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METHOD AND MEANS TO PRODUCE FOLDERS WITH EYELETS AND TANGS

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Fig. 1.

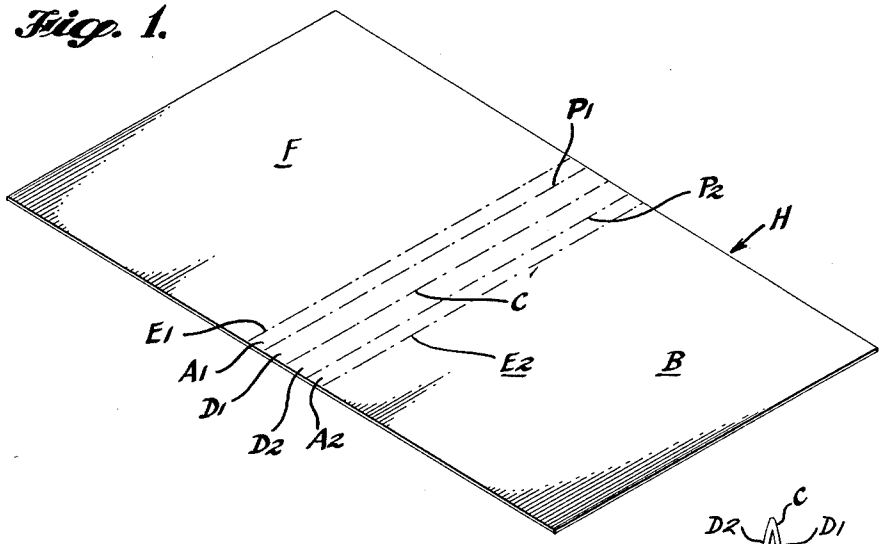

Fig. 2.

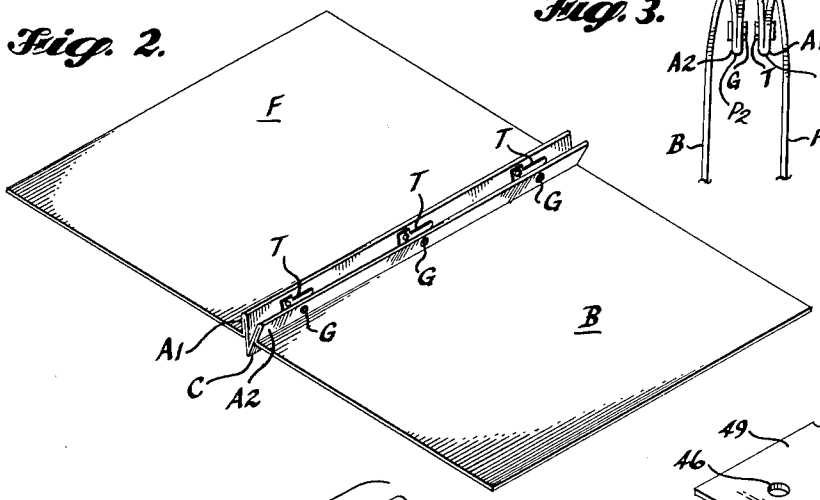

Fig. 3.

Fig. 5.

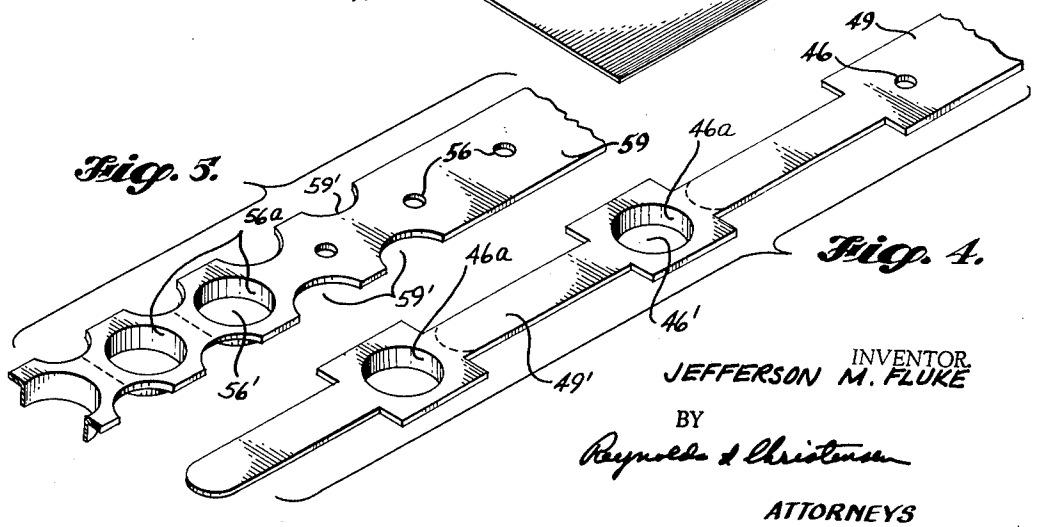

Fig. 4.

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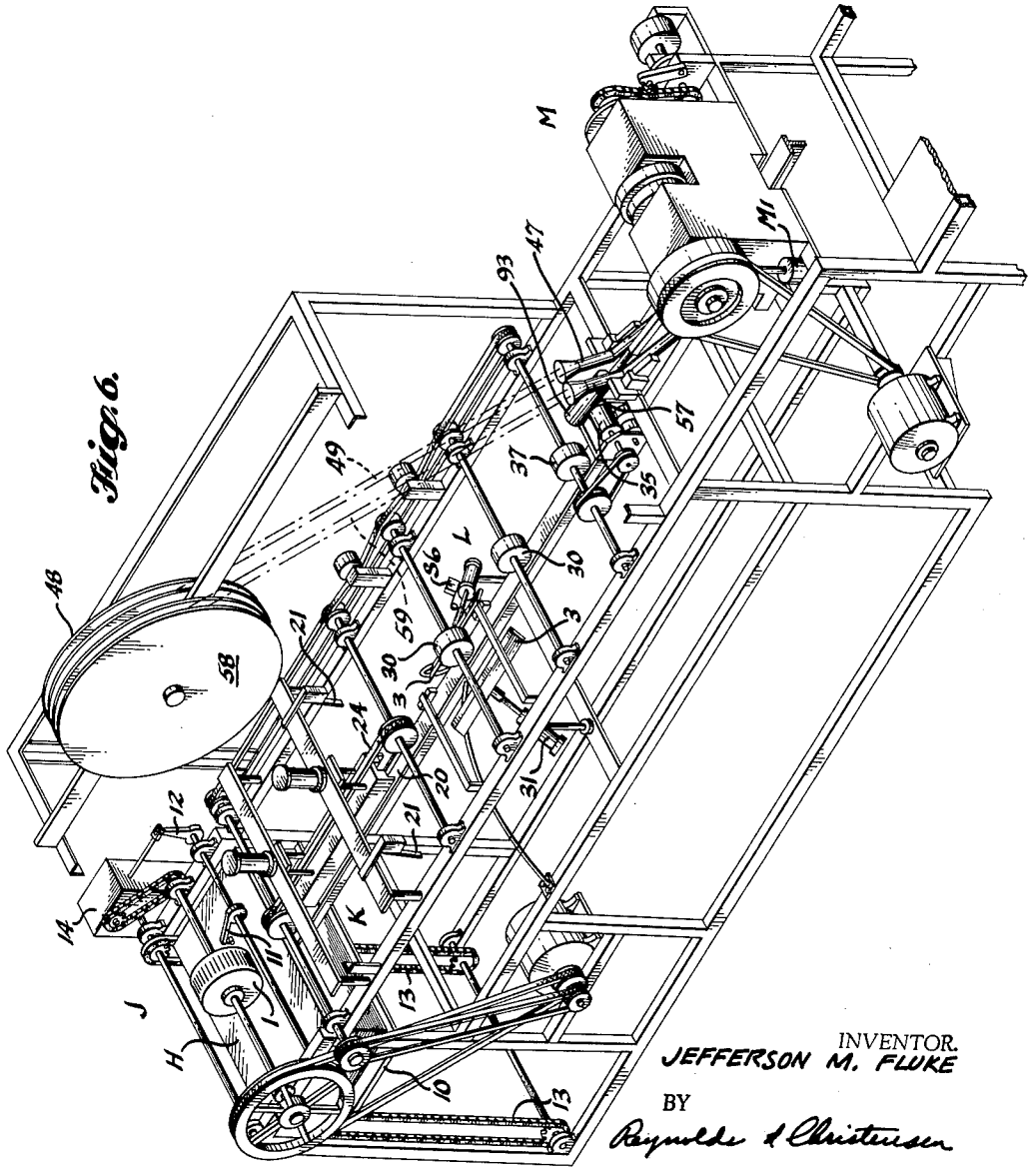
Fig. 6.



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METHOD AND MEANS TO PRODUCE FOLDERS WITH EYELETS AND TANGS

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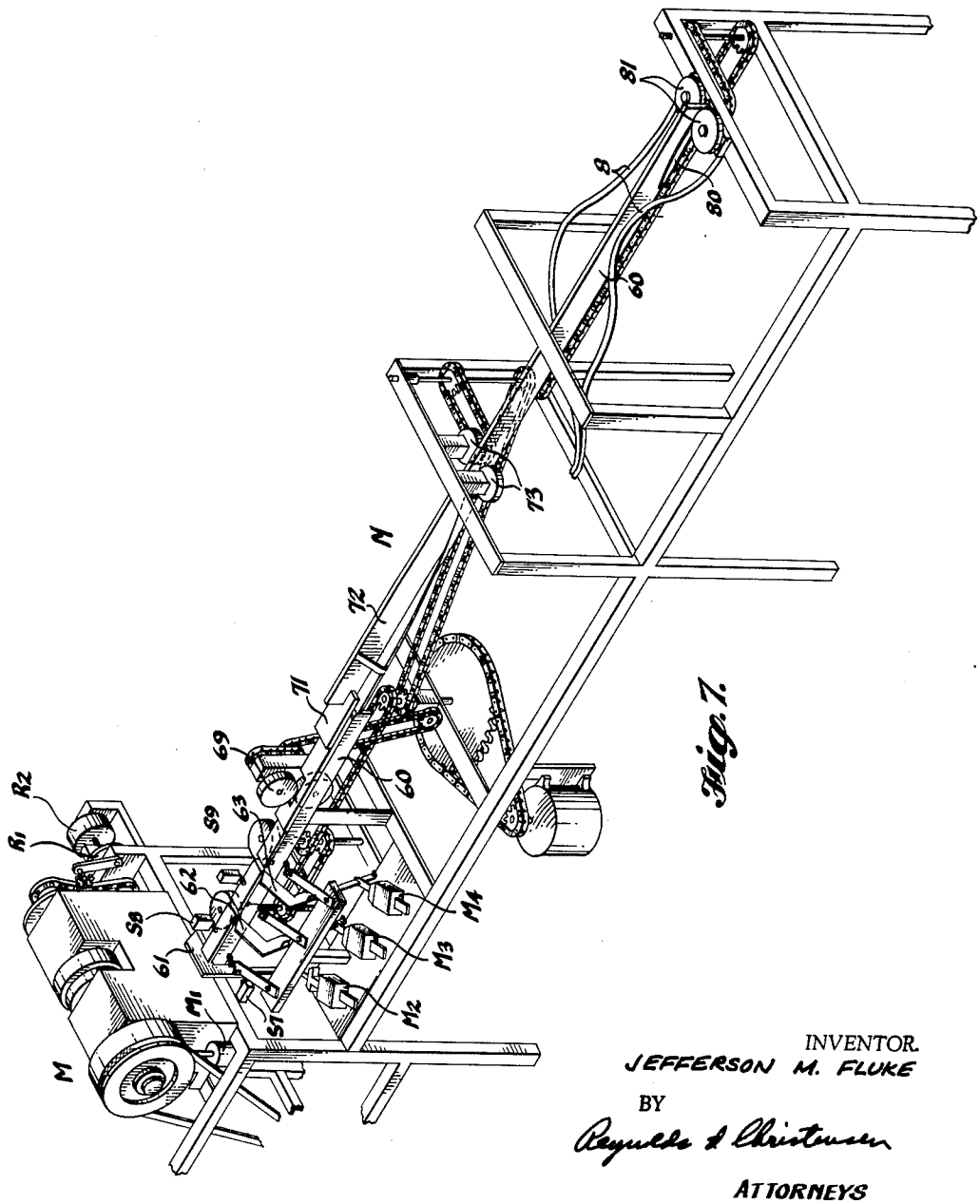

Fig. 7.

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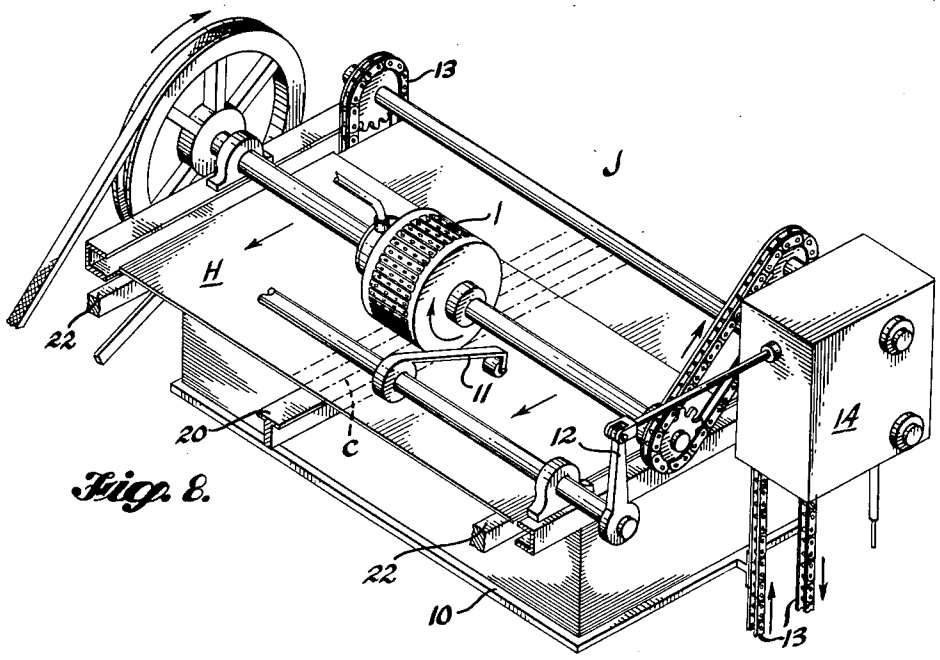

Fig. 8.

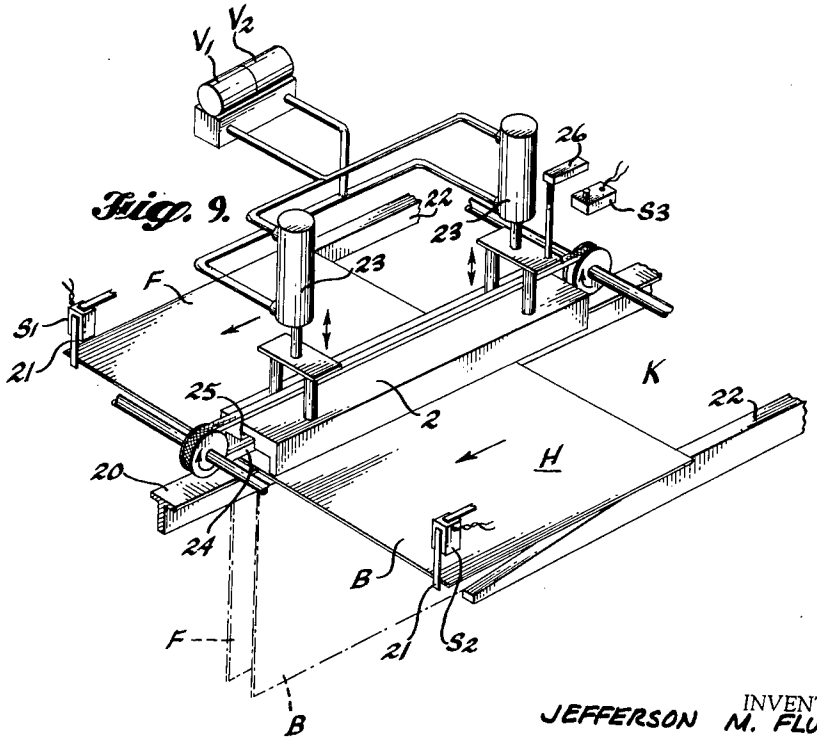

Fig. 9.

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Fig. 10.

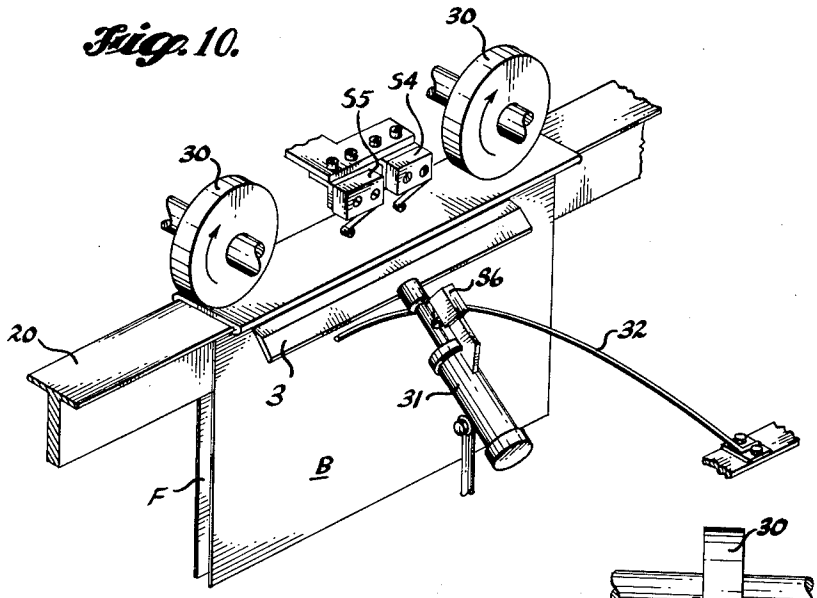


Fig. 12.

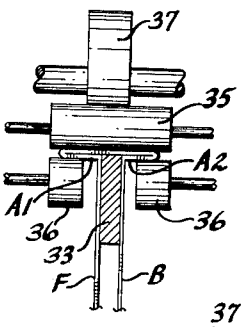
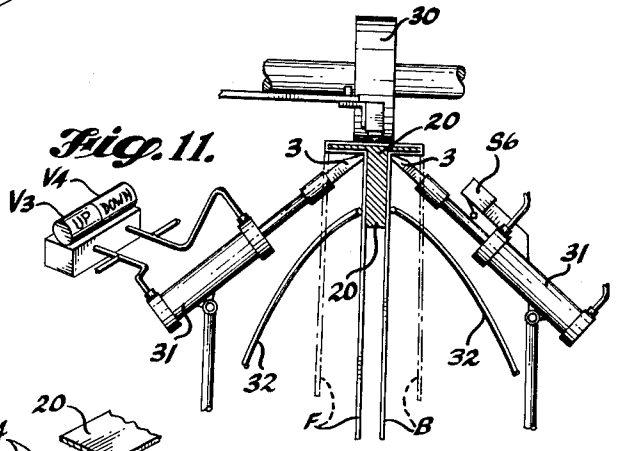


Fig. 11.



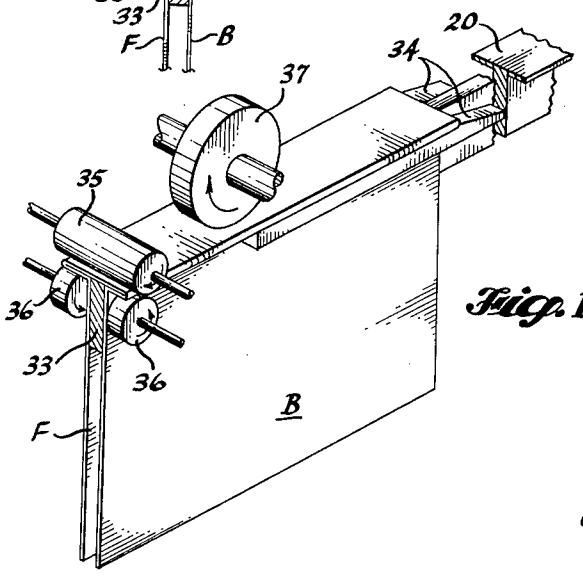


Fig. 13.

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Fig. 14.

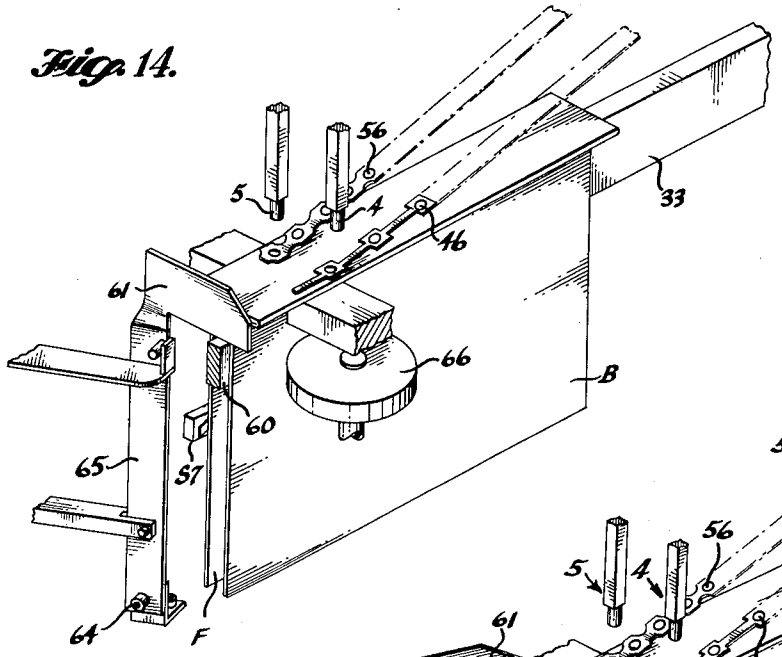

Fig. 13.

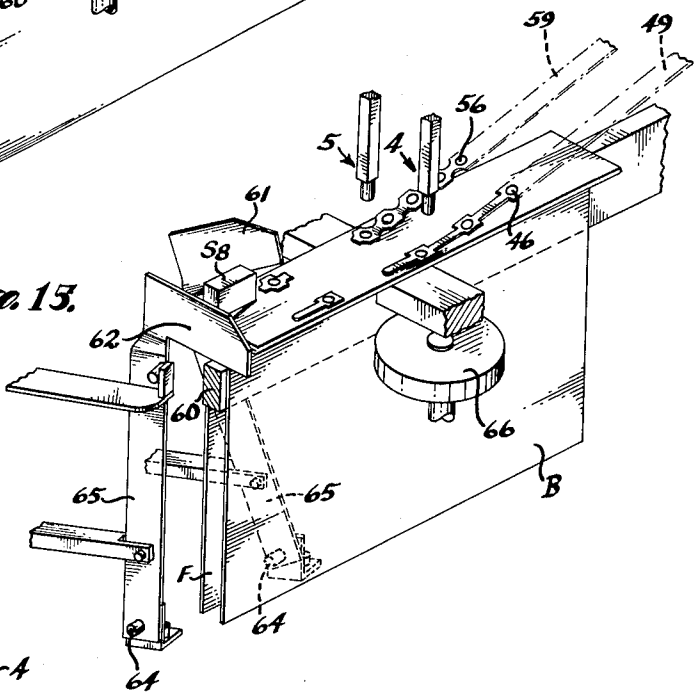

Fig. 18.

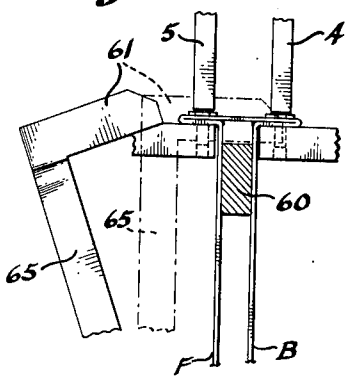

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Fig. 16.

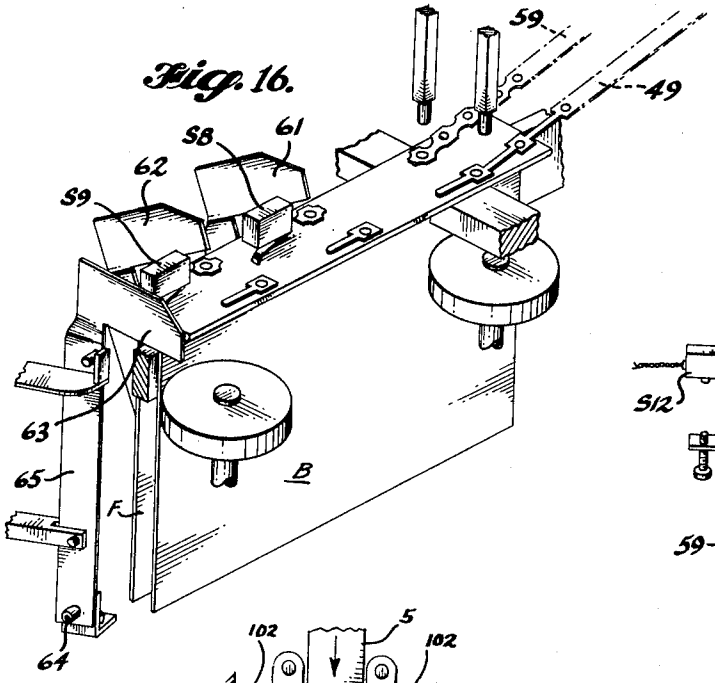

Fig. 18A.

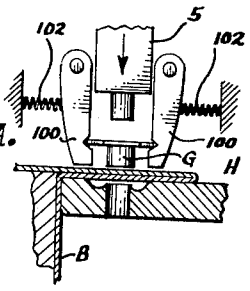

Fig. 18B.

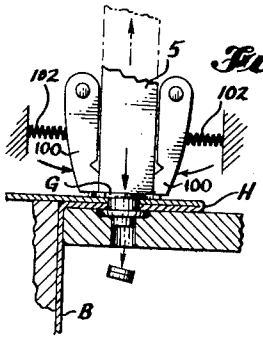

Fig. 17.

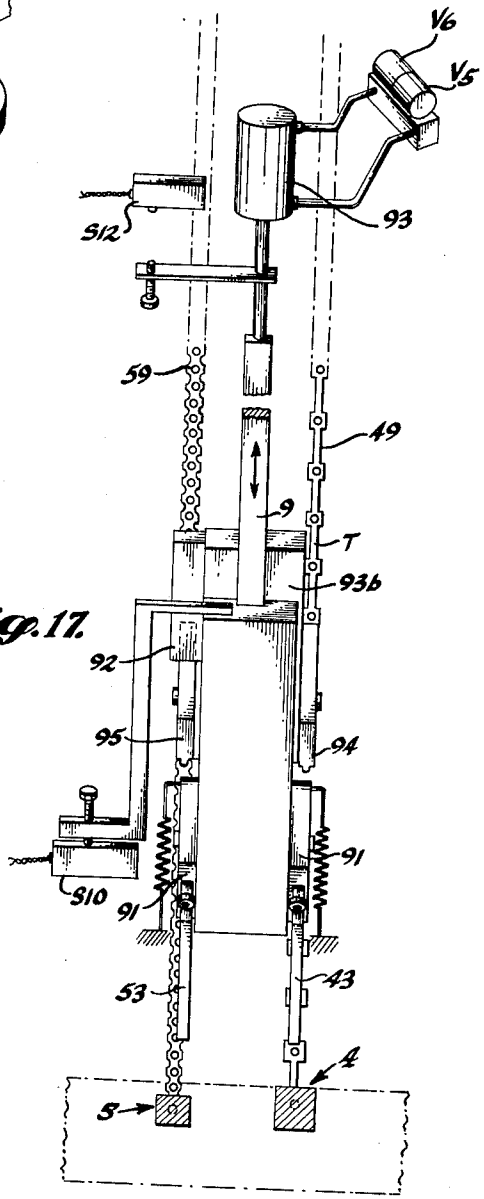

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Fig. 19.

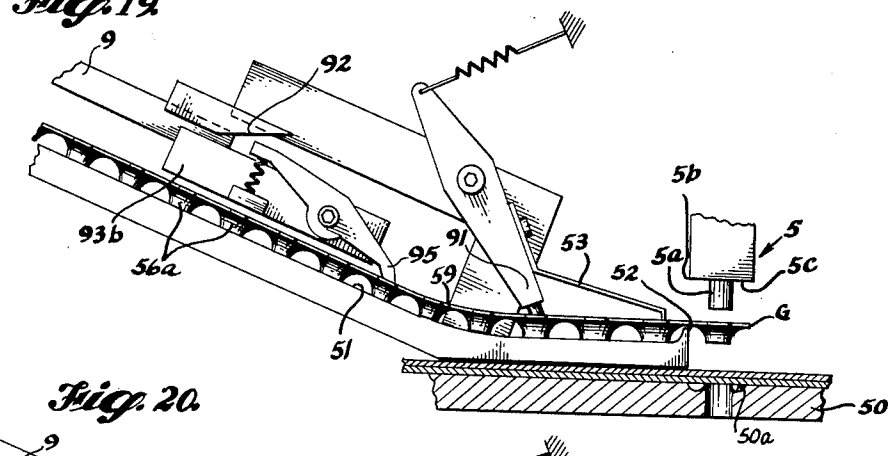

Fig. 20.

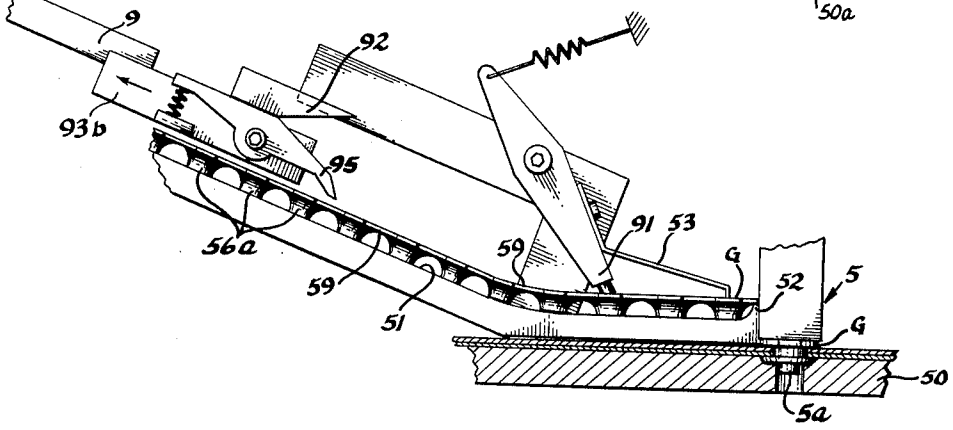

Fig. 21.

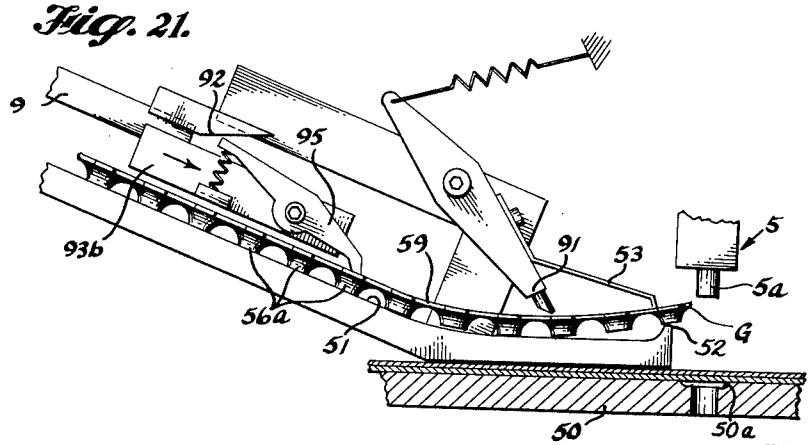

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Fig. 22.

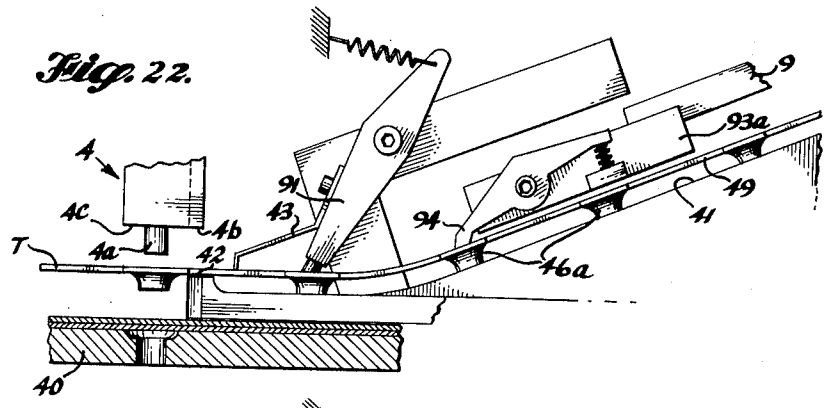

Fig. 23.

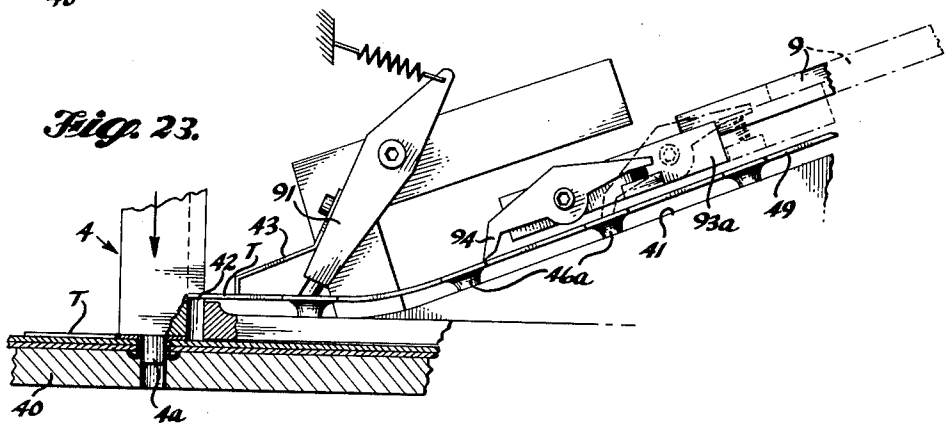

Fig. 24.

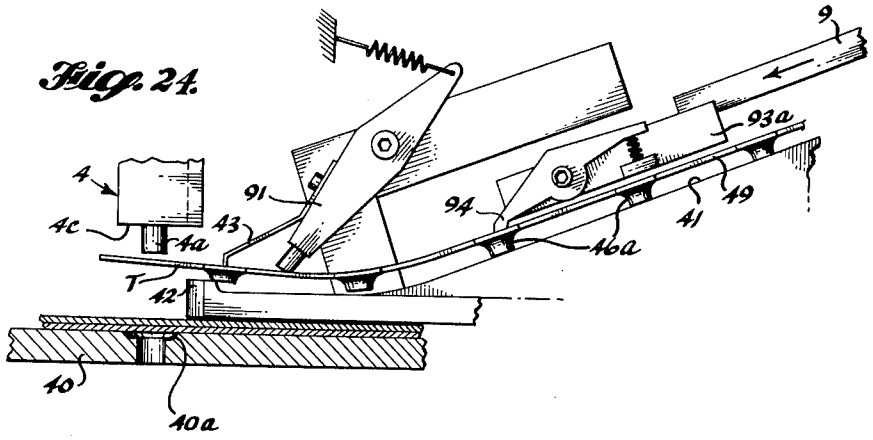

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Fig. 25.

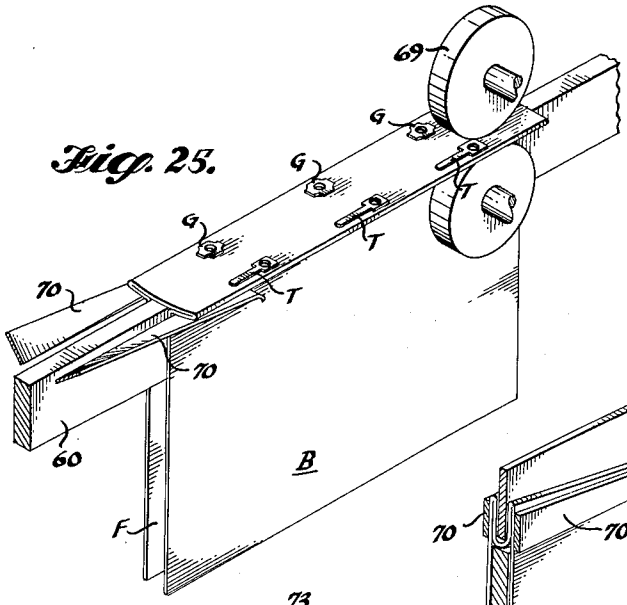


Fig. 26.

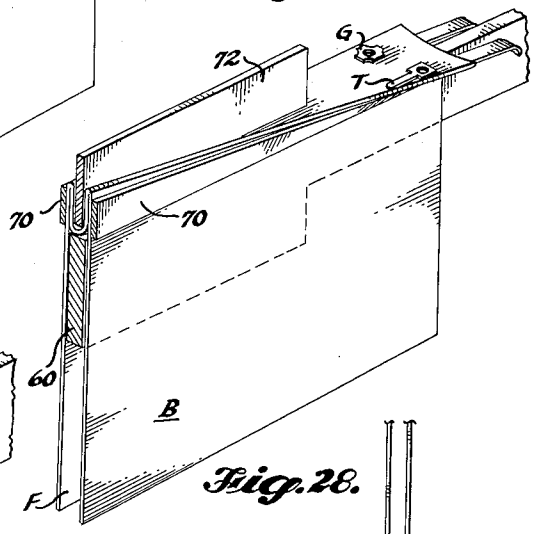


Fig. 27.

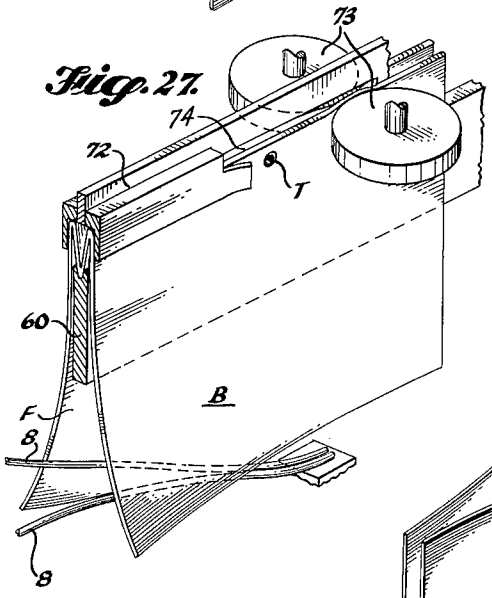


Fig. 28.

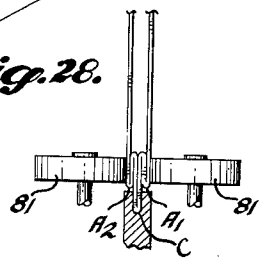
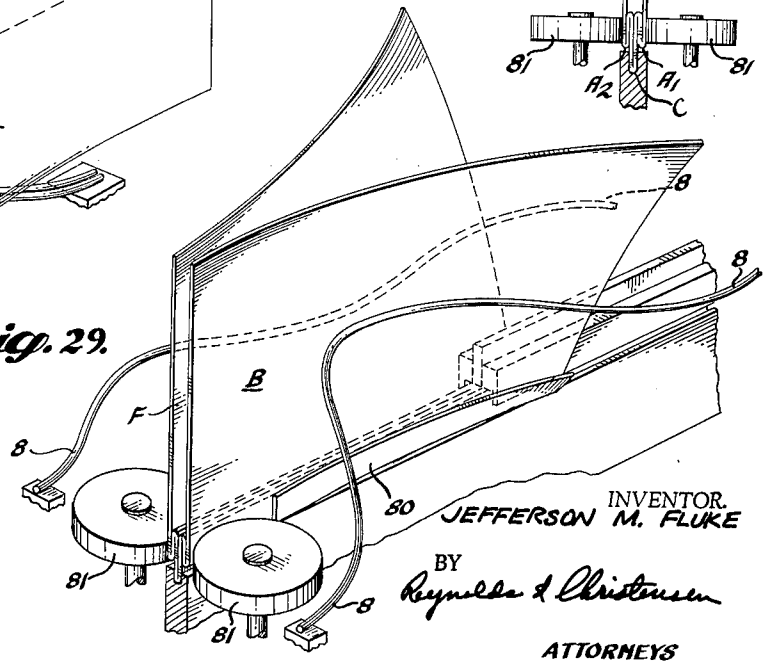


Fig. 29.



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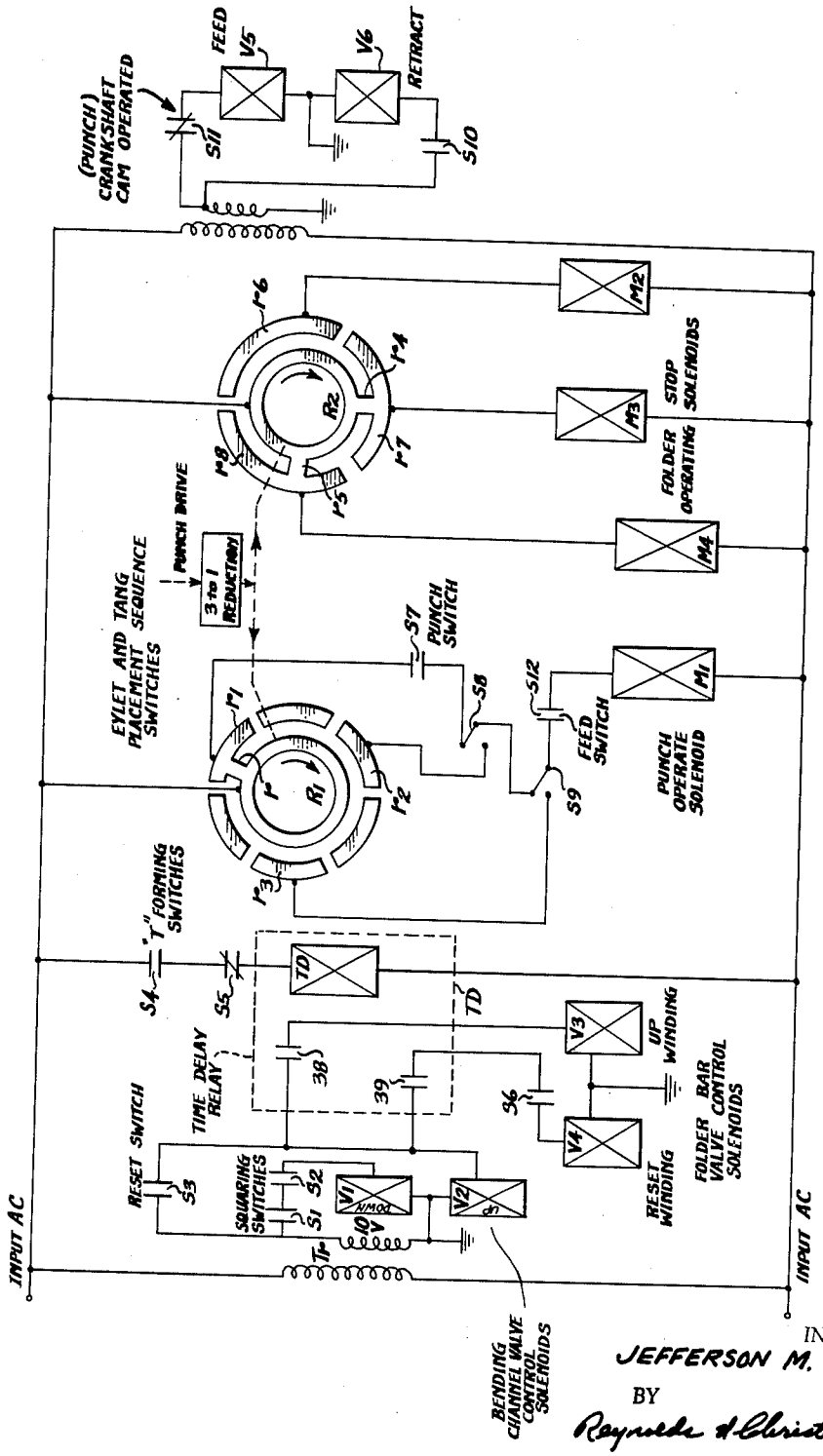

Fig. 30.

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United States Patent Office 3,200,487 Patented Aug. 17, 1965

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METHOD AND MEANS TO PRODUCE FOLDERS WITH EYELETS AND TANGS

Jefferson M. Fluke, Bothell, Wash., assignor of one-half to Aubrey L. Hilscher

Filed Nov. 12, 1963, Ser. No. 322,668
25 Claims. (Cl. 29—430)

This invention relates to the production of paper covers or folders such as those of the type commonly used for protectively binding loose sheets of paper into booklet form. More specifically the invention provides a continuous-production technique and means for manufacturing these paper covers or folders automatically and in a practical, efficient and inexpensive manner. The invention is herein illustratively described by reference to the presently preferred embodiment thereof; however it will be recognized that certain modifications and changes therein with respect to details may be made without departing from the essential features involved.

A further object of the invention is to devise a method and machine which produces the completed folders starting with flat cardboard or heavy paper blanks and with tang and eyelet blank stock fed to the operating components of the machine. A particular object is to provide new and improved means for preparing and presenting tang and eyelet stock to installing dies in the machine, and more specifically to provide such stock in continuous strip form adapted for reliable, jamb-free delivery in timed relation to the presentation of folded cover blanks.

A related object is to provide a means by which the functions of locating, severing and setting tang and eyelet units in the folded paper cover, including punching of the cover in properly indexed relation to the elements in conjunction with the setting operation, are performed efficiently and accurately so that the tangs and eyelets will be positionally matched and securely installed.

A specific object is to devise inexpensive material-conserving tang and eyelet stock in continuous strip form, which may be so indexed to the installing dies and the means for feeding the stock to the same as to insure accurate and reliable indexing in relation to the infed cover stock, all in a rapid continuous-production sequence. A related object is to devise a relatively simple and effective feed mechanism for the tang and eyelet stock and for the paper cover stock, the former using a common reciprocative drive mechanism to feed both strips while permitting impositive feed of the cover stock to the setting or installing station. A further object is to devise a feed mechanism for the tang and eyelet stock, using a common reciprocative drive member so constituted as to allow for material-conserving closer spacing between successive grommet apertures in the eyelet stock than the grommet aperture spacing in the tang stock.

A further object is to devise a new and improved means for folding the paper cover stock in a succession of operations preliminary to and subsequent to the eyelet and tang installation in a continuous-line feed system.

Still speaking in general terms, but with specific reference to the machine shown in the accompanying drawings, wherein the principles of the invention are made clear in a specific embodiment, from a stack of stiff paper cover blanks each of a size to make up one folder, one blank at a time is fed along a path leading to a delivery station, and it stops and resumes advance at at least one station along that path, but not at every station. At a first station it is folded downwardly in two parallel planes along two spaced lines located centrally intermediate its side edges. At a subsequent station its parallel opposite sides are folded inwardly, and creased, into T-shape. Now it arrives at the station where the tangs

and eyelets are to be anchored to it. At the anchoring station one, two, or more sets of the tangs and eyelets are anchored by their grommets in the opposite edges of the T-fold, at spaced intervals lengthwise thereof, the folder advancing by steps to establish these intervals. The folder is then creased along a line centrally between its initial folds, and is advanced to a final folding station, where the opposite sides (front and back) of the folder, now positioned one against the other, are each folded up to enclose the tangs, eyelets, and the folds wherein these are anchored, and the finished folder is delivered, ready for packaging or use.

The entire operation is automatic, and various controls and safeguards are employed, both in controlling the advance, stoppage and positioning of the folder, and in controlling the advance, registry, and stoppage of the metal tapes.

Certain features of the invention reside in the novel set of tang and eyelet blank strips and in the details thereof; in the means for feeding such strips in indexed relation to the installing dies utilizing common drive mechanism and associated strip engaging feed elements allowing for a difference in the unit lengths or spacings in the respective strips, in the novel die mechanism as such by which the cover stock is punched and the tang and eyelet units are severed from the strips and set; in the novel specialized means to perform specific folding operations upon the cover blanks both as they are being fed successively to the tang and eyelet installing dies and as they are thereafter fed to a delivery point; and in related feed and guide means and steps of the overall automatic system of production.

The specifics of these and other features, objects and advantages of the invention will become more fully evident from the following description by reference to the accompanying drawings.

FIGURE 1 is an isometric view of a blank, showing lines of fold, where are preferably initially scored.

FIGURE 2 is an isometric view of the finished cover or folder, opened as it would be to receive the loose sheets to be bound.

FIGURE 3 is an end view of the folded central part of the finished folder, as it would be delivered from the machine.

FIGURE 4 is an isometric view of a length of the tang tape, such as will be finally formed by the machine, ready for attachment to the folder, and FIGURE 5 is a similar view of the eyelet tape.

FIGURE 6 is an isometric view, somewhat simplified, of the feed end of the machine, to and including the means for anchoring the eyelets and tangs.

FIGURE 7 is a similar isometric view of the delivery end of the machine, from the several stop means associated with the means for anchoring the eyelets and the tangs, to but not including a receiving or delivery table or the like, such as is conventional in similar machines.

FIGURES 8 to 29 are views illustrating successive mechanisms of the machine, to perform successive steps of the process. Specifically:

FIGURE 8 is an isometric view of a suitable initial feed mechanism for a blank, this being conventional per se.

FIGURE 9 is an isometric view of the first folding mechanism.

FIGURE 10 is an isometric view of the second or T-folding mechanism; FIGURE 11 is a sectional view, looking at the same endwise; FIGURE 12 is a similar sectional view of the ensuing T-creasing mechanism; and FIGURE 13 is an isometric view of the latter.

FIGURE 14 is an isometric view of the mechanism for anchoring the eyelets and tangs, with the partially folded blank halted at a first station; FIGURE 15 is a similar

view, with the blank halted at a second station; FIGURE 16 is a similar view with the blank halted at a third station; FIGURE 17 is a plan view of the mechanism at the anchoring station; and FIGURE 18 (Sheet 6) is a cross-sectional view, looking at the edge of the blank.

FIGURES 18A and 18B are detailed sectional views showing stripper mechanism associated with one set of dies, but omitted from preceding views for clarity.

FIGURE 19 is a longitudinal sectional view of the eyelet setting mechanism, illustrating an initial stage of the eyelet unit severing and anchoring operation; FIGURE 20 is a like view showing a subsequent stage in this operation; and FIGURE 21 is a like view of the ensuing die retraction and eyelet blank strip feed operation.

FIGURES 22, 23, and 24 are views similar to FIGURES 19, 20 and 21, of the tang-anchoring and severing mechanism in corresponding stages of operation.

FIGURES 25, 26, 27, and 28 illustrate the next-to-last cover folding operation; FIGURE 25 shows in an isometric view the start thereof, FIGURE 26 a later stage, and FIGURE 27 a final creasing stage; FIGURE 28 is a cross-sectional view illustrating this final stage.

FIGURE 29 is an isometric view of the final operation, wherein the front and back of the completed cover are folded up into final form.

FIGURE 30 is a schematic diagram of the controls for the several operations.

A folder blank H is shown flat in FIGURE 1, and the finished but opened folder in FIGURE 2. It may be assumed that F is the front and B the back of the folder. It has enough excess material centrally between and integral with the front and back to form several folds, along lines that are preferably prescored. For example, the strips A1 and A2 fold flat against strips D1 and D2 along the lines P1 and P2. Anchor tangs T and eyelets G are set respectively in these folded strips A1, D1, and A2, D2. Finally the strips D1 and D2, which can be of a width exceeding that of strips A1, A2 to afford adequate expansion of the folder, are folded back against one another along center line C. Front F and back B are then folded relative to strips A1 and A2 along fold lines E1 and E2 to produce. The final delivered form of the folder is shown in FIGURE 3. According to this invention the finished folders as in FIGURES 2 and 3 are produced automatically and continuously from blanks as in FIGURE 1 and from the tang and eyelet blank strips shown in FIGURES 4 and 5.

It may be noted that the tangs and the eyelets, in the preferred arrangement illustrated, are formed in and individually severed from tapes or strips 49 and 59 respectively, of malleable brass or the like. In FIGURES 4 and 5 the respective tang and eyelet tapes illustrated are shown in stages of completion, starting at the right side with the raw strip having apertures at intervals to locate the units and continuing to the left to the completed stock ready for delivery to the setting dies. The means to form the stock to its illustrated optimum degree of tang and eyelet unit completion are not illustrated. The tapes ready for use are rolled up and stored on reels 48, 58. Alternatively the raw strips can be rolled up and fed through mechanism to form the stock in the process feeding the strips automatically to the setting dies at the anchoring station.

The tangs shown have but a single bendable finger, projecting at one side of the anchor grommet; however, if desired, grommets with two fingers may be employed.

Referring first to FIGURE 6, in which the blank advances from left to right, there is a feed station at J where individual blanks are advanced from the top of a stack on an incrementally rising table 10, by means such as the rotative vacuum wheel 1. This wheel is rotated continuously. As shown a contact finger 11 is engaged by the rising stack, and through means such as the lever 12 on the same rocking shaft as finger 11 and ratchet mechanism housed at 14, initiates further upward movement of the table 10 when paper height is insufficient to permit feed of sheets by the wheel. The table is lifted by means such as endless and vertically disposed chains 13 to which the table is secured. Such sheet feed means are known, and any suitable feed means may be employed in lieu thereof.

The blanks H are oriented on the table 10 with their ultimate center line C aligned with their direction of advance. At the first folding station K each blank rests upon a centrally disposed bar 20 of a width equal to the sum of the widths of the two central strips D1 and D2, and engages two stops 21, with which are associated squaring switches S1, S2. The purpose of these switches is to initiate operation of a folding shoe 2 when the blank arrives at station K properly squared in the machine, not cocked somewhat, and in consequence has closed both switches of S1 and S2 (FIGURES 6 and 30). The opposite ends of the blank may be supported, at least in the initial part of the advance, on side rails 22; see FIGURES 8 and 9. At station K a spring-returned folding shoe 2 of channel shape, just large enough to enclose the bar 20 and the interposed blank material, is depressed by pneumatic or hydraulic jacks 23. The jacks are actuated under control of a solenoid valve winding VI, and released to permit upward return motion of the shoe, under control of a solenoid valve winding V2. Details of the control operations are later described herein by reference to FIGURE 30. By movement of the channel-shaped folding shoe 2 downwardly relative to the fixed bar or guide rail 20 the ends of the blank H—its eventual front F and back B—are bent sharply downwardly along the lines P1, P2, as seen in FIGURE 9 in dot-dash lines. The continuously advancing endless feed belt 24 urges the so-folded blank forwardly, and since its ends that engaged stops 21 are now folded downwardly, there is no obstacle to the blank's further advance. The folding bar 2 has a channel 25 to receive the feed belt 24 when the bar comes down.

The centrally disposed bar 20, from the opposite edges whereof the front F and back B of the blank now depend, continues on to the T-bending station L, and at this station, if not in the previous station K, it is of T-shape in cross-section and thin in its upper head, although its web may be somewhat thicker; see FIGURES 10 and 11. The blank is advanced to proper position at this station by rolls 30 that press the central portion of the blank (that which rests upon bar 20) against the bar 20. At the same time the presser fingers 32 urge the front F and back B inwardly of the edges of bar 20. As the blank advances it first contacts normally open switch S4 and closes it, and very shortly thereafter it contacts normally closed switch S5 and opens it. These switches are in the energizing circuit of a time delay relay TD (FIGURE 30), and the combined effect of the switches S4, S5 is to create a pulse of current. While this pulse lasts and for a predetermined delay time thereafter the normally open contacts of switch 38 of the time delay relay are closed, which energizes the "up" control winding of solenoid valve winding V3, which supplies fluid to jacks 31 that carry creasing bars 3. These move upwardly and inwardly into the reentrant angle corners between the head of bar 20 and its web, as in FIGURE 11. A normally closed switch S6, associated with one of the jacks 31, is opened as the bar 3 moves upwardly. The pulse created by switches S4, S5 is but momentary, and when it ends the reset or reversing solenoid valve winding V4 is energized to actuate the jacks 31 downwardly. This reverse actuation is initiated by switch S6 being closed when its jack 31 is in its "up" position when the pulse ends (it opens again during downstroke of its jack), and the lower time delay contacts 39 close, and thereby the winding of solenoid valve V4 is energized to reset the controls. The pulse is of such short duration—while the blank is moving from S4 to S5—that only one upward stroke of the creasing bars 3 can occur. The machine

could be arranged to halt advance of the blank at the T-bending station L, and to resume its advance after bending, but this has not been found necessary.

The operation at this station bends the blank reentrantly along the lines E1 and E2, which are to become the hinges of the front and back, respectively.

The T-bends formed at station L are creased and made permanent as the blank advances beyond the bending bars 3. In order to accomplish this, the thin head of guide bar 20 terminates beyond the bars 3, leaving only the upstanding web 33 (FIGURES 12 and 13). The cover front F and back B are urged inwardly and held adjacent web 33 by guide strips 34 (FIGURE 13). Beyond the tail ends of these strips are mounted a wide upper creasing roll 35 and, cooperable therewith, narrow lower creasing rolls 36. These rolls "iron" or set the T creases initially formed by the creasing bars 3. A feed roll 37 advances the blank to the creasing rolls 35, 36 which help to continue its advance toward the tang and eyelet installing station.

The blank is now ready for installing the eyelets G and tangs T in place. This is done at station M, to which an eyelet blank strip 59 and a tang blank strip 49, such as have been briefly described above, are fed in side-by-side relation from reels 58 and 48 respectively. These strips or tapes are guided to the anchoring mechanism by guides 47, 57. If the eyelet and tang blank strips are still in flat strip form they will incorporate register holes 46 or 56 to be engaged for feeding the strips, prior to being fed to station M. Preferably, however, the strips as fed in the machine are preformed with grommet-size holes 46', 56', grommet flanges 46*a*, 56*a*, and selected width-reducing cuts. The usual spacing between the grommet holes 46' in the tang strip is greater (conveniently by three times) than the spacing of grommet holes 56' in the eyelet strip. The strips are advanced by a common feed mechanism that engages in the grommet and advances the strips for simultaneous arrival of each new tang and eyelet unit at station M. To accomplish this result allowing for the difference in length of the eyelet and tang units in the respective strips 49, the tang strip is fed three times as far as is the eyelet strip on each stroke of the feed strip mechanism utilizing feed mechanism for the grommet strip that in effect incorporates lost-motion means. Each strip could be advanced wholly independently of the other, yet still there would be need for coordinating the amount of advance of the one with the lesser amount of advance of the other, for the eyelets G can be closely spaced along the tape 59, whereas the tangs T, even if they have but one point or tine, must be of some appreciable length, to pass through the stack of papers to be bound, and the eyelet, and to permit their ends to be bent over. If longer or double-tined tangs are required, the tang unit spacing or length in the tang strip would be even greater than that shown.

As fed to the installing station M, the eyelet strip 59 preferably has regularly spaced holes 56' of a diameter slightly exceeding the tine width and rimmed by flanges 56*a* projecting from the bottom side thereof. Width-reducing notches 59' regularize the outline shape of the cut eyelet units and reduce the width of metal to be severed in the installing dies (i.e. by cutting on the dotted transverse lines shown). Similarly tang strip 49 has grommet holes 46' rimmed by downwardly projecting flanges 46*a*. Between the apertured or grommet sections of each tang unit the strip is narrowed by notching at both sides to provide a tang body of desired length (49') as shown. This is severed in the installing operation by cutting it transversely on the dotted line shown. At the installing station the strips are disposed in registry with a tang installing die 4 cooperating with a matching die or anvil 40, and an eyelet die 5 cooperating with a matching die or anvil 50. These sets of dies engage the locating holes in the respective strips, punch holes through the cover blank strips A1, D1 for the tangs, and A2, D2 for the eyelets, seat the grommets of tang and eyelet units in the punched holes, upset or clinch the ends of these grommets, as in FIGURES 20 and 23, and sever the tang and the eyelet units from the respective base strips. Thus the tang is anchored to one side of the T-fold and the eyelet to the other side thereof, in opposing positions of precise registry. The feed mechanism and the severing and anchoring mechanism will be described shortly, but first an understanding of the stop mechanism for the anchoring operation will be helpful.

It will be understood that sheets bound in such a folder will normally be engaged at two points at least (i.e. by two sets of tangs and eyelets), along one edge, although one point of engagement might suffice in some cases. In the folder illustrated there are three points of engagement, each at a predetermined distance from the blank's leading edge. In the illustrated machine the blank is advanced to a first stop and halted while a tang and an eyelet are anchored, then to a second stop and halted while a second tang and eyelet are anchored, and finally to a third stop for anchorage of the third tang and eyelet. The stops, in succession, are shown at 61, 62, 63, spaced at suitable intervals along the path of the blank, as defined by the bar 60. Each stop is carried on the upper end of a vertical arm 65. The lower end of each arm is pivotally mounted at 64 to swing about a substantially horizontal axis skewed with relation to the blank's direction of advance. Solenoids M2, M3, and M4 are connected to the respective stops 61, 62, 23. When energized each solenoid withdraws its stop from the path of the blank. When deenergized, as each is in succession, the solenoids permit their respective stops to return by action of a spring (not shown) to intercept and stop the blank. The skewing of its pivot axis 64 causes each stop, as it is retracted transversely from the path of the blank, to move away from it also with a component in the direction of the blank's advance. This avoids any tendency for the advancing cover to hang up on the stop or to be disoriented in relation to its line of movement. Feed of the blanks, in this part of the machine, is accomplished by the continuously rotating feed rolls 66, pinching the blank between the front F and back B, and the interposed bar 6.

The novel feed mechanism for the tang and eyelet strips is shown in detail in FIGURES 19 to 24. Unwinding from overlying reels 48 and 58, the tang and eyelet blank strips are led downwardly through downwardly inclined guides 47 and 57 to the respective final approach guide surfaces 41 and 51. The latter flatten out into generally horizontal planes overlying and parallel to the respective anvil tables 40 and 50. The feed mechanism advancing the strips employs a common reciprocative bar 9, individual shuttles 93*a* and 93*b*, and feed dogs 94 for the tang tape and 95 for the eyelet tape. Each feed dog is pivotally mounted upon its shuttle and spring-urged to engage a register hole or grommet opening of the corresponding blank strip. Carried at the lower end of the bar 9, the shuttles are guided for reciprocative movement in a direction parallel to the inclined portions of guide surfaces 41, 51. The dog 94 engages a grommet aperture 46*a*' in the tang tape 49 throughout substantially the entire feed stroke of the shuttle 93*a* and the tang 49 is advanced by a corresponding distance. During the shuttle's return movement an anti-retraction dog 91, spring-urged into position to engage within a grommet aperture 46' holds the tape 49 against retrograde movement while the feed dog 94 ratchets back along the tape until it engages within the next grommet aperture. The dog 95, however, does not advance the tape 59 throughout its full feed movement, but only during the final one-third of that movement, in the assumed conditions stated above (i.e. grommet aperture spacing in eyelet strip one-third that in tang strip). The dog 95 is held from engagement with tape 59 during the first two-thirds of its feed movement by a fixed cam 92. Thereafter it is per-

mitted by termination of the cam 92 to drop into engagement with the next grommet aperture 56′ and advance the tape 59 during the final one-third of the shuttle feed stroke. The matching grommet units of the two tapes thus arrive simultaneously at the installing station. An anti-retraction dog 91, holds the strip 59 against retrograde movement in the same manner as the similarly numbered dog 91 in the case of strip 49. The upper installing dies 4 and 5 have cylindrical paper punches 4*a* or 5*a* respectively that enter the grommet holes when the latter are positioned in proper registry therewith by the feed means. These upper die units also have respective shearing edges 4*b* and 5*b* that cooperate with fixed lower shearing edges 42 and 52 to sever the tang or the eyelet stock at an intermediate point in the operating stroke of the upper dies. These upper die units also have shoulders 4*c* and 5*c* that urge the severed grommets 46*a* and 56*a* through the punched layers A1, D1 or A2, D2 of the cover and into the curved upsetting dies 40*a* and 50*a* formed in the underlying anvils 40 and 50 respectively, thereby to set the grommets. Spring fingers 43 and 53, each associated with its anti-retraction dog 91, hold the respective tapes down against the severing edges 4*b* and 5*b* when the tapes are correctly positioned for severance and grommet setting.

With reference to FIGURES 18A and 18B stripper dogs 100 cooperate with die 5 to hold down the set eyelet unit G during the retraction (FIGURE 18B), so that raising of the die will not raise with it the cover H nor loosen the eyelet in the cover. Similar stripper dogs (not shown) cooperate in like manner with the die 4. The dogs of each set are urged toward each other by springs 102 shown schematically to relatively spaced positions (established by suitable stops not shown) which permit feed of eyelet stock between them and permit operating motion of die 5 between them. However, their lower tips 100*a*, while yielding apart for passing the eyelet stock and die on the latter's downstroke, catch the rim of the installed eyelet to perform the described holddown function.

The sequence of operations is shown in FIGURES 12 to 21 and 22 to 24. In FIGURE 22 the feed dog 94, at the limit of its feed stroke, has advanced the next tang unit with its grommet 46*a*, into registry with the die unit 4. In FIGURE 19 the feed dog 95 is at the limit of its feed stroke, and has advanced the next eyelet unit with its grommet 56*a* into registry with the die unit 5. In FIGURE 23 feed dog 94 has been retracted, but the upper die unit has descended to sever and set a tang unit T. In like manner the upper die unit 5 has descended in FIGURE 20, severing and anchoring an eyelet unit G. In FIGURE 24 the drive bar 9 and feed dog 94 have been retracted and again started forward, advancing the tape 49 nearly to position registering with the die unit 4. FIGURE 19 corresponds to FIGURE 22, the tape 59 having been advanced to its limit position, in registry with die unit 5. In FIGURE 20 the feed dog 95 has been retracted, but the cam 92 holds it out of engagement with the grommet 56*a*, and will continue so to do until two-thirds of its feed stroke is completed; in the final one-third stroke, shown in FIGURE 21, the feed dog 95 engages and advances the eyelet tape 59. A common actuator, the bar 9, is thus permitted to effect feed of both shuttles and their associated grommet strips even though the unit spacing in strip 59 is less (i.e. one-third in the example) than that in strip 49.

The shuttle bar 9 is actuated by a double-acting jack 93 supplied with fluid past solenoid valves V5, V6 controlled in a manner shortly to appear.

The several tang and eyelet units being now anchored to the folder, it emerges from the anchoring station M as seen in FIGURE 25, being advanced by a feed roll 69, and proceeds through a center creasing station N, where it is bent and creased along the center line C. Referring to FIGURES 7, 25, 26 and 27, the folder advances from station M with its center section, flat as heretofore, riding on the edge of rail 60, and passes beneath a restrainer 71 (FIGURE 7) and over bars 70 which gradually urge the strips A1, D1, and A2, D2 upwardly—see FIGURES 26 and 27—as the folder advances. A vertical divider bar 72 cramps strips A1, D1 and A2, D2 between itself and bars 70, and finally creasing rolls 73, acting through a gap 74 in divider bar 72, crease the folder material along center line C as well as again pressing the creases between strips A1 and D1, and between A2 and D2.

In order to complete the folder, its front F and back B should be bent up to enclose the center strips and their anchored tangs and grommets. As the folder emerges from center creasing station N the front and back are still spaced slightly apart by the thickness of rail 60. As shown in FIGURE 27, convergent guide rods 8 enter this space and diverge outward and upwardly from each other, so that as the folder advances, its front and back are deflected progressively upwardly, each through 180° into upwardly directed positions lying at opposite sides of divider bar 72. Auxiliary guides 80 that extend lengthwise of the center folds of the folder further assist in bending it along the lines E1, E2. These bends are then pressed and creased by the final creasing rolls 81. The finished folder is then discharged at the delivery station onto a suitable table or other receiving device, not a part of this invention.

The operation will now be described with more particular reference to FIGURE 30. An initial feed station J blanks B in flat condition are fed successively toward the first folding station. A folder blank arriving at the first folding station K is arrested by contact with detents 21 which actuate squaring switches S1, S2. When both are actuated (i.e. the folder blank is squared to the line of travel), solenoid valve winding V1 is energized by the secondary of transformer T*r*. This supplies pressure fluid to jacks 23 to move the folding shoe 2 downwardly. Reset switch S3 (FIGURE 9) is located where it will be closed by a finger 26 that moves downwardly with the shoe 2. Closure of this switch S3 energizes the solenoid valve winding V2 to effect upward movement of the shoe.

The U-shaped folder blank is next formed into a T at station L by pressure bars 3 operated by jacks 31. These jacks are operated by a time delay relay TD which is briefly energized by momentary simultaneous closure of folder actuated switches S4 and S5. Switch S4 is actuated by approach of the folder blank to station L to initiate the energy impulse, whereas switch S5 is opened promptly thereafter by continued advance of the folder. The bars are urged upwardly to form reentrant angle bends in the folder blank by closure of relay contacts 38 to energize the "up" control winding V3 of the solenoid valve that operates jacks 31. Termination of the time delay period of relay TD opens contacts 38 and closes contacts 39 to energize the "down" control winding of this valve and thereby depress the bars 3, provided switch S6 is closed in response to the bars being in their fully raised position.

The mechanism for placement and anchorage of the eyelets and tangs has been described as including reciprocative shuttles 93*a* and 93*b* mounted at the lower end of an inclined shuttle bar 9 common to the two shuttles. One cycle of reciprocation occurs each time the blank is halted by one of the stops 61, 62, 63, and is effected under control of solenoid valve windings V5 and V6, the first of which advances the shuttle bar 9 by actuating jack 93 in the feed direction, and the second of which actuates that jack in the "retract" direction.

The blank-stopping operation and the grommet-setting or anchoring operation, accompanying the severing of a tang T or eyelet G from its tape, all are controlled in part by rotating selector switches R1 and R2 (rotative with the die mechanism crankshaft), by solenoids M1,

M2, M3, and M4, by switch S11 (cam operated by the die mechanism crankshaft) and by switches S7, S8, S9, and S10, located to be actuated by the advancing blank or, in the case of switch S10, by the advancing tang or eyelet strip.

The first punch switch S7 is normally open, but is engaged and closed by an advancing folder arriving at the station M, just as the folder reaches the first stop 61; see FIGURE 14. At this time rotative selector switch R1 is halted in position such that its single rotative contact *r* is in engagement with fixed segment *r*1. A circuit is closed by way or *r*, *r*1, now closed switch S7, and S8 and S9, both of which switches S8 and S9 are normally closed in the positions shown, and normally open switch S12 which has been closed by the next tang blank unit being fed fully into position registering with the dies 4 and 5. Were it not for the latter control of the punches by switch S12 the punches might descend and cut through nonregistering grommets 46*a* or 56*a*. Downward movement of the upper dies 4 and 5 is initiated by closure of the circuit described, energizing solenoid M1 to effect engagement of the punch drive clutch (not shown). In the example a full down and up stroke of the dies occurs during one-third of a revolution of rotative selector switches R1 and R2. Means (not shown) of a conventional or suitable nature effect a full stroke of reciprocation of the dies down and up once the cycle is initiated in the described manner.

Switch R2 controls the stops 61, 62 and 63. The solenoids, M2 for stop 61, M3 fo rstop 62, and M4 for stop 63, when energized retract the corresponding stops. Having completed the down and up cycle of the dies with the selector switches R1 and R2 in the first third of their revolution, as described above, and these switches having rotated into position wherein brush *r* of R1 now engages contact *r*2, and wipers *r*4 and *r*5 of R2 engage contacts *r*8 and *r*6, respectively, a new die stroke cycle is ready to be initiated. When this condition exists solenoid M3 is deenergized and its stop 62 is advanced, but solenoids M2 and M4 are both energized, hence stops 61 and 63 are retracted. The blank advances to and is stopped by stop 62, and in advancing moves switch S8 to a position to close a circuit from brush *r* through *r*2, S8, still unmoved switch S9, and switch S12 to solenoid M1, which initiates the second die operating cycle. Again, this can only occur if the strips have advanced fully into registry with the punches, and have closed switches S10 and S12.

The second punch cycle being completed with the switches R1, R2 in the second third of their revolution, they arrive in the last third thereof. Wiper *r* of rotary switch R1 engages contact *r*3; contact *r*8 is deenergized and contacts *r*6 and *r*7 are energized. The latter energize solenoids M2 and M3, respectively, to retract stops 61 and 62, while stop 63 is advanced into the path of the blank. Switch S9 is actuated by the advancing blank to establish a circuit from wiper *r*, through contact *r*3, switch S9, and switch S12, to energize solenoid M1 and start a new die operation. This third cycle being completed, the blank passes beyond anchoring station M, a succeeding blank arrives there, and the operations are repeated in sequence.

For the rest of the machine the blank is advanced by impositive feed mechanism, whereby if desired it may be halted at any given folding station (although positive halting of blanks is only required at the anchoring station).

These and other aspects of the invention will be evident from the foregoing description and the example by which the invention is illustrated herein.

I claim as my invention:

1. A continuous method of forming folders with interrelated eyelets and tangs from a flat blank, which comprises advancing successive flat blanks from a feed station to a first bending station, and there bending the front and back of each blank along spaced parallel lines, relative to a central strip therebetween to form a channel configuration; advancing the folded blank to a T-creasing station and there bending reentrantly and creasing the blank at both sides of the central strip into T-shape with its front and back closely adjacent, and the two arms of the T doubled; advancing the blank to and through an anchoring station, and there applying to the doubled arms of the T an eyelet and a tang, respectively, at like distances from the leading edge of the blank; advancing the blank beyond the anchoring station to a second bending station, and there bending the opposite arms of the T into closely adjacent relationship; and finally hinging the front and back into adjacency along lines adjacent and parallel to the bend lines for the arms of the T, as bent at the second bending station.

2. In a method of forming a folder from a T-folded blank advancing edgewise, the step of anchoring eyelets and tangs in cooperating relation to the opposite doubled arms of the T-fold along the central portion of the blank, which comprises presenting the blank in correct positional relation to two punches and cooperating dies spaced to pierce the respective arms of the T-fold at like distances from the blank's leading edge, presenting an eyelet tape formed with a grommet element in registry with one punch, and a tang tape formed with a grommet element in registry with the other punch, urging the punches towards and through the grommet elements of the tapes and towards and through the arms of the T, into engagement with their dies, thereby punching holes in such arms, severing the punch-engaged eyelet and tang from their respective tapes, pushing their grommet elements through the punched holes, and clinching the ends of the grommets at the opposite surface of the T arms.

3. A continuous method of forming a folder with interrelated eyelets and tangs from a flat blank, which comprises advancing successive individual flat blanks edgewise from a feed station towards a delivery station; bending each blank as it advances into a T-fold along its central portion; advancing the T-folded blank to an anchoring station, halting it at spaced positions along that station; while halted at each such position applying an eyelet to one arm of the T-fold and a cooperating tang to the opposite arm; and folding the blank to fold the central portion upon itself and to enclose all central folds within the front and back of the folder, by the time the blank reaches the delivery station.

4. A machine for forming a folder, with interrelated eyelets and tangs, from a flat blank and from eyelet and tang tapes, comprising means to advance individual blanks edgewise in succession through a first bending station, a T-folding and creasing station, an anchoring station, a second bending station, and a final folding station; means at the first bending station to bend the flat blank about spaced lines adjacent its central portion, to form front and back panels disposed in generally parallel planes; means at the T-folding and creasing station to form reentrant bends in the front and back panels along lines offset outwardly of but parallel to the first fold lines, thereby to bend the blank into T-shape, with the arms of the T doubled; means to halt the T-folded blank at the anchoring station; two punches and cooperating dies at the anchoring station spaced apart to engage the respective arms of the T-fold at like distances from the blank's leading edge; means to locate the grommet of the next eyelet of an eyelet tape in registry with one punch and its die, and the grommet of the next tang of a tang tape in registry with the other punch and its die; means operable when said punches and dies are in such registry to advance the punches towards and through their respective grommets, severing said eyelet and tang each from its tape, and then through the arms of the T-fold, to punch holes therein in cooperation with their dies, to urge the punch-engaged grommets through such holes, and also in cooperation with their dies to upset their

ends; means at the second bending station to bend the two arms of the T-fold into adjacency, and means at the final folding station to hinge the front and back of the folder each through approximately 180 degrees to enclose the central folds and their anchored eyelets and tangs.

5. A machine as in claim 4, including a plurality of successive stops at the anchoring station to halt the blank at a plurality of positions, and actuating means to dispose the successive stops in position to halt the blank preparatory to anchoring the first and each succeeding eyelet and tang, and means to actuate the punches automatically while the blank is thus halted at each position.

6. A machine as in claim 4, including means to restrain actuation of the punches until the grommet to be engaged by each thereof is in registry with the corresponding punch.

7. A machine as in claim 4, wherein the blank-advancing means, throughout the path of the blank, is of a non-positive type.

8. Means for anchoring an eyelet and a tang, each formed with a grommet element, in cooperating relation in the opposite doubled arms of a T-fold along the central portion of an advancing blank, said means comprising two punches guided for movement towards the respective arms of the T-fold, a die cooperating with each punch, means to halt the advance of the blank with the punches at like distances from the leading edge of the blank, means to locate the grommet of the next eyelet of an eyelet tape in registry with one punch, and the grommet of the next tang of a tang tape in registry with the other punch, means to advance the punches towards and through their respective grommets, and towards and through the respective arms of the T-fold, to punch holes therein, to push the punch-engaged grommets through such holes, to upset the ends of the grommets in cooperation with their dies, and to sever the eyelet and tang from their respective tapes.

9. Anchoring means as in claim 8, including means to prevent actuation of the punches unless each punch is in correct registry with its grommet.

10. Anchoring means as in claim 9, wherein the actuation-preventing means is controlled by the advance of both tapes to the limit of their advance.

11. Anchoring means as in claim 8, wherein the distance advanced by a first tape into registry with its punch is a multiple of the distance advanced by the second tape, the anchoring means including an actuator common to both tapes, positive feed means engageable with each tape, and means to withhold the feed means for the second tape from operative engagement with that tape until the feed means for the first tape has advanced through a distance equal to the difference between the advances of the two tapes.

12. Means for producing a T-fold in a foldable blank, comprising a guide rail of T-shape disposed in the path of advance of the blank, intermediate its edges, means to advance the blank, folded at spaced parallel lines and with its front and back in spaced, generally parallel planes, along said guide rail, a folding bar at each side of said guide rail, each guided for movement into the angle between the arms and the stem of the T, and means to move said folding bars upwardly into its angle, carrying the blank with it, and then to retract said bars, as the blank reaches said guide rail during its advance.

13. Means for producing a T-fold, as defined in claim 12, including fluid-operated, double-acting jacks for moving said folding bars, solenoid valve means for advancing the jacks and solenoid valve means for retracting them, and means operable by advance of the blank to create a momentary pulse of current to energize the jack-advancing solenoid and immediately thereafter to energize the jack-retracting solenoid.

14. In a machine for folding flat blanks, means to advance a blank edgewise, a guide rail disposed in the direction of advance to support the central portion of the blank, and having its side edges spaced apart, parallel rails to support the side edges of the advancing blank, a shoe channel-shaped to fit closely said guide rail, and normally disposed above the same, and means to move said shoe downwardly to straddle the guide rail, with the central portion of the blank interposed therebetween.

15. Folding means as in claim 14, including means positioned for engagement by the advancing blank, near a side edge thereof, and operatively connected to said shoe-actuating means to initiate downward movement of the shoe when the blank arrives beneath the shoe.

16. Means for anchoring a plurality of eyelets and tangs, each formed with anchoring means, in cooperating relation in the opposite doubled arms of a T-fold along the central portion of an advancing blank, said means comprising two punches guided for movement towards the respective arms of the T-fold, a die cooperating with each punch, at the opposite surface of the T-fold, a plurality of stops disposed at successive predetermined spacings beyond the punches in the direction of the blank's advance, actuating means to dispose each of said stops in position to intercept and halt advance of the blank, and control means for said actuating means to leave a first stop in stopping position and the others out of stopping position, and to remove said first stop and to dispose a second stop in stopping position, and so on until the blank has passed the last stop, and means operable while the blank is stopped at each successive stop to actuate the punches for affixation of an eyelet and a tang to the blank.

17. Anchoring means as in claim 16, including means engageable by the blank, as it advances, to serially energize the control means for successive stops.

18. A machine for forming a folder of the type described, with interrelated eyelets and tangs, from a flat blank, comprising means to advance individual blanks edgewise in succession along a given path, means to bend the central portion of the blank into a T-fold, means at a succeeding station to halt the advance of the blank momentarily, and while it is halted to anchor to the opposite arms of the T-fold, at a given spacing from its leading edge, an eyelet and a cooperating tang, respectively, and means to complete the folding of the blank as it passes beyond the anchoring station, to enclose the anchored eyelet and tang.

19. A machine as defined in claim 18, wherein the anchoring means includes two punches and cooperating dies located to engage the respective arms of the T-fold, and means to actuate the punches simultaneously, and means to advance the next eyelet and the next tang into position for engagement by its punch, and for movement therewith into anchored engagement with the T-fold.

20. Apparatus for installing cooperable tangs and eyelets in portions of a folded cover and being adapted to operate with elongated tang and eyelet blank strips having individual grommet-forming apertures therein at regular intervals along the lengths thereof, with the spacing between apertures in the eyelet strip being less than that in the tang strip, said apparatus comprising means for positioning the cover at an installing station having sets of cooperable tang and eyelet installing die elements, means to support and guide such strips for advancement progressively in generally parallel relationship into installing position between the respective sets of die elements, and strip feed mechanism comprising a drive member reciprocative on alternate feed and return strokes in generally parallel relationship with the direction of said strip advancement, two strip feed elements connected with said drive member to reciprocate therewith, said feed mechanism including means operatively engaging the feed elements with the respective strips to feed the strips during the feed stroke of said drive member and disengaging the feed elements from the strips during the return stroke, and means cooperating with the feed element which feeds the eyelet strip to delay engagement thereof

with such strip during that initial portion of the feed stroke which substantially equals the difference in spacing intervals between apertures in the respective strips, whereby the two strips arrive in installing position substantially simultaneously.

21. The apparatus defined in claim 20, wherein the respective feed elements comprise dogs pivoted on the drive member and spring-actuated toward engagement with the respective strips, said dogs having tip portions operatively engageable with the strip apertures to effect advancement of the respective strips.

22. The apparatus defined in claim 21, further including holding devices mounted adjacent the installing station and yieldably engageable with the respective strip apertures to permit advancement of the strips by the feed elements and to prevent retraction of the strips by return motion of the feed elements.

23. Apparatus for installing cooperable tangs and eyelets in portions of a folded cover and adapted to operate with elongated tang and eyelet blank strips having individual grommet-forming apertures therein at regular intervals along the lengths thereof, with projecting flanges rimming the respective apertures on the lower sides of the strips, the spacing between apertures in the eyelet strip being less than that in the tang strip, said apparatus comprising means for positioning the cover at an installing station having sets of cooperable tang and eyelet installing die elements, means to support and guide such strips for advancement progressively in generally parallel relationship horizontally into installing position between the respective sets of die elements, sets of tang and eyelet strip cut-off dies positioned at the installing station immediately ahead of the respective sets of tang and eyelet installing dies and connected for conjoint operation therewith, said cut-off die sets each including a lower die element contiguous to the strip guide and having an upraised shearing end portion supporting the strip at a location between successive flanges to protect the latter against flattening during die operations, and spring means bearing downwardly in the strip adjacent said upraised shearing end portion while being yieldable upwardly to permit advancement of a flange over said upraised end portion.

24. Apparatus for installing cooperable tangs and eyelets in portions of a folded cover and adapted to operate with elongated tang and eyelet blank strips having individual grommet-forming apertures therein at regular intervals along the length thereof, and having projecting flanges rimming the respective apertures on the lower side of the strips, said apparatus comprising means for positioning the cover at an installing station having sets of cooperable tang and eyelet installing die elements means to support and guide such strips for advancemen progressively in generally parallel relationship horizon tally into installing position between the respective set of die elements, said sets of die elements comprising upper and lower die means, one of said die means including a projecting cylindrical punch of a size slightly smaller than the strip aperture to pass through the same for punching out the cover, a shoulder surface at the base of the punch for pressing the tang strip flange through the punched hole and applying pressure to clinch the flange, and a shearing edge for severing a unit of the strip, and the opposing die means comprising an anvil member with a punch receiving hole cooperable with the punch, a deflecting surface to bend outward and clinch the flange when under downward pressure from the opposing die shoulder, and a shearing edge cooperable with that of the opposing die means and having an upraised adjacent shoulder portion supporting the strip between flanges in position to be sheared after entry of the punch through the aperture therein.

25. In a machine for bending a moving blank edgewise along a predetermined line intermediate its side edges with the leading edge squared to such line, a guide having a rest contacted by the blank along said line, means to move the blank in positively, transversely spaced detents engageable by the blank's leading edge at respective points spaced along such edge at opposite sides of such rest as the blank moves over said rest, bending means operable to bend such blank over said rest and thereby to deflect its oppositely extending portions out of engagement with the detents to permit resumption of blank movement, and means to control the bending means for operation including cooperable elements respectively actuatable by positioning of the blank substantially in engagement with both of said detents and each element arranged to prevent operation of said bending means until the other element is actuated, thereby to insure squaring of the blank when bent.

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