Dec. 25, 1934. M. GODER 1,985,859

MACHINE FOR FOLDING FLAT PAPER MATTERS

Filed Aug. 22, 1933 3 Sheets-Sheet 1

Fig. 1

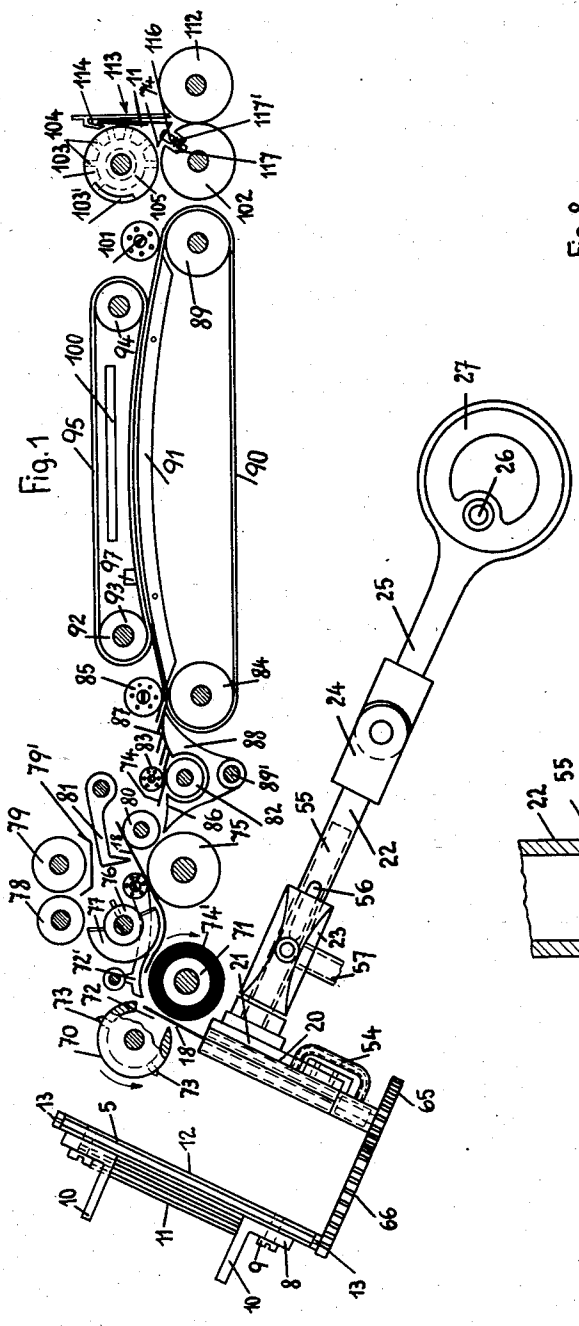


Fig. 8.

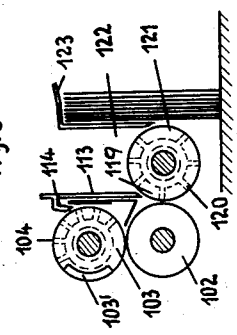
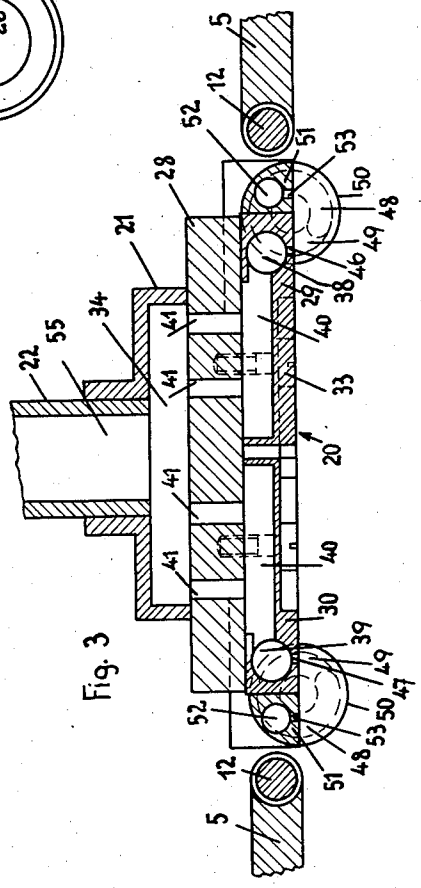


Fig. 3



Inventor:
Max Goder.
by:
Marks & Clerk
Attys.

Dec. 25, 1934. M. GODER 1,985,859

MACHINE FOR FOLDING FLAT PAPER MATTERS

Filed Aug. 22, 1933 3 Sheets-Sheet 2

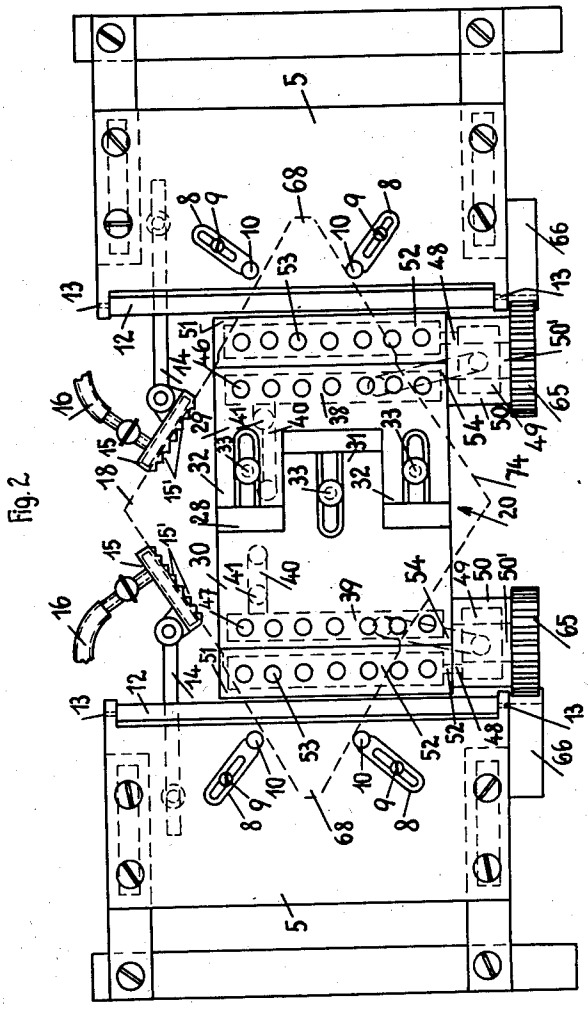


Fig. 2

Inventor:
Max Goder
by:
Marks & Clerk
Attys.

Dec. 25, 1934. M. GODER 1,985,859

MACHINE FOR FOLDING FLAT PAPER MATTERS

Filed Aug. 22, 1933 3 Sheets-Sheet 3

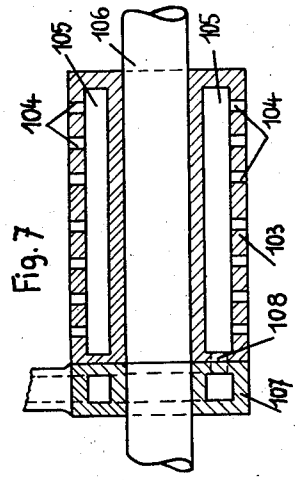


Fig. 7

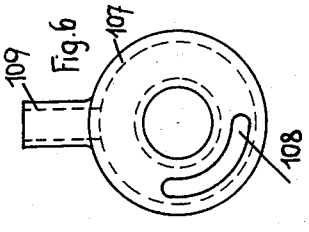


Fig. 6

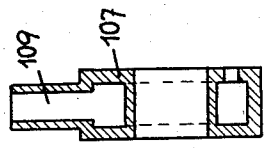


Fig. 4

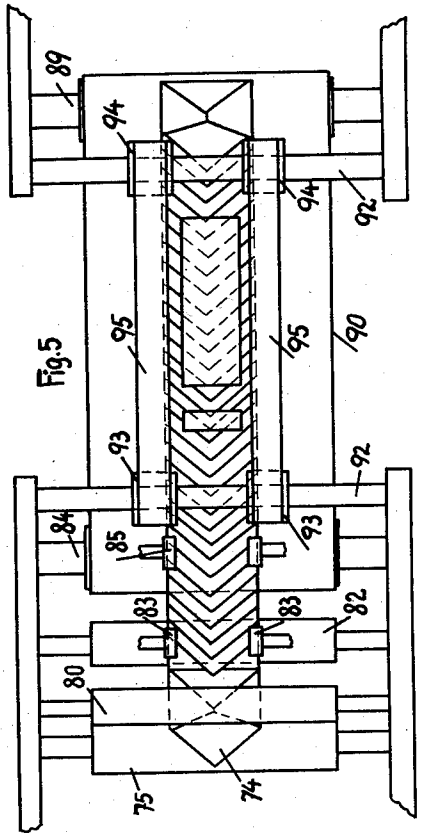


Fig. 5

Inventor:
Max Goder.
bey:
Marks & Clerk
Attys.

Patented Dec. 25, 1934 1,985,859

UNITED STATES PATENT OFFICE

1,985,859

MACHINE FOR FOLDING FLAT PAPER-MATTERS

Max Goder, Neuss, Germany, assignor to United States Envelope Company, Springfield, Mass., a corporation of Maine

REISSUED

Application August 22, 1933, Serial No. 686,273
In Germany August 18, 1932

7 Claims. (Cl. 93—61)

This invention relates to machines for folding flat paper articles, such as envelopes and flat bags requiring one or more folding operations, in the longitudinal direction parallel to the movement of the article through the machine during its manufacture and also perpendicular to that direction.

The object of my invention is to provide a machine of this class which is cheap to manufacture and has a considerable output capacity.

The invention is illustrated in the following drawings, in which

Fig. 1 is a vertical section through the complete machine,

Fig. 2 is a view of the rear of the machine with an envelope blank thereon shown in broken lines,

Fig. 3 is a vertical section through Fig. 2,

Fig. 4 is a part section of a detail on the line 4—4 of Fig. 7,

Fig. 5 is a part plan of the machine,

Fig. 6 is an end view of the detail shown in Fig. 4 and Fig. 7 is a section on the line 7—7 of Fig. 6 of the detail shown associated with another detail, also shown in section, and

Fig. 8 is a diagrammatic view of the delivery mechanism.

The machine comprises a frame on the back of which two plates 5 are fixed on horizontal cross rails by means of screws passing through slots in such a manner that the plates can be adjusted close to or further apart from one another to suit the width of the article being manufactured. These plates and their accessory parts which will be described subsequently are inclined with their upper ends facing towards the machine. On each plate 5, two slotted stud plates 8 are fixed by screws 9, said stud plates having studs or pegs 10 extending vertically upwardly therefrom, and serving for maintaining the work in position, said studs being adjustable in all directions about the axis of the screws 9. Preferably on the inner edge of each plate 5 a cylinder 12 is mounted on pins 13, so as to be freely rotatable, whereby easy running off of the blanks 11 is ensured when the later are drawn in between the plates 5 as subsequently described.

On the plates 5 above the pile of blanks 11 two nozzle boxes 15 with nozzles directed towards the blanks are adjustably secured by holding means 14. Beneath the nozzles the boxes 15 have teeth 15' which engage under the edge of the lowest sheet of paper on the pile and support the latter. By means of flexible pipes 16, compressed air is supplied from a source of compressed air which is not shown in the drawings. This compressed air flows between the sheets of paper on the pile and by this means separates those sheets in case they adhere together.

Between the two plates 5 a plate 20 is arranged which extends in the longitudinal axis of the machine and is displaceable towards the interior of the machine. The plate 20 is fixed through the intermediary of a hollow cylinder 21 on a rod 22 which is hollow in part and passes through a bearing support 23 fixed on the frame of the machine and which is connected up by means of a pivotal connection to an eccentric rod 25 of an eccentric 27 fixed on the main driving shaft 26 of the machine.

The plate 20 comprises three parts, namely a base plate 28 and two side parts 29 and 30 adjustable on this plate. These parts 29 and 30 are connected to each other by means of slotted plates 31 and 32 which are fixed by screws 33 on the base plate 28, so that the plate 20 comprising these parts can be adjusted in width. The hollow cylinder 21 is fixed on the back of the base plate 28 and the latter forms one of the end walls of the cylinder.

In the side parts 29 and 30 are hollow spaces 38 and 39 extending almost through the whole height of the side parts, said hollow spaces being in open communication with conduits 40 in the parts 29 and 30, said conduits extending across the parts 29, 30 and communicating through openings 41 in the base plate 28 with the interior 34 of the cylinder 21, so that in every position of the side parts 29 and 30 the hollow spaces 38 and 39 of the side parts are in open communication with the hollow space 34. When the interior of the hollow rod 22 is evacuated, the hollow spaces 34 and, through the openings 41, the hollow spaces 38 and 39 will also be evacuated. The hollow space 38 through a number of openings 46 and the hollow space 39 through a number of openings 47 is in open communication with the front side of the plate 20, so that a sheet of paper lying on the front side of the plate 20 is sucked up and held fast by the vacuum. A valve 51 is located on each side of the plate 20, being fixed on a shaft 50' which is rotatable in a bearing support 50, the said valves having preferably a segmental cross section equal to a quarter of a circle (Fig. 3). The valves 51 have in their interior a hollow space 52 which is in open communication with a line of openings 53 in the side of the valve in line with the front side of the plate 20. The hollow spaces 52 communicate through the bearing supports 50 and pipes 54 with the hollow spaces 38, 39 respectively in such

a way that a vacuum produced in the hollow spaces 38, 39 also causes the paper to be sucked up by the vacuum acting through the lines of openings 53. The bearing supports 50 are fixed on the side parts 29, 30 respectively. The hollow spaces 52 of the valves are in open communication with hollow spaces 49 in the bearing supports in all positions of the valve through an opening 52 in the valve and a segmental slot 48 in the bearing support 50.

The hollow space 34 of the cylinder 21 communicates through the interior 55 of the rod 22 and a slot 56 in the wall of the rod during certain positions of the latter in connection with a hollow space in the interior of the bearing support 23 during a certain portion of the stroke of the rod and the said hollow space communicates with a vacuum pipe 57 which is connected up to a suitable means for producing a continuous vacuum (not shown). The position of the slot 56 is such that air is drawn through the lines of openings 46, 47 and 53 and a sheet of paper 11 situated over the latter is held fast by the vacuum during the time that the plate 20 travels forward between the plates 5 and during a portion of the time during which it is being withdrawn from this position. Only when the plate 20 has nearly finished its return movement when the eccentric 27 has turned through about 180° from the position shown in Fig. 1, does the slot 56 pass out of the bearing support 23, thereby breaking the vacuum and releasing the sheet of paper.

On each of the shafts 50' a toothed wheel 65 is fixed so as to turn with the valve 51. This toothed wheel meshes with a rack 66 fixed on the under edge of the rear side of the respective plate 5. By the movement of the plate 20 the valves 51 are turned by means of the toothed wheels and racks in such a manner that, in the extreme forward position of the plate shown in Fig. 3, the sides of the valves in which the openings 53 are provided are in the same plane as the plate 20, while in the opposite position of the plate, shown in Fig. 1, when the plate 20 is completely withdrawn, the said sides of the valves 51 rest flatly against this plate.

Before commencing work, a pile of paper sheets 11 is put to the plate 5 between the studs or pins 10, the sheets being cut to the shape of the blanks required to form the articles, such as envelopes or flat bags to be manufactured. The parts of the machine are set in such a way that the lines of the folds for the two lateral flaps 68 (Fig. 2) are accurately over the inner apertured sides of the valves 51, which edges lie on the axes of rotation of the valves. In the forward position of the plate 20 (Fig. 3) the air drawn in through the openings 46, 47 and 53 causes the lowest sheet of the paper pile to be sucked up as soon as the work begins, so that it is held securely on the plate 20 and against the valves 51 and is carried back with the plate 20 during the return of the plate. During the latter movement the valves 51 are turned inwardly and fold the lateral flaps 68 of the article being manufactured accurately along the axes of the valves 51. In this position of the plate 20, the suction action ceases, because the slot 56 is out of the bearing support 23 and the sheet is no longer held fast on the plate 20, so that it can be drawn off between the valves 51 and the plate 20 in a way now to be described, as soon as the valves 51, at the beginning of the next forward movement of the plate 20 are raised slightly from the plate, the plate 20 continuing to move forward again and taking off another sheet.

The folded sheet 11 is withdrawn by two rollers 70 and 71 located so that in the fully withdrawn position of the plate 20, the upper edge of the plate 20 lies between the rollers, which turn in the direction of the arrows at the same speed as the main driving shaft 26. The roller 70 has a gap 72 therein into which the upper flap 18 of the sheet 11 enters during the withdrawal of the sheet from the pile by the plate 20. During its further rotation the roller 70 seizes the sheet and squeezes it between itself and the roller 71, which is provided with a yielding covering of rubber, the two rollers then withdrawing the sheet. On the roller 70 are fixed two paper creasing blades 73 which press into the paper during its passage between the rollers and form the creases for the upper flap 18 and the lower flap 74. During this creasing, the roller 71 which forms the abutment for the roller 70 has a layer of weak gum applied to it.

From the rollers 70 and 71 the sheet 11 is delivered to a roller 75, being forced under a curved sheet metal guide 72' on its way to the roller 75. Between the rollers 71 and 75 a roller 76 is interposed having ribs 77 arranged in V-formation which, during the rotation of the roller 76 make contact with a roller 78 and receive adhesive therefrom. The roller 78 receives the adhesive from a roller 79, the latter receiving the adhesive from a trough 79'. The ribs 77 apply the adhesive to the edges of the flaps 68 of the sheet 11 which in Fig. 2 are directed upwards but which in the meantime have been turned inwards. The roller 76 is interchangeable with other rollers having ribs 77 differently arranged to suit the shape of the article being manufactured.

The sheet continues to move until the flap 18 rests on a roller 80 which is in contact with the roller 75, and under a paper folder 81 swinging up and down in the direction of the arrows above the line of contact of the rollers. The paper folder is arranged in such a way that on swinging down, it engages the crease of the flap 18 which has been formed therein by one of the creasing blades 73 and moves towards the nip of the rollers 75 and 80, initiating the folding down of the flap 18 which is completed by the rollers, the flap 18 being firmly pressed against the previously gummed edges of the lateral flaps 68.

The work 11 passes from the rollers 75 and 80 to two pairs of rollers 82, 83 and 84, 85. Between the pairs of rollers 75, 80 and 82, 83 is located a concave sheet metal guide 86 and between the pairs of rollers 82, 83 and 84, 85 a convex sheet metal guide 87. Both guides 86 and 87 are fixed by side pieces 86 on a rod 89. The rollers 82 and 84 are driven at a peripheral speed considerably inferior to that of the rollers 75, 80. The rollers 83 and 85 are loosely rotatable and may be in the form of continuous cylinders or comprise a series of separate bosses or wheels arranged side by side so as to extend across the width of the work 11.

The edge of the guide 86 facing the rollers 82, 83 (the right hand edge in Fig. 1) is somewhat higher than the highest point of the roller 82, so that it presses the rearward flap 74 (Fig. 2) of the work between the cylinders 82, 83 slightly upwardly, whereby, owing to the articles 11 being advanced by the faster running rollers 75, 80 more rapidly than the articles being advanced by the slower running rollers 82, 83, each subse-

quent article is pushed below the one preceding it and the articles lie on the guide 87 in overlapping relationship as shown in Figs. 1 and 5.

A conveyor belt 90 is passed over two rollers 84 and 89 spaced some distance apart from one another, the upper run of said conveyor belt travelling over a cambered sheet metal support 91, the articles 11 being delivered to the belt 90 in overlapping relationship by the roller 84 which coacts with a roller 85 situated above it. Above the belt 90 are two pairs of rollers 94 and 95 which are axially displaceable on their shafts 92, each pair of rollers 93 and 94 having a conveying strap 95 passed round them. The articles 11 are conveyed between the straps 90 and 95 and the rollers 93, 94, which are adjusted on their shafts in such a manner that the straps 95 only engage the articles 11 at their edges (Fig. 5).

Between the straps 95 a box 97 is fixed which is open at its underside below which the articles 11 pass in close proximity thereto, an adhesive being supplied to the box 97 from a suitable source (not shown). By this means the edges of the flap 74 projecting from under the articles 11 in front of and overlapping them are spread over with adhesive.

After passing under the box 97, the articles 11 are subjected to the action of a suitable heating device, such as an electrical heater 100 which heats the articles to such an extent that on their arrival at the rollers 94 the adhesive has dried.

While situated above the roller 89, the articles 11 are pressed by a loose pressing roller 101 or by a plurality of loose bosses mounted on a shaft so as to be displaceable axially thereon.

By means of the two rollers 89, 101 the articles 11 are fed between two rollers 102 and 103 rotating with the same peripheral velocity as the rollers 75 and 80, thereby pulling the articles apart from one another. The roller 103 has on its periphery a recess 103' into which the article 11 passes after which it is engaged by the edge of the recess and is conveyed between the rollers 102, 103. Further the roller 103, as shown in Fig. 7, has on a part of its periphery apertures 104 which are in open communication with axial air-conduits 105 in the roller. On the shaft 106 of the roller 103 there is a hollow disc member 107 which can be turned or fixed independently of the shaft by means of a mechanism not shown. In the wall of the disc 107 there is a slot 108 which communicates through a conduit 109 with the source of a vacuum pipe.

A roller 112 is arranged at nearly the same height as and touches the roller 102. Above the line of contact of these two rollers is arranged a sheet metal guide 113 having a hook-shaped cross-section, the end of the shorter limb of which is situated above the line of contact of the rollers 102, 103.

The articles 11 of which till now the flaps 68 and 18 have been folded inwardly and secured together by adhesive while the flap 74 lying behind in the direction of movement is still open, are now taken hold of by the roller 103 by suction action and carried upwardly until they enter between the limbs of the guide 113. Shortly before this point is reached the conduit 105 of the cylinder 103 comes out of register with the slot 108 so that the vacuum is broken.

On the periphery of the roller 102 there are two pins 116 which are displaceable in the direction of the axis of the roller and are arranged in a groove 117 in the roller, the said pins being urged above the surface of the roller by means of springs 117. The location of these pins 116 is such that after the flap 74 has passed them they pass behind the edge of the flap and push the flap forward. As the flap 74 has already been creased by one of the paper creasers 73, the pins 116 pass the article 11 with the creased edge towards the line of contact of the rollers 102, 112, which complete the folding of the flap 74 by drawing the article 11 between them.

Another embodiment of the mechanism for completing the folding of the flap 74 is shown in Fig. 8, in which the roller 103 and the guide 113 are similar to that shown in Fig. 1 but the roller 102 is smooth without pins projecting therefrom, the roller 119 being situated at the same height as the roller 102, and the roller 103 being likewise provided with suction apertures 120. The roller 119 picks up the article 11 by suction action on its forward edge and draws it between the rollers 102 and 119 which completely fold down the flap 74. The suction is caused to continue in action nearly up to the point 121 and then ceases. The roller 119 is situated in the open end 122 of a box 123 and the articles are conveyed into this box, where they are stored.

What I claim is:

1. A machine for folding flat paper articles, comprising a pair of spaced sheet-supporting members for supporting a pile of sheets at a pair of opposed corners and means for folding a sheet on lines to form side flaps (or bottom flaps), in combination with a plate having suction means for suctionally engaging a lowermost sheet of the pile, said plate being arranged for movement from a point below the pile of sheets to a position for delivering the lowermost sheet to said sheet folding means, sheet-folding members pivoted to a pair of opposed edges of the plate and movable from a position in which they form a continuation of the plate at said edges into a position in which they bear against the plate and vice versa, said sheet-folding members having suction means for suctionally engaging the said sheet, means operatively connected to the sheet-folding members for turning said members towards the plate during the movement of the plate away from the pile so as to fold the sheet along lines registering with said opposed edges of the plate, and along lines to form the other two flaps, means for moving the plate towards and away from the pile of sheets, and controlling means for breaking the suction action on the plate reaching the delivery position.

2. A machine for folding flat paper articles, comprising sheet-supporting means for supporting a pile of sheets, a pair of creasing rollers for forming creases on lines to form side flaps (or bottom flaps), sheet-feeding means arranged for movement from a point below the pile of sheets to a position for delivering the lowermost sheet to said creasing rollers, said sheet-feeding means having sheet-folding means thereon for folding the sheet along lines to form the other two flaps, one of said creasing rollers having a gap therein to receive one of the first-mentioned opposed corners during the movement of the sheet-feeding means from the pile to the creasing rollers and folding means to receive the sheet from the creasing rollers to complete the folding of the corners along the creases.

3. A machine as set forth in claim 2, in which one of the creasing rollers has a pair of circumferentially spaced creasing blades thereon and the other creasing roller has a yielding surface to allow the creasing blades to enter it.

4. A machine for folding flat paper articles, comprising sheet-supporting means for supporting a pile of sheets, sheet-feeding means for removing the lowermost sheet from the pile and having means thereon for folding the sheet on lines to form side flaps (or bottom flaps), adhesive applying means for applying adhesive to the edges of the folded parts of the sheet, sheet folding means for folding the sheet on a line to form a third flap and applying the third folded part to the first two folded parts to stick the said folded parts together, a pair of conveying rollers for receiving the folded article from the second-mentioned sheet-folding means, a second pair of conveying rollers movable at a peripheral velocity lower than that of the first-mentioned conveying rollers, a guide interposed between the pairs of conveying rollers for tilting the unfolded parts of the sheets so as to enable the articles to pass to the second pair of rollers in overlapping relationship, means for applying adhesive to the unfolded part of the sheet, drying means for the adhesive, a conveyor for feeding the articles in overlapping relationship past the adhesive applying means and drying means and means for folding the sheet on a line to form a fourth flap arranged to receive the articles from the said conveyor.

5. In a machine for folding flat paper articles, the combination of means for folding sheets on lines to form three flaps, means for creasing the sheet on a line to form a fourth flap, means for applying adhesive to the folded parts and means for applying the folded parts to one another under pressure to stick the folded parts together with means for folding the sheet across the line to form the fourth flap, comprising a pair of rollers, arranged to receive the sheet with the creased part to the rear, one of said rollers having suction passages therein for enabling the roller to engage the sheet by suction and the second roller having a pair of axially spaced pins retractably mounted therein and springs arranged to push said pins forwardly so as to pass behind the creased part of the sheet and move it forwardly to initiate the folding of said part, a third roller co-operating with said second roller and a guide arranged to receive the sheet from the roller having the suction passages therein and co-operating with said pins to guide the folded sheet between said second and third rollers for enabling the latter to complete the folding of the creased part.

6. In a machine for folding flat paper articles, the combination of means for folding sheets on lines to form three flaps, means for creasing the sheets on a line to form a fourth flap, means for applying adhesive to the folded parts and means for applying the folded parts to another under pressure to stick the folded parts together with means for folding the sheet across the line to form the fourth flap, comprising a pair of rollers, arranged to receive the sheet with the creased part to the rear, one of said rollers having suction passages therein for enabling the roller to engage the sheet by suction, a third roller co-operating with said second roller and a guide arranged to receive the folded sheet from the roller having the suction passages therein to guide the folded sheet between said second and third rollers, said third roller having suction passages therein for enabling it to engage the folded sheet suctionally and pass it between itself and the said second roller to complete the folding of the creased part.

7. A folding apparatus for envelope machines and the like, comprising a plate or support adapted to underlie the central portion of the sheet or blank to be folded, and having suction apertures near its edges extending substantially along the proposed lines of fold of said sheet or blank, and a plurality of folding members, each hinged to said plate at an edge thereof, and each adapted to underlie an extension or flap of said sheet or blank, each folding member, adjacent its hinge having a suction aperture extending substantially along the proposed line of fold, means for exerting suction on the sheet or blank through the several suction apertures aforesaid, and means operative, while the sheet or blank is so held by suction, for swinging said folding members on their hinges into overlying relation to said plate or support, thereby to produce the desired lines of fold in said sheet or blank.

MAX GODER.