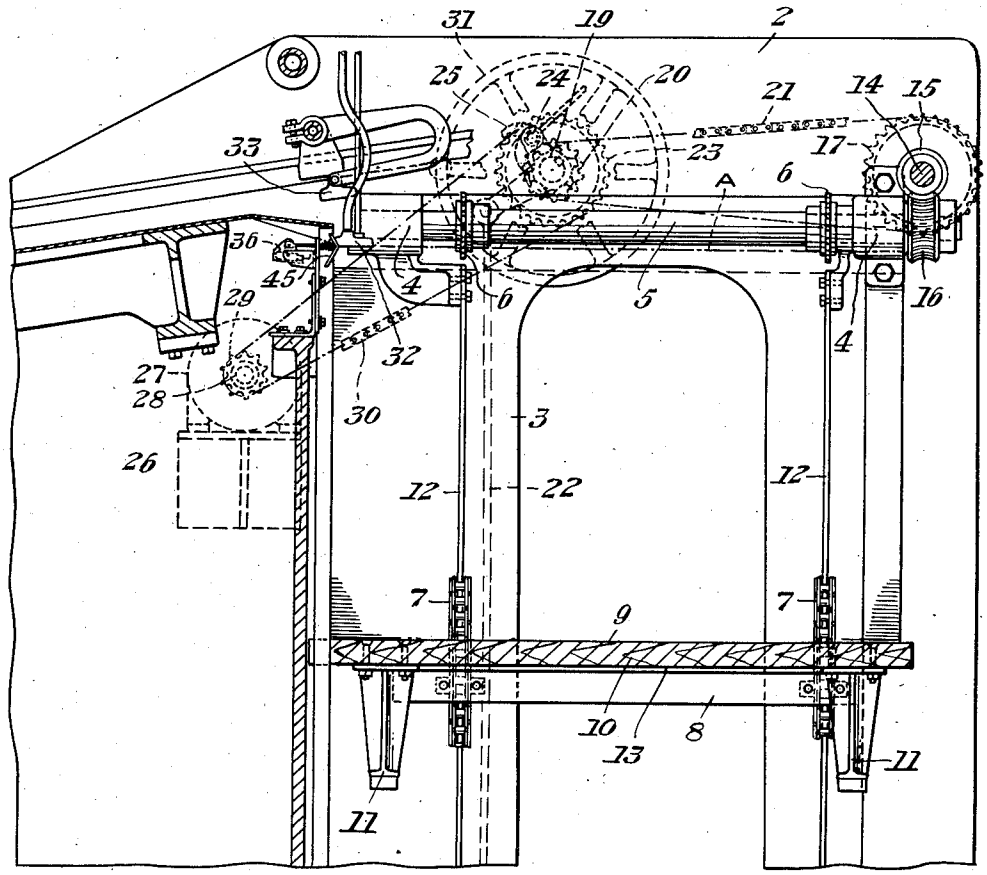
March 27, 1945. J. SINKOVITZ 2,372,229

SHEET HANDLING APPARATUS

Filed Oct. 10, 1941 3 Sheets-Sheet 1

Fig. 1.



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SHEET HANDLING APPARATUS

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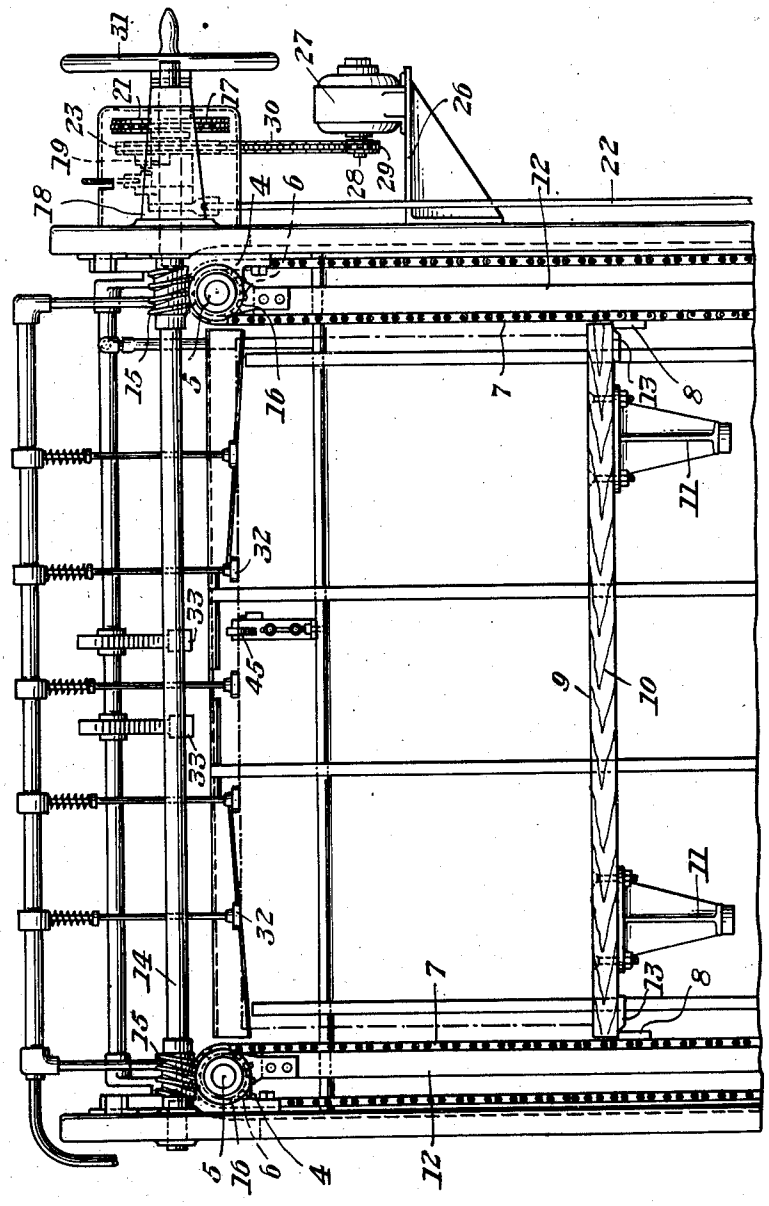
Fig. 2.



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SHEET HANDLING APPARATUS

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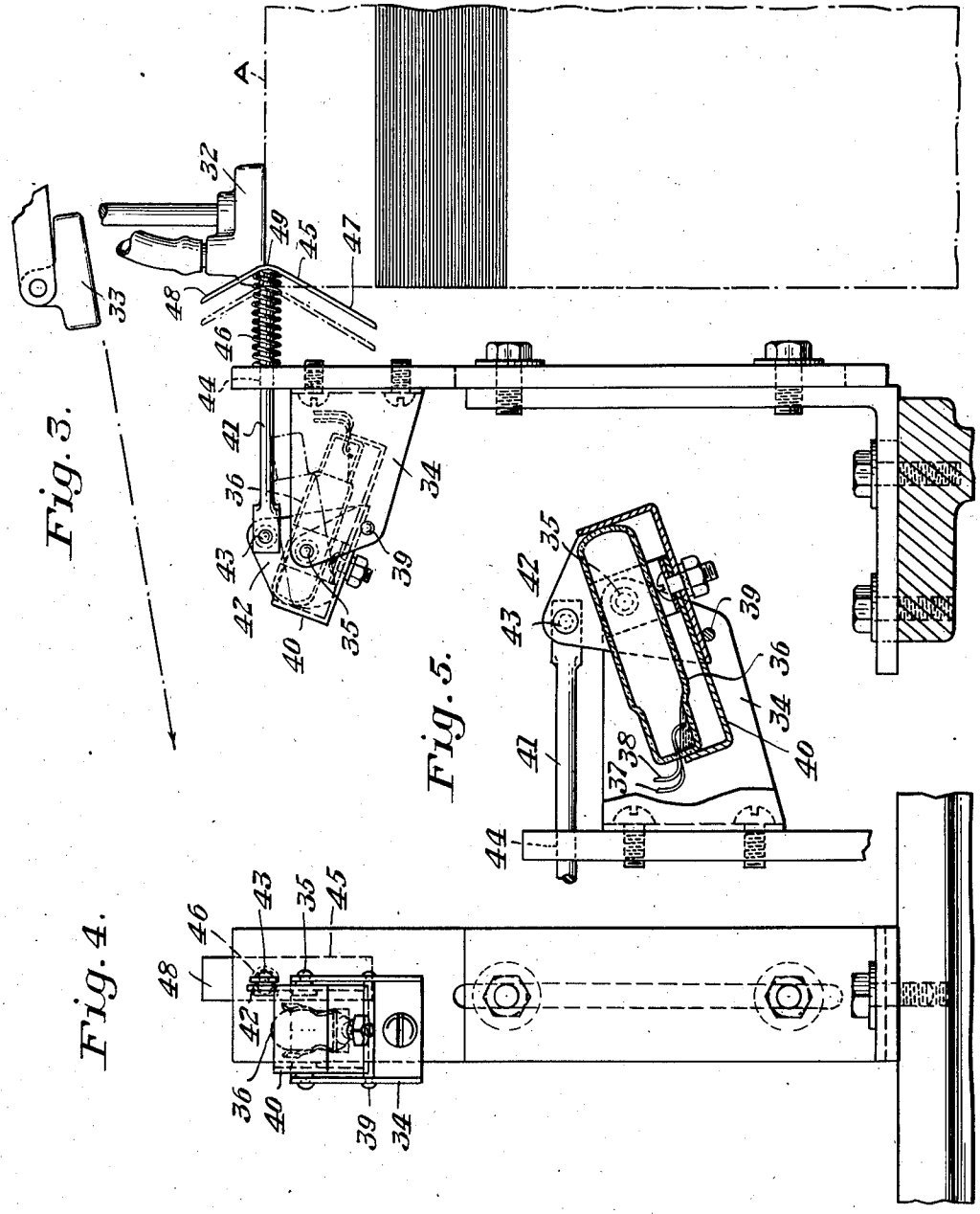

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UNITED STATES PATENT OFFICE

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SHEET HANDLING APPARATUS

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Application October 10, 1941, Serial No. 414,463

8 Claims. (Cl. 271—62)

This invention relates to sheet handling apparatus and particularly to control mechanism for controlling the operation of a portion of such apparatus. The invention relates more particularly to means for rendering inoperative sheet raising means such as a pile support.

While in its broadest aspects the invention is not so limited, it is particularly applicable to sheet feeding apparatus and will be described as embodied in a sheet feeder. A sheet feeder commonly employs a pile support upon which rests a pile of sheets to be fed and means for taking the sheets from the top of the pile and feeding them to a press or the like. The sheets may be taken and fed either singly and individually or in overlapped relation. As the sheets are taken from the top of the pile the pile support is slowly and periodically raised whereby to maintain the top of the pile of sheets at the proper height for taking of sheets therefrom by the taking means. Means are also commonly provided for rapidly raising and/or lowering the pile support. A feeder of the type broadly described in this paragraph is shown, for example, in copending application Serial No. 395,137.

The present invention has to do primarily with the means for controlling the means for rapidly raising and/or lowering the pile support. Perhaps the most important function of such control means is to stop the rapid raising of the pile support when the top of the pile is at the proper height for the taking of sheets therefrom by the taking means. If the pile support is not stopped at the proper time, not only may the top of the pile rise to too high a point, but there is danger of jamming and damage to the feeder and the sheets. Various proposals have been made for stopping the rapid raising of the pile support at at the proper time. Some of these have not proved to be sufficiently reliable or accurate and others have been unduly complicated. Moreover, most of the prior attempts to bring about satisfactory and controlled stopping of the raising of the pile support have involved the employment of a control member resting upon the top of the pile intermediate the edges thereof and interfering with the taking of sheets therefrom.

I provide apparatus for controlling the stopping of the raising of the pile support in a sheet feeder or the like whereby the pile support may be stopped at a predetermined point with great accuracy and without having any portion of such control apparatus engaging the top of the pile intermediate the edges thereof whereby to interfere with the taking of sheets therefrom. Moreover, I employ an extremely simple apparatus which can be fabricated at low cost yet which is highly reliable and may be operated for long periods without requiring adjustment or repair.

I preferably employ means including an electric motor for raising the pile support in a feeder. A switch may be provided in the motor circuit for stopping the motor. I preferably employ a tiltable switch and desirably a mercury switch which is reliable and accurate and may be used for a very long time without necessity of adjustment or repair. I preferably provide means for tilting the mercury switch to open the motor circuit when the pile support reaches the height at which the top of the pile is positioned so that sheets may be taken therefrom by the taking means for feeding to a press or the like. For this purpose I prefer to use a slidable operating rod. Such rod is preferably resiliently urged in one direction as by a spring and is adapted to be moved in the opposite direction against the action of the spring to tilt the mercury switch to open the motor circuit when the pile support has reached the desired elevation.

I preferably control the operation of the switch by the pile itself. I preferably employ a control member engaging an upper edge of the pile. This leaves the top of the pile free of any member engaging it intermediate its edges which may interfere with proper taking of the sheets therefrom. Desirably the control member which engages the pile is in the form of an inclined cam or follower member so mounted that as the pile rises it engages an inclined face of such member and gradually cams the member back away from the pile until when the top of the pile is at the desired elevation the upper extremity of the operative face of such member is disposed at substantially the height of the top of the pile. When a tiltable mercury switch and slidable control rod are employed the cam member is preferably connected with the end of the control rod and is spring pressed toward the pile and as it is forced back away from the pile the switch is tilted through the agency of the control rod until the motor circuit is opened.

Other details, objects and advantages of the invention will become apparent as the following description of a present preferred embodiment thereof proceeds.

In the accompanying drawings I have shown a present preferred embodiment of the invention, in which

Figure 1 is a fragmentary vertical longitudinal cross-sectional view through a sheet feeder;

Figure 2 is a fragmentary end elevational view of the feeder shown in Figure 1;

Figure 3 is an enlarged vertical longitudinal cross-sectional view of a portion of the mechanism shown in Fig. 1;

Figure 4 is an elevational view of the mechanism shown in Figure 3 as viewed from the left-hand side of that figure; and

Figure 5 is an enlarged detail elevational view of the mercury switch and its mounting and operating mechanism as viewed from the rear of Figure 3.

Referring now more particularly to the drawings, there is shown a sheet feeder designated generally by reference numeral 2 and employing a frame 3 in which the operative parts as mounted. The frame 3 carries bearings 4 in which are rotatably mounted two horizontal longitudinally extending shafts 5, one adjacent and parallel to each side of the frame, the shafts being parallel to each other. Each shaft 5 carries a pair of spaced sprockets 6. Disposed about each sprocket 6 and extending downwardly therefrom is a sprocket chain 7. Each sprocket chain 7 passes about a bottom guide (not shown) at the base of the feeder. Thus there are four pairs of cooperating sprockets and guides, each pair having a sprocket chain trained thereabout. Two of the chains are disposed at one side of the feeder and the other two are disposed at the opposite side. Each chain is directly opposed to one of the chains at the other side.

Connected with and extending between the two chains 7 at each side of the feeder are three bars 8 equally spaced along the chains. Since the driving sprockets 6 at each side of the feeder are fixed to the same shaft and all four driving sprockets are identical the chains will be operated synchronously by means presently to be described and the bars 8 will move with the chains. There is shown a pile carrier or support which is designated by reference numeral 9 and comprises a wooden top 10 and four legs 11 connected therewith. The length of the top 10 of the pile carrier 9 is slightly less than the transverse distance between the inner reaches of the chains 7 as shown in Figure 2. A pile carrier is adapted to be introduced to the feeder at the bottom thereof and to be set upon the floor to be picked up by the bars 8, as will presently be described.

All of the chains 7 are adapted to be driven upwardly, outwardly, downwardly and inwardly viewing Figure 2. Thus when the pile carrier 9 is positioned upon the floor in the space determined by the four chains it will upon operation of the feeder automatically be picked up by the opposed bars 8. The bars on the respective chains are, as above indicated, arranged so that they will move upwardly in transversely aligned pairs.

The inner reaches of the chains 7 are held against outward displacement by vertical guides 12 which lie between the inner and outer reaches of the chains and against the outer faces of the inner reaches thereof, as shown in Figure 2. The carrier is centered by guide members 13 fastened to the under surface of the top 10 thereof, as shown in Figure 2, and which lie between the bars 8. When the carrier has been raised to the upper portion of the feeder another carrier with a pile of sheets thereon may be positioned as above described and raised automatically below the first carrier. Thus as soon as all of the sheets of the upper pile have been fed the upper carrier may be quickly lifted out and the pile of sheets on the lower carrier may be quickly raised to bring the top sheet of such pile into feeding position. The whole operation may be performed in a few seconds so that there is no appreciable delay.

Extending transversely of the feeder and journaled in the frame 3 is a shaft 14. Such shaft fixedly carries two worms 15 of the same size and pitch but of opposite hand. Each of the shafts 5 fixedly carries a worm wheel 16 meshing with one of the worms 15. Thus rotation of the shaft 14 in one direction turns the shafts 5 to move the inner reaches of the chains 7 upwardly and rotation of the shaft 14 in the opposite direction turns the shafts 5 to move the inner reaches of the chains 7 downwardly.

Fixed to the shaft 14 outside the frame is a sprocket 17. Fixed to the frame is a bracket 18 carrying a shaft 19. Fixed to the shaft 19 is a sprocket 20 which is in longitudinal alignment with the sprocket 17. A sprocket chain 21 meshes with the sprockets 17 and 20. Since the sprocket 17 is fixed to the shaft 14 and the sprocket 20 is fixed to the shaft 19, turning of the shaft 19 in one direction results in raising of a pile carrier carried by the chains 7, and turning of the shaft 19 in the opposite direction results in lowering of a pile carrier carried by the chains 7.

The feeder is provided with oscillatory means for raising the pile carrier in the feeder while the press is in operation. Such oscillatory means may be driven from the press drive and may be of known construction and provided with known control mechanism for insuring that the top of the pile in the feeder remains substantially at a predetermined height. An oscillating rod 22 may be operated by the press drive and through a pawl and ratchet turns the shaft 19 periodically during operation of the press to maintain the top of the pile at the proper elevation for the feeding of sheets therefrom.

Rotatably mounted on the shaft 19 is a sprocket 23 to which is pivoted at 24 a pawl 25 adapted to cooperate with a ratchet (not shown) fixed to the shaft 19. Fixed to the frame is a support 26 which carries an electric motor 27 whose shaft 28 has a sprocket 29 fixed thereto. A sprocket chain 30 meshes with the sprockets 23 and 29.

A portion of the shaft 19 projects beyond the bracket 18 and is provided with a hand wheel 31. The hand wheel may turn the shaft 19 in either direction.

The oscillating rod 22 and its connections as above described can turn the shaft 19 only in a direction to raise the pile support. This is true also of the motor 27. When the motor 27 is operated the pawl 25 connected with the sprocket 23 turns the shaft 19 continuously in a direction to raise the carrier.

The mechanism thus far specifically described may be to all intents and purposes the same as that disclosed in said copending application Serial No. 395,137. Sheets are taken from the top of a pile of sheets carried by the pile support or carrier 9 by suckers 32 which have a generally vertically oscillatory movement as known in the art. The portion of the feeder which advances the sheets toward the press or the like may be as disclosed in copending application Serial No. 319,862, comprising cooperating generally horizontally oscillatable carriers which sequentially advance the sheets to the press or the like. However, the structure of such portion of the feeder

forms no part of the present invention. The suckers 32 raise the sheets one by one from the top of the pile and deliver them to suckers 33 mounted on a generally horizontally oscillatable carrier which advances the sheets toward the press or the like. The operation of the generally horizontally oscillatable carrier and of the suckers 32 and 33 forms no part of the present invention and is described in said copending application Serial No. 319,862.

The means for taking the sheets from the top of the pile operates at a predetermined height, that is, although the suckers 32 partake of limited generally vertically oscillatory movement and are also adjustable within limits they are always disposed at approximately the same elevation so that it is necessary in order that sheets may be taken from the top of the pile and advanced toward the press or the like that the top of the pile of sheets be positioned so that the suckers in their normal operation will take sheets from the top of the pile. Consequently the top of the pile must be just below the suckers 32. Since sheets are continually being removed from the top of the pile the pile support 9 moves upwardly gradually, this being accomplished by the oscillatory mechanism operating through the oscillating rod 22. When, however, it is desired to raise the pile support quickly from a position in which the top of the pile is spaced appreciably below the suckers 32 to a position in which such suckers will take sheets from the top of the pile the motor 27 and its connections as above described are utilized. When the motor circuit is closed and the motor operates the pile support is raised rapidly. It is important when this is done to insure against upward movement of the pile support beyond the point desired at which the suckers 32 may take sheets from the top of the pile, as further movement might result in damage to the feeder and to the sheets and also would impair proper feeding. On the other hand, it is important to avoid having control means for stopping the motor in engagement with the top of the pile intermediate the edges thereof as such means interfere with proper advance of the sheets from the top of the pile. I control and limit the upward movement of the pile support due to operation of the motor 27 by means now to be described.

Fastened to a portion of the frame is a bracket 34 to which is pivoted about a generally horizontal pivot 35 a mercury switch 36. The mercury switch 36 is of the tiltable type and may per se be of any desired construction. It contains a quantity of mercury and two contacts are connected with the switch so that when it is in one angular position the mercury makes contact between such contacts and when it is in another angular position the mercury moves away from at least one of the contacts and the circuit is opened. The leads to the contacts are shown at 37 and 38 and are preferably connected so that the mercury switch 36 is in the circuit of the motor 27. A suitable manually operable switch (not shown) may be employed for initially closing the circuit.

A stop pin 39 is connected with the bracket 34 and the mercury switch casing 40 rests against such pin when the switch is in closed position as shown in Figures 3 and 5. A control rod 41 is pivoted to a portion 42 of the switch casing at 43. The rod 41 is slidably received within a bore 44 in the frame, passing through such bore toward the position of the top of the pile of sheets carried by the pile support 9. Connected with the inner end of the rod 41 is a shoe 45 in the form of an inclined cam member or follower and which as the pile rises is adapted to engage an upper edge of the pile. A coil spring 46 is interposed between a portion of the frame and the shoe 45 and tends at all times to urge the shoe toward the right viewing Figure 3 and thus to maintain the switch casing against the pin 39 and hold the switch in closed position. The shoe 45 is shown in full lines in Figure 3 in the position which it assumes before the top of the pile has risen into contact with it. The shoe has a lower upwardly and inwardly inclined portion 47 and an upper upwardly and outwardly inclined portion 48, such portions merging into a rounded connecting portion 49. The function of the portion 48 is to insure against interference with advance of the sheets by the control mechanism for stopping the motor 27 when the pile has reached the desired height.

When the pile support is to be raised rapidly the manual switch for closing the circuit to the motor 27 is operated, the mercury switch 36 being at such time in the position shown in Figures 3 and 5 so that upon closing of the manual switch the motor circuit will be closed and the motor will operate. This will result in rapid upward movement of the pile support 9 with the pile of sheets thereon. An upper edge of the pile of sheets will engage the portion 47 of the shoe 45 and due to the inclination of such portion will cam the shoe outwardly or in a direction toward the left viewing Figure 3 from the full line position of the shoe toward the chain line position thereof viewing such figure. This in turn causes movement toward the left of the control rod 41 and compression of the spring 46. It also causes angular movement of the switch 36 about the axis of the pivot 35 in the counterclockwise direction viewing Figure 3 or the clockwise direction viewing Figure 5. The parts are adjusted so that just as the top of the pile reaches the elevation indicated by the line A in Figure 3 the switch will have been tilted to the point that the motor circuit will be opened, thus stopping the motor and discontinuing upward movement of the pile support. At such time the shoe 45 engages the upper edge of the pile mainly laterally so that sheets can be taken from the top of the pile without interference by the control means.

Ordinarily after the pile has been raised until its top is at the proper height for the taking of sheets therefrom by the suckers 32 the manual switch for controlling the motor 27 will be opened so that the control mechanism shown in Figure 3 will thereafter be inoperative until such manual switch is again closed. From this point on the automatic pile raising and controlling mechanism as known in the art will be employed. However, it is possible by the use of my control mechanism as shown in Figure 3 to dispense entirely with the oscillatory pile raising and control mechanism and to employ only the motor and its connections for raising the pile support together with the switch 36 and the control means for operating it. Thus when the manual switch is closed and the pile is raised until its top reaches the line A in Figure 3 the switch 36 is tilted to open position. It will remain in this position while the suckers 32 remove sheets from the top of the pile until enough sheets have been removed so that the shoe 45 moves toward the right viewing Figure 3 sufficiently to tilt the switch 36 until it again closes. Such closing of the switch will cause the motor

27 to operate to raise the pile support until the shoe 45 is again cammed back to open the switch. Thus my control mechanism, which is extremely cheap and simple in construction and operation, may be substituted for the expensive and complicated automatic control mechanism which has heretofore been employed for insuring maintenance of the top of the pile of sheets at the proper height during operation of the feeder.

While I have shown and described a present preferred embodiment of the invention it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied within the scope of the following claims.

I claim:

1. Sheet handling apparatus comprising a pile support, means for raising the support and means including means adapted to be engaged by an upper edge of the pile when such edge rises to a predetermined height and to be moved thereby rectilinearly transversely of the direction of movement of the support for rendering said first mentioned means inoperative.

2. Sheet handling apparatus comprising a pile support, means for raising the support and means for rendering said first mentioned means inoperative upon raising of the support to a predetermined height, said last mentioned means comprising an inclined follower member arranged to engage an upper edge of the pile and adapted to be cammed laterally thereby as the support approaches said height and a slidable operating rod operated by said follower member.

3. Sheet handling apparatus comprising a pile support, means for raising the support and means for rendering said first mentioned means inoperative upon raising of the support to a predetermined height, said last mentioned means comprising an inclined follower member adapted to be cammed laterally as the support approaches said height and a tiltable mercury or like switch operated thereby.

4. Sheet handling apparatus comprising a pile support, means for raising the support and means for rendering said first mentioned means inoperative upon raising of the support to a predetermined height, said last mentioned means comprising an inclined follower member adapted to be engaged by an upper edge of the pile and to be cammed laterally thereby and a switch operated by said follower member.

5. Sheet handling apparatus comprising a pile support, means for raising the support and means for rendering said first mentioned means inoperative upon raising of the support to a predetermined height, said last mentioned means comprising an inclined follower member adapted to be engaged by an upper edge of the pile and to be cammed laterally thereby, a slidable operating rod operated by said follower member and a tiltable mercury or like switch operated by said rod.

6. Sheet feeding apparatus comprising a pile support, means for raising the support, means including a tiltable mercury switch for rendering the raising means inoperative upon raising thereby of the pile support to a height such that taking means will take sheets from the top of the pile and control means for operating said second mentioned means, the control means including a cam member normally resiliently urged in one direction and cammed in the opposite direction as the pile support approaches said height and connections between the cam member and the tiltable mercury switch for tilting the switch upon camming of the cam member.

7. Sheet feeding apparatus comprising a pile support, means for raising the support, means including a tiltable mercury switch for rendering the raising means inoperative upon raising thereby of the pile support to a height such that taking means will take sheets from the top of the pile and control means for operating said second mentioned means, the control means including a cam member normally resiliently urged in one direction and adapted to engage the pile to be cammed in the opposite direction as the pile support approaches said height and means connected with the cam member and pivoted to the tiltable mercury switch for tilting the switch upon camming of the cam member.

8. Sheet feeding apparatus comprising a pile support, means for raising the support, an electric motor for operating the raising means, means including a tiltable mercury switch in the motor circuit for rendering the motor inoperative upon raising by the raising means of the pile support to a height such that taking means will take sheets from the top of the pile and control means for operating said second mentioned means, the control means including a cam member adapted to engage an upper edge of the pile to be actuated thereby and connections between the cam member and the tiltable mercury switch for tilting the switch upon actuation of the cam member.

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