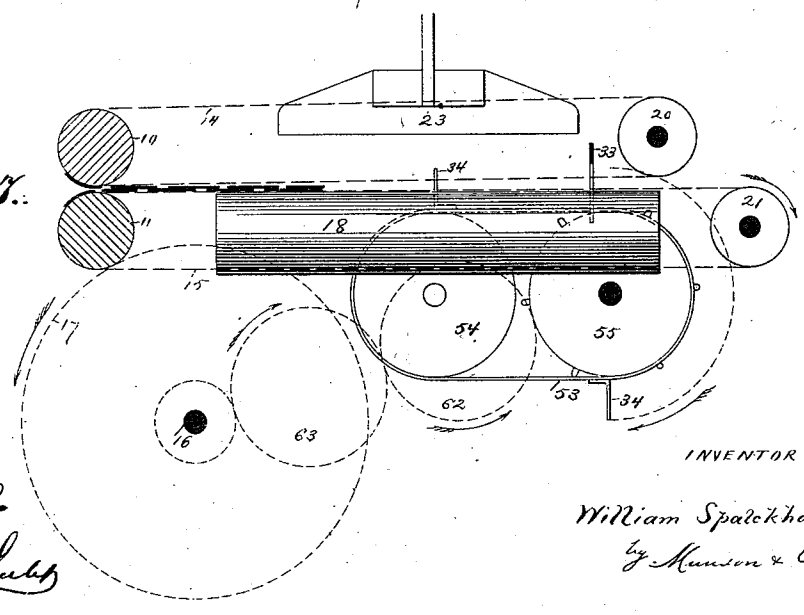


Fig 7.



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4 Sheets—Sheet 4.

W. SPALCKHAVER.

Paper-Folding Machine.

No. 212,998. Patented Mar. 4, 1879.

Fig. 8.

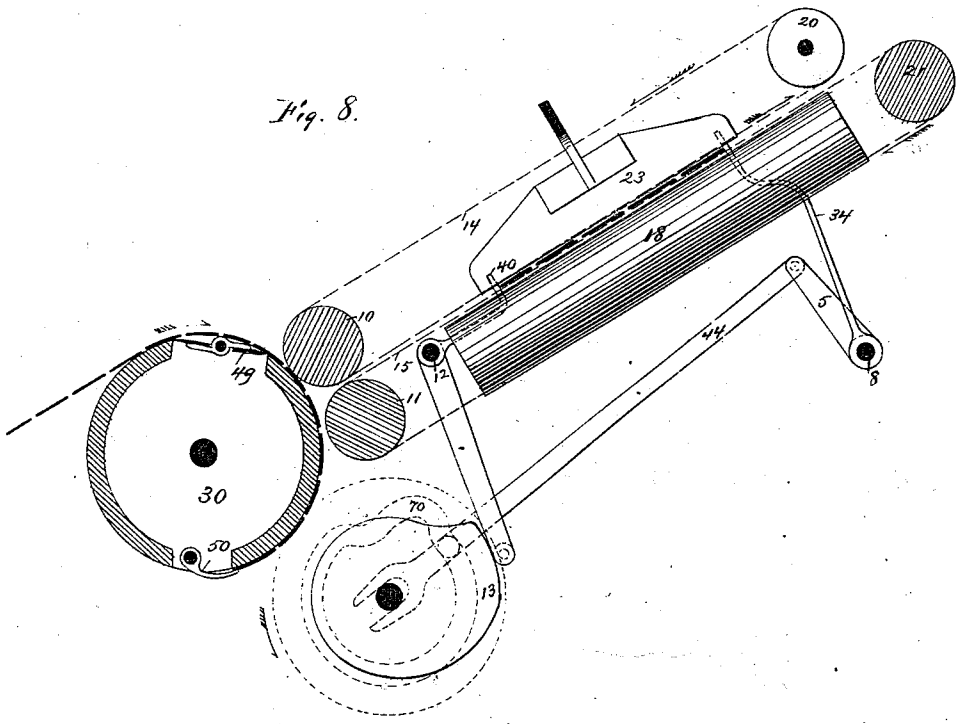
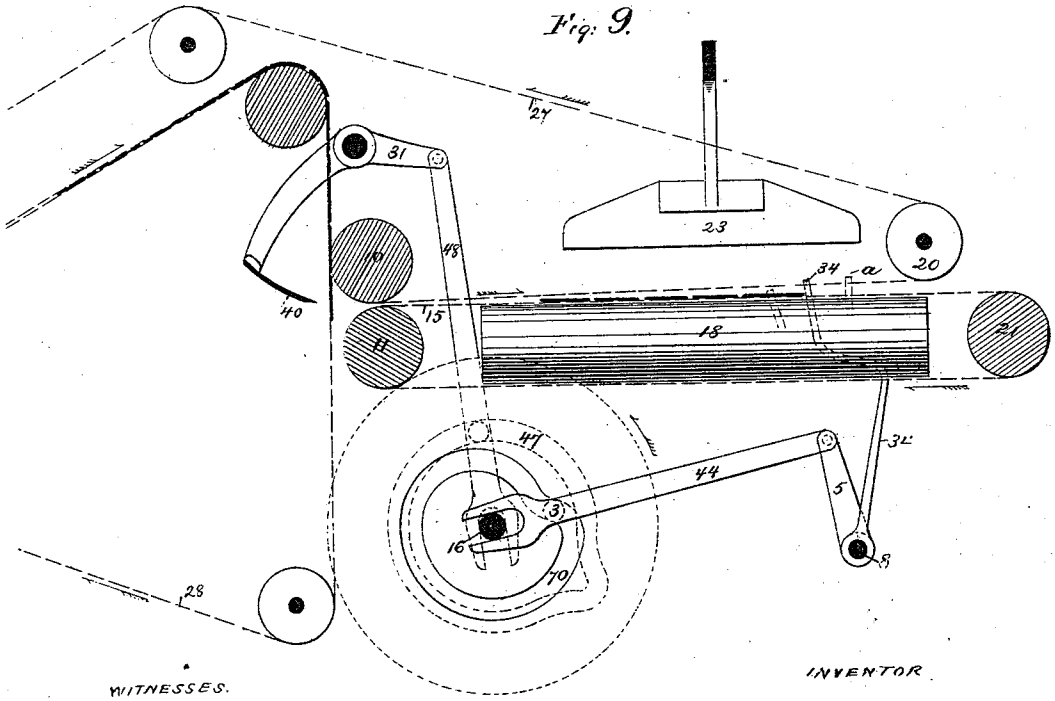


Fig. 9.



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UNITED STATES PATENT OFFICE.

WILLIAM SPALCKHAVER, OF BROOKLYN, ASSIGNOR TO R. HOE & CO., OF NEW YORK, N. Y.

IMPROVEMENT IN PAPER-FOLDING MACHINES.

Specification forming part of Letters Patent No. **212,998**, dated March 4, 1879; application filed June 5, 1878.

To all whom it may concern:

Be it known that I, WILLIAM SPALCKHAVER, of the city of Brooklyn, Kings county, and State of New York, have invented certain new and useful Improvements in Paper-Folding Machines, of which I hereby declare the following specification, when taken in connection with the accompanying drawings, to be a full, clear, and exact description, sufficient to enable others skilled in the art to make and use the same.

This invention or improvement relates to that class of mechanisms known as "sheet-controlling devices," which are combined with folding-machines, and operate to so govern the movements of the sheets that they may be delivered with great rapidity into the folding-machine, and then have their speed so reduced that a proper register of them in position to be folded may be effected.

My invention relates to a branch of the subject-matter of Patent No. 204,772, dated June 11, 1878; and consists principally in sheet-controlling arms, which are automatically projected across the plane in which the sheet travels to intercept the leading end of the same, and, moving in said plane, act to control the position of said sheet, and also includes various modifications thereof and combinations of devices therewith, all of which will be clearly hereinafter set forth.

In the drawings, Figure 1 is a side elevation, Fig. 2 an end elevation, and Figs. 3 and 4 longitudinal sectional elevations, of a machine embodying this invention, while Figs. 5, 6, 7, 8, and 9 are diagrams illustrating modifications thereof.

As is well understood, a mechanism for controlling the movement of a sheet of paper, either folded or to be folded, though desirable in all rapidly-operating folding-machines where the sheet is to be arrested over folding-rollers in order to be doubled through the same, is especially adapted to such folding-machines as are designed to operate with or form part of a perfecting or web-printing machine, both of which, as is well understood, operate with great rapidity, and deliver printed sheets at the rate of many thousands per hour.

In consequence of the great surface speed which the sheets have when they enter the folding-machine, it follows that if said sheets are projected directly against a fixed gage or stop, as 33, to be thereby registered over folding-rollers, as 18 19, their momentum will cause the sheets to strike said stop with great force, which will make them buckle up or otherwise become disarranged and out of proper position or register. By the use of my improved sheet-controlling arms this defective operation is overcome, and a folding-machine is adapted to run at high speed and receive sheets moving with great surface velocity, slow the same down, and cause them to move gently against a fixed gage or stop, or gradually bring them to a state of rest, whereby their proper position or register for receiving a fold is effected.

In order to a perfect understanding of the construction, operation, and adaptability of this invention, the structure of the folding-machine shown in Figs. 1 to 4, which embodies one form of it, will first be described, the means for combining the same with a printing-machine will next be pointed out, and, finally, modifications of the invention will be explained.

In said machine the rollers 10 11, which are geared together to run in unison by the toothed wheels 72 73, the latter of which meshes with the driving toothed wheel 17, may constitute feeding-rollers acting to deliver sheets to the conducting-tapes 14 15, or act as folding-rollers, co-operating with a folding-blade, and delivering folded sheets to said tapes, all of which will be more particularly hereinafter explained.

The sheet-conducting device, as shown, consists of tapes 14 15, which are stretched from the rollers 10 11, extend out over folding-rollers 18 19, and return over pulleys or rollers 20 21. They are driven by and consequently run at the same surface speed of the rollers 10 11, and operate to conduct sheets delivered to them out over the folding-rollers 18 19, and against a fixed gage or stop, 33, which registers them in position to be doubled by the vibrating folding-blade 23 into the nip of the said folding-rollers 18 19, which are geared to-

gether by the wheels 58 59, and constantly rotated by the miter-wheel 45 on the shaft of roller 18, which gears with a similar wheel, 46, on the shaft of the roller 11.

The folding-blade 23 is fast at the end of an arm, 22, hung upon a rock-shaft, 24, which is vibrated at proper intervals of time by means of a rock-arm, 25, operated by the face-cam 26 on the shaft 16, a spring, 36, holding said folding-blade in a raised position and the rock-arm 25 in contact with the cam 26.

The sheet-controlling device consists of a series of arms, 34, which are fast upon a shaft, 8, which is rocked by means of an arm, 5, and a connecting-rod, 44, which latter is pivoted to the face of the toothed wheel 17. This wheel thus acts as a crank, and moves the arms alternately toward and from the rollers 10 11, said arms passing by the fixed gage or stop 33, which is recessed at the proper points to permit this movement of them.

The gearing of the parts is such that the rearward movements of the arms shall be slower than that of the conducting-tapes 14 15, and gradually decrease until said arms come to a state of rest, as in Fig. 4, then be vibrated forward to the position shown in Fig. 3 to repeat these movements.

As a sheet emerging from the rollers 10 11 is carried at their high speed of travel out over the rollers 18 19, its leading edge will come into contact with the slower-moving arms 34, which have been vibrated forward and commenced their rearward movement. Said sheet will thus be partially arrested and forced to take up the gradually-diminishing speed of said arms in its farther onward movement, and thereby caused to move slowly up to the fixed gage or stop 33, against which the sheet will be carried slowly enough by the decreasing motion of the crank and arms 34 to allow it to be gently registered against said gage, while the arms 34 leave it and retreat slightly behind said gage, as in Fig. 4. The folding-blade 23 then descends to double the sheet into the nip of the folding-rollers 18 19, which carry it between them and deliver it in a folded condition. The folding-blade rises, the sheet disappears, and the arms 34 begin their forward movement, while a new sheet is fed forward by the tapes 14 15, and the operation is repeated. These arms 34 are so bent that they shall not interfere with the free passage of the sheets through the rollers 18 19.

When the folding-rollers 18 19 are arranged in an inclined position, as is fully hereinafter described, vibrating sheet-stops 40, automatically raised behind the tail of the sheet, as is yet to be explained, may act simply as stops to prevent a sheet from sliding out of the machine.

While this sheet-controlling mechanism will work advantageously with a hand-fed folding-machine, it is, as before remarked, designed more particularly to be used in a folding-machine connected with a perfecting or web-printing machine, the sheets produced by which may be conveyed to it by means of tapes leading from said printing-machine and passing over the rollers 10 11.

If unfolded sheets are carried directly to the rollers 10 11, and receive their first fold by means of the blade 23 and rollers 18 19, a means for separating the sheets and providing a sufficient space between them, such as the accelerating-tapes described in the United States Patent No. 192,954, would be required in order to prevent an advancing sheet from overrunning the preceding one which is being folded; but if the sheets passing through the rollers 10 11 are once folded, no other means for providing a space between them is required, as this folding operation reduces their length one-half.

The rollers 10 11 of the machine here shown may constitute the folding-rollers, co-operating with the folding-blade of a rotating folding mechanism, as in Fig. 8, with which web-printing machines are now commonly provided. Such rotating folding mechanisms, as is well known, run at the high speed of the rotating printing mechanisms, thus operating to fold the sheets as rapidly as they are produced by the printing mechanisms, and delivering them once folded with great rapidity, an example of which is shown and described in the United States Patent No. 191,494.

In said Fig. 8, the revolving carrier 30 is provided with gripers 50 and a rotating folding-blade, 49, constructed and operating as is fully set forth in said patent, and connected with the printing-machine in like manner as therein described, by means of tapes leading from the cutting-cylinders of said printing-machine.

As shown in Fig. 9, and as described and illustrated in the patent granted to me June 11, 1878, the sheets may be led by tapes 27 28 down before the rollers 10 11, and be doubled into the nip thereof by a folding-blade, 40, vibrated by a rock-arm, 31, and connecting-rod 48 from a cam, 47, on the driving-shaft 16, which sheet thus once folded will be carried out by the tapes 27 15 over the folding-rollers 18 19.

A folding-machine provided with the sheet-controlling arms 34 may be connected with any other form of folding-machine than is herein represented and receive and manipulate the product thereof—for instance, such as are illustrated in the United States Patents 171,196, 180,880, 191,494, 192,034, 195,115, and 196,502.

It is sometimes desirable that the folding-rollers of a sheet-folding mechanism shall be arranged in an inclined position, whereby an economy of space is secured and the stoppage and registration of the sheets is partially aided by gravity. This is shown in Figs. 1 to 4 and 8, with which arrangement of them the sheet-controlling arms will effectively operate, as they will also when said rollers lie in a horizontal plane, as in the remaining figures.

The modification shown in Fig. 5 differs from

that already described in this particular only—that is to say, its mechanisms and their mode of operation are the same as has been hereinbefore described, except that the devices are arranged to operate with rollers 18 19 when placed in a horizontal plane.

Modifications of the sheet-controlling arms 34 are shown in Figs. 6 and 7. In the former they are arranged upon a revolving shaft, 60, which is driven by means of a train of toothed wheels, 61 62 63, to which motion is imparted by a pinion, 64, on the shaft 16. Their mode of operation is not essentially different from that hereinbefore explained, since they slowly move in the pathway in which the sheets travel, intercept the sheet, and control its onward movement until the gage 33 is reached, and then, leaving the sheet, pass through the recesses in said gage; but, instead of making a reverse movement to repeat this operation, they pass onward by a rotative movement, and are thus returned to repeat the operation. In order to secure the proper speed of travel, two such arms project at opposite points from said shaft, and, of course, are alternately brought into position to control the sheet.

Fig. 7 illustrates a modification of the rotative arrangement of the arms 34, said arms being made to project from a belt or belts, 53, which run over wheels or pulleys 54 55, one of which is provided with teeth or pins, which take into holes in said belts, and thus insure their positive movement. The pulley 55 is driven by a train of wheels—as 62 63—from the pinion 64, and both of said pulleys are so arranged as to stretch the belts 53 in such a position as to carry the arms 34 a distance through the pathway of the sheets and along under the gage 33.

A further modification of the sheet-controlling arms 34 is shown in Fig. 8, wherein, though their mode of operation is not essentially different from that of them which has already been described, they are so actuated as to co-operate with a gage brought into position behind the sheet, whereby said sheet may be registered by its tail end. In order to register a sheet in this manner, it is obvious that there must be a sheet-stop at or near the front ends of the folding-rollers 18 19, which shall intercept the pathway in which the sheet must travel in being fed beyond it, and also that while the sheet is passing over it the said sheet-stop must not intercept the pathway of the sheet. This is provided by the movable sheet-stops 40, which are constructed and operated as is fully described in the aforesaid patent granted to me June 11, 1878, and which are herein illustrated in Figs. 1 to 4 and 8 in their co-operative relation to the arms 34, which Figs. 1 to 4 also serve to show the mechanism actuating them and its relation to the other parts of the machine. These sheet-stops consist of a number of right-angular arms fixed upon a shaft, 12, which is rocked by means of a cam, 13, on the shaft 16. The movements of these stops and the arms 34 are so timed that they will act in harmony with each other and the devices which feed or fold the sheets and deliver the same over the rollers 18 19, as will appear from the following description of them.

As the sheet emerges from the rollers 10 11, and is carried by the tapes 14 15, and moves so far over the rollers 18 19 as to pass the point occupied by the stops 40, the said stops will remain in their lowest position—that is to say, their points will be below the surface of the rollers 18 19, as is illustrated in Fig. 3, the cam 13 being so shaped as to effect the same; but as soon as the tail of the sheet has passed said point occupied by the stops 40, said cam will operate to quickly raise said stops into the position shown in Fig. 8, where they stand across the pathway in which the sheet has traveled. Now, by preference the sheet-controlling arms will be so timed in their movements that they shall first gradually stop the sheet and then begin a reverse movement which shall push or force the sheet backward until its rear edge is registered against the stops 40. This done the folding-blade 23 descends to double the sheet through the folding-rollers, the stops 40 retreat to their lowermost position, the reverse movement of the arms 34 is effected, and a new sheet is delivered by the rollers 10 11 and tapes 14 15, to be manipulated as before described. These sheet-controlling arms may not only act to slow down the speed of the sheets, and thus cause them to slowly approach and be registered against a gage or stop, and be operated to slow down, arrest, reverse, and slowly move the sheets against a gage, as last hereinbefore described, but also to slow down the speed of the sheets and bring them to a state of rest without the aid of a gage or stop, as 27, at which time they will be in proper register to be acted upon by the folding-blade. This mode of their operation is shown in Fig. 9, where the sheet-controlling arms 34 are vibrated by means of a grooved cam, 70, the groove of which is so shaped that the rearward movement of the arms 34 shall be slower than that of the conducting-tapes, and gradually decrease until they come to a state of rest, whereby they will cause the sheet which comes into contact with them to be controlled in its travel and move with their speed, and thus be gently stopped and evenly registered in a correct position to be folded through the rollers.

This operation is as follows: A sheet emerging from the rollers 10 11 will be conducted onward by the tapes 27 15, travel at their high speed, and come into contact with the ends of the arms 34 while they are moving in the same direction with it, but at a somewhat slower speed than the sheet is traveling. Said sheet will thus be partially arrested and forced to take up the gradually-diminishing speed of said arms in its farther onward movement until they reach a state of rest, as at the point indicated by the dotted lines *a*. When the said arms have reached such limit of their

rearward movement, which is while the stud or friction-roller 3 on the side of the rod 44 is passing through the lowest part of the cam 70, they will momentarily rest there, and the sheet will thus be held motionless and in register. At this time the folding-blade 23 will descend to double the sheet into the nip of the folding-rollers 18 19, and quickly rise again. As the sheet passing through the rollers to be folded disappears, the arms 34 will be vibrated forward by the cam 70 to repeat the operation upon a new sheet.

The conducting-tapes guiding the sheets from the rollers 10 11 out over the rollers 18 19 may have substituted for them two sets of guide-rods, as in Patent No. 188,987, or one lower set of such rods alone, or combined with an upper set of tapes.

What, therefore, is claimed is—

1. The combination, with a folding mechanism, of sheet-controlling arms automatically projected across and moved in the pathway of the sheets at a less speed than said sheets are driven, whereby the movement of each sheet is gradually checked, all substantially as described.

2. The combination, with a feeding mechanism delivering sheets out over folding-rollers, of sheet-controlling arms automatically projected across the plane in which a sheet travels and caused to move therein at a less speed than the sheets are driven, whereby each sheet is intercepted and gradually checked, all substantially as described.

3. The combination of the sheet-controlling arms 34, automatically projected across and moved in the pathway of the sheets, with folding-rollers 18 19, a sheet-conducting device, and a coacting folding-blade, substantially as described.

4. The combination, with folding-rollers, as 18 19, a sheet-conducting device, a folding-blade coacting therewith, and a sheet gage or stop, of sheet-controlling arms automatically projected across and moved in the pathway of the sheets, substantially as described.

5. The combination of rollers 10 11 with rollers 18 19, a sheet-conducting device, a coacting folding-blade, and sheet-controlling arms 34, which are automatically projected across and moved in the pathway of the sheets, 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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D. P. COWL.