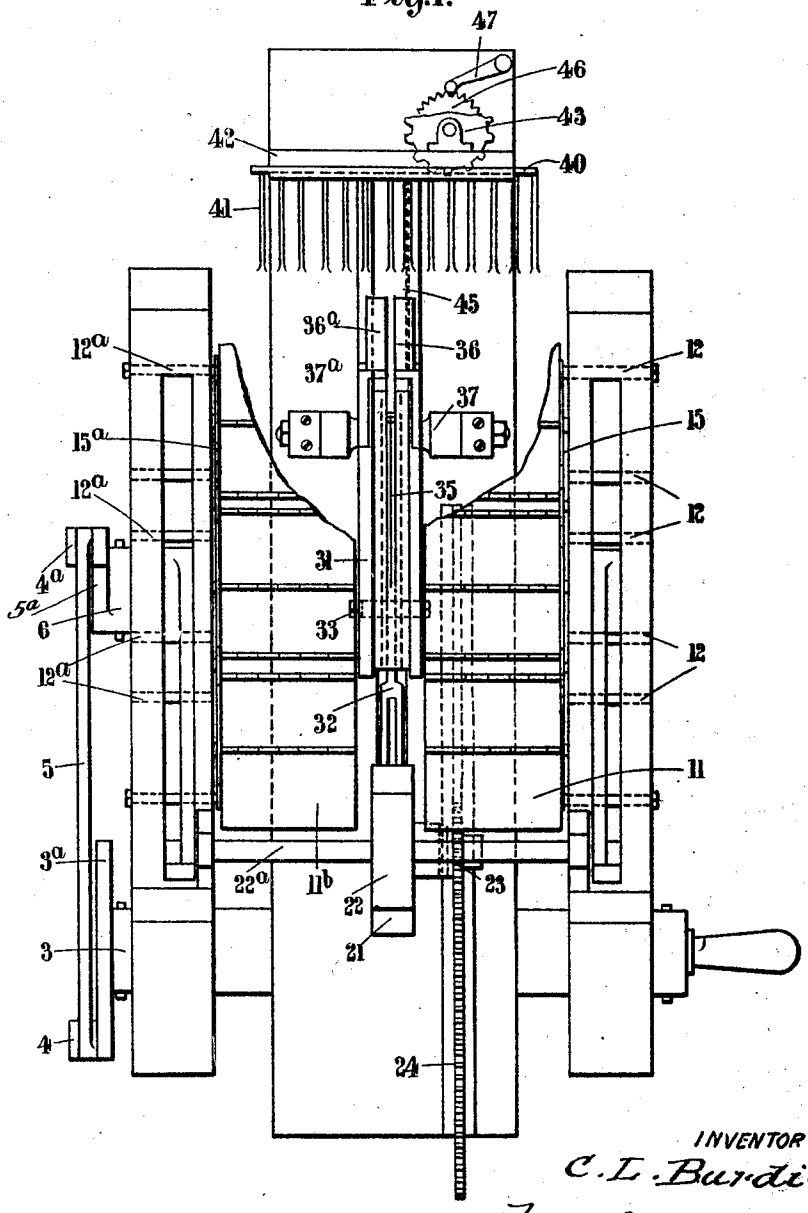
Jan. 26, 1926. 1,571,105

C. L. BURDICK

PAPER FOLDING MACHINE

Filed Jan. 12, 1922 5 Sheets-Sheet 1

Fig. 1.



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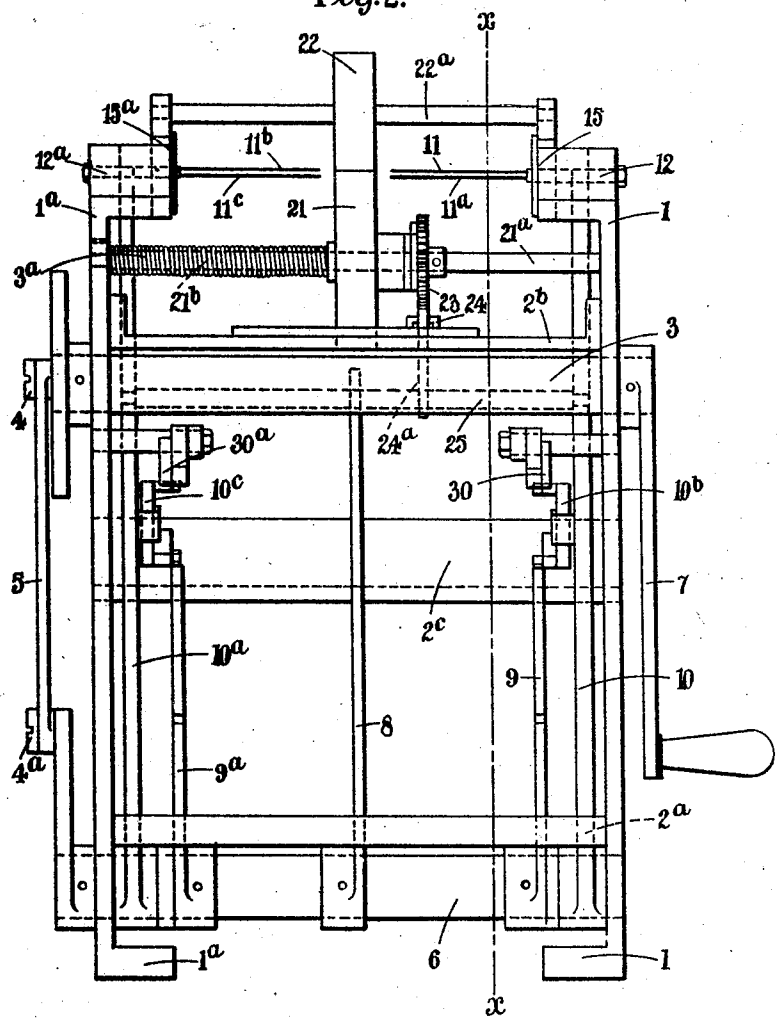
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Fig. 2.



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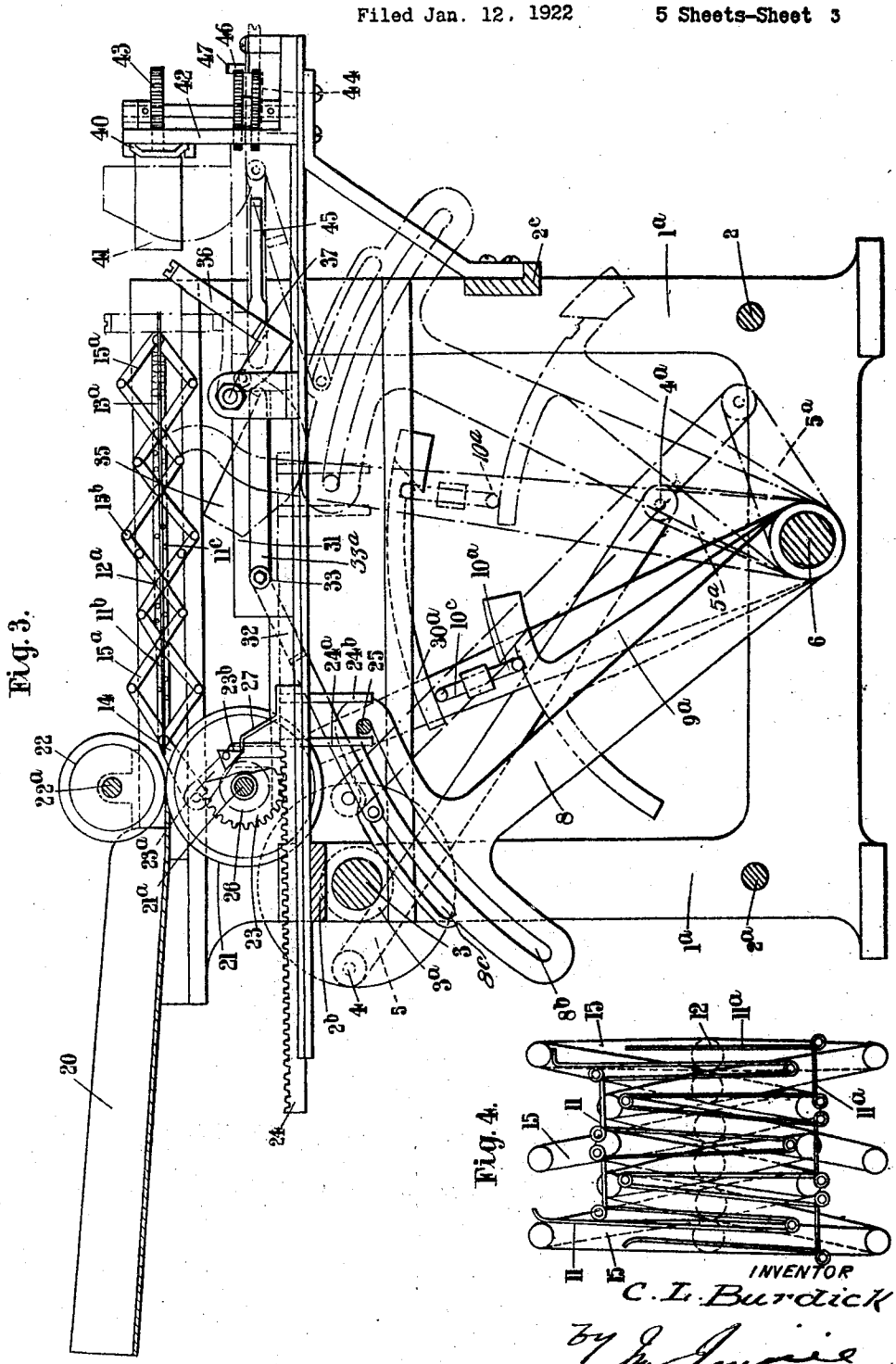


Fig. 3.

Fig. 4.

INVENTOR

C. L. Burdick

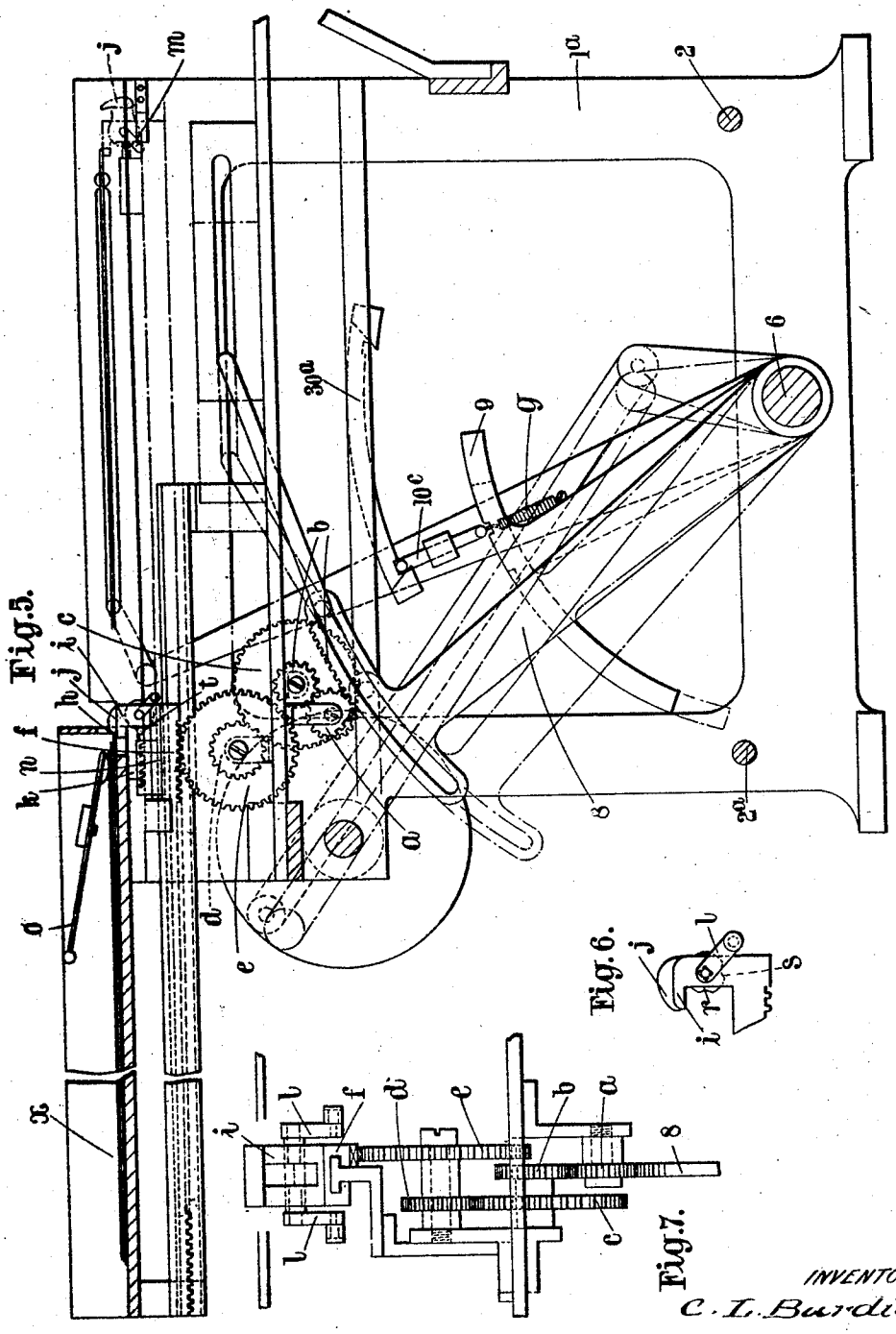
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Filed Jan. 12, 1922 5 Sheets-Sheet 4



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PAPER FOLDING MACHINE

Filed Jan. 12, 1922 5 Sheets-Sheet 5

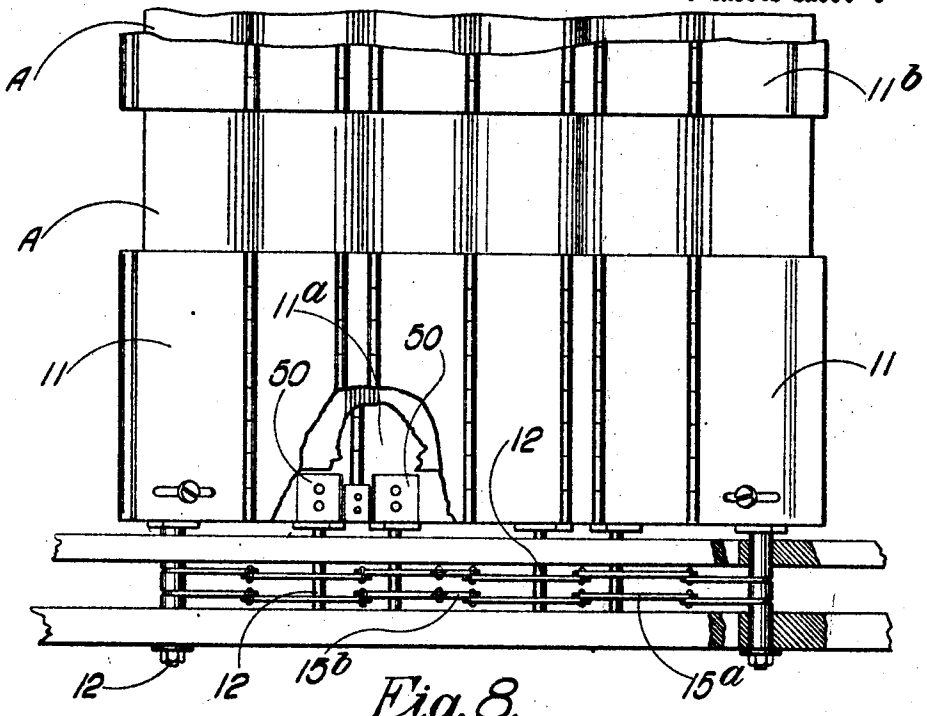


Fig. 8.

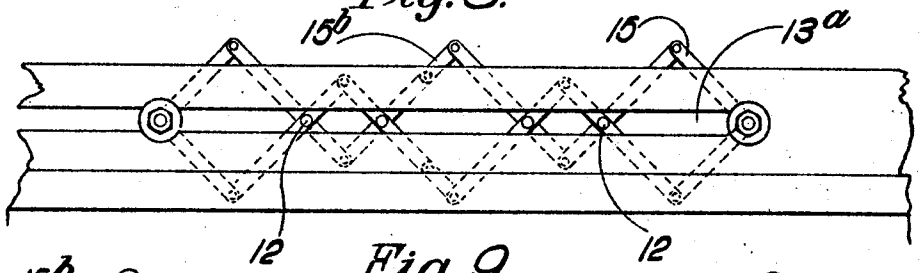


Fig. 9.

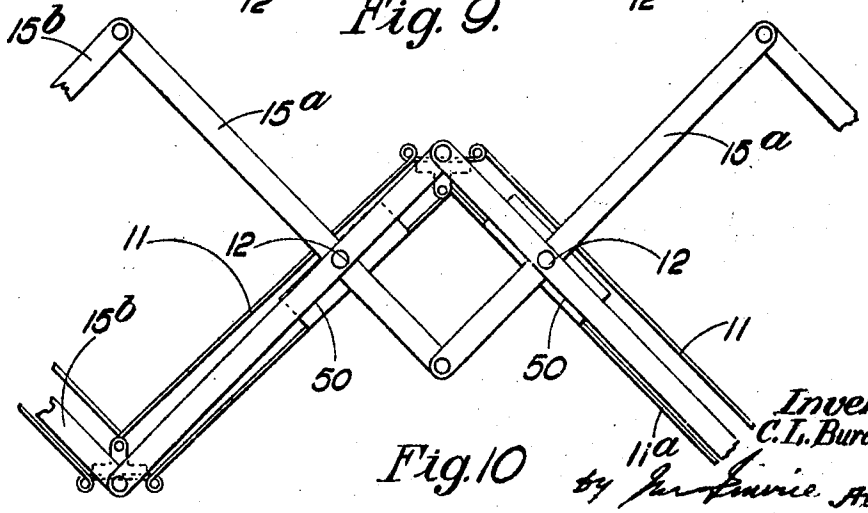


Fig. 10

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Patented Jan. 26, 1926. 1,571,105

UNITED STATES PATENT OFFICE.

CHARLES LAURENCE BURDICK, OF LONDON, ENGLAND.

PAPER-FOLDING MACHINE.

Application filed January 12, 1922. Serial No. 528,752.

To all whom it may concern:

Be it known that I, CHARLES LAURENCE BURDICK, a citizen of the United States of America, residing at 4 Eastern Road, London, N. 22, England, have invented certain new and useful Improvements in Paper-Folding Machines, of which the following is a specification.

This invention relates to machines for folding sheets of paper and is specially designed for folding paper money which is more conveniently handled for the purpose of paying out wages or giving change if the sheets or notes are compactly folded. The invention is, however, also applicable for folding letters or circulars for insertion in envelopes and like purposes.

The invention has for its object to provide a folding machine in which sheets are fed one at a time between two or more folding plates which are then folded, thus causing the sheet held between them to be correspondingly folded.

A further object is to provide a folding machine in which there are two sets of pairs of folding plates the edges of which do not meet; these plates are so supported that they can be folded up with the sheet between them and a blade or the like then engages the free portion of the sheet between the edges of the plates and withdraws it from the latter, at the same time giving the sheet a further fold about a line at right angles to the line or lines of the previous fold or folds. This blade preferably drives the folded sheet between bars or rollers which prevent more than one sheet from being passed through the machine. The folded sheets may then be fed into clips mounted on a bar which is moved transversely one step at each operative movement of the machine, the folded sheets being thus assembled in convenient numbers. The bar may be removed when filled with folded sheets and a fresh one substituted and by counting the number of filled bars a ready means of computing the number of notes or the like is provided.

A further object of the invention is to provide improved means for feeding the sheets between the folding plates so as quickly to be placed between the plates when in their flat or unfolded positions.

With these and other objects in view the invention consists in the features hereinafter described and claimed in the annexed claiming clauses.

In the accompanying drawings which illustrate a convenient form of machine embodying the present invention:—

Fig. 1 is a plan view, certain elements being eliminated for clearness of presentation.

Fig. 2 is an end elevation, certain elements being eliminated for clearness of presentation.

Fig. 3 is a sectional side elevation through the lines x—x of Fig. 2—the dotted lines made with long and short dashes indicating the movement of certain operative parts.

Fig. 4 is a drawing showing the position of certain operative parts, which are not shown in Fig. 3.

Fig. 5 is a sectional elevation of a folding machine showing a reciprocating gripper feed for taking sheets one at a time from a pile.

Fig. 6 is a detail of the gripper.

Fig. 7 is a part side elevation showing some of the parts illustrated in Fig. 5.

Fig. 8 is a partial plan illustrating the mounting of the folding plates and the means for operating the same.

Fig. 9 is a side view of the same.

Fig. 10 is an enlarged side elevation showing a portion of the plates and their operating means in partly folded relation.

The framework of the machine comprises standards 1, 1^a which are kept in position by cross pieces 2, 2^a, 2^b and 2^c. A shaft 3, carrying a disc 3^a to which is secured a crank pin 4, is journalled in the framework; a link 5 connects this pin with a similar pin 4^a mounted on a crank arm 5^a, which is secured to a shaft 6, also journalled in the framework. This arrangement provides means for oscillating the shaft 6 with each complete rotation of the shaft 3. On the end of the shaft 3 remote from the disc 3^a, a driving crank 7 is carried, while rigidly to the shaft 6 are a central arm 8 and two side arms 9, 9^a, two other arms 10, 10^a being loosely journalled on the shaft 6.

At the top of the machine are mounted two sets of folding plates 11, 11^a and 11^b, 11^c; these plates are provided with wide and narrow hinged portions as shown in Fig. 1 in order that they may fold up as shown in Fig. 4 the plates of each set being so spaced as freely to admit a sheet of paper between them. The plates are supported from the sides and a wide gap is left between their free ends in the centre of the machine as shown in Figs. 1 and 2.

The plates are supported in position by a series of rods 12 and 12ª one of which on either side at the forward end pivots in a hole in the framework while the others both slide and rotate in grooves indicated at 13ª Fig. 3. The folding and opening movement of the plates is effected by arms 10, 10ª; through links 14. The supporting rods 12 and 12ª are formed as stems on the brackets 50 which are riveted to the plates as clearly shown in Figs. 8 and 10. It is thus apparent that the rods rotate according to the angular positions of the plates 11ª, and this is the extent of their rotational movement. The rods come together as shown in Fig. 4 in the forward position of the rearmost rod 12, Figs. 8, 9, and 10, illustrating an intermediate position.

Links 15 and 15ª forming a kind of lazy-tongs are mounted on the rods 12 and 12ª and serve to keep the folding of the plates uniform for each side and as some of the spaces are wider than others the lengths of those links are correspondingly chosen; the long outer arms may be slotted though this is not always necessary and is not illustrated. The central links are made with short links 15ᵇ to enable them to fold compactly, while allowing for any slight differences between the pivotal centers and inclinations of the links and those of the folding plates.

Paper sheets A are fed to the machine from a platform or holder, 20 by two rollers 21 and 22 mounted to rotate on shafts 21ª and 22ª; the wheel roller 21 is actuated in one direction by a spring 21ᵇ mounted on the shaft 21ª which has loosely mounted thereon a toothed wheel 23 which engages with the teeth of a rack 24. This rack is mounted in guides and is moved longitudinally through posts 24ª and 24ᵇ from a rod 25 which passes from the arm 10 to the arm 10ª to which arms it is secured. On the gear wheel 23 is a spring actuated ratchet pawl 23ª which engages with a notch in a boss or extension from the wheel roller 21. When the toothed wheel is rotated on its shaft by the advancing rack, it carries the roller 21 with it through the pawl 23ª. The pawl 23ᵇ secured to the framework then retains the roller in position while the rack is being returned to normal; when however, the rack has nearly reached its limit of backward travel a tripping piece 27 strikes and displaces the pawl 23ᵇ releasing the roller 21 so that the action of the spring 21ᵇ will rotate the roller and feed the sheet of paper forward between the plates.

The next forward movement of the arms 10, 10ª will fold the plates as shown in Fig. 4 the paper between being folded at the same time.

The arms 10 and 10ª are loosely journalled on the shaft 6, and are moved forward and backwards by arms 9 and 9ª by means of sliding locking pieces 10ᵇ and 10ᶜ which are secured to the arms 10 and 10ª respectively and are operated by fixed cams 30 and 30ª and cam shaped extensions at the top of the arms 9 and 9ª which engage with rollers on the pieces 10ᵇ and 10ᶜ and move them longitudinally, notches being provided into which the rollers fall at the limit of travel in either direction, so that the free arms 10 and 10ª are locked to the arms 9 and 9ª during a portion of the movement, and are rigidly secured in their forward position by being locked to the rigid cams 30 and 30ª. In the full line position of arm 10ª, locking piece 10ᶜ has moved down toward the pivot of the arm 10ª and engages the notch of the arm 9ª. When the notch 9ª comes opposite to notch 30ª, the locking piece 10ᶜ is enabled to move upward into the notch of 30ª to release the arm 9ª for further movement into the position shown in dotted lines at the right of Fig. 3.

When the sheets have been received between the sets of folding plates and have been folded, the folded sheets are removed from the plates by a thin blade 35 which advancing centrally makes a further fold of the paper, carrying the sheets between a set of rollers 36, 36ª and forcing them into clips 41 on a bar 40.

This movement is accomplished by linking a carriage 31 by means of a rod 32, and a cross piece 33 to the slot 8ᶜ in the movable arm 8, the carriage 31 providing a mounting for the hinged blade 35, and having a slot 33ª within which the cross piece 33 is free to slide.

Lost motion is provided by a slot 8ᵇ in the extension of the arm 8 to ensure the correct timing of the movement of the operative parts.

The blade 35 is shaped in such a manner that the pressure of the cross piece 33 as it moves forward along slot 33ª will bring it to an upright position, and retain it there while the paper is being folded and carried forward between two standards with rollers 36, 36ª. The action of the cross piece 33 is a cam action against the rearward sloping surface of the blade 35, which is pivoted at its forward end. The cross piece strikes the rear sloping surface of the blade and, owing to the inclination, raises the blade as the cross piece moves forward. As illustrated in dotted lines, the cross piece is in contact with the lower surface of the blade at one side of the blade pivot, and hence the blade is prevented from falling back until the cross piece 33 has been withdrawn to clear the blade. These standards are brought to an upright position, when the blade with the paper is passing; this is accomplished by hinging them at points 37, 37ª and bringing the cross piece 33 underneath as it is advanced. By mounting the standards carry-

ing rollers 36, 36ª at a suitable distance, means are provided for arresting the machine if by any chance two sheets of paper are fed through at the same time, this being a very important feature if paper money is being folded.

The folded sheets may fall in a box or any other means may be provided for receiving them; in the form of machine shown means are provided for placing them in clips 41 in a bar 40 Figs. 1 and 3. The bar is mounted to slide in a framework 42 and is advanced by a sprocket wheel 43 journalled in the framework; holes or perforations are made in the bar which receive the teeth of the wheel.

This wheel 43 is advanced one tooth at a time by means of a ratchet wheel 44 mounted on the same shaft which has teeth corresponding in number to the teeth on the sprocket wheel; an arm 45 secured to the carriage 31 is provided with a notch which engages a tooth on the ratchet wheel 44, and advances it one tooth with the return of the carriage, a detent wheel 46 provided with a spring detent arm 47 carrying a roller serves to keep the bar with the clips (which thus serves as a magazine of clips) always in alignment with the advancing blade carrying the folded sheets. As indicated in Fig. 3, the arm 45 has a terminal hook of more or less resilient material, so that on the forward movement, the hook springs away from the teeth of the wheel 44 and on the rearward movement cooperates with the teeth to rotate the wheel, this being an ordinary ratchet action.

When the clips carried by the bar have all been filled, the bar may be removed and a new one substituted. By making each bar accommodate a convenient number of folded sheets, say twenty, this mechanism provides an indirect means for counting notes or the like.

In cases in which a reciprocating-gripper feed is preferable for bringing the sheets between the folding plates, the mechanism shown in Figs. 5–7 is employed.

The sheets are placed in a trough or the like x with the front edge of each sheet projecting beyond the front edge of the one above it and the edge of the lowermost sheet is gripped between grippers i, j and pulled downwards below projecting portions of a gate h which prevents the upper sheets from moving beyond it. The gripper then runs along the gap between the folding plates carrying the sheet into position between the latter; when the gripper arrives near the end of its forward movement, crank arms l carried by the pivoted member j of the gripper engage stops m which cause the latter to tilt over to the position shown in dotted lines on the right hand side of Fig. 5. On the return movement of the gripper, the member j is below the level of the sheet between the folding plates and the crank arms l are engaged by stops n which return the member j to initial position and causes it to engage the forward end of the next sheet.

The shaft of the pivoted gripper member j carries recesses r, s which engage with a spring detent t and cause the member to snap into its extreme position.

The fixed member i of the gripper is secured to a rack f which is driven through change gearing e, d, c, b, a from a mutilated toothed sector carried by the arm 8, so that the reciprocating gripper feed is actuated during a portion of the movement of the latter. In order to ensure correct re-engagement of the parts after the sector has passed out of operative connection with the pinion a, the latter is provided with detent means of any suitable form.

Locking bars 10^c for the arms 10, 10^a previously described are assisted in their movement by the springs g; these bars engage notches at each end of cam races 30^a, simultaneously passing out of engagement with notches with the arms 9.

The operation of the machine may be summarized as follows: The sheets are fed in one at a time between the plates when in their unfolded position. The plates are then closed up as in Fig. 4, to fold the sheet and the blade 35 comes into an erect position and, advancing, withdraws the sheet from the folding plates, passes it between the rollers 36, 36^a thus giving an additional fold at right angles to the others and deposits it within the clip which will at the time be in alignment with it. The return of the carriage 31 with its arm 45 will move the toothed wheel 43, and the bar 40 is moved along one step so that another clip is brought in position for the next sheet.

I claim:—

1. In a machine for folding paper and like sheets, the combination of a pair of plates, each plate of said pair being foldable, said plates lying in different planes with a space between them, means to feed the sheet into the space between the plates, and means to fold the plates with the sheet between them.

2. In a machine for folding paper and like sheets, the combination of a plurality of pairs of folding plates, said pairs being arranged with a gap between them, a sheet to be folded lying across said gap, and a member at right angles to the line of the folds, means to fold said plates, and means to pass said member through said gap, so withdrawing and at the same time folding the already folded sheet on a line at right angles to the above mentioned line of folds.

3. In a machine for folding paper and like sheets, the combination of two sets of pairs of folding plates disposed with a gap

between the sets, means to feed a sheet between the pairs of plates of both sets, means to fold the plates with the sheet between them, and means to withdraw the sheet through the aforesaid gap.

4. In a machine for folding paper and like sheets, the combination of two sets of pairs of folding plates disposed with a gap between the sets, means to feed a sheet between the pairs of plates of both sets, means to fold the plates with the sheet between them, a plurality of receiving devices, means to push the sheet through the aforesaid gap into a receiving device, and mechanism to cause another receiving device to move into position for receiving a folded sheet.

5. In a machine for folding paper and like sheets, a pair of folding members having a plurality of joints, means to place a sheet between said members, means to fold said members with the sheet therebetween, and means to withdraw the folded sheet from the edges of the folded members.

6. In a machine for folding paper and like sheets, a pair of folding members for holding a sheet between them, means to fold said members with the sheet in position between them, said members comprising a plurality of plates connected alternately by pivots and by short links, the pivot connection of each member being opposite to, and adapted when the members are folded to lie inside a space provided by the short link connection of the other.

7. A paper sheet folding machine having means provided with a gap and means to bring a partially folded sheet in proximity thereto, and a member passing through the gap and adapted to carry the sheet with it and to fold the sheet again in its passage, said member being thinner than the gap by very slightly more than twice the normal thickness of said partially folded sheet, so that its passage is blocked in case of any thickness of the sheet substantially above the normal.

8. In a machine for folding paper sheets, the combination of a plurality of upper plates joined together, a plurality of lower plates jointed together and upon which a sheet is adapted to be placed, a lazy-tongs linkage, and connections between the plates and the linkage so that as the linkage is closed the plates are folded in zig-zag fashion.

In testimony whereof I affix my signature.

CHARLES LAURENCE BURDICK.