

July 14, 1936.

F. SCHWARTZ

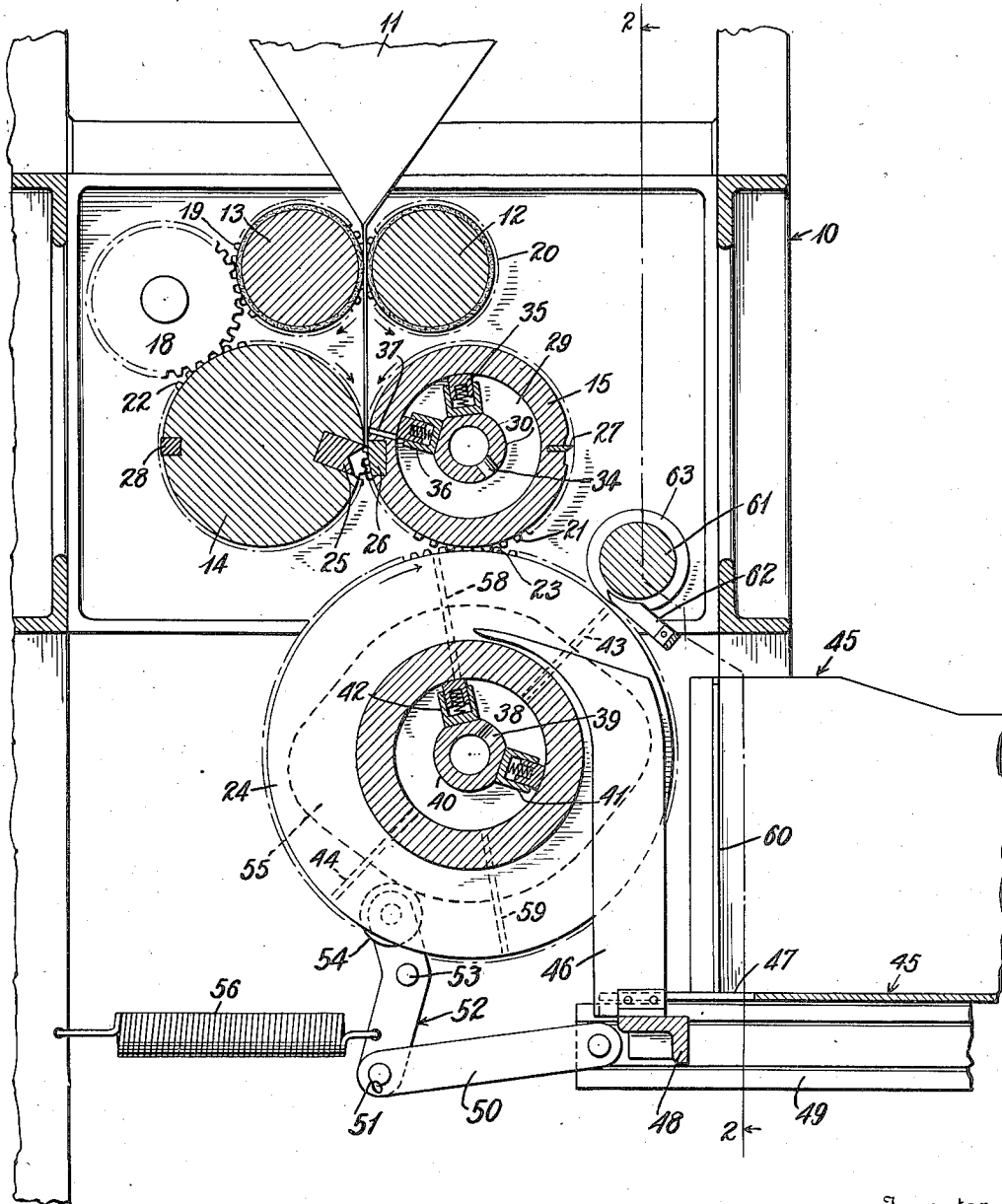
2,047,710

FOLDING MACHINE

Filed Nov. 8, 1933

4 Sheets-Sheet 1

Fig. 1.



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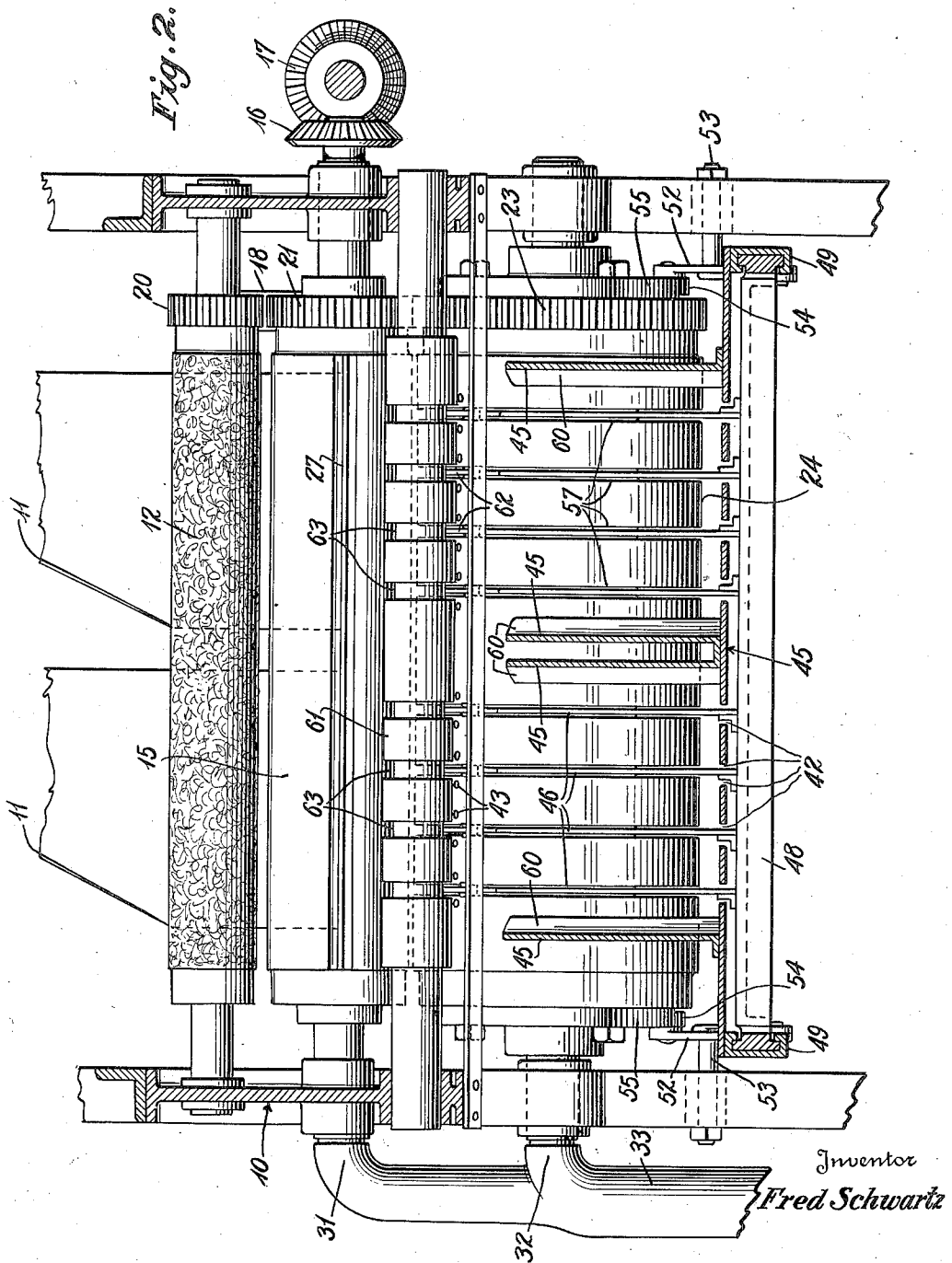
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4 Sheets-Sheet 2



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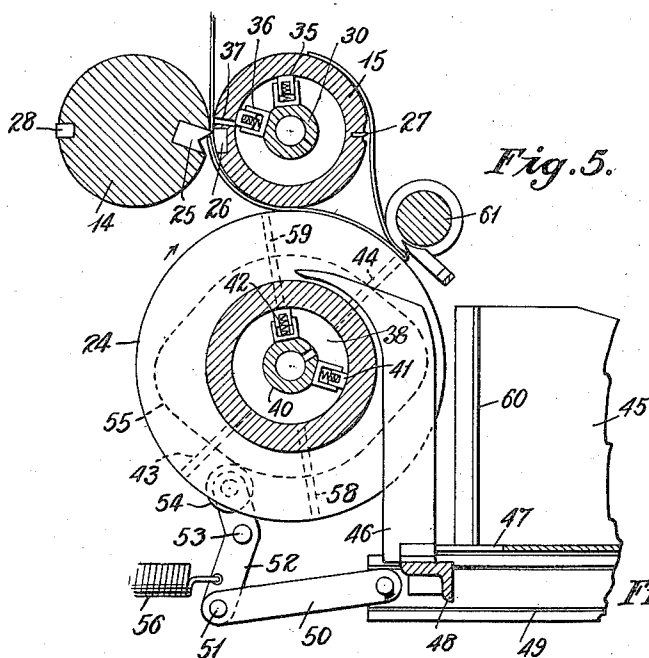
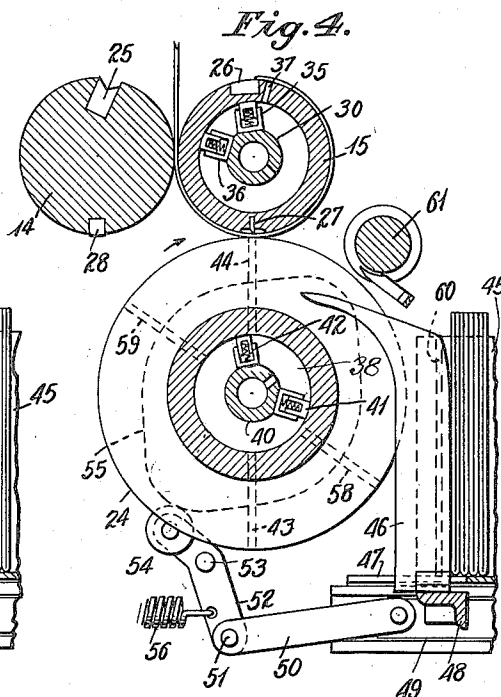
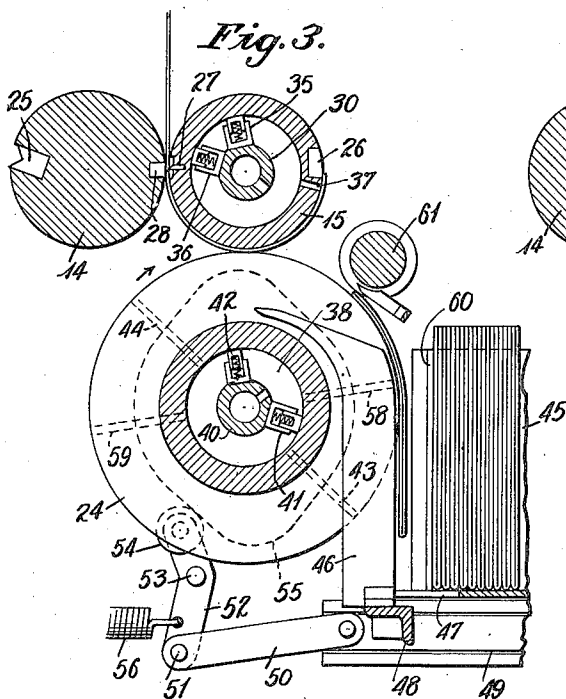
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4 Sheets-Sheet 4

Fig. 6.

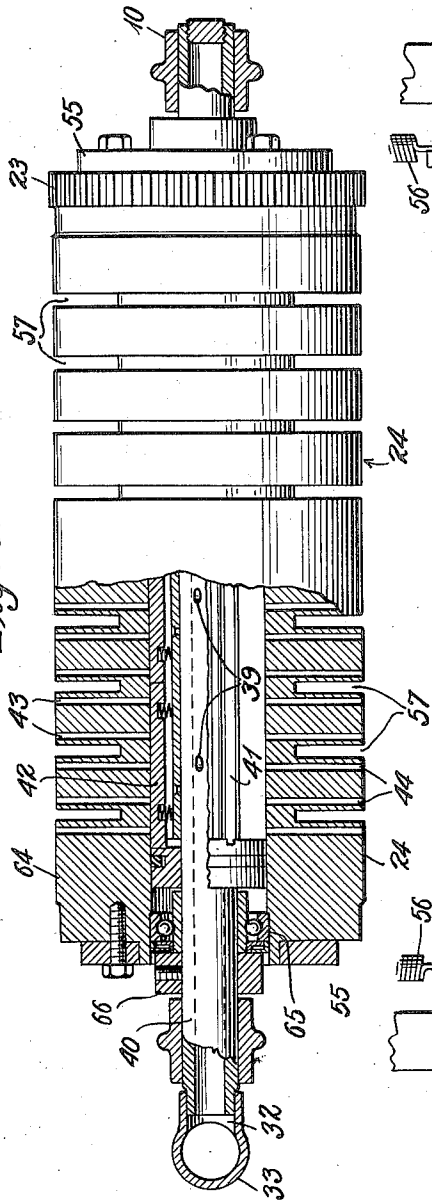
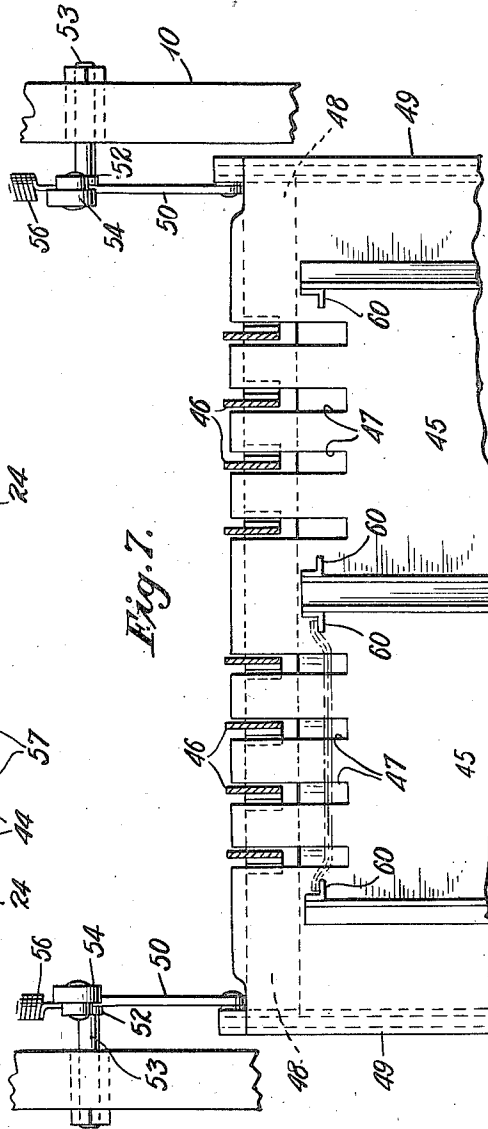


Fig. 7.



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UNITED STATES PATENT OFFICE

2,047,710

FOLDING MACHINE

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Application November 8, 1933, Serial No. 697,176

13 Claims. (Cl. 270—69)

The invention relates to folding machines of the type shown in patents to Shaffer and Wirtz No. 1,520,312 and Christman No. 1,566,079, and has as an object the provision of a folding machine embodying a folding roller which also acts to deliver folded sheets directly to the mouth of a chute for packaging.

It is a further object of the invention to utilize the vacuum principle not only in folding sheets but in delivering the same to the packer.

It is a further object of the invention to simplify machines of this character.

Further objects of the invention will appear from the following description when read in connection with the accompanying drawings forming part thereof disclosing an illustrative embodiment of the invention, and wherein:—

Figure 1 is a detail vertical transverse section;

Fig. 2 is a detail vertical longitudinal section on line 2—2 of Fig. 1;

Figs. 3, 4, and 5 are detail sectional views showing different positions of rotation of the rolls;

Fig. 6 is an elevation partly in section of a folding and delivery roll; and,

Fig. 7 is a plan view of the receiving chutes showing the packing fingers in section.

As shown the device comprises a frame 10 supporting plates 11 adapted to fold strips of paper longitudinally at their central portions.

The embodiment here shown is of a machine to produce a quarter-folded napkin. The sheet of paper passing over one of the plates 11 is led between rolls 12 and 13 shown as geared together so as to be driven in opposite directions downwardly at their meeting surfaces in Figure 1. The strip thus folded passes between rolls 14, 15 whereby the sheets are cut into napkin size, when napkins are the article to be produced, and are also creased.

Desirably, the roll 14 may be utilized as the driving roll to the train of rolls and for this purpose an end of the shaft carrying the roll 14 is shown as provided with a bevel gear 16 in mesh with the driving bevel gear 17 as shown in Figure 2, the roll 14 then driving roll 13 through an idle gear 18 in mesh with gear 19 carried upon the end of roll 13, which gear 19 is also in mesh with the gear 20 upon the roll 12. The roll 15 is shown as provided with a gear 21 in mesh with the gear 22 upon roll 14, which gear 22 also drives the gear 18 and the gear 21 is shown in mesh with a gear 23 on roll 24 for drive of the latter.

To cut the paper strip into lengths, the roll 14 is shown as provided with a knife 25 coacting with an anvil 26 carried by the roll 15 and to

crease the folded and segregated sheets midway of their lengths, the roll 15 is shown as provided with a creaser 27 to coact with a pad 28 desirably of rubber also carried by the roll 14.

The knife 25 and pad 28 are shown at diametrically opposite points upon roll 14, and the creaser 27 is diametrically opposite the operating portion of the anvil 26 on roll 14. Rolls 15 and 24 are shown as freely revoluble upon their fixed shafts as illustrated for roll 24 in Figure 3. To carry the free end of the strip of paper to be folded about the periphery of the roll 15 as it revolves, a vacuum chamber 29 is shown in roll 15 which may be evacuated by forming the shaft 30 of the roll hollow and connecting it with a conduit 31 which also has a branch 32, the conduits 31, 32 being in connection with the common conduit 33 which may be connected to a vacuum pump, not shown. The shaft 30 is shown as provided with an opening or openings 34 and with stationary partition strips 35, 36 which limit the circumferential extent of the vacuum chamber 29.

Openings 37 are formed in the periphery of the roll 15 through which suction acts upon the margin of the strip to cause the leading edge of the strip to adhere to the surface of the roll 13 throughout a portion of its revolution.

The roll 24 is also shown as formed with a vacuum chamber 38 in communication with 30 opening or openings 39 in its stationary shaft 40 which is hollow and connected with conduit 32, the vacuum chamber 38 being segregated by partitions 41, 42. To pick the creased sheet from roll 15, the roll 24 is shown with openings to its periphery as at 43, 44, two series of such openings being shown for the reason that the roll 24 is designed to revolve once for each two revolutions of the rolls 14, 15, here shown as so located as to cause the creased sheet to adhere to the surface of roll 24 immediately at the crease therein, as particularly illustrated in Figures 4 and 5.

To pack the severed and quarter-folded sheets into a chute 45 there is shown a packer comprising a plurality of vertical fingers 46 reciprocable in slots 47 in the bottom of the chute, the fingers carried by a cross head 48 slidable in ways 49 adjacent each side of the chute, the cross head 48 being reciprocated by means of links 50 pivoted at 51 to bell cranks 52, which bell cranks are pivoted at 53 upon the frame of the device and carry upon their opposite ends rollers 54 coacting with cams 55. The bell cranks are designed to be returned to normal position by means of retractile springs 56 anchored to the

bell cranks and to a portion of the frame as indicated in Figure 1.

For the purpose of delivering the sheets by the roll 24 to the action of the packer fingers 46, the fingers 46 are shown as normally standing in circumferential slots 57 in the surface of the roll 24, the slots being particularly illustrated in Figure 6, and the openings 43, 44 are shown as opening closely adjacent to each side of the slots 57.

The vacuum applied to the openings 43, 44 will release the folded edge of the sheets when they have been carried to a position about half-way down the length of the packer fingers 46, as will be seen from an inspection of Figure 1. To complete the delivery of the sheets to a point closely adjacent the bottom of the chute 45, additional vacuum passages 58, 59 are provided which will cause the folded sheets to adhere to the roll 24 at substantially their central portions, which adhesion will be released by breaking of the vacuum upon passage of the openings 58, 59 past partition 41. When sheets have been forced to substantially the bottom of the chute, the cams 53 cause a reciprocation of the fingers to take place immediately the sheets are completely placed in the opening of the chute, to press the sheets into the chute in position to snap past the baffles 60 carried by the side walls of the chute adjacent its opening, which baffles will prevent the sheets from returning out of the chute. The fingers 46 therefore act as packers and also as strippers to prevent any cohesion of the sheets to the roll 24 in its further revolution.

To condense the crease in the final fold of the napkin an idle roll 61 is shown which is desirably slotted as at 63 in registration with slots 57 and provided with stripper fingers 62 standing in said slots. Figure 1 corresponds to the position of the sheet and parts when the machine is started into operation.

If a short length of paper has been grasped by the rolls 14, 15 in initiation of the feed, it is cut off by the knife 25 and goes to waste. From the position of Fig. 1 the end of the strip of paper is carried around by the vacuum openings 37 to the position of Figure 3 where the strip is creased by means of creaser 27 and pad 28.

In the position of Figure 4, the crease has reached the first vacuum opening 43 or 44, which results in the carrying of the strip to the position of Fig. 5 wherein the vacuum upon the leading edge of the strip has been released. The folded edge of the strip has been pressed by the roll 61 and is being severed by the knife 25. The continuing revolution of the roll 24 then carries the sheet to the position shown in Figure 3 ready for the actuation of the packer fingers 46 and the succeeding sheet is in process of being carried around roll 15. In operation the machine is found to operate very smoothly at a good speed and to produce a pack of paper superior to that produced by any other machine of which I am aware.

It will be seen by inspection of Fig. 4, that the shape and the length of the points of the free ends of packing finger 46 are such that these points never leave the slots 57 of the roll 24, even at the extreme movement of the packer into the chute. As a result a sheet even though torn so as to not be properly held and advanced by the vacuum of the roll 24 cannot get behind the packer fingers to become jammed into the slots by the returning fingers, which jamming could clog the

machine and even break the fingers if it were possible for it to occur.

The details of the roll 24 are shown in Figure 6 wherein the roll is shown as a shell 64 mounted upon nonfrictional bearings 65 retained by a collar 66 upon the fixed hollow shaft 40.

Minor changes may be made in the physical embodiment of the invention without departing from the spirit thereof within the scope of the appended claims.

I claim:

1. A folding machine comprising, in combination; means to fold a strip longitudinally; pairs of rolls to compress said fold; means carried by one pair of said rolls to sever said strip into sheets; means carried by said last named rolls to crease said sheets transversely; a folding and delivery roll; means carried by said last named roll to engage said sheets closely adjacent said crease and fold the same on the crease line; a packer; said last named means acting to deliver the folded sheets to the packer.

2. A folding machine comprising, in combination: means to fold a strip longitudinally; pairs of rolls to compress said fold; means carried by one pair of said rolls to sever said strip into sheets; means carried by said last named rolls to crease said sheets transversely; a folding and delivery roll; means carried by said last named roll to engage said sheets closely adjacent said crease and fold the same on the crease line; a packer; said last named means acting to deliver the folded sheets to the packer, and additional means carried by the last named roll to engage the folded sheets midway thereof acting to further impel the same toward the packer.

3. A folding machine comprising, in combination: a stationary hollow shaft having an opening through its wall; a hollow folding roll freely revoluble on said shaft providing a vacuum chamber between the shaft and roll and having passages through its wall; means to limit the circumferential extent of said chamber; means to exhaust air from said chamber through said opening and shaft; means to deliver partially folded and creased sheets to said roll; a reciprocable packer; driving means to operate the roll so synchronized, and said limiting means so placed as to cause sheets delivered to said roll to adhere to its surface closely adjacent said crease, and to release said sheet in the path of movement of said packer.

4. A folding machine comprising, in combination: a folding roll formed with circumferential slots in its surface; a reciprocable packer comprising a plurality of fingers of a length to span a major portion of a folded sheet; said fingers in sheet receiving position standing entirely within the surface of the roll at their sheet receiving ends; means to reciprocate the packer; and means carried by the roll to deliver throughout substantially their entire width, sheets folded thereby into the path of movement of said packer.

5. A folding machine comprising, in combination: a folding roll formed with circumferential slots in its surface; a packer comprising a reciprocable cross-head and spaced fingers projecting therefrom; said fingers standing in and reciprocable to project from said slots; the free ends of said fingers extended in a direction and to a distance to stand at all times in said slots, whereby to prevent access of sheets between said roll and fingers; means to reciprocate said packer; and means carried by the roll to feed sheets

folded thereby into the path of movement of said fingers.

6. A folding machine comprising, in combination: a pair of rolls carrying coacting paper creasing and paper cutting means; means carried by one of said rolls to cause the leading edge of paper to travel therewith; a folding roll coacting with the last named roll; a reciprocable packer including a portion standing closely adjacent the periphery of the folding roll while the packer is in paper receiving positions; means carried by the folding roll to remove paper from said coacting roll to which the edge of the paper adheres, and to deliver the paper to said packer, folded in such removal; a chute into which the paper is forced by the packer; and means to prevent return of the paper from the chute upon return of the packer.

7. A folding machine comprising, in combination: a roll having circumferential slots; means to drive said roll; a packer comprising fingers standing in said slots in paper receiving position; a chute to which paper is delivered by said packer; means to press the central portion of a sheet against said roll; means carried by the roll to cause said portion to travel with the roll, and to cause the edges of the sheet to trail whereby to fold the sheet and deliver the folded sheet to the packer; and supplemental means carried by the roll to cause a central portion of the sheet to travel with the roll to complete delivery of the sheet to the packer.

8. A folding machine comprising, in combination: a roll having circumferential slots; means to drive said roll; a packer comprising fingers standing in said slots in paper receiving position; a chute to which paper is delivered by said packer; means to press the central portion of a sheet against said roll; means carried by the roll to cause said portion to travel with the roll, and to cause the edges of the sheet to trail whereby to fold the sheet and deliver the folded sheet to the packer and means to cause adherence of said edges of the sheet to the roll to further move the sheet into the path of movement of the packer.

9. Quarter-folding and packing mechanism comprising, in combination: means for folding a strip longitudinally, means to sever said strip into sheets; a circumferentially grooved final fold roll; a reciprocable packer comprising fingers standing in sheet-receiving position in the grooves of said roll; and means carried by said roll to deliver through substantially the entire extent thereof finally folded sheets into the path of movement of said packer.

10. Quarter-folding and packing mechanism comprising, in combination: means for folding a strip longitudinally; means to sever said strip into sheets and to crease said sheets transversely; a circumferentially grooved final fold

roll; vacuum means in said roll to grasp the sheets adjacent said crease; a press roll coacting with said fold roll to produce the final fold; a reciprocable packer comprising fingers standing in sheet-receiving position in the grooves of said fold roll; said vacuum means causing delivery of the folded edge of the sheets in front of said packer; and supplemental vacuum means in said roll synchronized to grasp a center portion of the final fold to further move said fold into the path of movement of said packer.

11. Quarter-folding and packing mechanism comprising, in combination: means to fold a strip longitudinally; a pair of coacting rolls to receive said sheet therebetween; sheet-severing means carried by said rolls; vacuum means in one of said rolls to cause adherence of an edge of a sheet thereto; a folding roll coacting with the last named roll; vacuum means in said folding roll becoming effective at the line of coaction thereof with said severing vacuum roll to cause adherence of the center of a sheet to the folding roll; a fold compressing roll coacting with said folding roll; a horizontal chute; a vertical, reciprocable packer to receive folded sheets from the folding roll and press the same into said chute; and cam means carried by the folding roll to actuate said packer.

12. Quarter-folding and packing mechanism comprising, in combination: means to fold a strip longitudinally; a pair of coacting rolls to receive said sheet therebetween; sheet severing means and sheet creasing means carried by said rolls; vacuum means in one of said rolls to cause adherence of an edge of a sheet thereto; a folding roll coacting with the last named roll; vacuum means in said folding roll becoming effective at the line of coaction thereof with said severing vacuum roll to cause adherence of the sheet adjacent the crease therein to the folding roll; a fold compressing roll coacting with said folding roll; a horizontal chute; a vertical, reciprocable packer to receive folded sheets from the folding roll and press the same into said chute; and cam means carried by the folding roll to actuate said packer.

13. A folding machine comprising, in combination: a circumferentially grooved roll; means carried by the roll to deliver folded sheets into the path of movement of a packer; a packer comprising spaced fingers movable between sheet-receiving position and a position to pack sheets into a receiving chute; said fingers, in sheet-receiving position standing in said grooves below the periphery of said delivery roll; laterally projecting extremities upon said fingers standing in said grooves in all operating positions of the packer, whereby to prevent entrance of a portion of a sheet between said fingers and the periphery of the roll.

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