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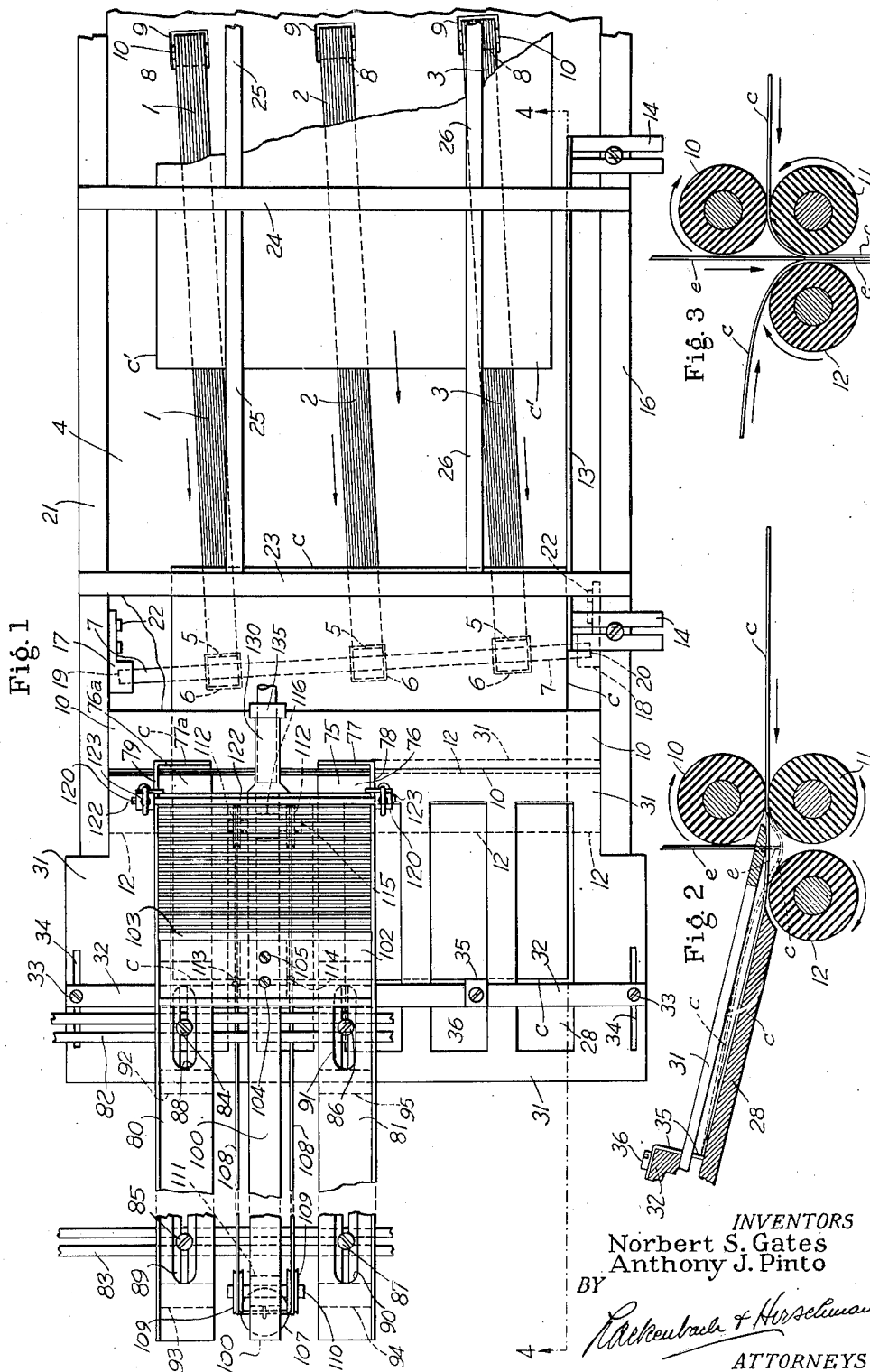
N. S. GATES ET AL

2,482,060

INTERLEAVING ATTACHMENT FOR FOLDERS

Filed March 24, 1948

2 Sheets-Sheet 1



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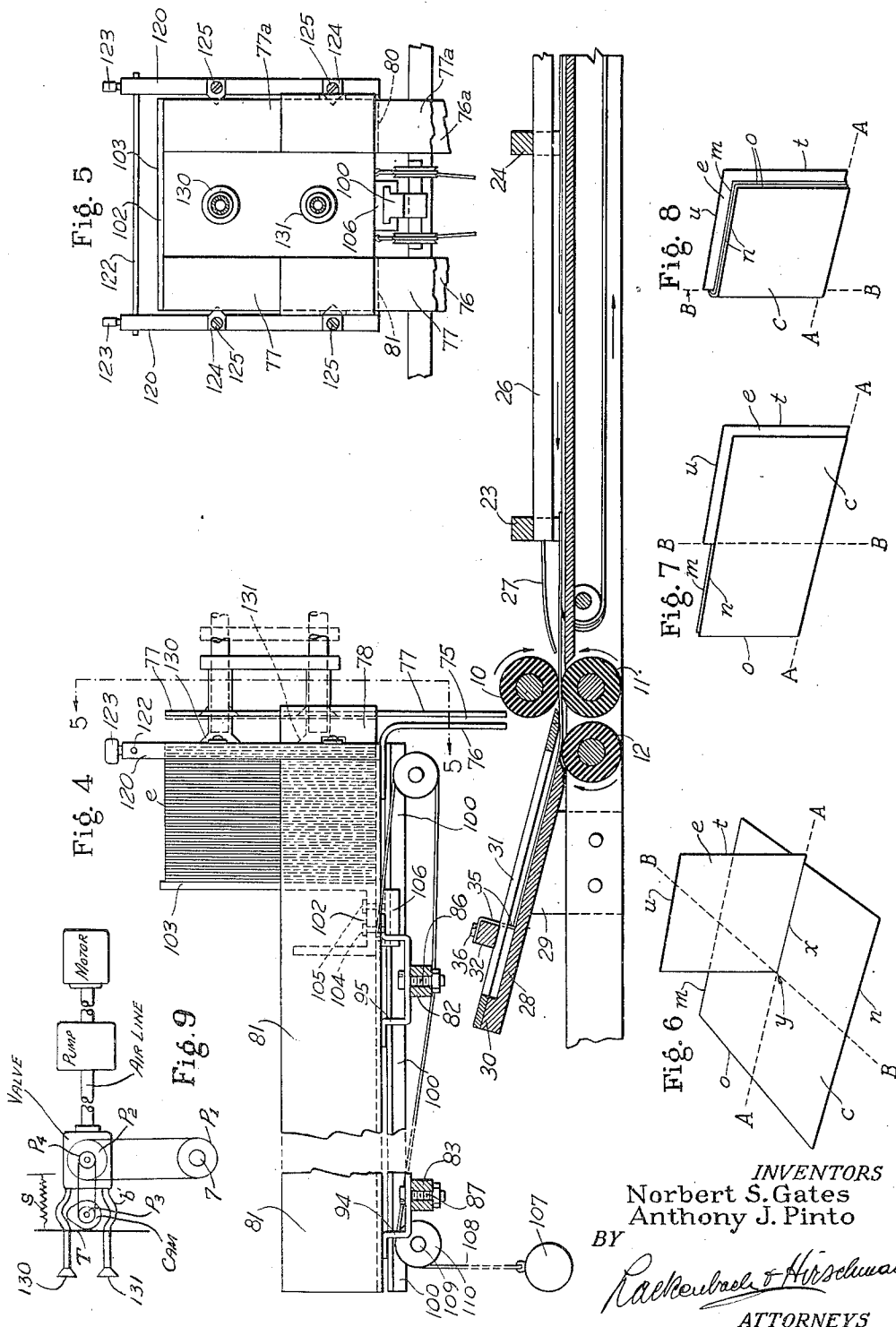
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2 Sheets-Sheet 2



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INTERLEAVING ATTACHMENT FOR
FOLDERS

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The present invention relates to method and apparatus for folding a sheet, e. g., of paper, and for interleaving an insert, such as an envelope, a blotter, or another sheet, inside a fold of the first sheet.

The general object of the invention is to provide a novel, simple, inexpensive, and practical method and apparatus for folding a sheet, e. g., of paper, one or more times, including French-folding the same, and for interleaving an insert inside a fold of the first sheet.

A special object of the invention is to provide simple means for interleaving an envelope inside the first fold of a greeting-card or the like while the same is being French-folded, i. e., folded first along a median line normal to two opposite sides and then folded a second time along the median line normal to the other two opposite sides, to form a four-leaf or eight-page product having a facial area substantially equal to one quarter the original facial area.

Many greeting cards and the like, of the French-folded type, are manufactured not from what is generally called card stock but from fairly flexible paper which may be readily folded at high speed. The flat form of the stock upon which the text and illustrations is printed is usually rectangular, sometimes with one or more die-cut edges which are not straight but scalloped or otherwise ornamentally shaped. The trade customarily provides envelopes for enclosing the greeting cards for mailing, the envelopes being slightly larger, of course, than the cards for which they are intended. Lately the trade practice of delivering the greeting cards for sale with their related envelopes interleaved therein has become quite standard, and, in mass production, apparatus is now generally employed which rifles the French-folded card and interleaves therein, between two pages, an envelope for mailing. It will be understood that the envelope is desirably interleaved inside part of the first fold of the card, so that one leaf is on one side of the envelope and the other three leaves on the other side of the envelope, for adoption of this practice results in a corner of the envelope being snugly held inside the card at the intersection of the two fold lines thereof, whereas if the envelope were interleaved only inside the second fold it would readily slide or fall out of the card in handling. Counting and packing the cards and envelopes is obviously facilitated if each card and its envelope forms a fairly stable unit.

Thus the present invention contemplates means for interleaving the envelope so as to accomplish the resultant unit product described above, but for performing the operation of interleaving during the French-folding operation and at the time of making the first of the two folds for the purpose of obviating subsequent riffling and inter-

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leaving and thereby considerably speeding up production of the finished product.

It will be plain to those skilled in the art that the invention may be utilized in various applications other than that described above with respect to greeting cards. However, for convenience, an embodiment of the invention specially adapted for French-folding greeting cards and for interleaving the envelope at the same time has been selected for purposes of illustration in the drawing, and the following description is principally concerned with this embodiment which, in essence, is also illustrative of various modifications available within the scope of the present invention.

In the drawing:

Fig. 1 is a view, in plan, of part of a buckle-folding machine combined with one embodiment of the attachment of the present invention.

Figs. 2 and 3 are enlarged elevational details illustrating two stages of a folding and interleaving operation.

Fig. 4 is the vertical section 4—4 of Fig. 1.

Fig. 5 is the vertical section 5—5 of Fig. 4.

Figs. 6, 7, and 8 are, respectively, perspective views, drawn schematically, of a flat card to be French-folded with an envelope positioned upon the same, of the same card folded once partly over the envelope, and of the same card French-folded over the envelope.

Fig. 9 is a diagrammatic view of an arrangement for feeding sheets and inserts in synchronism.

The principles involved in buckle-folding may be briefly set forth as follows: Flat sheets are usually fed on horizontally disposed conveyor belts, or the equivalent, to a pair of horizontally disposed and cooperating feed rollers between which the sheets are driven as the leading edges of the same are engaged by the rollers. Such rollers are either placed normal to the direction of travel of the conveyor belts or nearly normal thereto. In Fig. 1, a plan view, three such belts 1, 2, and 3, are seen; these are driven synchronously, and are, as shown, parallel each to the other. Arrows indicate the direction of movement. In the elementary structure shown the belts travel over and in contact with the flat upper surface of a table 4, and are engaged by pulleys 5 at the forward portion of the table, such pulleys turning in slots 6 provided in the table and being mounted on a shaft 7, and pulleys 8 at the rear portion of the table, these last-mentioned pulleys turning in slots 9 provided in the table and being mounted on another shaft 9a. Flat sheets are introduced onto the conveyor belts at the rear portion of the table 4 (i. e., to the right in Fig. 1, which is shown erased. A flat sheet *c* is shown having been driven partly through the above-mentioned feed rollers. These

feed rollers are disposed with respect to each other so that their axes are in a common vertical plane. In Fig. 1 the upper roller 10 is seen in plan. In Figs. 2, 3, and 4 (all elevational sections on a common plane, the first two figures being enlarged with respect to the latter) the lower roller 11 is seen also. Cooperating with roller 11 and having its axis of rotation parallel to that of roller 11 in a horizontal plane, is a similar feed roller 12 (cf. Figs. 2, 3, and 4).

In the buckle-folder illustrated the conveyor belts are shown arranged to move slightly obliquely with respect to the longitudinal axis of the table. This arrangement is arbitrary, but is advantageous. At the lower part of Fig. 1, i. e., on the left-hand side of the table 4 with respect to the general direction of movement of the belts 1, 2, and 3, is an adjustable stop or gage 13, provided with slotted brackets 14, 14, which are secured by means of screws 15, 15, to a runner 16 edging the table 4. The stop or gage 13 may be adjustably positioned parallel with the edge of the table and obliquely with respect to the belts, as shown. The sheet carried by the belts is of course advanced toward the stop or gage as it is also being carried more or less longitudinally with respect to the table. A second sheet *c'* is shown in part in Fig. 1. The rear portion of sheet *c'* is torn away so that the rear portions of the conveyor belts and table may be seen. It is obvious from the figure that presently sheet *c'* will be carried against the stop or gage, and, that thereafter as the sheet is urged forward by the belts the sheet will skid with respect to the belts as one edge of the sheet is restrained by the stop or gage, so that presently the leading edge of the sheet is carried between rollers 10 and 11 in parallelism with these rollers, and also in such manner that the sheet engages the rollers with a lateral disposition which is common to all sheets fed thereto by the belts.

The shafts 7 and 10 are disposed parallel to each other at opposite ends of the table 4, and beneath the same (Fig. 4 shows shaft 7 in section but does not extend as far backward as shaft 10). Shafts 7 and 10 are not precisely transverse with respect to the table, but are of course normal with respect to the direction of movement of the belts 1, 2, and 3. Rackets 17 and 18 providing journals at 19 and 20 respectively for shaft 7 (cf. Fig. 1) are duplicated as equivalents for shaft 10 (no equivalent brackets are shown in the drawings). The brackets supporting journals for these shafts are secured to the runner 16, mentioned above, and another runner on the opposite side of the table, the latter runner being designated 21, as, for example, by screws 22, 22, and similar screws not shown.

An elementary structure is illustrated as a means for preventing the sheets from assuming buckled shapes as they travel over the table toward the rollers 10 and 11. We show here, in Fig. 1, two bridge members 23 and 24 which may be supported in any suitable manner-transversely over the table 4, as, for example, by means of the runners 16 and 21. Carried beneath these members and disposed normal thereto are two additional bridge members 25 and 26 (cf. Figs. 1 and 4) the lower surfaces of which are slightly above the normal upper surface of a sheet being advanced by means of the belts 1, 2, and 3. The forward portion of each bridge member 25 and 26 is continued in the form of a preferably flexible wire 27 slightly bent downward toward the top of the table 4 and terminating just short of

the rollers 10 and 11 (see Fig. 4 particularly). The purpose of these wires 27 is of course to guide the leading edge of the sheet properly between the rollers 10 and 11.

After the sheet, say, for example, *c*, has been advanced by the rollers 10 and 11 until a median line of the sheet normal to the direction of travel is within a vertical plane passing between the rollers 11 and 12 the leading edge of the sheet is directed usually into what is known in the art as a buckling bay and is arrested therein by a suitable detent while the trailing portion of the sheet is being advanced so that the sheet is caused to buckle (in the illustrated case, downwardly between nipping rollers, such as 11 and 12.) The gist of buckle folding is of course that the sheet is caused to buckle downwardly (in the illustrated case) between rollers 11 and 12 or their equivalents. The outer surface of the buckled portion being engaged by rollers 11 and 12 (see the arrows in Figs. 2, 3, and 4, indicating the relative directions of motion of the rollers), the buckle is almost instantaneously narrowed into a sharp fold which is forced between the rollers, the rest of the sheet following, that portion which originally was the most advanced now being a trailing portion. Figs. 2 and 3, which are slightly enlarged details (each being a vertical section on the plane of the section of Fig. 4), clearly illustrate the process of buckle folding. In Fig. 2 the sheet *c* is shown in solid lines to be in the position it assumes relative to the three rollers just at the moment the leading edge of the sheet is arrested; and in dotted lines to be in the position it assumes just as the buckle begins. In Fig. 3 the sheet *c* is shown in process of being folded between rollers 11 and 12. In this last figure an envelope *e* being interleaved in sheet *c* is shown in part. See, also, Fig. 2, wherein the beginning of interleaving of the envelope *e* is illustrated.

In the apparatus illustrated we show means for guiding the leading edge of the sheet after the same has passed between the rollers 10 and 11 so as to form a slight upward bend in the sheet. A similar structure is common in the art. Its purpose is to give the sheet a controlling buckling stress to determine the direction in which the fold is to be effected. Such means may comprise, as shown, a slanting table member 28 conveniently supported by legs (one, designated 29, is seen in Fig. 4) attached to runners 16 and 21. The member 28 is assumed to be provided with a raised edge on three sides (see 30, Fig. 4), which indicates the only transversely disposed edge. That side of the member 28 opposite to the raised edge 30 has no such edge, and a sheet advanced onto said member by means of rollers 10 and 11 may slide upward on the upper surface of the member (cf. Figs. 2 and 4). Resting upon and secured in any suitable manner to the edges of member 28 is a cover member, designated 31, and which is preferably provided with considerable fenestrations so that access to rumpled sheets beneath the same may be facilitated. See Fig. 1. A bridge member 32 is adjustably supported on the upper surface of cover member 31 by means of screws 33, 33, in slots 34, 34, at either side of member 31, and in similar slots, not shown, in the raised edges of the table member 28, said screws being locked by means of nuts beneath, also not shown. At one or more places on bridge member 32 are stops or gages 35 (one shown in Fig. 1; see also Fig. 2 and Fig. 3), secured to member 32 by means of a screw 36, each such stop or gage being a small angle one leg of which is disposed down-

wardly and at its end engages the upper surface of the table member 28 so that the leading edge of a sheet being advanced on such surface is arrested when said sheet strikes said stop. See Figs. 1, 2, and 4, where sheet *c* is shown abutting a stop 35.

The surfaces of the rollers are sometimes slightly knurled where metal rollers are employed to increase the frictional engagement between them and the sheet passing between. Where rubber rollers are used the surfaces may be practically smooth.

The rollers 11 and 12 in the illustrated structure rotate in opposite directions, and are arranged to feed downwardly material introduced between them. Thus, as the buckle of the sheet *c*, in Fig. 2 indicated in dotted lines, increases, the convex surfaces of the buckle engage the oppositely rotating rollers, and the buckle is accordingly drawn down between the rollers where it is sharply folded. It will be understood that in the meantime the trailing portion of the sheet is being forced forwardly, and consequently also downwardly. The three rollers, 10, 11, and 12 rotate synchronously. Therefore, as rollers 11 and 12 take the folded sheet and feed it downwardly, the trailing portion of the sheet traveling between rollers 10 and 11 is advancing at the same rate of speed that the folded portion of the sheet is being drawn downwardly by rollers 11 and 12, and there is substantially no tendency to tear the sheet. Of course what was originally the most advanced portion of the sheet lying on the upper surface of the table member 28 now has its direction of motion reversed; presently the entire sheet has been withdrawn and discharged downwardly by rollers 11 and 12.

Where it is desired to French-fold a more or less rectangular sheet, as in the greeting card trade, the folder involves two practically equivalent assemblies of rollers with associated stops and gages and guides. Such assemblies are usually arranged at 90° each with respect to the other, so that a sheet having been first folded subsequently travels into means for applying the second fold normal to the original direction of travel. In the present invention it is immaterial how the second fold is accomplished, the invention being principally concerned with interleaving an insert, say an envelope, with leaves of the sheet at the time of the first fold and in such position with respect to the leaves that when the second fold is accomplished the same is substantially registered with an edge of the insert which is adjacent to another edge registered with the first fold.

In Fig. 6 it may be assumed that *m* indicates that edge of a sheet *c* which first enters between rollers 10 and 11 and which is arrested by a stop or gage 35; *n* indicates the opposite, or trailing, edge; and *o* indicates that edge which strikes stop or gage 13. In Fig. 6 no bend is shown in the sheet *c*, but two median lines, each normal to the other and each normal to two opposite edges of the sheet, representing loci of folds in a prospective French fold, are designated A—A and B—B. Here, then, the dotted line A—A represents the first, and dotted line B—B the second, fold line. Diagrammatically an envelope *e* is shown in the figure. The envelope is represented as being disposed at 90° to the sheet; the lower edge of the envelope is designated *x*, and a lower corner, *y*. Fig. 6 is schematically illustrative of the relationship of the envelope and sheet at the beginning of the first folding of the latter.

Edge *x* of the envelope *e* is in register with the righthand half of the fold line A—A; the lower corner *y* is in register with the intersection of fold lines A—A and B—B.

In Fig. 7 we show the sheet *c* folded once on line A—A. The envelope is shown partially enclosed within the fold. The envelope occupies only one half the fold; the upper margin *u* and the righthand margin *t* of the envelope extend beyond the edges of the sheet. Fig. 7 is illustrative of the sheet *c* and envelope *e* after both have been carried together between rollers 11 and 12. In Fig. 8 we show the sheet *c* after the same has been French-folded. If we assume that the sheet as shown in Fig. 7 has had its lefthand portion—line B—B being regarded as a median—folded toward the viewer flat over against the right hand portion around the envelope, Fig. 8 is then a representative perspective diagram of result. Fig. 8, therefore, illustrates what the attachment of the present invention produces as an end product.

Thus the object to be achieved by the illustrated embodiment of the invention as an attachment combined with a buckle folder is primarily to deliver an envelope, preferably at 90° to the plane of the sheet to be French-folded, onto the sheet or into the forming buckle thereof immediately upon the beginning of the first folding operation and to deliver such envelope edgewise so that the leading edge thereof is substantially in register with the first fold line, and one leading (i. e., lower) corner of the envelope is substantially in register with the intersection of the two fold lines.

In the exemplary structure shown the sheet is fed to the buckle folding means horizontally and beyond the rollers 10 and 11 is deflected slightly upwardly. Thus we prefer, here, to deliver the envelope vertically, and have shown attachments arranged to do so. It will be obvious that, as the envelope is facially larger than a quarter of the sheet, if a corner of the envelope meets the sheet at the exact center thereof and the leading edge of the envelope is registered with one fold line, part of the envelope will project beyond an edge of the card. See, as theoretically illustrated, the diagram of Fig. 6.

We provide apparatus which may be supported in any suitable manner over the buckle-folding rollers and the upwardly inclined structure having as its base the table member 28 (or, as will be immediately apparent upon comprehending Fig. 4, which may be supported over the rollers and the table 4) for the purpose of carrying a supply of envelopes and feeding the same one after another, here horizontally and then vertically downward, to the sheet as the same is being folded for the first time.

The apparatus, i. e., the attachment of the present invention, comprises a magazine for envelopes and means connected therewith to feed envelopes one after another from such magazine, and a chute, carried on one end of said magazine, arranged to receive an envelope delivered from said magazine and to discharge the envelope onto the sheet as the same is being folded, and also in proper register with respect to said sheet.

On one end, i. e., the righthand end in Figs. 1 and 4, we provide a rigidly attached chute 75, comprising two members 76 and 76a each of which is attached by any suitable means beneath the front of the magazine and bent, as shown in Fig. 4, to form vertically disposed guiding means for the rear of the chute; two vertical members 77

and 77a mounted beyond the front of the magazine on two lateral extensions thereof 78 and 79. In Fig. 5, an elevational view of the front of the magazine and of the chute (the section 5—5 of Fig. 4), it is seen that the front of the chute is open between the members 77 and 77a.

The chute is arranged to permit an envelope placed therein to fall edgewise, without deflection, and in predetermined register with respect to a sheet being buckled in the buckle folder, substantially along the plane passing between the rollers 11 and 12, as is clearly shown in Fig. 4. The edge *x* of any envelope (cf. Fig. 6) is thereby caused, as the envelope drops, to pass roller 10 practically tangent thereto (cf. Figs. 2 and 3).

The assembly comprising a magazine for envelopes is made up, in part, of two lengths of angle stock 80 and 81 (cf. Figs. 1, 4, and 5), each of which is supported on and independently attached to a pair of slotted bridge members 82 and 83 which are horizontally disposed (here, in a preferred arrangement) above the lefthand portion of the buckle folder shown in Figs. 1 and 4. The bridge members 82 and 83 may be supported in any suitable manner. No supporting means, however, are illustrated, as such means are not part of the present invention; and it will be seen, in Figs. 1 and 5, that the ends of the bridge members are erased. The sole function of the bridge members 82 and 83 is to support the magazine assembly at a suitable height above the folder. Also, as various sizes of envelopes and sheets are met with it is important that the magazine assembly be capable of adjustment to accommodate a variety of stock. Of course it is well known, and is also clearly illustrated in the drawing, that the buckle folder itself is arranged to handle any of a variety of sizes of sheets. Thus various adjustments may be provided for, and, in Fig. 1, particularly, provisions for certain adjustments is recognizable in the slotting of several parts.

The angles 80 and 81 may be variously positioned with respect to each other upon the bridge members 82 and 83, and independently secured thereto by means of sets of bolts and nuts 84, 85, 86, and 87 (see, particularly, Figs. 1 and 4). The horizontal flanges of the angles 80 and 81 are slotted near the front and rear portions of the same, as seen in Fig. 1, the slots being designated 88, 89, 90, and 91. Beneath each angle and in register with a slot therein is a foot member, which is also slotted, as shown in Fig. 1; these foot members, designated 92, 93, 94, and 95, may each be made of a strip of sheet material folded as shown in Fig. 4 in elevation, wherein members 94 and 95 are seen, the same obscuring members 92 and 93. The members are attached in any suitable manner to the undersides of their respective angles. The purpose of the foot members—apparent in the drawing—is to hold the envelope magazine somewhat above the supporting bridge members 82 and 83 so that means for feeding envelopes from the magazine into the chute may freely operate beneath the magazine itself and above the supports.

Disposed horizontally and midway between the angles 80 and 81 and parallel thereto, and also supported by the bridge members 82 and 83, is a rail 100, having an expanded head (cf. Fig. 5, where the front end is seen). The rail 100 may be secured to the bridge members 82 and 83 in any convenient manner. For example countersunk screws may be employed so that the upper surface of the rail will not be obstructed.

Within the magazine formed by the angles 80

and 81, and slidably mounted on rail 100 so that it may move lengthwise with respect to the magazine, is a member 102, which, in Fig. 4, can be seen to be a piece of sheet material bent twice at 90° to simulate a bookend. The forward portion, which is vertically disposed, is designated 103. The front surface of portion 103 serves as a buffer and bears against the endmost of a group of envelopes carried in the magazine (see Figs. 1 and 4; *e* indicates any individual envelope as well as the group).

With reference to Fig. 1 wherein the relative positions in an exemplary setting of the angles 80 and 81 and the track 100 upon bridge members 82 and 83 is best illustrated, screws 104 and 105 secure a block 106 (indicated in dotted lines in Fig. 1; plainly visible in solid lines in Fig. 4) to the bottom of member 102. This block is channeled, as indicated in Fig. 5, the front view, to be slidably keyed to the head of rail 100, which, together with the horizontal flanges if the angles 80 and 81, serves as the support for member 102. The member 102 need not be as wide as an envelope, as shown.

The member 102 is normally urged toward the front of the magazine assembly by means of a weight 107 (cf. Fig. 4) suspended at the rear of the magazine assembly on a looped cord, or the like, 108, which passes over grooved pulleys 109, 109, both mounted on a stub shaft 110 journaled in a block 111 fixed in any suitable manner to the rear end of rail 100 (cf. Figs. 1 and 4). The ends of the loop are lead over bridge member 83 and beneath bridge member 82 and up and around two additional grooved pulleys 112, 112, and thence, doubling upon themselves, to the underside of member 102 (between the horizontal flanges of angles 80 and 81 and the block 106) where the ends of the loop are attached at 113 and 114 (cf. Fig. 1). The pulleys 112, 112, are carried on a stub shaft 115 journaled in a block 116 attached beneath the front end of rail 100. See Fig. 4, wherein blocks 111 and 116 are indicated by dotted lines.

Thus when the envelopes are loaded in the magazine assembly, each envelope being disposed vertically on edge, as shown in Figs. 1 and 4, the member 102 continuously tends to push the group of envelopes out the forward end of the magazine assembly. However, at the forward end of each angle (i. e., 80 and 81) is an upright post 120 secured to the outer vertical flange of the angle; see Figs. 1 and 3. These posts extend upwardly beyond the top of the vertical flanges of the angles, and are higher than the length of an edge of the largest size envelope to be handled by the magazine. Near the upper end of each post 120 is a bore 121 through which is placed an extremity of a rod 122. The rod 122 serves as a tie or brace, as required, to bring together or to expand the vertical flanges of the angles 80 and 81; and the rod is locked in position by means of wing-headed set screws 123 (cf. Figs. 1, 4, and 5).

Each post 120 is provided on its front surface (cf. Fig. 5) with a plurality of tapped holes 123a, the holes 123a of one post 120 being aligned with those of the other post. A plurality, here four, of extremely thin, flexible, and preferably metallic tabs 124 are secured as desired to posts 120 by means of cap screws 125. A preferred shape for the tabs 124 is illustrated in Fig. 5. The tabs extend slightly in front of the most forward envelope of the group carried within the magazine and serve as weak detents to prevent the

group of envelopes from being pushed out of the magazine by member 102.

In order that envelopes may be delivered from the front of the magazine and dropped into the chute in synchronism with the arrival of a sheet *c* at the position shown in Figs. 1 and 4, and also in solid lines in Fig. 2, we provide means for withdrawing the frontmost envelope from the magazine load against the resistance of the tabs 124. Here we have shown (Figs. 1, 4, and 5) a pair of cups 130 and 131 which may be connected with suitable hoses (erased, Figs. 1 and 4; in section, Fig. 5) to an air pump (not shown). The cups are arranged to be reciprocated toward and away from the front of the magazine, and over the chute, in cooperation with the buckle folder by any suitable crank-mechanism (not shown), said mechanism being utilized to open and close a valve in the lines connecting the cups with the pump so that when the cups are disposed as shown in solid lines in Figs. 1 and 4 (i. e., up against the frontmost envelope while the same is still within the magazine and being restrained by the tabs 124) suction obtains; and that when the cups are disposed as shown in dotted lines in Figs. 1 and 4 (i. e., withdrawn slightly so that the envelope taken from the magazine is held over the chute as indicated in dotted lines, indexed *e'*, Fig. 4) suction is terminated so that the envelope drops.

It will be noticed most clearly in Fig. 2 that a lip of member 31 intersects the vertical plane between rollers 11 and 12. This lip is desirable for stopping any upwardly tending curving of the sheet *c* too immediately after coming from between the rollers 10 and 11. Notice that the edge of the lip, indicated by a dotted line indexed 31, Fig. 1, does not continue beneath the envelope chute and thereby block a dropping envelope.

Fig. 9 is a diagrammatic view of an arrangement coupling shaft 7 of the sheet feed mechanism with a vacuum feed mechanism for inserts. Suction cups 130 and 131 of Figs. 1, 4, and 5 are rigidly connected to any suitable tie *T*, normally retracted from the insert magazine by means of a spring *S*. A cam engaging said tie operates, when rotated, to reciprocate the tie and the vacuum cups toward and away from the magazine so that inserts are withdrawn from the magazine, positioned in a particular plane, and released, one after another. Fig. 9 shows a motor directly coupled to a pump; an air line from said pump to a valve; and, beyond said valve, a pair of flexible air lines *a'* and *b'* leading respectively to vacuum cups 130 and 131. A pulley *P*₁ is mounted on shaft 7 and is connected by a belt with another pulley *P*₂ mounted on the shaft of the valve, which latter shaft may be adapted to open and close the valve in any well known manner in accordance with rotation of said shaft. A pulley *P*₃ mounted on the shaft of the cam is connected by a belt with another pulley *P*₄ also mounted on the pump shaft. It will be obvious that the valve is opened and closed with a periodicity related to the revolutions of shaft 7. This elementary arrangement is set forth as an illustration of one of many obvious ways in which the delivery of sheets and inserts may be synchronized.

We claim:

1. The method of folding a sheet over an insert which comprises positioning said sheet over a pair of cooperating feed rollers lying in a sub-

stantially horizontal plane; positioning said insert above and normal to said sheet in a plane passing between said feed rollers; releasing said insert so that the same falls vertically on edge onto said sheet; and buckling said sheet beneath the edge of said insert and forcing the buckle of said sheet between said feed rollers.

2. The method of interleaving an insert between a fold of a sheet which comprises positioning said sheet over a pair of cooperating feed rollers lying in a substantially horizontal plane; positioning said insert upon said sheet edge-wise and normal thereto in a plane passing between said feed rollers; releasing said insert; and buckling said sheet beneath the edge of said insert and forcing the buckle of said sheet between said feed rollers.

3. In a buckle folder having a buckling bay, a pair of buckling rollers, a pair of nipping rollers lying in a substantially horizontal plane, and a mechanism for feeding unfolded sheets, said mechanism feeding one unfolded sheet at a time to said buckling rollers, said buckling rollers advancing said sheet into said bay and over said nipping rollers, and said nipping rollers nipping the buckle formed in said sheet, the combination therewith of a magazine carrying inserts, another feed mechanism delivering an insert from said magazine and positioning said insert above and normal to said sheet in a plane passing between said feed rollers and releasing said insert so that the same falls vertically on edge onto said sheet in said plane when said sheet is over said nipping rollers, said other feed mechanism operating in timed relationship to said firstnamed mechanism, and guide means for holding said insert, when released, in said plane.

4. In a buckle folder having a buckling bay, a pair of buckling rollers, a pair of nipping rollers, lying in a substantially horizontally plane, and a mechanism for feeding unfolded sheets, said mechanism feeding one unfolded sheet at a time to said buckling rollers, said buckling rollers advancing said sheet into said bay and over said nipping rollers, and said nipping rollers nipping the buckle formed in said sheet, the combination therewith of a magazine carrying inserts, another feed mechanism delivering an insert from said magazine and positioning said insert upon said sheet edgewise and normal thereto and releasing said insert thereon in a plane passing between said nipping rollers when said sheet is over said nipping rollers, said other mechanism operating in timed relationship to said firstnamed mechanism, and guide means for holding said insert, when released, in said plane.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,373,187	Freeman	Mar. 29, 1921
2,143,715	Rosebush	Jan. 10, 1939
2,444,504	Grogan	July 6, 1948

FOREIGN PATENTS

Number	Country	Date
270,391	Great Britain	May 5, 1927