5 Sheets—Sheet 1.

S. D. TUCKER.

FOLDING-MACHINE.

No. 191,819. Patented June 12, 1877.

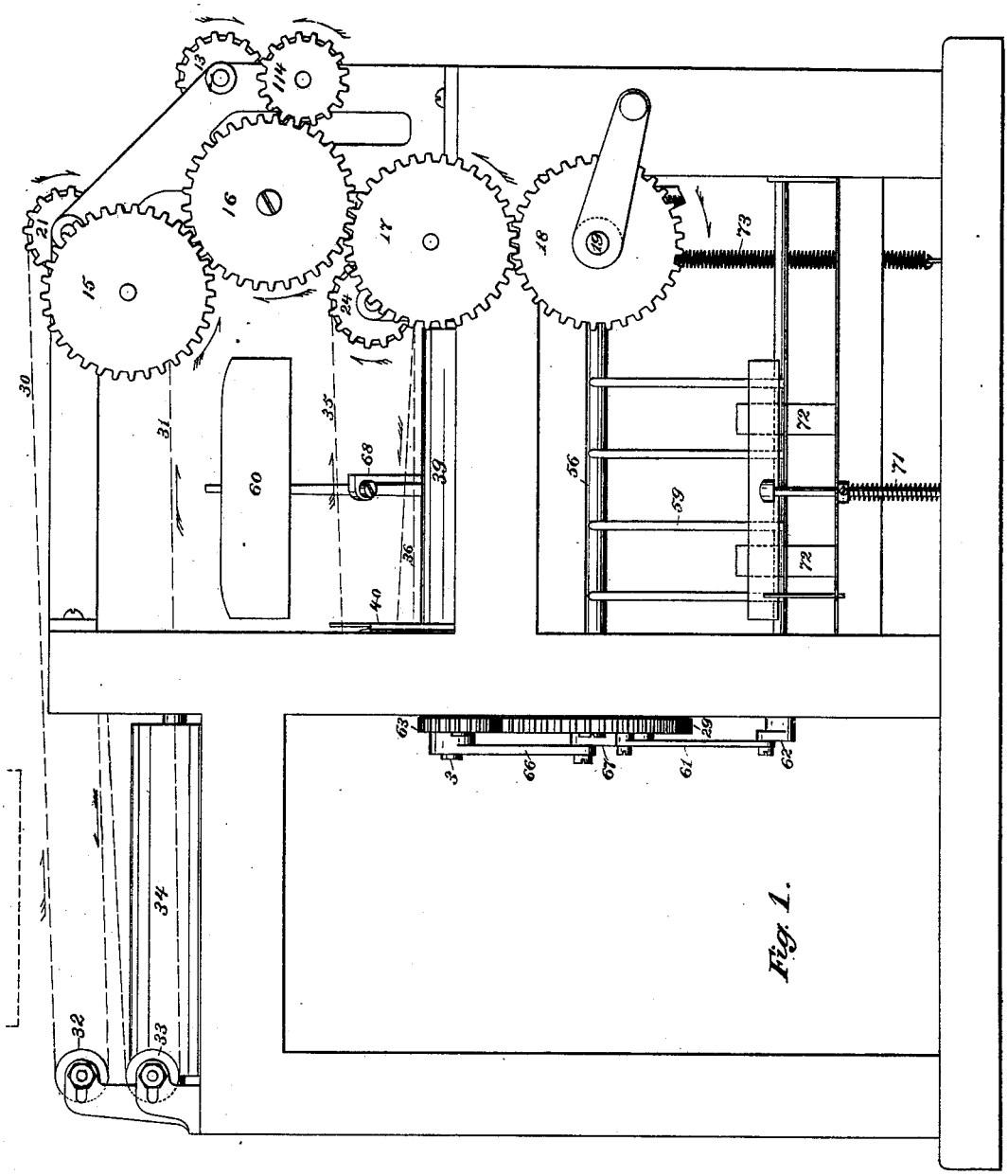

Fig 1.

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5 Sheets—Sheet 2.

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FOLDING-MACHINE.

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Fig. 2.

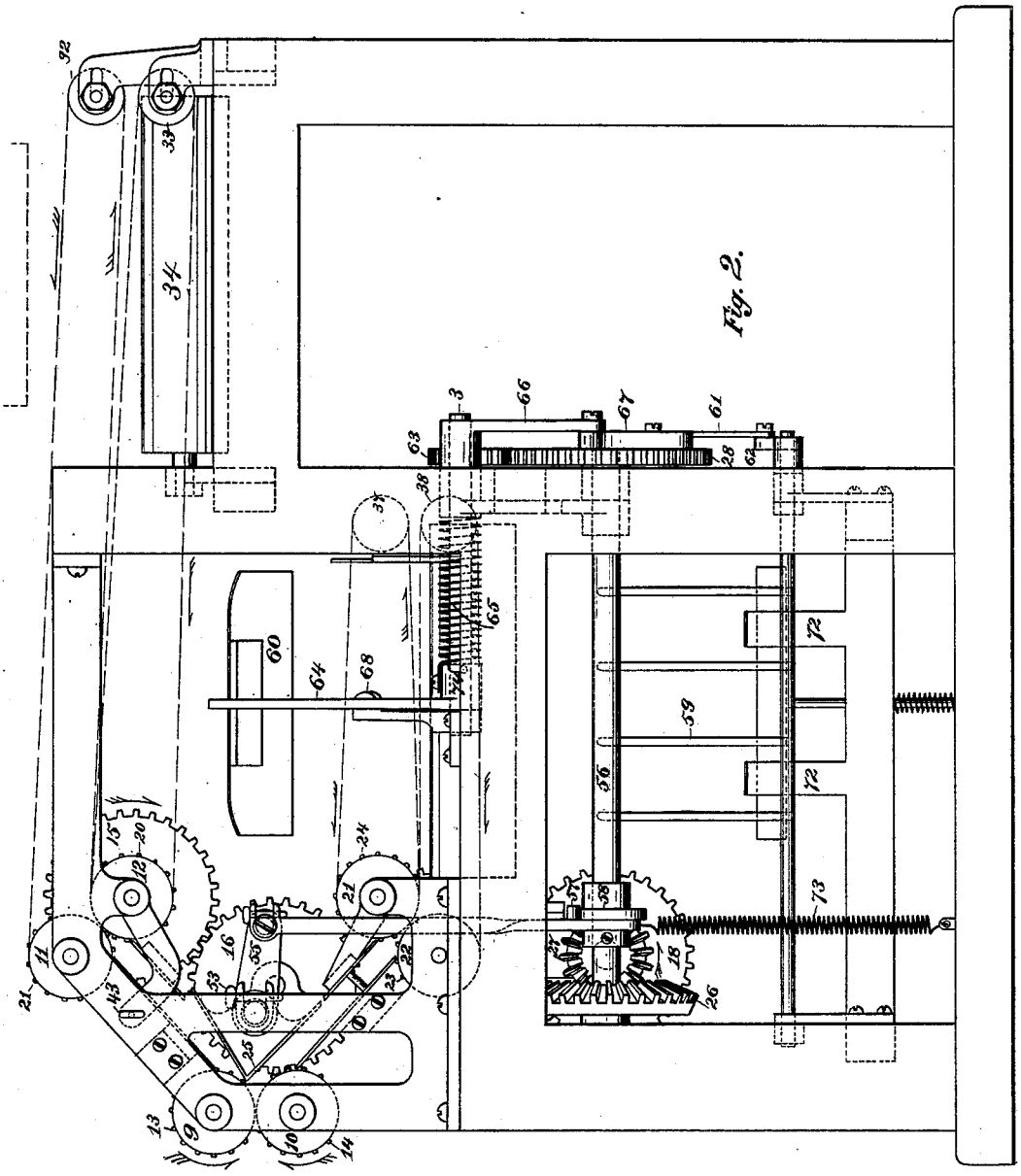
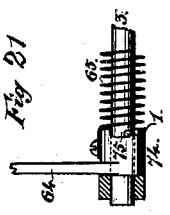


Fig 21



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5 Sheets—Sheet 3.

S. D. TUCKER.

FOLDING-MACHINE.

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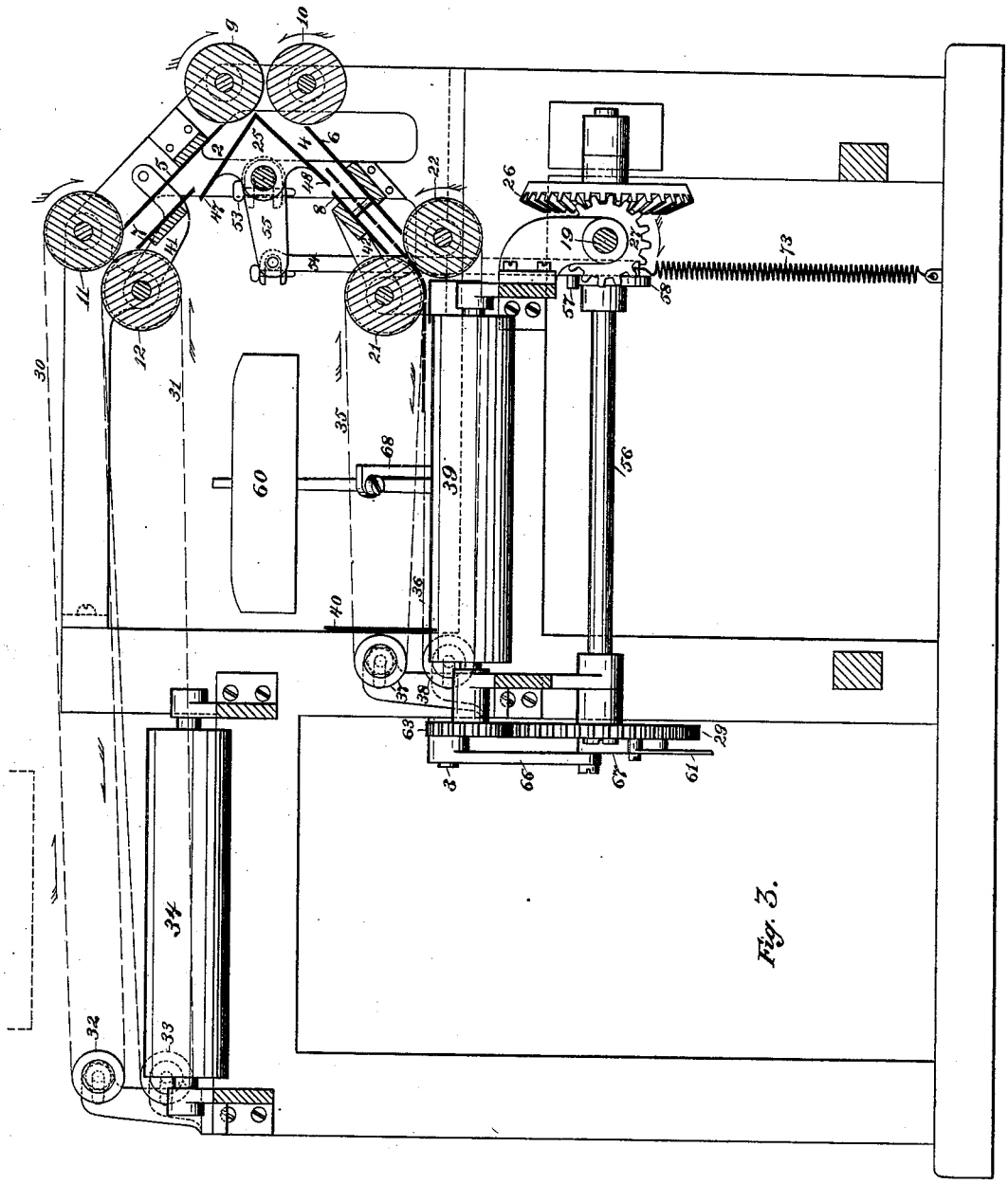

Fig. 3.

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5 Sheets—Sheet 4.

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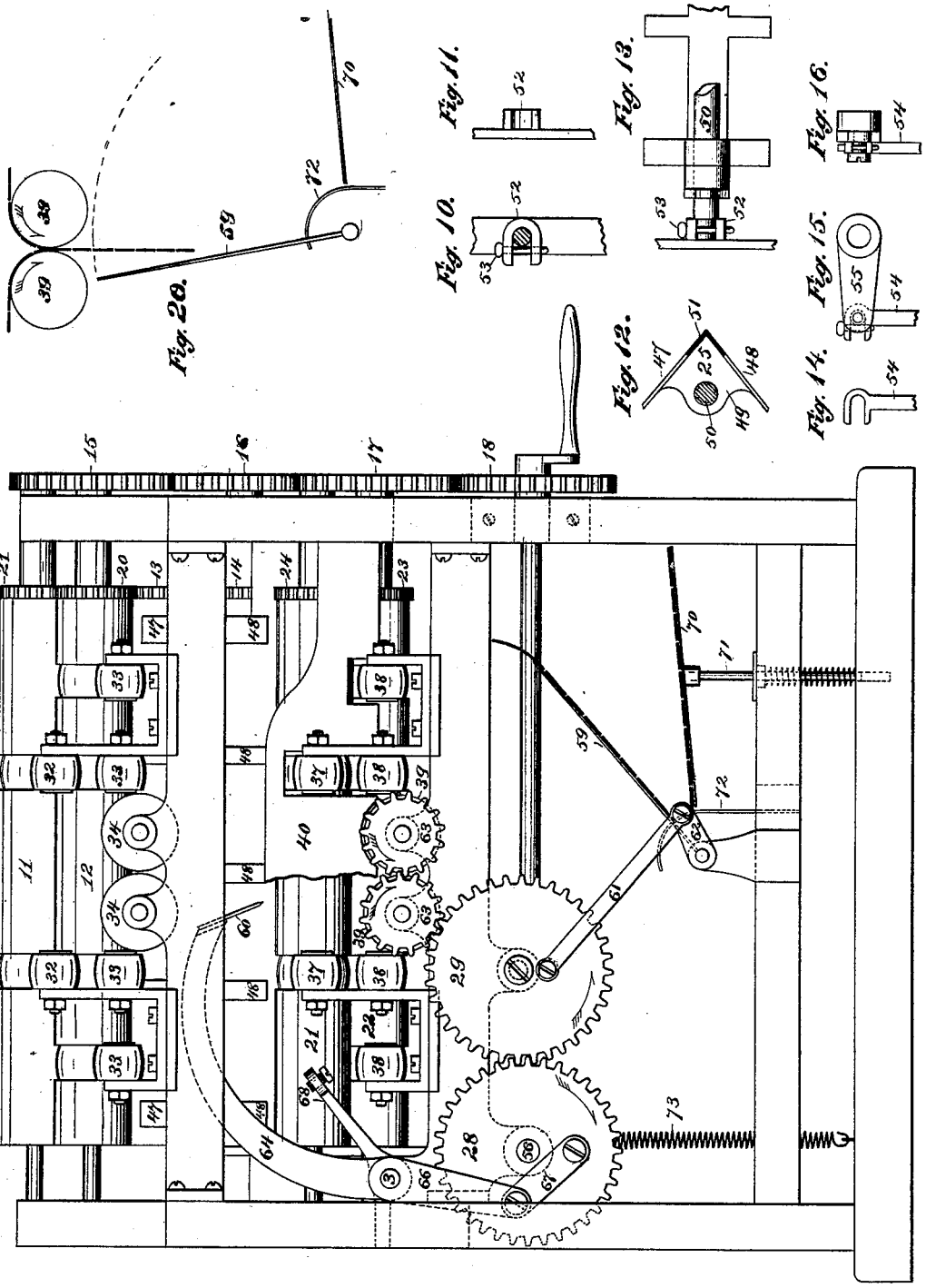

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5 Sheets—Sheet 5.

S. D. TUCKER.

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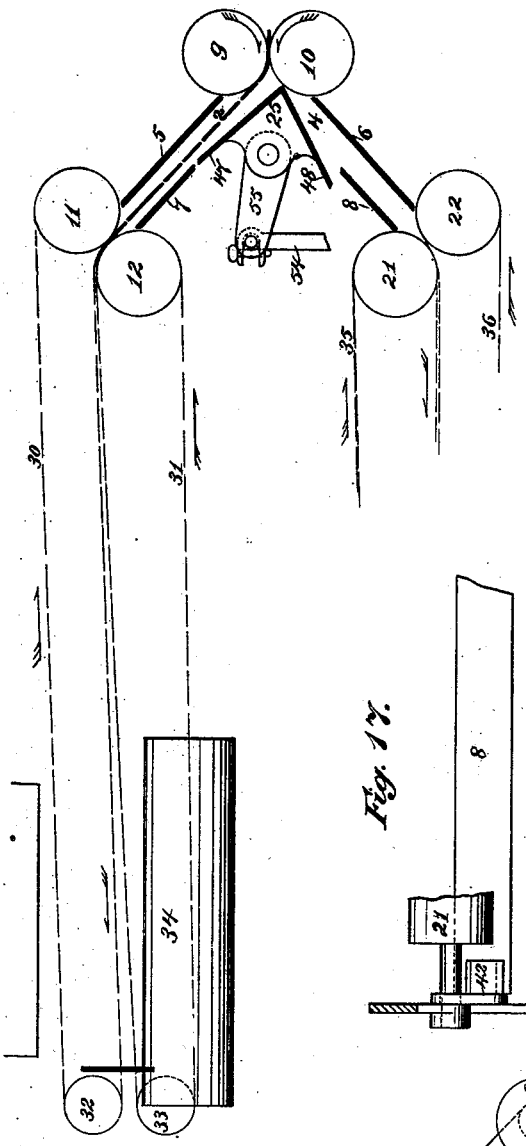

Fig. 5.

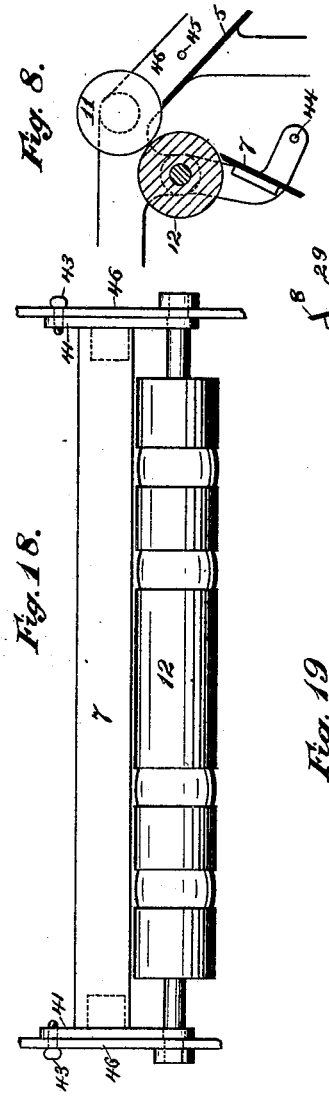

Fig. 8.

Fig. 18.

Fig. 17.

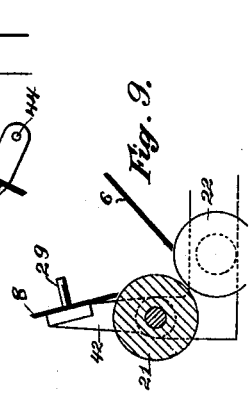

Fig. 9.

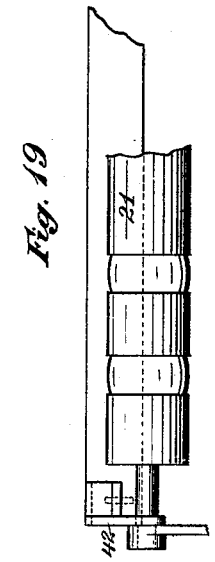

Fig. 19

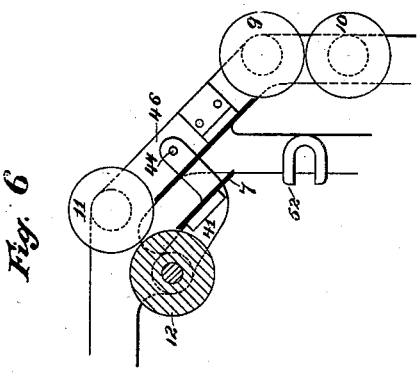

Fig. 6

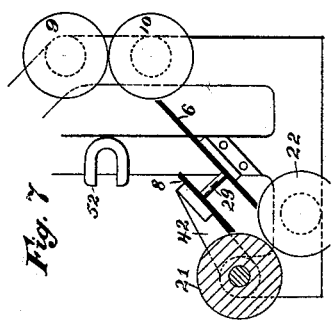

Fig. 7

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UNITED STATES PATENT OFFICE.

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

IMPROVEMENT IN FOLDING-MACHINES.

Specification forming part of Letters Patent No. **191,819**, dated June 12, 1877; application filed March 21, 1877.

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 Folding-Machines, of which the following is a full, clear, and exact description.

In the accompanying drawings, Figure 1 is a left-hand side elevation; Fig. 2, a right-hand side elevation; Fig. 3, a longitudinal vertical section, as seen from the left-hand side; Fig. 4, a rear elevation; Fig. 5, a diagram illustrating the sheet-conducting mechanism; Figs. 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, and 19, details thereof; Fig. 20, the sheet-flier; and Fig. 21 a detailed view of the attachment of the folding-blade to its shaft.

This invention relates to improvements in the mechanism for conveying a once-folded sheet from the delivering-rollers to the folding apparatuses, which impart to such a folded sheet one or more additional folds; and it consists in combinations and constructions of devices which will be fully hereinafter pointed out, and particularly described.

This mechanism is adapted to be used in connection with any folding apparatus which imparts one fold to a sheet of paper; but it is particularly designed to operate with a folding apparatus which produces such primary fold with great rapidity, such as the well-known rotary folding-blade, which doubles the sheet between a pair of rollers, (as 9 10,) which rollers deliver the same in its onward course.

Such a rotary folding apparatus may, as is also well understood, act upon sheets fed in succession to it by hand, or through the medium of any approved mechanical feeding device. Such a rotary folding apparatus is best adapted to work in conjunction with a web perfecting printing-press, in which is embodied a cutting mechanism, whereby a web of paper is printed upon both its surfaces, cut into sheets, and said sheets delivered directly to the rotary folding apparatus; but, whatever be the apparatus for producing the primary fold, it is placed in such a position with respect to this mechanism as to deliver the double edge of the sheet it folds into the bite of the rollers 9 10, passing through which it is delivered into one of the conductors 2 4, and thereby conveyed to one of the pairs of receiving-rollers 11 12, 21 22, by which it is directed to an apparatus for folding it a second time, as will presently more fully appear.

The delivering-rollers 9 10 are geared together by toothed wheels 13 14, the shaft of roller 10 being extended to support a toothed wheel, 114, which meshes with a toothed wheel, 16, which is one of a train of such wheels, 15 16 17 18, by which motion derived from the main shaft 19 is imparted to a portion of the mechanisms of this apparatus.

The lower one of the pair of receiving-rollers, 11 12, is upon the shaft of the wheel 15, and carries a gear-wheel, 20, meshing with a similar wheel, 21, on the upper roller 11.

The lower of the pair of receiving-rollers, 21 22, is upon the shaft of the wheel 17, and carries a gear-wheel, 23, meshing with a similar wheel, 24, on the upper roller 21.

Endless tapes 30 31 run over the receiving-rollers 11 12, and around pulleys 32 33. These tapes are designed to convey the sheet from the receiving-rollers 11 12 out into position over a pair of second folding-rollers, 34, through which it is to be a second time folded. A similar set of tapes, 35 36, are stretched from the receiving-rollers 21 22 to and around pulleys 37 38, and convey the folded sheet in position over a second pair of folding-rollers, 39.

These second folding-rollers 34 39 are, of course, to be provided with gages or stops, (as 40,) against which each sheet is registered for its second fold.

As is now well understood, sheets once folded by a rotating folding mechanism which runs at a high rate of speed cannot be conducted to, and folded by, a second folding apparatus of the vibrating type with precision and accuracy, for various reasons, among which are the slow speed of the vibrating folding-blade, and the impossibility of arresting and accurately registering a rapidly-traveling sheet against a stationary gage or stop over the second folding-rollers.

This apparatus is, therefore, constructed with duplicate sets of folding mechanisms set

in different horizontal planes, and provided with conductors 2 4 for conveying the sheets to such mechanisms; and in order that each alternate sheet shall be conveyed to the upper and lower mechanisms, for producing their second folds, these conductors 2 4 are controlled by a switch, 25, which is shunted so as to alternately open one conductor and close the other, as in Figs. 3 and 5, the operation of which is to divide the folded sheets from the delivering-rollers 9 10 into two streams, one of which shall pass to the lower folding-rollers 39, and the other of which shall pass to the upper folding-rollers 34.

The conductors are illustrated as made up of fixed plates 5 6 and swinging plates 7 8. The fixed plates 5 6 bridge the space between the peripheries of the rollers 9 11 and 10 22, while the swinging plates 7 8 are adapted to lie in planes nearly parallel with the plates 5 6, and bridge about one-half the distance between the rollers 12 9 and 21 10, the remaining space between these said rollers being covered by the faces of the switch 25.

The switch 25 is made up of plates 47 48, set at angles to each other, as shown, which plates may have a length nearly equal to that of the rollers 9 10, and be secured together by solid ends, as 49, (see Fig. 12,) by which they are hung upon the shaft 50. These plates might be cut away, so as to form narrow sections, as in Fig. 4, which sections are united by a continuous nose-piece, as 51. (See Fig. 12.) It is furthermore possible to have the sections shown in Fig. 4 entirely separated from each other, each independent section being hung fast upon the shaft 50.

It sometimes occurs in the rapid delivery of sheets from the delivering-rollers 9 10 that one or more of said sheets becomes buckled up or otherwise jammed in one of the conductors 2 4, or caught upon the switch 25. This defective operation may result from an inferior quality of the paper—what are known as "pasters," or from tears existing in the reeled paper which is fed into the printing-press.

This machine is, therefore, provided with means for removing both the switch 25 and the plates 7 8, so as to afford access to the conductors 2 4 or to the rollers 9 10 from their rear sides.

To this end the switch-shaft 50 is hung in open gudgeons 52, wherein it is secured by pins 53, thus permitting said shaft and the switch to be removed bodily from its working position, its actuating-rod 54 being connected to the crank-arm 55 in like manner, so as to be readily detached therefrom. (See Figs. 14, 15, and 16.)

The plates 7 8 are hung upon arms 41 42, which swing upon the shaft of the rollers 12 21.

When in their working position the plate 7 is held in place by pins 43, which key its ends to the side frames 46 by means of the holes 44 45. The lower plate 8 is provided at its ends with pins 29, on which it rests by gravity upon the plate 6. Either of these plates 7 8 is thus capable of being swung away from the plate 5 or 6 when either of the conductors 2 4 becomes choked with accumulated paper, or for any other reason it is desirable to reach them.

The said switch may thus be removed, and the plates 7 8 swung back, as in Figs. 6, 7, 8, and 9, to completely clear the rear side of the conductors 2 4 and delivering-rollers 9 10, thus providing for the removal of any obstruction or the repair of any of the parts.

The rod 54 for actuating the switch 25 is bifurcated at its lower end to straddle the transverse shaft 56, and is provided with a pin, 57, which rests upon a cam, 58, fast on the shaft 56, and thereby rocks the switch 25 through the rock-arm 55, (see Fig. 2,) a spring, 73, attached to the lower end of this rod 54, aiding this movement.

This shaft 56 carries a miter-wheel, 26, which gears with a similar wheel, 27, of one-half its size, fast on the driving-shaft 19. This shaft 56 carries at its outer end a toothed wheel, 28, which gears with a similar wheel, 29. (See Fig. 4.) The wheel 28 actuates the second folding-blade 60 in a manner to be explained, and the wheel 29 vibrates the fly 59 by means of the rod 61 being eccentrically upon the face of the wheel 29, and pivoted to the rock-arm 62 on the fly-shaft.

The second folding-rollers 39 39 are geared together by pinions 63 63, one of which gears with the wheel 29.

The second folding-blade is fixed at the end of a curved arm, 64, which is hung loosely upon shaft 3, but held in place thereon by means of its hub 74, which is recessed at 75 to receive a pin, 1, rising from the shaft 3, which thus permits the blade to rock a limited distance upon the said shaft.

A spring, 65, fast at one end to a collar on shaft 3, or it may be to the frame-work, is coiled about the shaft 3, and fastened to the hub 74 of the folding-blade arm 64, the tendency of this spring being to hold the said arm 64 in its foremost position, as in Fig. 21.

The shaft 3 carries fast upon its outer end a rock-arm, 66, hung to the wheel 28 by a connecting-rod, 67, which is pivoted to the free end of the rock-arm and eccentrically to the face of the wheel 28.

The effect of the extremely short connecting-rod 67 is to give the folding-blade a very quick movement while forcing the sheet into, and withdrawing itself from, the nip of the folding-rollers 39, and a corresponding slow motion at the other extremity of its stroke.

The forward vibration of the folding-blade 60 is limited by an adjustable stop, 68, with which the arm 64 engages, and which prevents its ever being caught in the nip of the folding-rollers; but if, for any reason, the folding-blade meets with obstruction at the folding-rollers, which prevent its completing its forward vibration, said impediment will arrest the forward movement of the knife, while by the

yielding of the spring 65 the recessed hub 74 of its arm 64 will permit the shaft 3 to complete its vibration without injury either to the folding-blade or to the mechanism rocking said shaft 3.

It will be observed that the pairs of receiving-rollers 11 12 and 21 22 are so geared to their prime mover that they run in unison, and that the pair of delivering-rollers 9 10 is so geared to the said prime mover that they run at a speed about twice as great as that imparted to the receiving-rollers; and these said receiving-rollers are arranged at a distance from the folding-rollers which is a little less than the length of the doubled sheet emerging from the said folding-rollers, the result of which is that said doubled sheet is thus fed through the conductor 4 (the parts being in the position shown in Fig. 3) at a high velocity, and is slightly entered between the delivering-rollers an instant before it leaves the said folding-rollers. The speed of travel of the sheet is thus arrested, and it is forced to move in unison with the slowly-running receiving-rollers. While the sheet is being drawn out of the conductor 4, and carried onward over the folding-rollers 39, the switch 25 will have been moved in the position shown in Fig. 5, whereby the succeeding folded sheet will be directed, through the conductor 2, into the nip of the receiving-rollers 11 12, and thence will be carried on to the second folding rollers 34.

Experience has determined the impossibility of moving a sheet at high velocity against a stop or gage, which arrests it over a pair of folding-rollers in proper position to be folded. In this mechanism the receiving-rollers 21 22 are therefore run at such a diminished speed as will feed the sheet against the gage 40 without causing it to recoil therefrom, be buckled up, projected over the gage 40, or otherwise delivered in any but a true position of register with respect to the folding-rollers 39.

When the sheet has arrived in place over the folding-rollers 39, the vibrating folding-blade 60 descends, and doubles it between the folding-rollers 39, which deliver it down before the fly-frame 59, standing in proper position to thus receive it. The fly is then vibrated to deposit the sheet upon the piling-board 70, curved guides 72 directing the sheet into proper position. This piling-board is supported by a spring-seated rod, 71, the strength of the spring being so graduated as to permit its descent as each sheet is deposited upon it, and still keep the top of the pile at the proper height, as the weight of the mass is thus constantly augmented.

The apparatus herein illustrated shows a single complete mechanism for folding a sheet received from the delivering-rollers 9 10.

It is to be understood, however, that the folding-rollers 34 for operating upon each alternate sheet received from the delivering-rollers 9 10 are to be supplied with a folding-blade, gage or stop, a fly, a delivery-table, and mechanism for operating said parts, in like manner as has been described with reference to the folding-rollers 39 and folding-blade 60.

Thus constructed, the machine is adapted to direct each alternate sheet emerging from the delivering-rollers 9 10, in diverging paths, to separate folding apparatuses, whereby said sheets are folded a second time, and delivered at different points of the machine.

It is obvious that the delivering-rollers 9 10 and receiving-rollers 11 12 and 21 22, as well as the plates 5 6 7 8 and switch 25, may be made twice the length illustrated, and thus be adapted to fold a very wide sheet of paper—that is, one equal to the width of two ordinary sheets—which sheet may contain duplicated printed matter, is adapted to be severed in its longitudinal center, and in that case would form two distinct and complete duplicate printed sheets. This severing may be accomplished by means of a circular cutter fixed to one of the receiving-rollers 11 12 and 21 22, and running in a groove in the other, the result being that the doubly-wide sheet in passing through the rollers 11 12 and 21 22 will be divided longitudinally into separate sheets.

But in such an organization of this machine, the mechanisms for producing the second folds in the sheets hereinbefore described will be duplicated, and the resulting pairs of sheets emerging from the rollers 11 12 and 21 22 will pass alternately over their folding-rollers, and be simultaneously folded a second time, and delivered at opposite sides of the machine, as is apparent.

Such a machine, it will readily be understood, will have four delivery-points, two of which will be on each side of the machine in different planes.

Though this machine is primarily intended to receive folded sheets through the rollers 9 10, it is obvious that the sheets resulting as the product of a web perfecting-press having a sheet-severing device might be led through the rollers 9 10 in a flat or unfolded condition, in which case they would be alternately delivered in two paths, and directed to folding mechanisms, as has been herein described with reference to folded sheets, and the result would be a folding attachment capable of disposing of the rapidly-produced sheets from such a press.

But in such an organization of the mechanisms, the receiving-rollers 11 12 and 21 22 will be placed a distance from the delivering-rollers 9 10 which is nearly equal to the length of such flat or unfolded sheets, and the conductors 2 4 will be elongated accordingly.

The conductors 2 4, which are herein shown as constructed of continuous plates, may be formed from rods or bars supported on rods seated in the side frames of the machine. The rods taking the place of the plates 5 6 might extend into grooves in the rollers 9 11, 10 22,

and the rods supporting the plates 7 8 would be fast upon shafts connecting the arms 41 41 and 42 42, and their forward ends might extend between the arms 47 48 of the sectional switch 25.

The tapes 30 31 and 35 36 might carry the once-folded sheets down before the fly-frames, by which they would be delivered, or the said tapes might be brought together so as to carry two sheets, either unfolded or folded, simultaneously before a single fly-frame for delivery; but in such delivery one set of the tapes must be enough longer than the other as will make one stream of sheets travel enough farther than the other to cause the two to meet and be delivered together. This mode of flying is, however, shown in patent to Hoe and Tucker, No. 131,217, September 10, 1872.

The sides of the switch might be extended far enough to span the space between the delivering and receiving rollers, and thus take the place of the plates 7 8. In such arrangement it is preferable to construct the switch in sections, as described, and to groove the receiving-rollers to receive them.

The delivering and receiving rollers may, instead of being grooved, be made up of separate pulleys set upon a common shaft.

The mechanism forming an elastic connection between the folding-blade 60 and its driver forms the subject-matter of another application, and is therefore not claimed broadly herein.

What is claimed is—

1. The combination, with a pair of delivering-rollers, of diverging rigid conductors, for conveying the sheets in two distinct streams, substantially as described.

2. The combination of the delivering-rollers, receiving-rollers, and diverging rigid conductors, substantially as described.

3. The combination of a pair of delivering-rollers driven at high speed with a pair of receiving-rollers driven at low speed, for controlling the movements of the sheet, substantially as described.

4. A pair of delivering-rollers driven at high speed, and a pair of receiving-rollers driven at low speed, said pairs of rollers being separated such a distance that the sheet will enter the latter an instant before leaving the former, and thus be carried onward, substantially as described.

5. The combination, with rollers, as 9 10 and 11 12, of the stationary plate 5, removable plate 7, and switch 25, substantially as described.

6. The combination, with delivering-rollers 9 10 and diverging rigid conductors, of the removable switch, substantially as described.

7. The combination of the switch, fast-running delivering-rollers, and slow-running receiving-rollers, substantially as described.

8. The combination of the delivering-rollers, switch, and diverging rigid conductors, substantially as described.

9. In combination with the folding-blade shaft, the rock-arm 66, short connecting-rod 67, and wheel 28, whereby an alternately fast and slow movement is imparted to the folding-blade, substantially as described.

10. The combination, with the folding-blade shaft 3, of the recessed hub 75, pin 1, and spring 65, substantially as described.

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

STEPHEN D. TUCKER.

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CHAS. W. CARPENTER.