March 22, 1932. P. E. HUNTER ET AL 1,850,108

METHOD OF AND APPARATUS FOR FEEDING SHEETS

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Fig. 1.

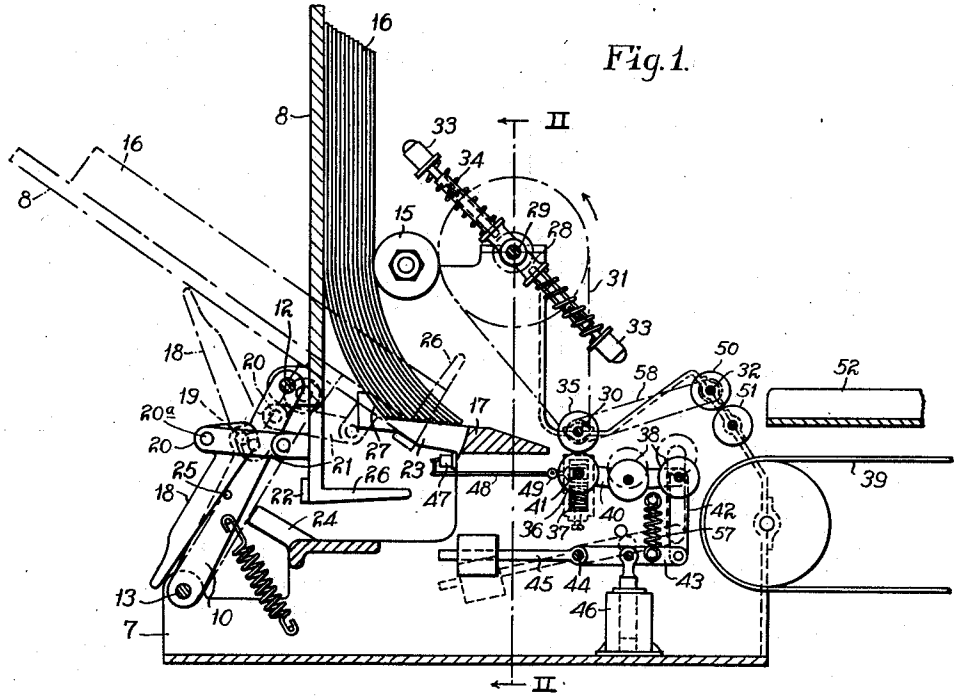


Fig. 2.

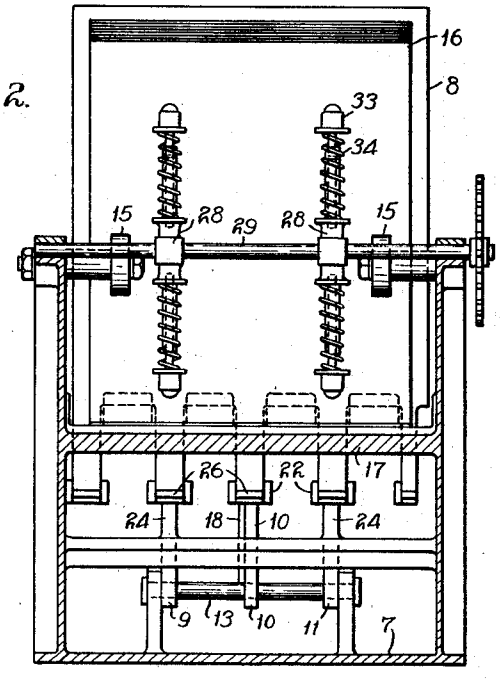
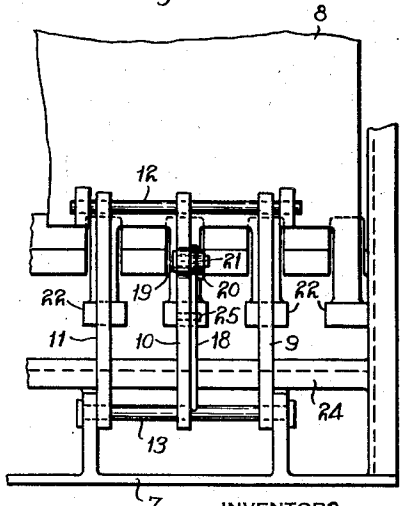


Fig. 3.



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METHOD OF AND APPARATUS FOR FEEDING SHEETS

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Fig. 4.

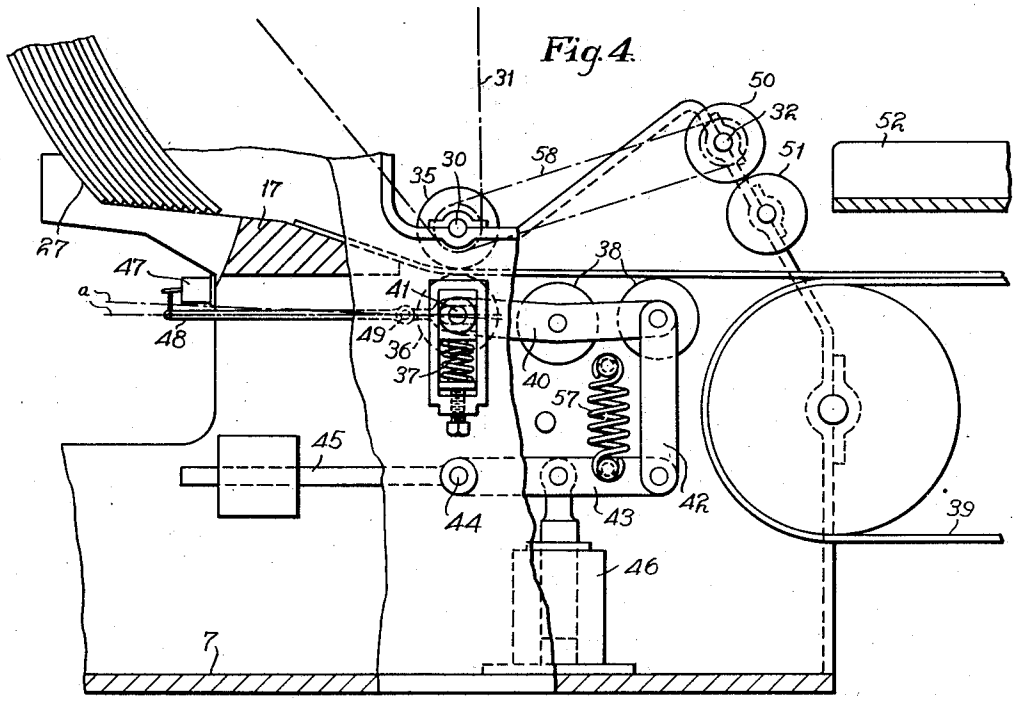


Fig. 5.

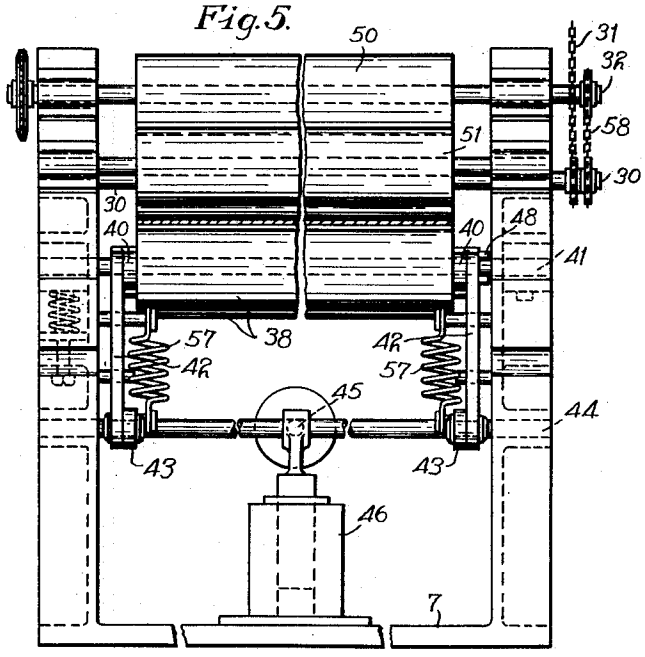
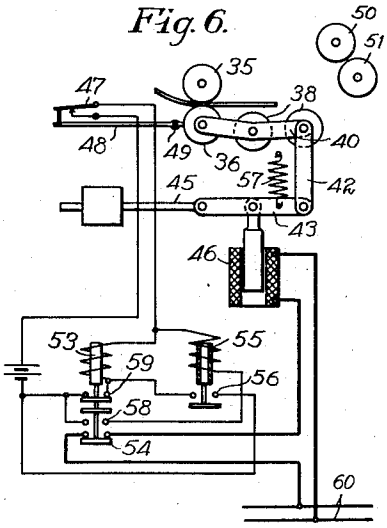


Fig. 6.



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METHOD OF AND APPARATUS FOR FEEDING SHEETS

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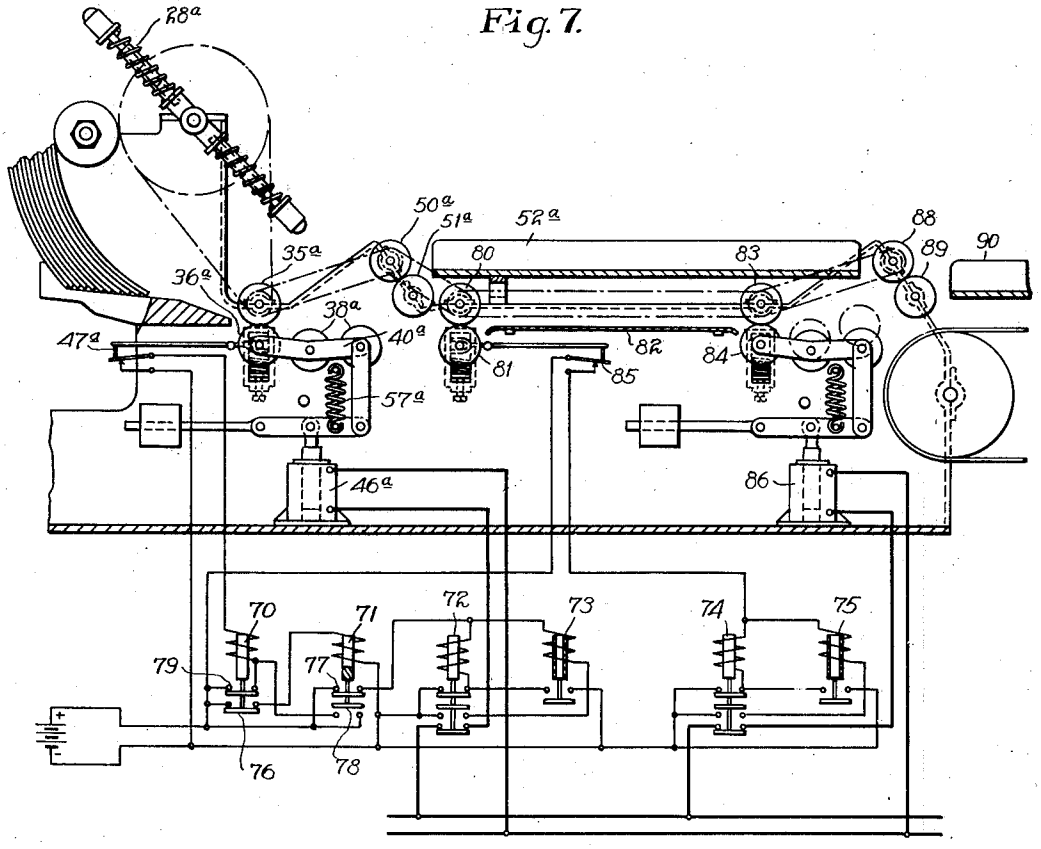
Fig. 7.



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UNITED STATES PATENT OFFICE

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METHOD OF AND APPARATUS FOR FEEDING SHEETS

Application filed November 22, 1929. Serial No. 409,051.

Our invention relates to a method of and apparatus for feeding sheet material, and more particularly to the feeding of metal sheets such as the sheets contained in the piles or packs of steel sheets in connection with tin plate mill operations, etc., but may be employed in connection with various other operations.

In tin plate mill operations, it is desirable that the metal sheets of a pack, after having been loosened or separated in any well-known manner, be arranged to be automatically fed, one-by-one to various of the machines used in the making of tin plate.

One object of our invention is to provide a means and a method whereby a pack may be so arranged as to facilitate the feeding of sheets therefrom.

Another object of our invention is to provide a method of feeding sheet material whereby single sheets can be easily and positively separated from the remainder of the pack.

A further object is to provide a sheet feeding apparatus to advance single sheets and to prevent the advancement of double sheets or one which is not suitably formed.

Still another object of our invention is to simplify and improve generally the structure and operation of sheet-feeding apparatus.

One form of apparatus by which our invention may be practised is illustrated in the accompanying drawings wherein Figure 1 is a sectional elevational view of a machine for feeding single sheets of a pack; Fig. 2 is a sectional view taken on the line II—II thereof; Fig. 3 is a fragmentary end view looking from the left hand side of Fig. 1; Fig. 4 is a view, on an enlarged scale, showing a portion of the sheet-guiding mechanism of Fig. 1; Fig. 5 is an end view thereof; Fig. 6 is a diagrammatic view showing the manner in which the guiding mechanism of Fig. 4 is controlled, and Fig. 7 is a modification of the apparatus of Fig. 1.

While the apparatus is hereinafter described as employed in connection with the handling and feeding of metal sheets, it will be understood that it is capable of use in connection with various other materials.

A base 7 serves as a support for a tilting table or rack 8. The rack 8 is supported by links 9, 10 and 11. These links are connected at their upper ends to the table 8 by means of a pin or shaft 12 and at their lower ends they are connected to the base by means of a shaft or pin 13. The table is supported entirely by the links 9, 10 and 11, when in upright position as shown in full lines in Fig. 1.

A pair of idle rollers 15 which primarily function to hold a pack of sheets 16 against the table, also function in conjunction with a stationary table 17, to prevent the table swinging forward or falling from the position shown in Fig. 1.

In order to swing the table 8 to the dotted line position for receiving a pack of sheets, we provide a hand lever 18 which is pivotally connected at 19 to the link 10 and which has a crank-like extension 20 that is connected through a link 21 to the rear side of the table 8.

With the parts in full line position as shown in Fig. 1, forward movement of the lever 18 will result in the link 21 being shifted to the right, thus swinging the table on its pivot 12 to the dotted line position. When the table reaches the position shown in dotted lines, stop members 22 will engage against the undersides of rib-like portions or extensions 23 of the stationary table 17 to limit further tilting movement of the table 8. With the parts in dotted line position, the links will rest against a bar or web 24 that projects upwardly from the base and serves as a stop.

When the table 8 is in the position shown in Fig. 1 there is necessarily considerable pressure against the front or upper side thereof tending to return the parts to dotted line position. The connection at 20*a* between the handle 18 and the link 20 is below or over dead center with respect to the pivot point 19, the handle bearing against a stop member 25 on the link 10. The parts are thus locked in the position shown in Fig. 1, until the handle 18 is elevated toward dotted line position.

With the table in the dotted line position of Fig. 1, a pack of sheets 16 is placed there-

on, the lower edges of the sheets bearing against upwardly projecting fingers 26 at the lower edge of the table.

The rib-like extensions 23 of the stationary table 17 are spaced apart such distance as will permit the fingers 26 to pass between them, when the table 8 is being swung to upright position. The extensions 23 are shaped at their upper extremities as indicated at 27, to provide inclined surfaces for guiding the lower edges of the sheets 16 when they are being moved to the full line position of Fig. 1, so that the lower portions of the sheets are deflected on curved lines. The sheets at approximately their mid-portions are brought into position against the rollers 15 which serve to maintain them in position against the table. It will be seen that the flexing of the lower portions of the sheets will have the effect of spacing them somewhat so that when sheets are to be slid therefrom one-by-one as hereinafter explained, there will be no vacuum or suction effect tending to resist sliding of the sheets, but rather an air film which will facilitate the sliding thereof one-by-one off the pack.

Feeding fingers or presser members 28 are mounted upon a shaft 29 that is driven from a shaft 30 through a sprocket chain 31, the shaft 30 being in turn driven from a shaft 32. The shaft 32 is provided with a sprocket wheel which may be driven in any suitable manner. Each of the fingers 28 has a nose portion 33 that has a sheet-contacting surface preferably of rubber, leather, or other relatively soft material. The shank of the nose portion has telescopic engagement with the body portion of the finger and is yieldably held in expanded relation thereto by means of a compression spring 34, it being understood that the fingers are secured to and rotate with the shaft 29, so that their nose portions will engage the faces of the exposed sheets and slide them downwardly off the pack and along the stationary table 17 and between feeding or advancing rolls 35 and 36.

The roll 35 is carried by the shaft 30 and has frictional contact with the roll 36, either directly or through the medium of a sheet being advanced by the roll. The roll 36 is mounted on a shaft 41 which is spring-pressed upwardly by springs 37, to allow yieldable vertical movements thereof.

The feeding fingers 28 of course have a greater radius than the radius of the roll 35 and for this reason, we provide proper gear reduction so that the peripheral speed of the nose portions 33 of the fingers will approximately equal the peripheral rate of travel of the roll 35, and the rolls will therefore advance the sheets at the same rate as that at which the sheets are fed down by the fingers. The axis of rotation of the fingers 28 is at such height that the fingers will engage the sheets at points above the rollers 15, where the sheets are held tightly against one another, rather than at points below such rollers 15 where the sheets are spaced apart somewhat as above-explained and the fingers could not engage the sheets with as great pressure.

As heretofore stated, the purpose of the apparatus is to feed the sheets from the pack one-by-one. At times, two sheets may be stuck together and therefore be simultaneously moved between the rollers 35 and 36. In such case it is desired to deflect the adhering sheets from the normal path of travel of the separated sheets. In order to automatically effect this separation or deflection, we mount guide rollers 38 beyond the rollers 35 and 36. These rollers ordinarily direct the sheets to a conveyer 39 which leads to sheet-flattening rolls (not shown) or to any other desired destination, the rollers 38 being journaled on a rack 40 which is pivoted at one end to the shaft 41 that carries the roller 36. The outer end of the rack 40 carries a pair of links 42 that depend therefrom and at their lower ends are pivotally connected to links 43.

The rear ends of the links 43 are connected to a rock shaft 44 that is journaled in the sides of the base 7. A weighted arm 45 is secured to the shaft 44. It will be seen that as the shaft 44 is oscillated, the links 42 will be moved up and down to raise and lower the guide rollers 38. The rollers 38 are normally maintained in the position shown in Fig. 1, by means of a solenoid 46 whose circuit is controlled by a switch 47. An operating lever 48 for the switch 47 is pivotally mounted at 49 and has its one end bifurcated, with the arms of the bifurcations engaged by the shaft 41, so that as such shaft is moved up and down, the switch lever 48 will be rocked to open and close the switch 47. The throw of the switch lever 48 as shown more clearly by the broken lines *a*—*a*, Fig. 4, is such that if two sheets pass between the rolls 35 and 36, the lever will be moved such distance that the switch 47 is opened, thus breaking the control circuit for the solenoid 46 and permitting springs 57 to swing the rack 40 and the rollers 38 carried thereby upwardly such distance that the two sheets will be directed between rollers 50 and 51 to a receiving table or rack 52.

This breaking of the circuit opens the circuit of an auxiliary relay 53 which, through switch contacts 54, controls the circuit of the solenoid 46 that has connection to a suitable power supply line 60, such circuit being broken by the switches 54 so long as the coil of the relay 53 is de-energized. The solenoid 46 will remain de-energized for a slight period of time after the sheets actually pass between the rolls 35—36 to give such sheets time to reach the rolls 50 and 51. As soon as the sheets have passed from between the rolls 35 and 36, the switch 47 is permitted to again

close, thus completing the energizing circuit of a slow-to-energize relay 55, this circuit extending through the now closed contacts 58 of the relay 53.

After a short interval of time this relay 55, through its associated switch 56 completes a circuit through the coil of the relay 53 which results in closing of the switch contacts 54 to cause the energization of the solenoid 46 from the power line 60, thus causing the solenoid 46 to return the rack 40 to its lower position, as shown in Fig. 1, against the tension of the springs 57. The energization of the relay 53 also completes a holding circuit for itself at the contacts 59, and opens the circuit of the relay 55 at the contacts 58 and this relay restores to normal. The springs 57 are depended upon to swing the rack 40 and the rolls 38 to upper position when the coil 46 is de-energized and the weighted lever 45 serves as a counter-balance for such rack and rolls.

It will therefore be seen that at a predetermined time after two adhering sheets have passed from between the rolls 35 and 36 and are passing through the rolls 50 and 51 to the table 52, the guide rolls 38 will be returned to their lower position to direct succeeding sheets to the conveyer 39.

When a sheet of abnormal thickness passes between the rolls 35—36 the above-described operation takes place and delivers such sheet to the table 52. Also, if the leading or forward edge of a sheet is bent back or bulged to such an extent that it might cause damage to the sheet-flattening rolls, the solenoid 46 will be de-energized as above described and such sheet will be directed through the rollers 50—51 to the table 52. The time element of the relay 55 is sufficient to permit the guide rollers 38 to remain in elevated position until the deformed sheet enters the rollers 50—51. In this manner, only the desired sheets are permitted to advance one-by-one to the conveyer 39.

The roll 50 is driven from the shaft 32 by a sprocket chain 58 and suitable sprocket wheels.

Referring to Fig. 7, we show a modified form of the apparatus of Fig. 1, wherein provision has been made for deflecting sheets from the normal path of travel of the separated sheets, in case either the leading edge or the rear edge of a separated sheet is bent back or bulged. In order to automatically effect this deflection of damaged sheets, we provide apparatus that is actuated by the bent portion of the sheet, such apparatus being in duplicate and each being substantially similar to the deflecting apparatus of Fig. 1.

The sheets are fed from a pack, one-by-one, by feeding members 28*a* and between feeding rolls 35*a* and 36*a*. In case a sheet is of abnormal thickness, or the leading edge of the sheet is bent back, a switch 47*a* is actuated to break the control circuit for a hold-down solenoid 46*a*, and permitting springs 57*a* to swing a rack 40*a* and guide rollers 38*a* carried thereby upwardly so that such sheets will be directed between rollers 50*a* and 51*a* to a receiving table 52*a*.

The actuation of the switch 47*a* does not result in the immediate de-energization of the hold-down solenoid 46*a* and the swinging up of the deflecting rollers 38*a*, but the solenoid is maintained energized for a short time interval thereafter, for a purpose hereinafter described.

The actuation of the switch 47*a* results in the de-energization of a relay or switch 70, and at contacts 76 of this relay open the circuit of a slow-to-deenergize relay 71. After a short interval of time, relay 71 de-energizes and at contacts 77 opens the circuit of a relay 72 which de-energizes.

At contacts 78 of the relay 71 an energizing circuit is completed for the relay 70 which extends through the switch 47*a* and this relay energizes to complete a locking circuit for itself at contacts 79 and to complete the energizing circuit for the relay 71. Relay 71 energizes and at contacts 78 opens the original energizing circuit for the relay 70, and at contacts 77 completes a point in the battery circuit for the relays 72 and 73. The operation of the relay 72 which is now de-energized, and the slow-to-energize relay 73 is the same as the operation of the relays 53 and 55, as heretofore described.

Thus, sheets of abnormal thickness or sheets having their forward edge bent back or bulged will be deflected from the normal path of travel and prevented from advancing to the conveyer.

However, if the rear edge of a sheet is bent back, or is of abnormal thickness adjacent to its rear edge, such sheet passes between the rolls 35*a* and 36*a* and is guided by the rollers 38*a* between rolls 80 and 81. These rolls advance said sheet forwardly along a guide plate 82 and between rolls 83 and 84. The rear edge of the sheet being bent back, causes the operation of the switch 47*a* which is associated with the roll 36*a*, but due to the retarded action of the control circuit, the solenoid 46*a* remains energized for a short time interval, permitting the sheet to completely pass from between the rolls 35*a* and 36*a* before the rollers 38*a* swing up in their deflecting movement.

The rollers 38*a* do not exert a damaging force on a sheet, which would be the case if the rollers were permitted to swing upwardly immediately after the operation of the switch 47*a*, since the sheet by its dis-engagement with the rolls 35*a* and 36*a* is merely flexed upwardly by the rollers 38.

A switch 85 is associated with the roll 81 and is actuated by the bent portion of the sheet in its passage between the rolls 80 and

81. The actuation of the switch 85 results in the de-energization of a hold-down solenoid 86 through the operation of relays 74 and 75, that operate in the same manner as the relays 53 and 55. The solenoid 86 releases the rollers 87 which move upwardly to deflect the sheet between rollers 88 and 89 to a receiving table 90. The rolls 80 and 81 are spaced apart such distance from the rollers 88 and 89 that the leading edge of the sheet will be directed between the rollers.

The rolls 36*a*, 81 and 84 are spring pressed upwardly to allow yieldable vertical movements thereof. The rolls 35*a*, 80 and 83 and the rollers 50*a* and 88 are driven at the same speed in any suitable manner.

We claim as our invention:—

1. The method of feeding sheets which comprises bending a pack of sheets adjacent to one edge thereof while said edge is in engagement with a supporting surface, and applying a force to the sheets in succession, at points in advance of the zone of bending and in a direction generally parallel to the plane of the pack.

2. Apparatus for feeding sheets comprising a table occupying a generally horizontal position, a tiltably-mounted table adjacent to one edge of the first-named table, and movable into vertical position to carry a pack of sheets to vertical position, means on the horizontal table for engaging the lower edge of said pack as it is tilted toward vertical position by movement of the second-named table, a stop member positioned to engage the exposed side of the pack when the tilting table reaches approximately a vertical position, and means above the horizontal table movable into position against the exposed side of the pack in a direction generally parallel to said side, for feeding sheets therefrom.

3. The method which comprises placing one end of a pack of loosely-assembled sheets against an approximately horizontal supporting surface, bending the pack adjacent to said end at such angle as to permit sheets to be slid from the pack along said surface, maintaining that part of the pack above the bent portion in approximately an upright position above said surface, the weight of the sheets being imposed on the said surface and applying a feeding force to the sheets in succession, at the concave side of the pack and in a direction generally parallel to the plane of the pack.

4. The method which comprises placing one end of a pack of loosely-assembled sheets against a supporting surface, bending the pack adjacent to said end at such angle as to permit sheets to be slid from the pack along said surface, with approximately all of the sheets in engagement with the said surface, supporting the unbent portion of the pack in a plane substantially perpendicular to the plane of the said surface, and applying a feeding force to the sheets in succession, at the concave side of the pack, at points in advance of the bend, and in a direction generally parallel to the plane of the pack.

5. The method which comprises placing one end of a pack of loosely-assembled sheets against a supporting surface, bending the pack adjacent to said end at such angle as to permit sheets to be slid from the pack along said surface, with approximately all of the sheets in engagement with the said surface, supporting the unbent portion of the pack in a plane substantially perpendicular to the plane of the said surface, and applying a feeding force to the sheets in succession, at the concave side of the pack and in a direction generally parallel to the plane of the pack, the feeding force being in the nature of a wiping action initiated at a point in advance of the bend.

6. Apparatus for feeding sheets, comprising a table, a rack for receiving a pack of sheets and tiltably mounted for movement from a plane inclined with respect to the table to a plane perpendicular thereto, the rack being positioned to deposit the pack endwise upon the table when being tilted to upright position, a stop member for holding the upper portion of the pack against the rack, and a feeder device movable downwardly at the inner side of the pack, for sliding sheets therefrom.

7. Apparatus for feeding sheets, comprising a table, a pack-holding device movable to bring one edge portion of a pack of sheets into engagement with the table and cause further movement of another portion of the pack, to effect bending thereof, and a feeder device operating at the concave side of the pack to slide sheets therefrom.

In testimony whereof we, the said PERCY E. HUNTER and LOUIS E. ENDSLEY have hereunto set our hands.

PERCY E. HUNTER.
LOUIS E. ENDSLEY.