

Dec. 23, 1958

G. C. NYDEGGER
APPARATUS FOR FOLDING SHEETS AND
INSERTING THEM IN ENVELOPES

2,865,155

Filed Nov. 12, 1954

5 Sheets-Sheet 1

FIG. 1.

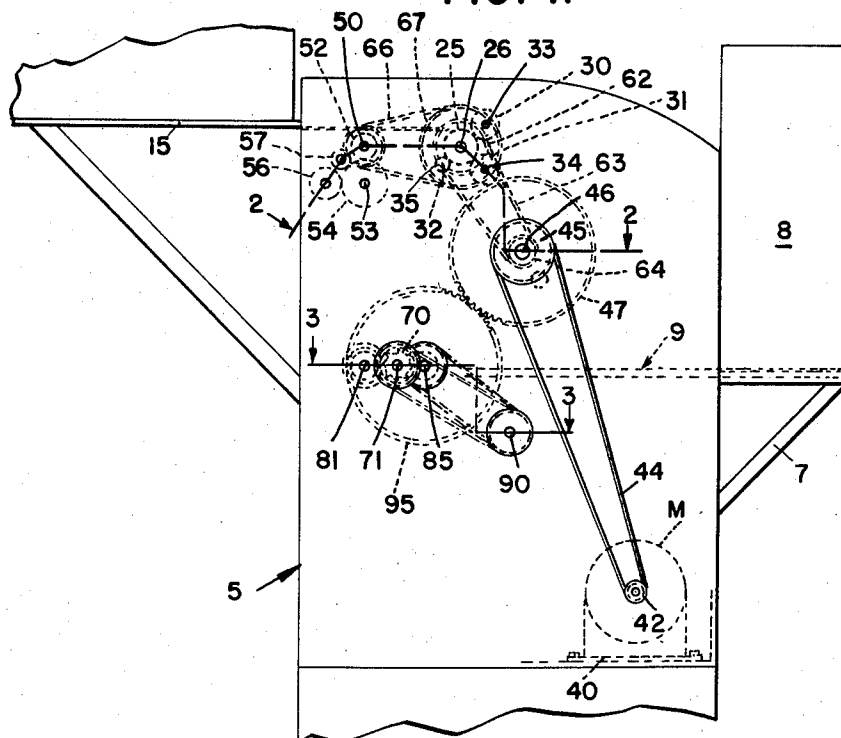


FIG. 2.

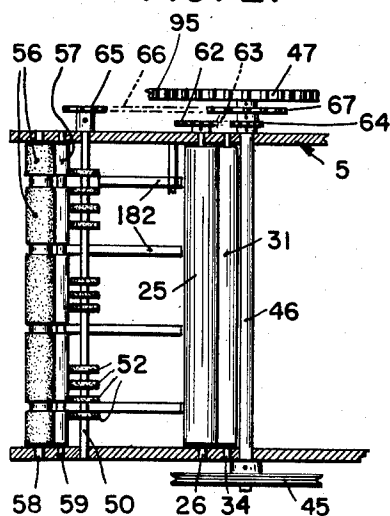
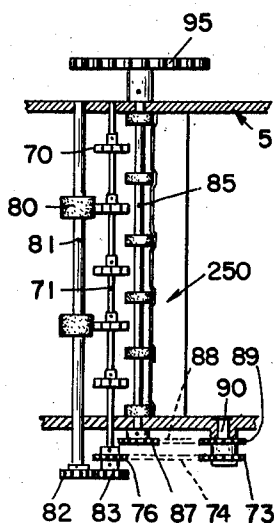


FIG. 3.



INVENTOR

GEORGE C. NYDEGGER

BY

Marion L. Huber

ATTORNEYS

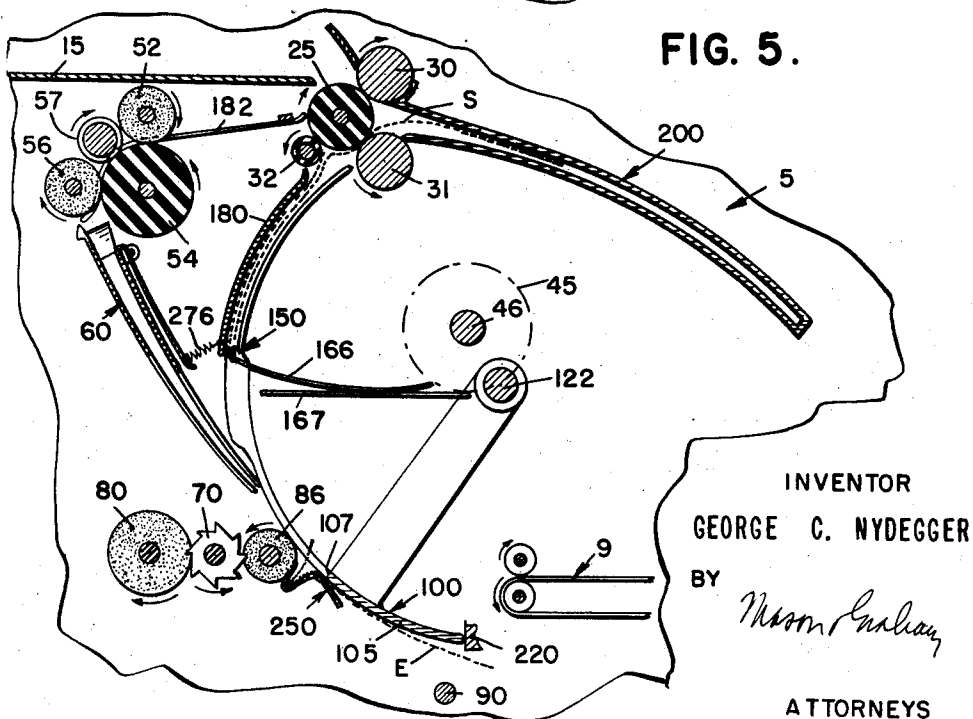
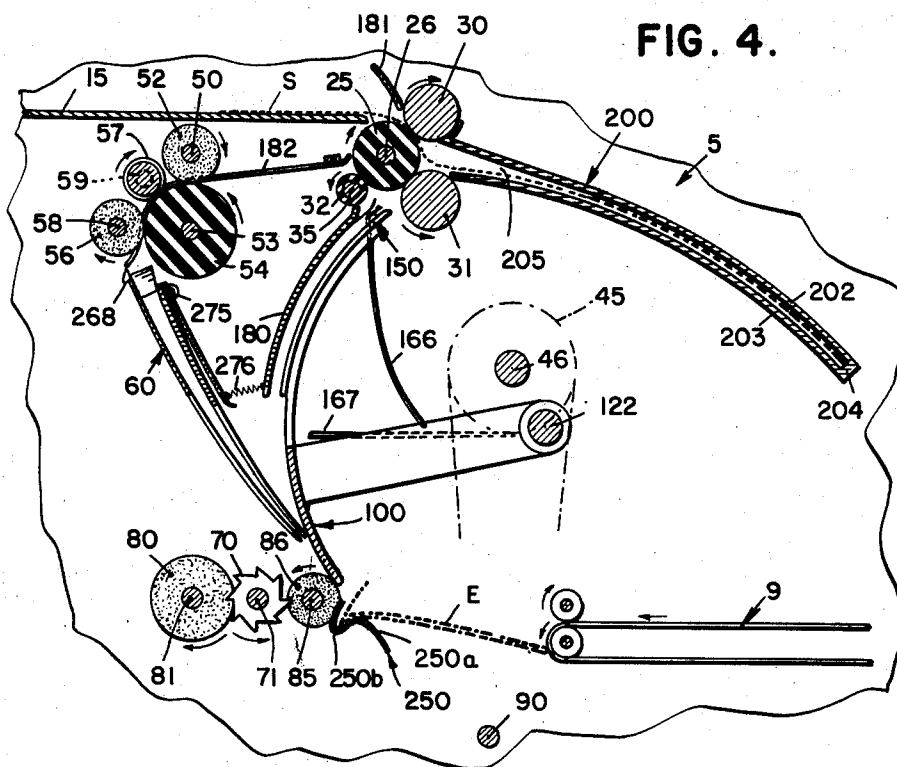
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FIG. 6.

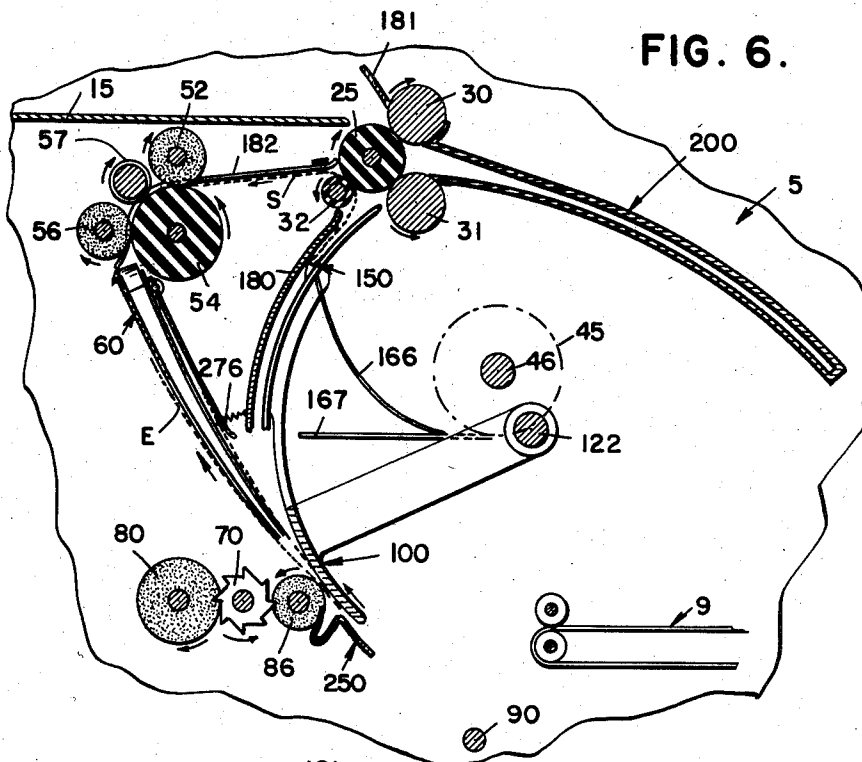
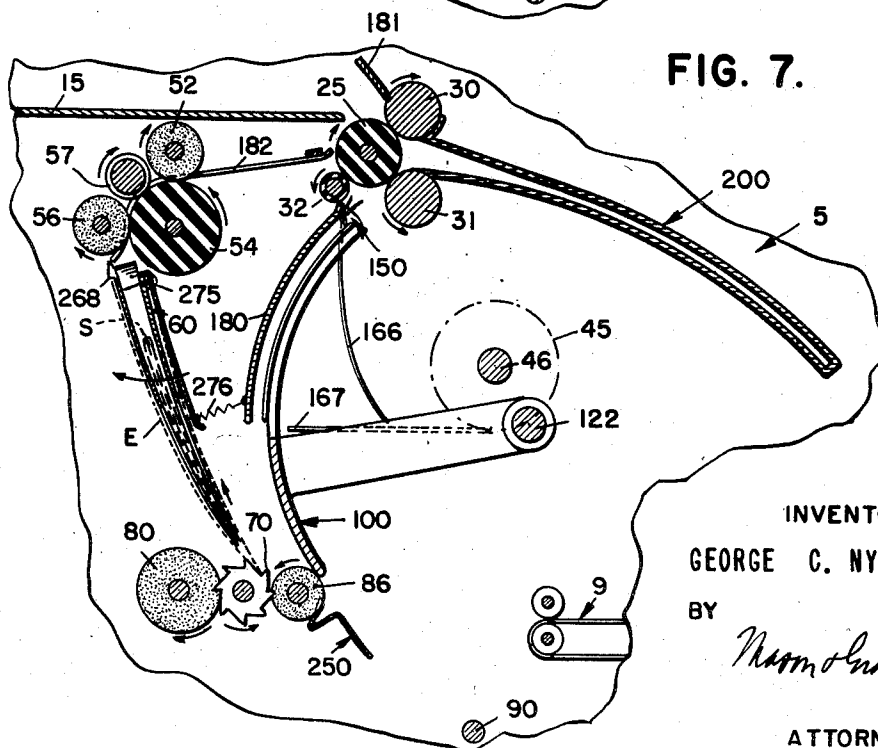


FIG. 7.



INVENTOR
GEORGE C. NYDEGGER
BY *Norman Graham*
ATTORNEYS

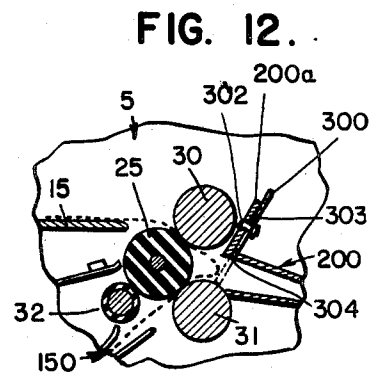
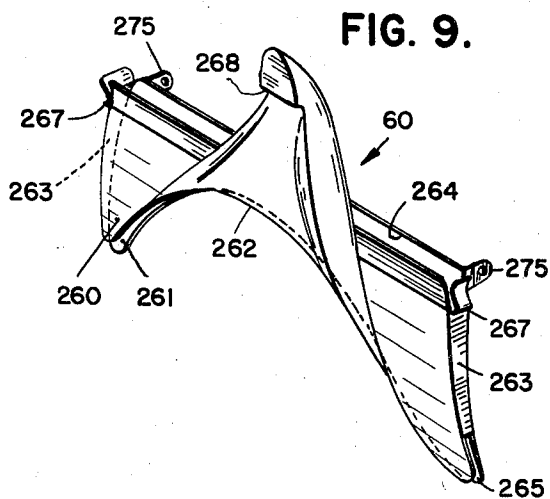
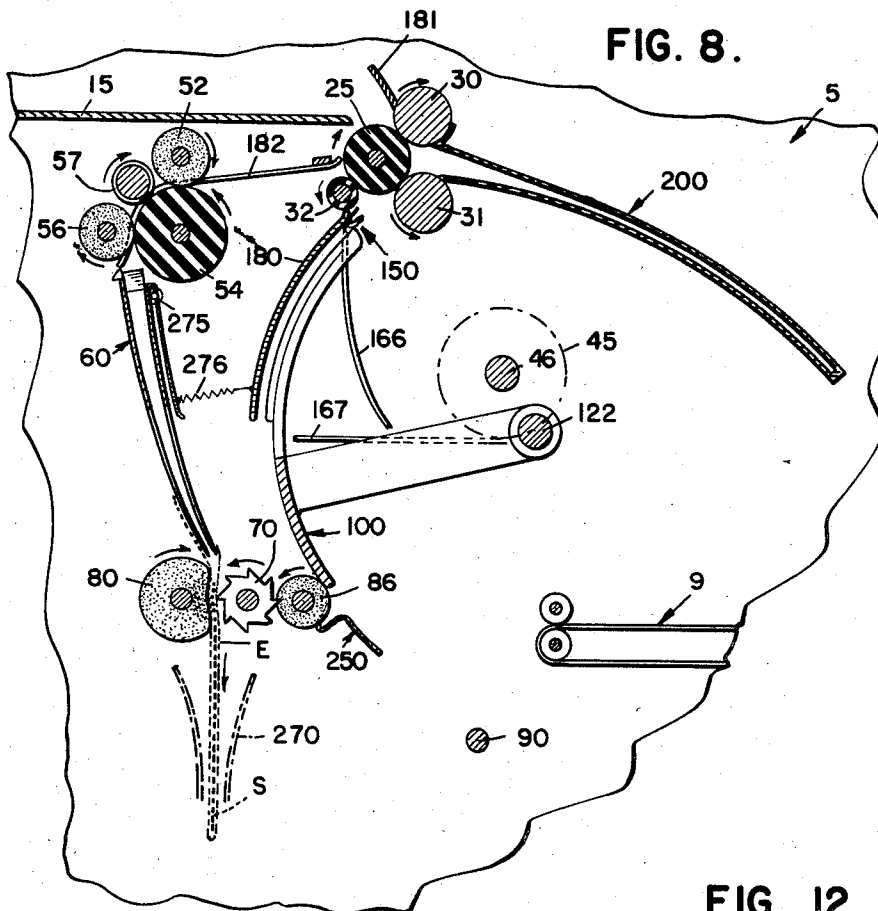
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INVENTOR

GEORGE C. NYDEGGER

BY

Wm. O. Graham

ATTORNEYS

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5 Sheets-Sheet 5

INVENTOR
GEORGE C. NYDEGGER

BY

Marion Graham

ATTORNEYS

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2,865,155

APPARATUS FOR FOLDING SHEETS AND INSERTING THEM IN ENVELOPES

George C. Nydegger, Sunland, Calif.

Application November 12, 1954, Serial No. 468,364

10 Claims. (Cl. 53—117)

My invention has to do with apparatus for automatically mechanically folding sheets of paper, such as letter sheets or sheets of advertising matter, and inserting the folded sheets into envelopes.

While, in the prior art, there are machines for folding sheets and machines for inserting folded sheets into envelopes, there are not, so far as I am aware, machines for performing both the folding and inserting operations in timed relation. Moreover, such machines as there are for inserting folded sheets in envelopes are too complicated and costly to render them available to small concerns.

Still another objection to conventional equipment is this: in using envelopes whose flaps carry gum adhesive, after the envelopes have been packed in a box for some time the flaps tend to adhere lightly to the overlapping part of the envelope. Also, the flaps often become curled so that they do not lay flat against the envelope. Insofar as I am aware, conventional machines have no positive means for breaking this adhesion or flattening out the curls, and consequently the machines become fouled up because the folded sheet cannot be inserted in the envelope.

It is among the objects of my invention to provide a simple machine which performs both the sheet folding and inserting operations in positively timed relation.

More specifically, it is an object to provide a machine of this character which positively insures proper relative timing as between the operation of folding and handling of the sheet and the operation of inserting the folded sheet into an envelope.

It is another more specific object to provide a machine which incorporates novel means for breaking any accidental adhesion of the envelope flap to the body of the envelope and flattens out any curl of the flap before the inserting operation commences.

Still more specifically, it is an object of my invention to provide a machine wherein the means for moving the envelope into position to receive the folded sheet is actuated by the folded sheet itself while it is receiving its final fold.

My invention has still further objects and advantages, which will become apparent hereinafter.

I shall point out in the appended claims the features which I believe to be new, but for the purpose of explaining my invention I shall now describe it in one of its presently preferred embodiments, for which purpose I shall refer to the accompanying drawings. I wish it understood, however, that I do not intend thereby to limit the broader scope of my invention to the details illustrated in the drawings and now to be specifically described, except insofar as such limitations may appear in the appended claims.

In the drawings:

Fig. 1 is a side elevation of a machine embodying my invention;

Fig. 2 is a section taken on line 2—2 of Fig. 1;

Fig. 3 is a section taken on line 3—3 of Fig. 1;

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Figs. 4, 5, 6, 7, and 8 are views showing respectively the positions of parts during successive stages of operation;

Fig. 9 is an enlarged perspective view of the means for guiding the folded sheet into the envelope;

Fig. 10 is an enlarged perspective view of the envelope actuating member and its carried gripper for gripping the folded sheet by which it is actuated;

Fig. 11 is a section taken on line 11—11 of Fig. 10; and

Fig. 12 is a fragmentary view showing a modification. Referring now to the drawings, the numeral 5 denotes a casing in or on which are mounted the elements now to be described.

Supported at the front side of the casing, as by a brace 7, there is an envelope magazine 8 positioned to carry a stack of envelopes in position to deposit them one at a time upon a conventional conveyor 9 which is operated in timed relation to the other mechanism. Such magazines and conveyors are well known in the art and need not be specifically described.

The rear side of the casing supports a sheet magazine arranged to contain stacked sheets to be folded and to deposit them one at a time on a conventional conveyor 15. Such sheet magazines and conveyors are also well known in the art and their specific construction forms no part of my present invention.

The letter S denotes a sheet of paper or the like in its movement through the machine, the sheet being shown in broken lines. The letter E denotes an envelope in its movement through the machine, the envelope likewise being shown by broken lines.

The main sheet-feeding roller is denoted by the numeral 25, being fixed on a shaft 26, and frictionally engaging rollers 30, 31, and 32 coaxially arranged thereabout on shafts 33, 34, 35, respectively, journaled at their ends in the casing side walls.

A conventional motor M has its base 40 secured to the base of the casing. The motor shaft carries a pulley 42 from which a belt 44 drives a pulley 45 on shaft 46, which shaft also carries a gear 47.

A shaft 50 carries longitudinally spaced rollers 52 which frictionally engage the periphery of roller 54 carried by shaft 53. Roller 54 in turn frictionally engages and drives longitudinally spaced rollers 56, 57 carried by shafts 58, 59, respectively. Rollers 52, 54, 56 and 57 move the finally folded sheet into the sheet-inserting guide 60 to be later described.

Shaft 26 carries cog wheel 62 driven by cog belt 63 from a cog wheel 64 on shaft 46 (Fig. 2). Shaft 50 carries cog wheel 65 driven by belt 66 from cog wheel 67 on shaft 46.

In Fig. 3, I show, in plan, the mechanism for aiding in the moving of the envelope into position to receive the folded sheet and then to discharge the envelope with its contents. This mechanism includes a plurality of star wheels 70 fixed on a shaft 71, the star wheels being longitudinally spaced apart along the shaft. The shaft 71 carries a cog wheel 76 driven by a cog belt 74 from cog wheel 73 fixed on stub shaft 90. A shaft 85 carries longitudinally spaced rollers 86 and a cog wheel 87 from which a cog belt 88 extends about a cog wheel 89 fixed on shaft 90. A shaft 81 carries longitudinally spaced rollers 80 and gear 82 meshing with gear 83 on shaft 71. Shaft 85 carries gear 95 meshing with gear 47. Thus it will be seen that the various described rollers and star wheels are driven by the motor M through shaft 46.

The envelope actuator, generally denoted by the numeral 100 (Fig. 10), comprises a curved envelope-engaging member 105 whose top edge has a concaved surface 107 midway between its ends for the purpose to be described, and its outer or rear surface presents grooves 108

to pass rollers 86 in the course of travel of the actuator. Adjacent each end, member 105 also has a groove 109 to pass end portions of the sheet-inserting guide 60.

The envelope actuator 100 has parallel lateral arms 120 whose outer ends are secured by collars 121 to a shaft 122 journaled at its ends in the casing side wall. An element, which I term the sheet gripper, 150, is supported on the top of the envelope actuator by arms 152.

As best seen in Figs. 10 and 11, the sheet gripper 150 has a rear jaw 155 having a longitudinal row of perforation 156, which jaw is supported stationarily by arms 152. A front jaw 160 is pivoted by pin 161 to the rear jaw, the pin 161 being journaled at its ends in flanges 162 projecting from the rear jaw. The lower portion of the front jaw 160 extends through an opening 163 in the rear jaw. A coil spring 164, in tension between an arm 165 on jaw 160 and the rear jaw, normally urges the front jaw away from the rear jaw. To move the front jaw towards the rear jaw in response to movement of the envelope actuator 100, in order to grip the sheet S being folded, I provide an arched leaf spring 166 which is secured at its inner end to jaw 160 by screw 166a and is disposed to engage at its free end a fixed abutment plate 167. The front jaw carries protruberances 168 in register with perforations 156 so as to effectively grip the sheet S as the front jaw is moved towards the rear jaw. The rear jaw has at each of its ends an upwardly and forwardly projecting part 170 opposite guides 174 carried by end extensions 172 of the front jaw. Each of the extensions 172 also has an upwardly and forwardly disposed guide 175. Extensions 172 and guides 174, 175 move with the front jaw.

An arched guard plate 180 is fixed at its ends to the sides of the casing in spaced parallel relation to the envelope actuator, to prevent the sheet S, while receiving its final fold, from being bowed in the direction of said guard plate. Additional transversely spaced guard plates 182 are disposed between the shafts 53, 57, 58 and 59 on which the rollers 52, 54, 56, 57 are mounted, for the purpose of guiding the folded sheet into the sheet-inserting guide 60. A guide 181 is secured to the casing adjacent roller 30 to guide the entering sheet S between rollers 30 and 35.

The machine which I have shown in the drawings is constructed to make two folds in a sheet, the first fold being to fold the sheet transversely along a line spaced from its leading edge two thirds the length of the sheet, and the second fold being in the opposite direction and along a transverse line spaced from the leading edge of the sheet one third of its length, thereby effecting an accordion fold.

After the sheet S is inserted between rollers 25 and 30, those rollers push the sheet endwise into a guide member 200 (Figs. 4-8) comprising opposite arched plates 202, 203 having an end stop 204 therebetween, so as to provide a sheet guideway 205 two thirds the length of the sheet to be folded. When the leading edge of the sheet S abuts the stop 204, it cannot move any further although the driven roller 25 continues to urge it forward. Thus the first fold will be initiated in the sheet by its being bowed towards the contacting portions of rollers 25 and 31 two-thirds the distance between the ends of the sheet, and further movement will cause that bowed or folded edge of the sheet to enter between rollers 25 and 31 (Fig. 4).

The then folded edge of the sheet will then enter the gripper between the rear and front jaws 155, 160 of the latter, and further driving movement of the roller 25 will cause the partly-folded sheet to push the envelope actuator 100, to which the gripper is attached, downwardly, rotating the shaft 122 through arms 120 until the leading edge of the envelope actuator engages the stop 220 (Fig. 5). Then, since the partly-folded sheet can move no further in that direction it will be bowed, as shown in Fig. 5, into position to enter between rollers

25 and 32. Further driving movement of roller 25 will thus cause the last folded edge of the sheet to enter between rollers 25 and 32, effecting the final fold.

As the folding sheet moves between rollers 25, 32, the driving movement of roller 25, through tension on the folded sheet, will pull the envelope actuator 100 upwardly (Fig. 6) and as the envelope actuator reaches the upper limit of its travel the leaf spring 166 will release its pressure against abutment 167, allowing the resiliency of the front jaw 160 of the gripper to cause said latter jaw to move away from the rear jaw, thus releasing the folded edge of the sheet from the gripper. The finally folded sheet is then moved by rollers 25 and 32 along the under surface of guides 182 until its leading edge enters between rollers 52, 54, after which it is guided by rollers 54, 57 and 56 into the sheet-inserting guide 60.

Before describing the construction and operation of the sheet-inserting guide 60, I shall now describe the movement and actuation of the envelope E into which the folded sheet is to be inserted through the sheet-inserting guide 60.

By referring to Figs. 4-8, it will be seen that, immediately ahead of the rollers 86, there is a stationary envelope guide plate 250 which is fixed at its ends to the side walls of the casing. This guide plate has a flat forward portion 250a and terminates immediately adjacent the rollers 86 in aligned, longitudinally spaced, V-shaped portions 250b, which latter portions are disposed between the peripheries of rollers 86.

The envelope E is moved onto the envelope guide 250 by the conveyor when the envelope actuator 100 is in its uppermost position (Fig. 4), with the flap carrying or leading edge of the envelope being forced by the conveyor into the aligned V-shaped portions 250b of guide 250, which edge portion becomes bowed so as to cause the flap of the envelope to swing upwardly even though it may be lightly adhered to the envelope body.

Thus as the actuator 100 is pushed downwardly into the position of Fig. 5, in response to movement of the partially folded sheet S by rollers 25, 31 (the leading edge of said sheet having entered between the gripper jaws) the leaf spring 166 will have engaged the abutment 167 causing the leading edge of the sheet to be gripped between the gripper jaws, and the lower portion 105 of the envelope actuator slides over the envelope, flattening it against portion 250b of the envelope guide to iron out any curls in the envelope. When the actuator engages stop 220 the portion 105 of the actuator will have passed by the flap portion of the envelope allowing the flap of the envelope to flex upwardly into the space above the actuator portion 105 provided by recess 107. As the actuator reaches the position of Fig. 5 the sheet S becomes bowed into the position to enter between rollers 25, 32 to receive its final fold. Further clockwise driving movement of roller 25 then exerts an upward pull on the sheet causing the sheet (whose edge is now gripped between the jaws of the gripper 150), to pull the actuator 100 upwardly first to the position of Fig. 6 and finally to the position of Figs. 4 and 7, at which latter point the leaf spring 166 will have disengaged from abutment 167 allowing spring 166 to swing jaw 160 of the gripper forwardly to free the edge of the sheet from the gripper. As the portion 105 of the actuator is thus dragged upwardly over the envelope E, it will move the envelope upwardly so that the sheet-inserting guide 60 will become inserted in the envelope, the rollers 86 assisting in pushing the envelope over the guide 60. The upward movement of the envelope onto the guide 60 is arrested when the point of the flap engages the abutment 268 of the guide and the top end edges of the envelope engage the stops 267 of the guide. At this moment the folded sheet will have been moved first by rollers 25, 32 and then by rollers 52, 54, 57 and 56 into the sheet-inserting guide 60 (Fig. 7)

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from whence it moves by gravity into the envelope. The trailing edge of the envelope will ride over rollers 86 and be thereby deposited against a counter-clockwise moving tooth of each of the star wheels 70, thus causing the envelope to swing the inserting guide 60 away from the actuator 100, against the pressure of a spring 276, and move the bottom edge of the envelope into position between the star wheels 70 and roller 80 which discharge the filled envelope into a discharge chute 270 (Fig. 8). If any initial adhesion of the envelope flap to the envelope body has not been broken by bowing it into the V-shaped guide, the dragging of the actuator over the adhered flap will positively break the adhesion. The operation is then repeated by inserting the leading edge of an unfolded sheet between rollers 25, 30 and by the conveyor 9 moving another envelope onto the envelope guide 250.

By reference to Fig. 9 it will be seen that the sheet-inserting guide 60 comprises two opposite side walls 260, 261, whose bottom edges are concaved at 262, and end walls 263. Thus the side walls provide a guideway tapering from a relatively wide top or inlet end 264 to a relatively narrow bottom or delivery end 265. The end walls 263 terminate short of the bottom edges of the side walls whereby to render the bottom end portions of the side walls more flexible. At each of its ends, adjacent its top, the sheet-inserting guide 60 is provided with said abutment shoulder 267 while, intermediate its ends, the back wall 260 is provided with said downwardly facing abutment shoulder 268.

Inasmuch as the envelope engages the abutments 267, 268 it cannot be moved further upwardly by the rollers 86 and actuator 100, so that its bottom edge will be moved, by its engagement with the periphery of rollers 86, into position between rollers 86 and star wheels 70, in which position its bottom edge will be engaged by a tooth of each of the counterclockwise moving star wheels 70, which star wheels will then move the envelope into position between the star wheels and rollers 80, causing the envelope, with the folded sheet inserted therein, to be deposited in the flared top end of a chute 270 by which it will be guided.

The sheet-inserting guide 60 is pivoted at its ends 275 to the casing and is resiliently urged laterally towards the envelope actuator 100 by the spring 276 so as to be in position to enter the envelope as the latter is moved upwardly by the rollers 86 and actuator 100. However, the tension of the spring 276 is sufficiently light that the guide 60 will be swung away from the actuator 100 into the position of Fig. 8 in response to the movement of the envelope by the star wheels.

From the foregoing, it will be apparent that it will be impossible for the timing of the operations of folding the sheet into position to be inserted in the envelope and the operation of moving the envelope into position to receive the folded sheet, to get out of properly timed relationship, because the envelope actuator is itself initially actuated by the folded sheet and the actuation of the actuator 100 is not commenced until the sheet is in the course of receiving its final fold. Also, the cooperation of the guide member 250 with the envelope actuator 100 insures not only that the flap of the envelope will be opened ready to receive the guide 60 but also insuring that any accidental adhesion of the flap to the body of the envelope will be broken before the envelope is brought into position to receive the folded sheet.

While I have described my invention in an embodiment wherein the sheet is folded by the machine, my machine is readily adaptable for use merely as a device for inserting or "stuffing" previously folded sheets or post cards in envelopes, and in Fig. 12, I show how the machine which I have described hereinabove may be so adapted. Here, guide member 200 has a stop plate 300 slidably carried by its inner end flange 200a, 75

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the flange carrying longitudinally spaced rivets 302 which extend into and are slidable along transverse slots 303 in the stop plate. The stop plate is slidable against the face of flange 200a and through a slot 304 in guide 200 so that it may be moved between the full and broken line positions of Fig. 12. In the broken line position, the inner end portion of the stop plate is in the path of movement of the folded sheet or post card so that the leading edge of the latter is caused, by rollers 30, 31, to enter between rollers 25, 31 into such position that it becomes engaged in the gripper 150. Further rotation of the rollers then forces the folded sheet or card downwardly, moving the envelope actuator with it. When the latter engages stop 220 the trailing edge of the folded sheet or card will be in engagement with roller 25 rotating clockwise, which will guide said edge to enter between rollers 25, 32. Shaft 122 is lightly urged to move clockwise by a coil spring 310 (Fig. 10) which is secured at its outer end to the shaft by a screw 311 and secured at its inner end (not shown) by a screw to the casing side wall. Spring 310 is only of sufficient strength to substantially counterbalance the weight of the actuator assembly. That is, it is not strong enough to prevent the actuator 100 from being moved downwardly by the sheet, but it is strong enough so that when the machine is being used merely as a stuffer and not for folding, the actuator will, upon striking stop 220, bounce in the return direction to insure the edge of the sheet or card entering between rollers 25, 32. The spring 310 will urge the envelope actuator 100 upwardly sufficiently to insure that the said edge of the folded sheet or card will enter between rollers 25, 32, after which further rotation of roller 25, through tension on the folded sheet or card, returns the actuator 100 to its upper position.

I claim:

1. In a machine for folding a sheet of paper or the like and inserting the folded sheet into an envelope, the combination of a guideway for receiving a portion of said sheet less than the full length thereof, said guideway having an abutment at its outer end to be engaged by the leading edge of said sheet, roller means for moving a sheet endwise into said guideway and against said abutment whereby to cause said sheet to become bowed between its ends when its leading end engages said abutment, driven roller means for receiving said bowed portion of said sheet to create a first fold therein and to move said sheet in the opposite direction, an arched envelope actuating member mounted to swing about a radius conforming to the path of movement of said sheet during said latter movement, said member having opposed jawed sheet-gripping means positioned to receive and grip the first fold of said sheet during said latter movement of said sheet, said sheet during said latter movement being operable to swing said member in one direction, stop means for limiting said last mentioned movement of said member whereby to cause said sheet to buckle at the end of the first named fold, driven roller means for receiving said last named buckled portion of said sheet to create a second fold in said sheet, a folded-sheet-inserting guide shaped to fit in an envelope, third roller means for moving said folded sheet into said folded-sheet-inserting guide, an envelope conveyor, an envelope guide positioned to receive an envelope from said conveyor, said envelope guide having a substantially flat portion adjacent said conveyor and a substantially V-shaped opposite end portion, said substantially flat portion being positioned to be engaged by said envelope actuator during said last named swinging movement thereof, driven roller means mounted adjacent said V-shaped portion of said envelope guide, a driven star wheel mounted parallel with and adjacent said last named roller means, said envelope actuator being operable during its reverse swinging movement to move said envelope into engagement with said last named roller means and thence in cooperation with said last named

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roller means to move the flap end of said envelope onto said folded-sheet inserting guide whereby to enable said envelope to receive said folded-sheet from said folded-sheet inserting guide, and sheet releasing means operable in response to said last named swinging movement of said envelope actuator to release said sheet from said sheet-gripping means whereby to permit said folded sheet to be moved into said folded-sheet inserting guide by said third roller means.

2. The machine of claim 1 which additionally includes means for discharging said envelope after the latter has received said folded sheet from said folded-sheet inserting guide.

3. The machine of claim 1 wherein said folded-sheet inserting guide comprises opposed spaced side and end walls defining a folded sheet passageway therebetween.

4. The machine of claim 1 wherein said folded-sheet inserting guide comprises opposed spaced side and end walls defining a folded sheet passageway therebetween, the bottom edge portion of said side walls being shaped to define a pair of bifurcations.

5. The machine of claim 1 wherein said folded-sheet inserting guide comprises opposed spaced side and end walls defining a folded sheet passageway therebetween, and stop means on said folded-sheet inserting guide positioned to abut the edges of said envelope about the open end of the latter.

6. The machine of claim 1 wherein said sheet releasing means comprises a leaf spring attached at one end to the first of the jaws thereof, an abutment plate mounted to be engaged by the other end of said spring in response to the first mentioned swinging movement of said envelope actuator to cause said first jaw to clamp said sheet against the second jaw, and second spring means operable upon disengagement of said leaf spring with said abutment plate to move said first jaw in the opposite direction.

7. In a machine for folding a sheet of paper or the like and inserting the folded sheet into an envelope, an envelope guide plate whose front end portion is substantially V-shaped in cross-section, means for moving an envelope into position with its leading flap edge portion inserted in said rear end portion of said guide plate with its trailing end portion against said front end portion of said guide plate and with its intermediate portion bowed over said guide plate at the intersection of said front and rear portions of said guide plate whereby to cause the flap portion of said envelope to flex away from the underlying portion thereof, driven roller means for moving a sheet to cause it to be folded and inserted in said envelope, and drag means operative in response to movement of said sheet to move said envelope from said guide plate

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into position to receive said folded sheet, said last named means comprising an arched member mounted to swing over and against said envelope positioned on said guide plate.

8. In a machine for folding a sheet of paper or the like and inserting the folded sheet into an envelope, an envelope guide plate whose front end portion is substantially flat and whose rear end portion is substantially V-shaped in cross-section, means for moving an envelope into position with its leading flap edge portion inserted in said rear end portion of said guide plate with its trailing end portion against said front end portion of said guide plate and with its intermediate portion bowed over said guide plate at the intersection of said front and rear portions of said guide plate whereby to cause the flap portion of said envelope to flex away from the underlying portion thereof, driven roller means for moving a sheet to cause it to be folded and inserted in said envelope, and drag means operative in response to movement of said sheet to move said envelope from said guide plate into position to receive said folded sheet, said last named means comprising an arched member mounted to swing over and against said envelope positioned on said guide plate, in response to movement of said sheet.

9. In a machine for inserting a sheet in an envelope, envelope spreading and sheet guiding means, roller means mounted to move said sheet into said envelope spreading and sheet guiding means, rotatable means for moving said envelope onto said envelope spreading and sheet guiding means, an envelope guide plate mounted ahead of said rotatable means, conveyor means mounted to position said envelope on said guide plate, and an envelope actuator of curved cross-section mounted for movement in one direction relative to said guide plate to flatten said envelope against said guide plate and for movement in the opposite direction to move said envelope into engagement with said second roller means.

10. The machine of claim 9 wherein said actuator is moved at least in one direction in response to movement of said sheet.

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