

May 24, 1949.

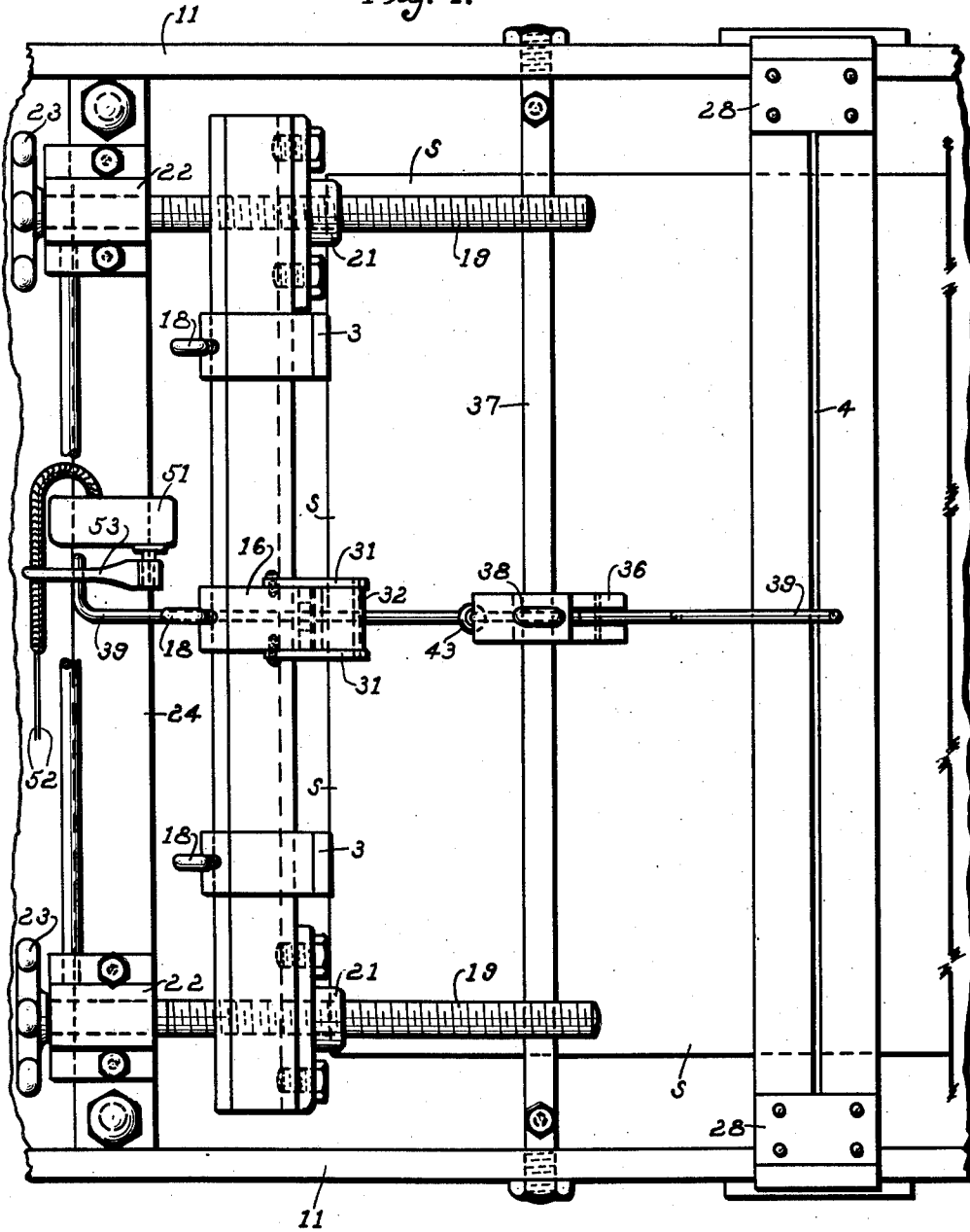
M. D. ALBER
FOLDING MACHINE

2,470,754

Filed April 25, 1947

5 Sheets-Sheet 1

Fig. 1.



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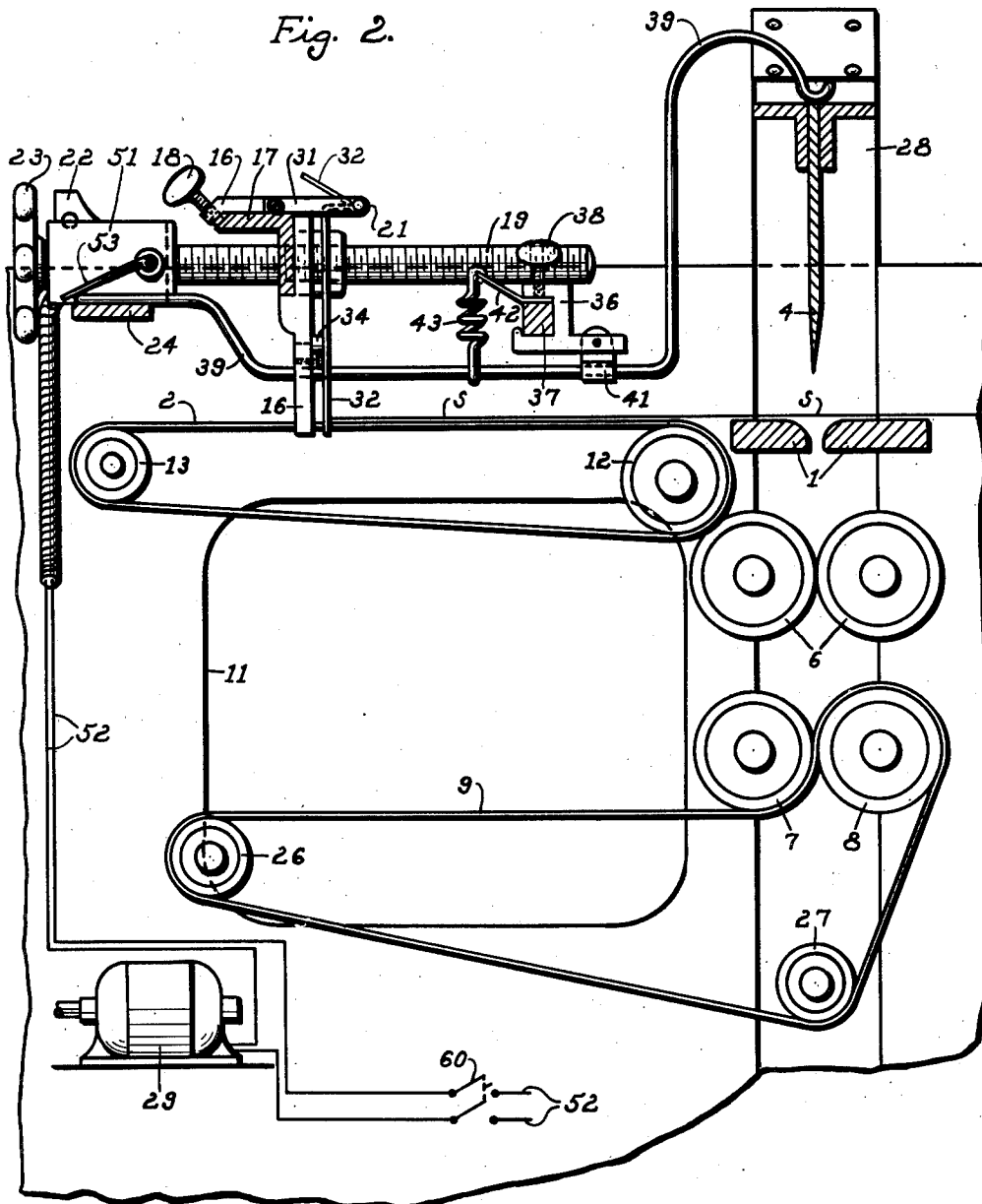
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5 Sheets-Sheet 2

Fig. 2.



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5 Sheets-Sheet 3

Fig. 3.

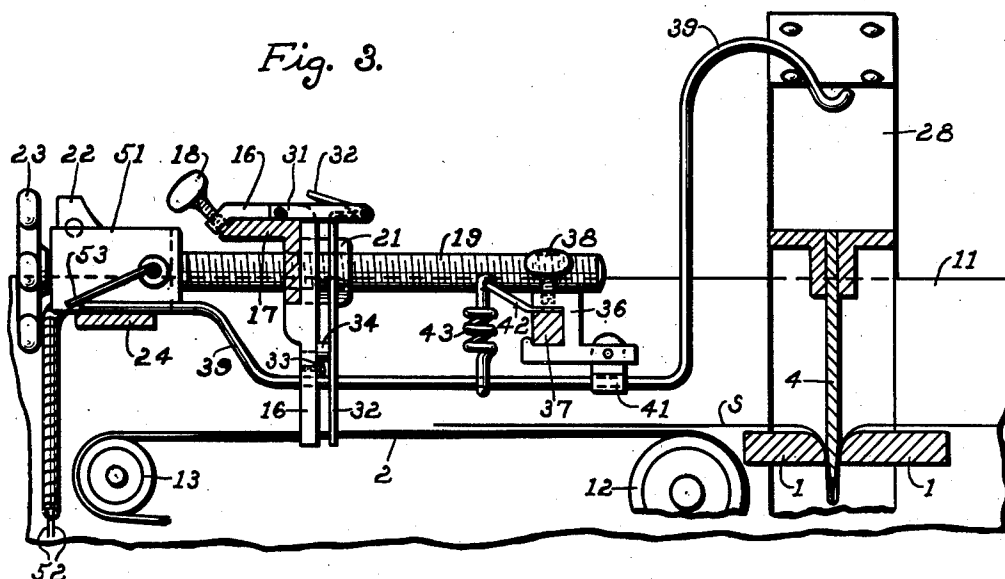
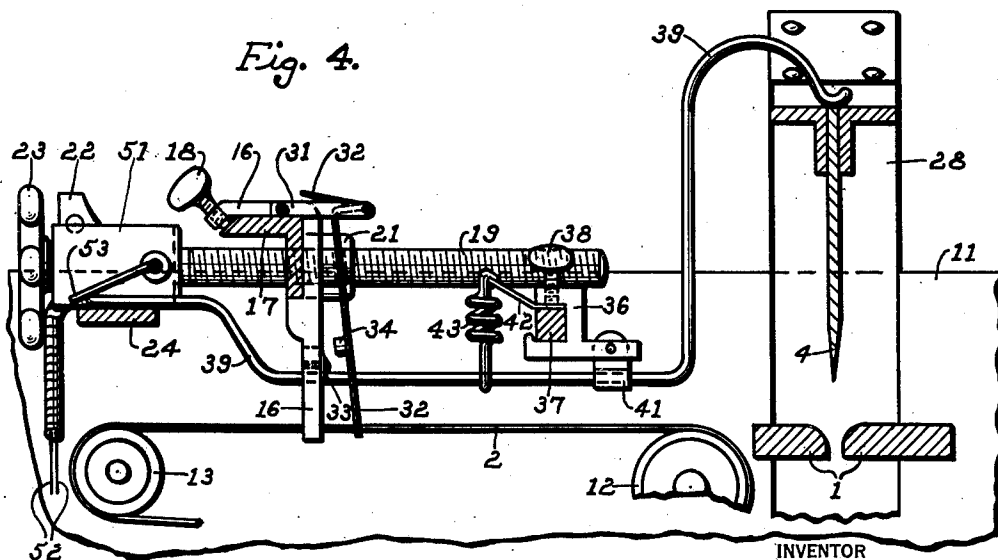


Fig. 4.



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5 Sheets-Sheet 4

Fig. 5.

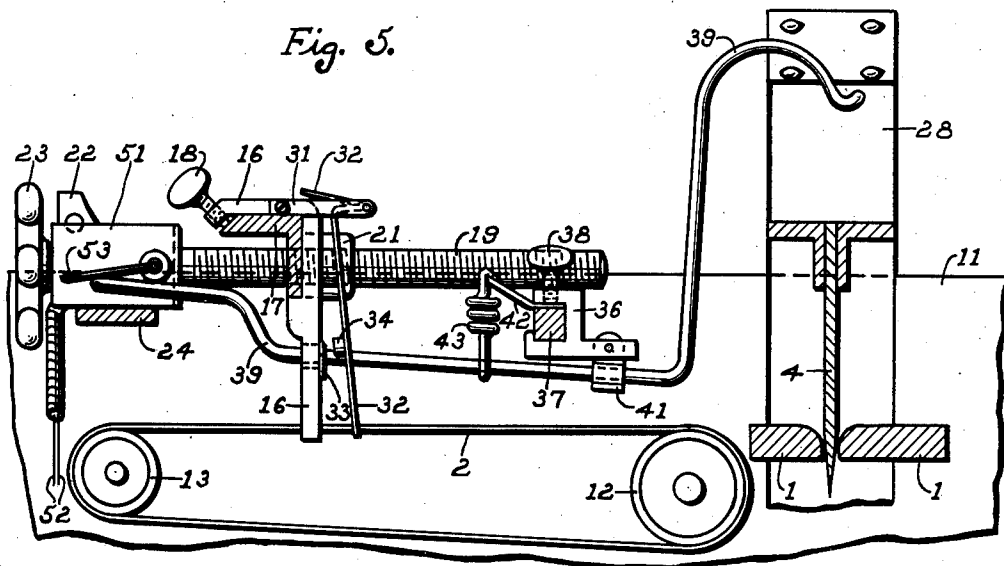


Fig. 6.

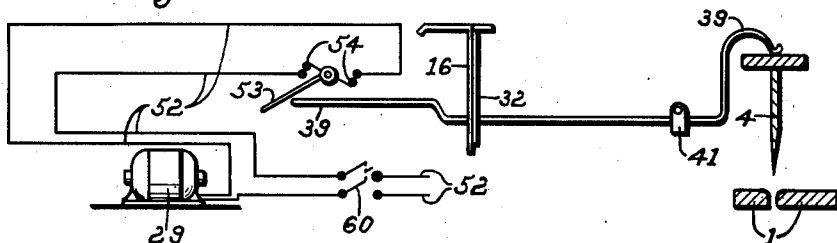
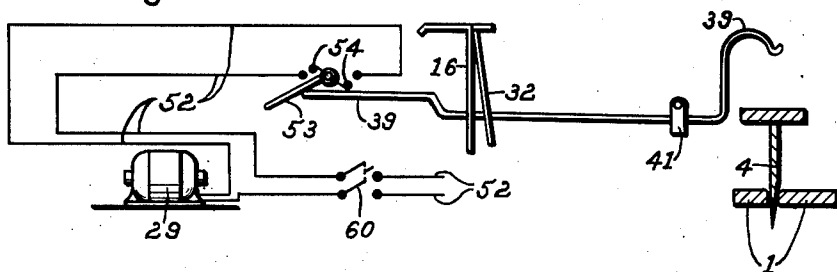


Fig. 7.



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5 Sheets-Sheet 5

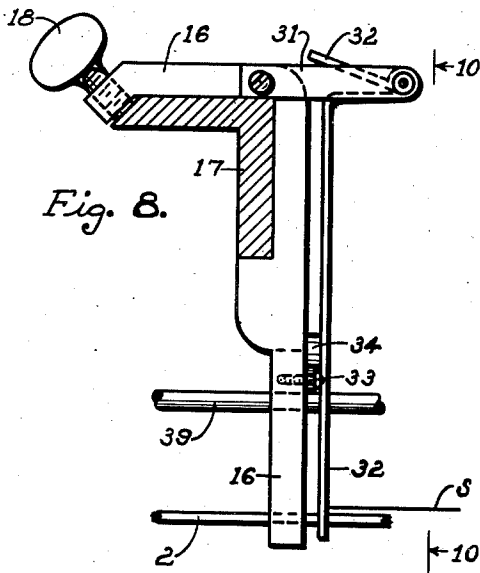


Fig. 8.

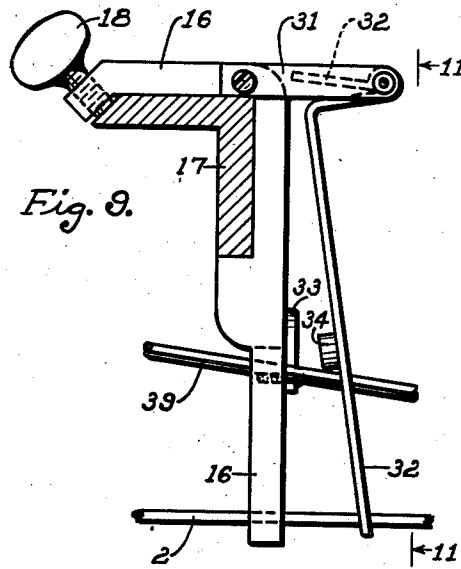


Fig. 9.

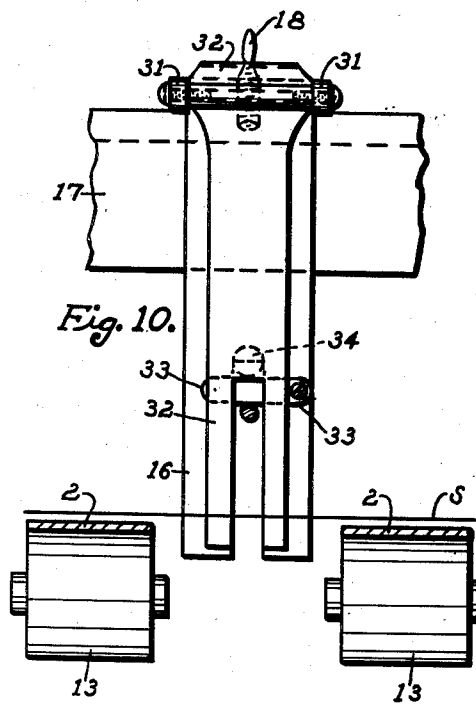


Fig. 10.

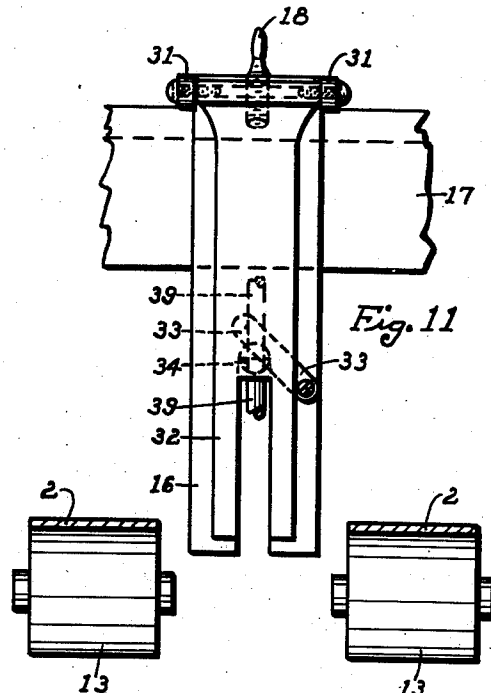


Fig. 11

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UNITED STATES PATENT OFFICE

2,470,754

FOLDING MACHINE

Myron D. Alber, Alexandria, Va.

Application April 25, 1947, Serial No. 743,905

3 Claims. (Cl. 270-83)

(Granted under the act of March 3, 1883; as amended April 30, 1928; 370 O. G. 757)

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The invention described herein may be manufactured and used by or for the Government of the United States for governmental purposes without the payment to me of any royalty thereon in accordance with the provisions of the act of April 30, 1928 (Ch. 460, 45 Stat. L. 467).

This invention relates to folding machines, and more particularly to improvements in sheet folding machines of the drop knife type.

This invention is particularly useful in a sheet folding machine having a plurality of drop knives which operate in a succession on sheet material, such as sheets of paper or the like, passing through the machine to provide a plurality of folds in the material in the production of a signature or folded form. It is, therefore, appropriate to explain the present invention in its application to such machine.

In these machines, sheets are fed therethrough in succession at a relatively high speed and from folding station to folding station. The sheet feeding mechanism usually includes moving tapes and rollers driven from the machine motor. The drop knives in their folding operations also feed the sheet material from the folding stations. The sheet material frequently becomes jammed or balled up by accident in the feeding mechanism for any one of a number of reasons. As a result, time and effort are lost in removing the fouled sheet and restoring the machine to normal operation. Fouling of a sheet may also cause damage to the machine and necessitate costly repairs. At the same time, there is a loss in production of signatures by the machine.

This invention provides the folding machine with a device which operates to stop the machine in event a sheet fails to reach proper position at a folding station below a drop knife and which permits the machine to continue its normal operations as long as sheets are properly passing therethrough.

It is therefore an object of this invention to improve sheet folding machines by eliminating the disadvantages incident to sheet fouling in the sheet feeding means of the machines.

Another object is to provide a sheet folding machine with an automatically operating device for stopping the operation of the machine in the event a sheet fails to reach proper position at the station below the knife which serves to provide the first fold.

Still another object is to provide a sheet folding machine with a machine safety device of the character described which is of relatively simple and rugged construction, is inexpensive to manufac-

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ture, is highly efficient for its intended purpose, and will minimize interruptions in the productive operations of the machine.

Other objects and advantages will be apparent from the following description, the appended claims, and the accompanying drawings, in which

Fig. 1 is a top plan view of the first folding station of a multifolding machine, equipped with the improvement of this invention.

Fig. 2 is a side view, part in elevation and part in cross-section, of the construction of Fig. 1. Figs. 1 and 2 show the machine with a sheet properly positioned at the folding station prior to the knife being lowered in a folding operation.

Figs. 3, 4 and 5 correspond to Fig. 2 but show different settings for the illustrated construction. Fig. 3 shows the machine and the safety device with the knife in a partially lowered position during a sheet folding operation. Fig. 4 shows the machine and the safety device just prior to a sheet being fed below the raised knife and to the folding station. Fig. 5 shows the setting of the machine and the safety device that occurs in event a sheet is not fed to the folding station at the proper time or is improperly fed to the folding station.

Figs. 6 and 7 are in general diagrammatic views to illustrate the operation of the present improvement.

Figs. 8 and 9 are enlarged detail views of the trip mechanism of Figs. 1 to 5 and show such mechanism in two settings.

Figs. 10 and 11 are views taken on line 10-10 and 11-11, respectively, of Figs. 8 and 9.

The drawings show the improvement of this invention installed at the first folding station of a conventional multifolding machine for producing signatures or folded forms from paper sheets fed in succession into and through the machine. In the normal operation of the conventional folding machine a sheet *s* is fed over spaced guide bars *1*, and onto a tape *2* which carries the sheet *s* into engagement with guide clips *3* (Fig. 1). The sheet *s* is now in the position illustrated in Figs. 1 and 2 and ready for the folding operation. In the descent of the drop knife *4*, it folds the sheet *s* by passing it through the slot formed by the spaced guide bars *1* and to the folding rollers *6*, which then pass the folded sheet to the tape guide rollers *7* and *8*. A tape *9* feeds the folded sheet from the tape rollers *7* and *8* to the second folding station (not shown).

The sheet guide bars *1* at their ends are rigidly secured to and supported by the machine side frame members *11* (see Figs. 1 to 5).

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The tape 2 passes around and is driven by two tape rollers 12 and 13, which also are supported by the machine frame members 11.

The guide clips 3 which engage the leading edge of the sheet s to arrest the same are mounted on a guide supporting bar 17 and secured thereto in conventional manner by means of thumb screws 18 (Fig. 1).

The guide supporting bar 17 is adjustably supported in conventional manner by two guide adjusting screws 19 (Fig. 1). Each of the adjusting screws 19 has threaded engagement with an adjusting screw nut 21 secured to the guide supporting bar 17. Each of the adjusting screws 19 is also rotatably supported in a guide adjusting screw gear box 22 and provided with a hand wheel 23. The two gear boxes 22 are mounted on a gear box supporting bar 24 which is connected at its ends to the frame side members 11.

In addition to the guide rollers 7 and 8, the tape 9 is provided with a tape roller 26 and an idler roller 27 (see Fig. 2).

The drop knife 4 is supported and vertically reciprocated by two upright members 28.

The reciprocating drive (not shown) for the knife supporting uprights 28, and the rotary drive (not shown) for the tape rollers 7, 8, 12, 13 and 26 and the folding rollers 6 are provided by the machine motor 29 according to conventional practice.

Safety device

In the normal operation of the machine a sheet s at the folding station shown in Figs. 1 and 2 engages the guide clips 3 (see Fig. 1) and also a trip plate or member 32 (see Fig. 2). The trip plate 32 forms part of the present safety device and in its Fig. 2 position serves to arrest the leading edge of the sheet s similarly to the guide clips 3.

The trip plate 32 is pivotally secured adjacent its upper end to the outer ends of two arms 31. The inner ends of the arms 31 are secured as by means of screws to the opposite sides of a bracket member 16 as shown in Figs. 1 and 2. This member 16 is mounted on the bar 17 and secured thereto by a thumb screw 18.

The trip plate 32 is so constructed and weighted that it normally assumes the inclined position illustrated in Figs. 4, 5, 7, 9 and 11. The trip plate 32, when engaged by the leading edge of an advancing sheet s, is adapted to be swung on its pivotal support to a vertical position as shown in Figs. 2, 3, 6, 8 and 10.

A gate 33 is pivotally connected to the bracket member 16 for pivotal movement to the two positions illustrated in Figs. 10 and 11.

The trip plate 32 has a block or lock 34 which, in the vertical or Fig. 8 position of the trip plate 32, overlies the gate 33 and precludes it from rising or pivotally moving to the Fig. 11 position.

A fulcrum support clamp 36 (see Figs. 2 through 5) is mounted on a bar 37 and is adjustably secured thereto by a thumb screw 38. The bar 37 is secured at its opposite ends to the machine side frame members 11 (see Fig. 1). At one side of the bar 37 a fulcrum rod 39 is pivotally suspended from the clamp 36 by means of a fulcrum support 41 for pivotal movement to the two positions illustrated by Figs. 2 and 5. At its other side, the bar 37 carries a spring support 42 which is connected by a spring 43 to the rod 39.

One end of the rod 39 is shaped to rest and slide on the head of the drop folding knife 4

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when in raised position (see Fig. 2). The rod 39 at the other side of its fulcrum support 41 extends through the trip plate 32, below the gate 33, through the bracket member 16, and over the bar 24. The lower ends of the trip plate 32 and the bracket member 16 are bifurcated to receive the rod 39 as shown by Figs. 10 and 11.

A switch 51 of conventional design is mounted on the bar 24 and is connected by wiring 52 to the machine motor 29 and a source of current (not shown). Contacts 54 of the switch 51 are connected to and operated by a lever 53 which overlies and is actuated by the rod 39 (see Figs. 1 to 3, 6 and 7).

Operation

In the operation of the illustrated machine having the improvement of this invention, the main line switch 60 of the motor circuit is in the closed position and sheets s are fed in succession to the first folding station illustrated in Fig. 2. Each sheet s in flat unfolded condition is fed over the spaced bars 1, below the knife 4 (now in raised position), and to the guide clips 3 and the trip member 32. The moving tape 2 assists in advancing the sheet s and aligning its leading edge with the engaged surfaces of the clips 3 and the trip member 32. In its advancing movement the sheet s shifts the trip plate 32 from the position of Figs. 4 and 7 to the position of Figs. 1, 2, 3, and 8. The gate 33 is now held in its lowered position by the overlying block or lock 34 (see Figs. 8 and 10). The knife 4 being in fully raised position, holds the rod 39 in the setting of Figs. 2, 4 and 6 as the trip plate 32 assumes its position of Figs. 2, 6 and 8. The spring 43 urges the fulcrum rod 39 in a clockwise direction (looking at Fig. 2), but the rod 39 is held by the cooperating action of the gate 33 and the lock 34 (see Figs. 2, 3, 8 and 10). The switch operating end of the fulcrum rod 39 now rests on the bar 24 (see Fig. 2) and permits the switch lever 53 to remain in its closed switch position (Figs. 2 and 6).

Thus, with a sheet s in proper position at the folding station (see Figs. 2 and 8), the energization of the machine motor 29 remains uninterrupted and the folding operation immediately follows in conventional manner. The knife 4 drops and passes the sheet s through the slot between the bars 1 and to the folding rollers 6 which in turn pass the folded sheet to the guide rollers 7 and 8, at which point the folded sheet s is received by the tape 9 for feeding movement to the next folding station (not shown).

As long as the sheets s are being fed properly by the machine to the illustrated folding station, the safety device is ineffective to interrupt the circuit of the motor 29 and to stop the operations of the machine. When a sheet s has set the trip plate 32 in the position of Figs. 2, 3, 6 and 8, the safety device by the coaction of the spring 43, the gate 33, the lock 34, and the rod 39 maintains the setting of Fig. 2 until the drop knife 4 has completed its downward stroke and has nearly completed its upward stroke. In its upward stroke, the knife 4 is completely withdrawn from the slot between the bars 1 and then further elevated to its highest position. During this final rising movement of the knife 4, two operations occur simultaneously. In one operation the next succeeding sheet s is passed under the knife 4 and into the folding station of Fig. 2. In the other operation the knife 4 engages the adjacent end of the rod 39 and moves it counterclockwise

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sufficiently to relieve the gate 33 of its frictional binding action on the lock 34 and thus free the plate 32 to return to its normal position of Fig. 4 if not engaged by a properly positioned sheet s at the folding station. The knife 4 in its raised position now maintains the rod 39 in its switch releasing position (see Figs. 4 and 6), whereby the switch contacts 54 are held by the lever 53 in motor circuit closing position.

When a sheet s has been fed properly and the knife 4 is descending in a folding operation, the machine setting is that illustrated in Figures 3, 8, and 10. The plate 32 is in a vertical position and its lock member 34 overlies the gate 33. The spring 43 urges the rod 39 in a clockwise direction (Fig. 3) about its pivotal axis and upwardly against the gate 33. The latter (33) thus frictionally engages the lock member 34 to retain the plate 32 in its vertical position until the rod member 39 is again contacted by the knife 4 in its next rising movement.

In the event any sheet s fails to reach the folding station of Fig. 2, the trip plate 32 remains in its position of Figs. 4, 5, 7 and 9, the gate 33 is free of its lock 34, and the rod 39 is free to move clockwise to its position of Figs. 5, 7 and 9 under the action of the spring 43 when the knife 4 begins its next downward stroke. As the knife 4 begins its downward stroke, it is followed by the corresponding end of the rod 39 under the action of the spring 43. At the same time, the other end of the rod 39 rises, engages the switch lever 53 and lifts it to open the switch 51 and the circuit of the motor 29. The parts are now in the setting illustrated by Figs. 5, 7, 9 and 11 and the machine operation is interrupted.

It will be noted that the gate 33 rides on the top of the fulcrum rod 39 and travels between the positions of Figs. 10 and 11 in the pivotal movements of the rod 39.

The machine is restored to normal operation in conventional manner. When the knife 4 is again in fully elevated position, it positions the rod 39 as illustrated in Fig. 4 so that it frees the switch lever 53 to assume under gravity action its lowered, closed switch position of Figs. 4 and 6.

The foregoing is to be understood as illustrative as this invention includes all embodiments and modifications coming within the scope of the appended claims.

I claim:

1. In a sheet folding machine having a drop knife for folding sheet material, means for feeding sheet material to a station below said knife, a motor for driving the knife and the feeding means, and means for arresting sheet material at said station, the improvement comprising means for controlling the operation of the machine motor, means responsive to movement of the knife in sheet folding operations to actuate said motor control means for stopping said motor, and movable means positioned in the path of movement of said sheet material and being mounted for movement by engagement with the leading edge of sheet material advancing into engagement with said arresting means, said mov-

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able means being operated by said advancing sheet material for rendering said actuating means inoperative.

2. In a sheet folding machine having a motor for driving the machine, a drop knife for folding sheet material, means for feeding sheet material to a station below said knife, and means for arresting sheet material at said station, the improvement comprising means for controlling the operation of the machine motor, a lever member pivotally mounted on the machine with one lever arm operatively associated with said control means to actuate the same and with a second lever arm associated with said knife, means urging said lever member about the pivot thereof, said second arm being responsive to both said urging means and said knife in the folding movement thereof to rotate said lever arm and actuate said control means to stop said motor, and means operated by sheet material moving into engagement with the sheet arresting means to lock said lever arm in position to free said control means.

3. In a sheet folding machine having an electric motor for driving the machine, a drop knife for folding sheet material, means for feeding sheet material to a station below said knife, and means beyond said knife for arresting and positioning sheet material at said station, the improvement comprising a two-arm lever member pivotally mounted on the machine with one lever arm so associated with said knife as to be raised in the upward travel of the knife, a spring for urging said lever arm in the reverse direction to follow said knife in the downward travel thereof, a switch for opening the circuit of the machine motor, said switch being operable by the second arm of said lever as said first arm follows the downward travel of said knife, a latch member pivotally supported on the machine to engage said second lever arm, a trip member pivotally supported on the machine and adapted to be swung from a first and normal position to a second and retracted position by a sheet passing into the folding station and into engagement with the sheet arresting means, said trip member in said second position thereof engaging said latch member to lock said lever member and free said switch of control by said lever member, said trip member in said first position thereof freeing said latch member to provide control of said switch by said second lever arm on the downward travel of said knife.

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