Feb. 10, 1942. A. BROADMEYER 2,272,457

SHEET FEEDER

Filed June 25, 1940 3 Sheets-Sheet 1

FIG. 3.

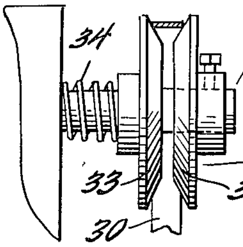


FIG. 1.

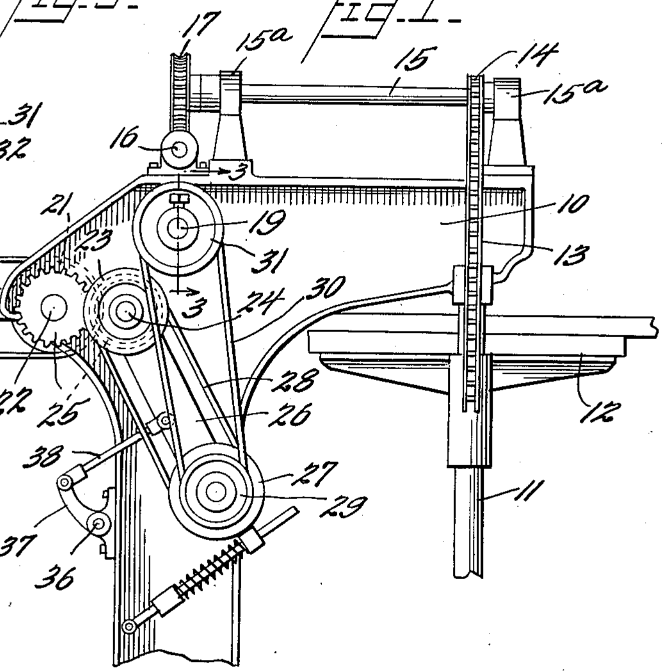
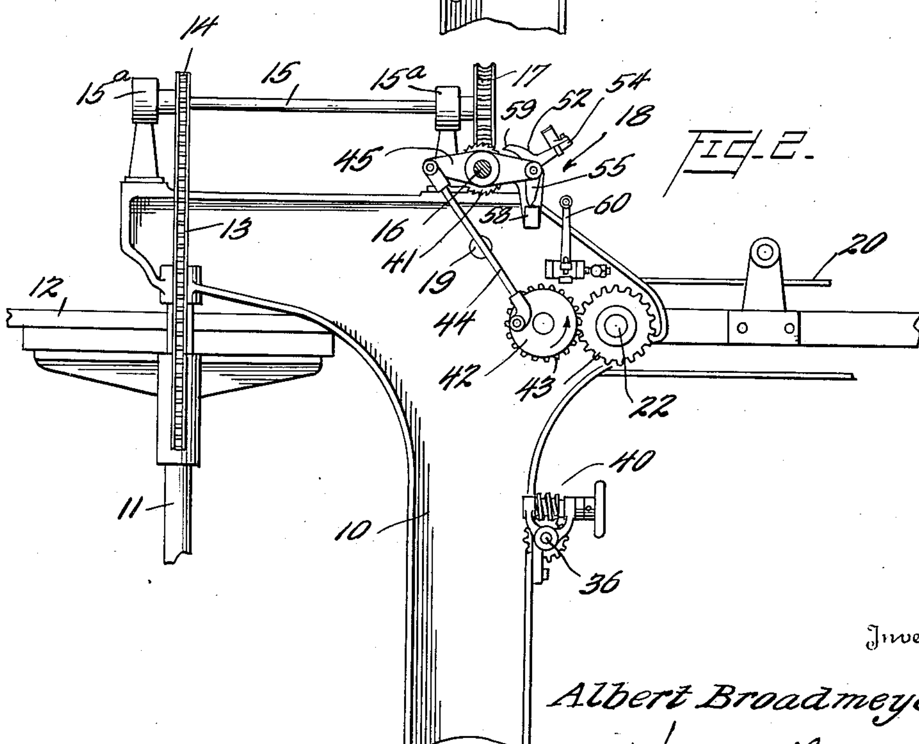


FIG. 2.



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SHEET FEEDER

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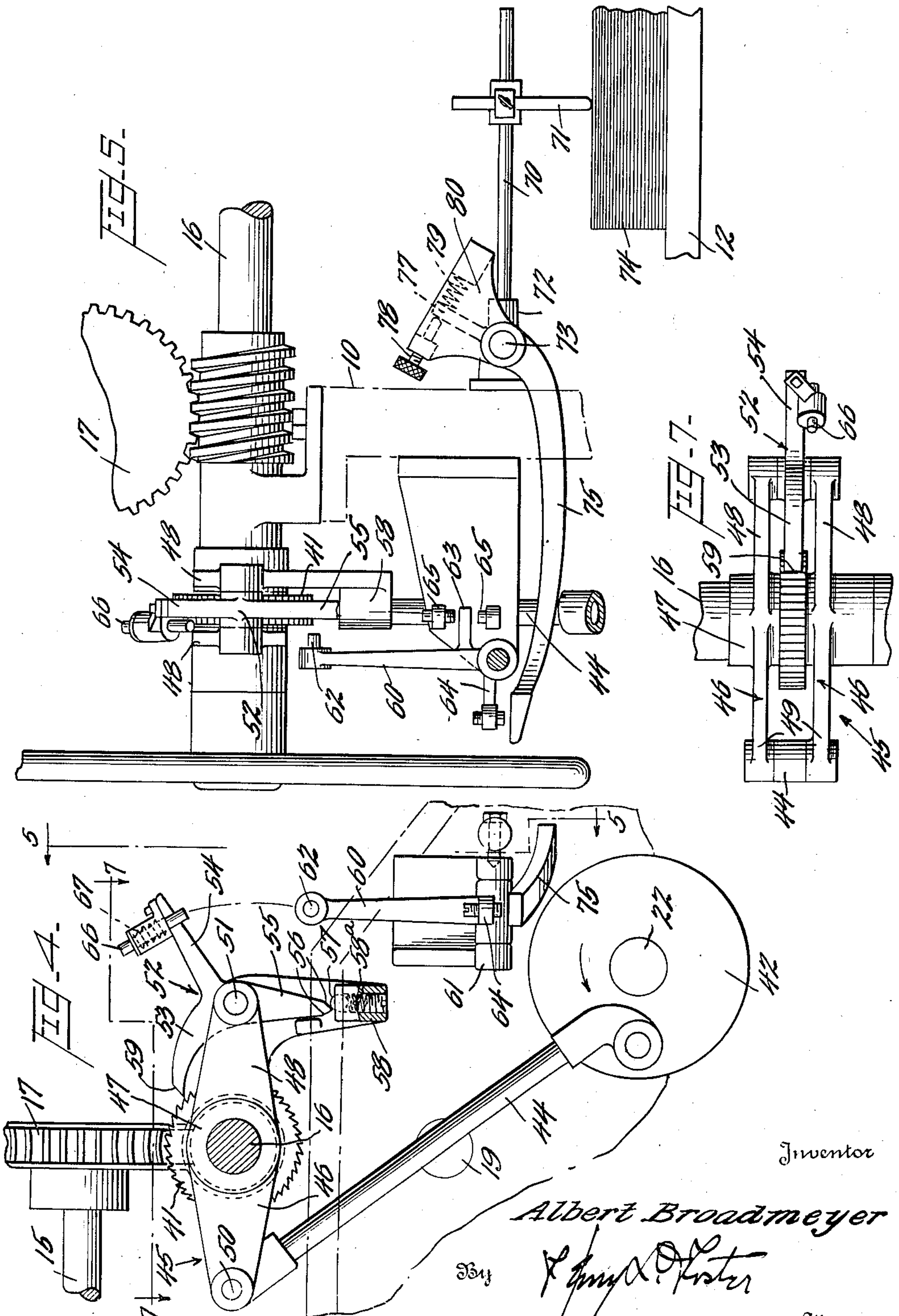

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SHEET FEEDER

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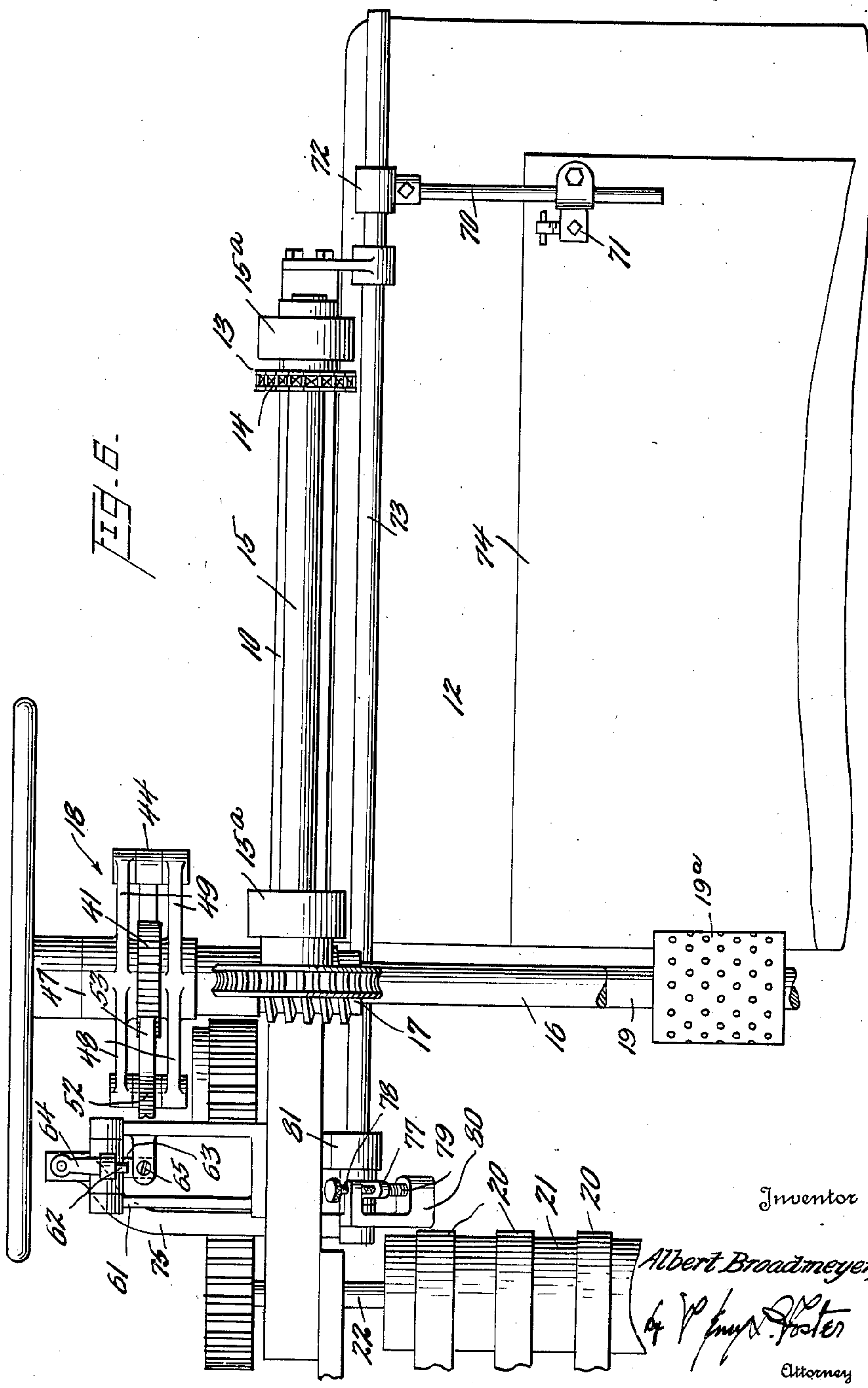
FIG. 6.



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UNITED STATES PATENT OFFICE

2,272,457

SHEET FEEDER

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Application June 25, 1940, Serial No. 342,354

2 Claims. (Cl. 271—12)

This invention relates to sheet feeders of the type wherein single sheets are fed successively from the top of a stack supported upon a vertically movable table, the sheets being moved from the stack to a conveyor by which they are carried to a point of delivery, which may be the feed end of a machine that performs some operation, as ruling, upon them.

Such feeders are well known and the present invention concerns certain improvements whereby superior operation and greater convenience is achieved.

One object of the invention is to provide a novel arrangement for regulating the spacing of the successive sheets as they are delivered to the conveyor, whereby any desirable spacing may be effected for sheets of any size.

Another object is to provide for a simple and positive adjustment for such a variable spacing means.

Still another object is the provision of a novel system for effecting the progressive elevation of the table that supports the stack of sheets to be fed.

A further object is the provision of a novel feeler-controlled intermittent device for effecting operation of the table-elevating mechanism as a stack of sheets on the table is depleted.

A still further object is the provision of a novel feeler-controlled system for elevating the table wherein no shock or force of operating parts can be transmitted to the feeler to cause it to dig into the paper.

Another object is the provision of novel feeler mounting and control system operated by a feeler wherein adjustment of the feeler in directions of the motion of the sheets may be accomplished without changing the leverage of the feeler mounting.

In the accompanying drawings:

Figure 1 is a broken side elevation of a feeder embodying the novel drive by means of which the spacing of the sheets may be adjusted.

Figure 2 is a broken elevation of the opposite or "operator's" side of the feeder.

Figure 3 is a sectional view on line 3—3 of Figure 1.

Figure 4 is a detail side elevation of the intermittent drive for the table-elevating mechanism.

Figure 5 is a sectional view on line 5—5 of Figure 4.

Figure 6 is a top plan of the table-elevating mechanism, showing the intermittent drive and feeler mounting.

Figure 7 is a detail plan of the intermittent drive.

The feeder comprises a pair of transversely spaced standards **10** upon which the feeding mechanism is supported, and in the rear of which is slidably mounted for vertical reciprocation a table **12** upon which a stack of sheets may be supported. Table **12** is supported on sprocket chains **13** that are trained over sprockets **14** mounted respectively on shafts **15** supported by bearings **15**a carried by the standards **10**, the shafts **15** extending longitudinally in the directions of feeding.

The table **12** is counterbalanced by weights (not shown) which are attached to the free ends of the chains **13**. Simultaneous rotation of the shafts **15** is accomplished by means of a transverse shaft **16** that drives the shafts **15** through gearing **17**. Mechanism designated generally **18**, which is controlled by a feeler system, is provided for turning the shaft **16** according to the depletion of a stack on the table, elevation of the table being accomplished in a manner to maintain the top of the stack at a substantially constant level.

Feeding of the sheets from the top of a stack on the table is accomplished by a feeder device, preferable of the well known rotary suction wheel type (not shown), in a manner well known in the art. The feeder device is carried by a transverse shaft **19** journalled in suitable bearings in the standards **10** as is shown in Figure 6 as a suction wheel **19**a. The sheets are fed forward in an edgewise direction from the stack to a conveyor that comprises a plurality of tapes **20** that extend about a conveyor roller **21** to a point of delivery. The roller **21** is mounted on a shaft **22** that acts as the main drive shaft of the machine, and to which power is applied in any suitable manner.

The speed of the feeding depends upon the speed of rotation of the shaft **19**, which drives the feeder device, and consequently the spacing of the sheets upon the conveyor tapes **20** depends upon the relative speeds of the shafts **19** and **22**. To adjustably control the relative speeds of these shafts, and thereby permit adjustment of the spacing of the sheets on the conveyor, the following arrangement is provided.

A pulley wheel **23** is mounted adjacent the shaft **22** on a stub shaft **24** extending from the outside surface of the standard **10** on the side of the machine away from the operator's side, and such pulley **23** is driven by the shaft **22** by gearing **25**. Pivotally mounted on the stub shaft **24** for swinging motion about the center line of the pulley 23 is an arm 26 that carries at its distal end a pulley 27 driven by pulley 24 through a belt 28. Connected with the driven pulley 27, as by being an integral part thereof, is a driving pulley 29 that by means of a belt 30 turns a driven pulley 31 secured upon the shaft 19.

One of the paired pulleys 29 and 31, advantageously the driven pulley 31 as shown in Figure 3, is of variable effective diameter according to belt tension as of the type comprising two separate and relatively movable halves 32 and 33, one of which, here shown as 33, is fixed to the shaft, and the other being movable and urged towards the fixed half by a spring 24. By increasing the tension of the belt 30, the halves 32, 33 are forced apart, permitting the belt to ride towards the center of the pulley and decreasing its effective diameter, while by decreasing the tension of the belt the effective diameter of the pulley is increased. As the diameter of the other pulley remains constant, a change of belt tension results in a change of ratio of the diameters of the driving and driven pulleys, and consequently the speed of shaft 19, which governs the speed of the feeder device, with relation to that of the shaft 22, which governs the speed of the conveyor, may be governed by changing the distance between the pulleys 29 and 31, which change alters the tension of the belt 30.

Change of the distance between the pulleys 29 and 31 is accomplished by swinging the arm 26, and the pulley 29 that it carries, about the center line of the pulley 23. As the arm swings concentrically about the pulley 23, tension of the belt 28 remains constant, but because of the eccentric movement of the pulley 29 with relation to the pulley 31, such movement changes the distance between them.

As a convenient means of adjusting the position of the pulley 29 from the operator's station on the opposite side of the machine, a transverse shaft 36, extending across the machine, is mounted upon the standards 10. The shaft 36 is connected by a crank 37 and link 38 to the arm 26, so that rotation of the shaft swings the arm. A compression spring 39 is suitably mounted to counterbalance the arm. At the operator's station a manual operating device 40 is arranged to turn the shaft 36 so that remote adjustment of the position of the pulley 29 may be readily accomplished.

Referring to the table-elevating mechanism, the shaft 16 is driven through a ratchet wheel 41 secured upon the shaft. Power to effect this drive is supplied from the main shaft 22 through a crank wheel 42 driven from the main shaft through gearing 43 (see Figure 2). A pitman 44 connected eccentrically to the crank wheel 42 constantly reciprocates a pawl carrier, designated generally 45, which is rotatably mounted on the shaft 16.

As best shown in Figures 4, 5 and 7, the pawl carrier 45 comprises a pair of body members 46 arranged on opposite sides of the ratchet wheel 41, such members being provided with central bearings 47 through which the shaft 16 extends, and both members 46 extending forwardly and rearwardly of the shaft 16 as arms 48 and 49 respectively. The end of the pitman 44 is connected with the pawl carrier 45 by a pivotal connection with a pin 50 extending between the rearward arms 49 of the carrier.

Between the forwardly extending arms 48, upon a pin 51, is a swinging pawl 52 comprising a tooth arm 53 for engaging the teeth of the ratchet wheel 41, an actuating arm 54 that extends forwardly of the pin 51, and a detent arm 55 that extends downwardly from below the pin 51. For cooperation with the detent arm 55 of the pawl, which is provided with a pointed end having inclined approaching surfaces 56, a plunger ball 57 is mounted in a bracket 58 that extends downwardly from one of the forwardly extending arms 48 of the pawl carrier and under the end of the detent arm 55. The plunger ball 57 is urged upward towards the pivot pin 51 by a spring 58, and its position is so related to the inclined surfaces of the detent arm 55, and the latter is so related to the tooth arm 53, that the point of the arm 55 passes the center line of the ball when the sharp tooth 59 of the arm 53 is slightly within the outer circumference of the ratchet wheel 41. This arrangement is such that upon rearward motion of the pawl (clockwise as seen in Figure 4), the pawl tooth 59 in riding over a tooth of the wheel 41 will move the point of the arm 55 to the left of the center line of the ball 57, so that the pawl will be moved and held out of engagement with the wheel.

Movement of the pawl 52 to effect engagement of the tooth 59 with the wheel 41 when the wheel is to be driven is effected by a vertically extending trip arm 60 that is pivoted between brackets 61 extending from the standard 10 for swinging along a plane at right angles to the planes along which the pawl carrier and pawl swing. The trip arm 60 has a trip member 62 at its upper end, a stop arm 63 adjacent its lower or pivoted end and extending in the same direction as the trip member 62, and an operating arm 64 adjacent its lower end and extending from the side opposite to the direction in which the arms 62 and 63 extend. The stop arm 63 is positioned between two adjustable stops 65 rigidly mounted on the bracket 61, so that movement of the arm 60 in either direction may be limited.

The trip arm 60 effects engagement of the tooth 59 of the pawl 52 with the ratchet wheel 41 by being swung to such a position that the trip member 62 is placed in the path of the actuating arm 54 of the pawl, so that when the latter swings downwardly upon rearward motion of the pawl carrier (clockwise as seen in Figure 4) the member 62 of the trip arm will engage the arm 54 of the pawl and thereby swing the pawl upon the pivot pin 51 and move the tooth 59 into engagement with the ratchet wheel.

In order that the tooth 59 may be brought into engagement with the wheel 41 at the beginning of the forward stroke of the pawl carrier (counterclockwise as seen in Figure 4), when the trip member 62 has been positioned in the path of the actuating arm 54 of the pawl, and to provide relief for the pawl at the end of the rearward stroke after the member 62 has been engaged by the arm 54 prior to the end of the rearward stroke, a plunger 66 urged downwardly by a spring 67 is carried by the arm 54 and is so arranged that the end of the plunger 66 will engage the member 62 prior to the end of the rearward stroke, so that during completion of the stroke the arm 54 may continue to move downwardly while the plunger is held against motion, the spring 67 interposed between the arm 54 and the plunger 66 being compressed during this time. This permits the tooth 59 to ride over the teeth of the wheel 41 if necessary during the last part of the rearward stroke of the pawl carrier and assures that at the end of such rearward stroke the tooth 59 will be forced into engagement with the wheel 41, so that upon forward motion of the pawl carrier and pawl the wheel 41 will be driven by the pawl throughout such forward motion.

The position of the trip arm 60, and consequently the positioning of the trip member 62 for engagement by the plunger 66, is controlled by a feeler that rests upon the top of a stack of sheets upon the table 12, in such fashion that when the stack is depleted and the feeler lowered the trip arm 60 is moved to place the member 62 in the path of the plunger 66, thereby effecting engagement of the pawl with the wheel 41, which results in driving the table-elevating mechanism to raise the table and restore the level of the top of the stack. The controlling system that accomplishes the movement of the trip arm is best shown in Figures 5 and 6.

A feeler arm 70 which has a slidable finger 71 mounted thereon extends laterally from a mounting 72 that is slidably adjustable along a shaft 73 that extends parallel to the sides of the table 12, in the direction of feed and is rotatably mounted on the standard 10. This arrangement is contrary to usual practice wherein a feeler arm is mounted on a transverse shaft at the delivery end of the table. The end of the feeler finger 71 rests on the top sheet of the stack 74, and as the top of the stack is lowered due to the successive removal of sheets the finger falls, swinging the arm 70 and turning the shaft 73 in a direction that is clockwise as seen in Figure 5.

An operating arm 75 is secured to the forward end of the shaft 73 and extends past the standard 10 to a point at which its end is positioned for cooperation with the actuating arm 64 of the trip arm 60.

Referring to Figure 5, it will be seen that rotation of the shaft 73 in clockwise direction by the feeler arm 70, resulting from lowering of the level of the top of the stack 74, will raise the arm 75, swinging the trip arm 60 towards the path of the plunger 66. This swinging motion of the arm 60 continues until the plunger 66 is intercepted by the trip member 62, which causes the pawl to swing on the pawl carrier and effects engagement of the pawl with the ratchet wheel 41 as above described. Upon rearward motion of the pawl and carrier, following a forward stroke during which the pawl has been in driving engagement with the ratchet wheel, the pawl is moved out of engagement with the ratchet wheel and held in disengaged position by the plunger ball 57, as above described. Whether the pawl will be again engaged with the ratchet wheel upon the next forward stroke or remain out of engagement, depends upon the position of the trip member 62 with relation to the path of the plunger 66, which position depends in turn upon the level of the top of a stack of sheets upon the table 12 with which the feeler finger is engaged.

By reason of the gearing ratios employed each forward movement of the ratchet wheel 41, due to a forward stroke of the pawl and carrier, raises the table a very small distance. The relative lengths of the arms 60 and 64 of the trip, together with the small units of distance through which the table is raised during each operation, render the system very sensitive, as the trip member 62 is moved through a relatively large arc upon a small movement of the feeler.

The arm 60 and its members 63 and 64 are so balanced that normally the arm swings to its inoperative position with the trip member 62 removed from the path of the plunger 66. It is so balanced as to require little effort to swing it to operative position. It is to be noted that there is no positive connection between the end of the arm 75 and the actuating arm 64.

It is further to be noted that the force of the descending plunger 66 when exerted upon the member 62 is transmitted to the arm 60 upon the same side of the pivot of such arm as the stop arm 63 projects from, which results in the resulting turning effort being finally exerted upon the lower stop 65. None of the force of the descending pawl carrier is transmitted back through the feeler system, which presents a material advantage over the prior practice wherein at each rotation of the constantly moving crank wheel commonly employed with a slotted link held out of operation by a feeler, an impulse was transmitted to the feeler, causing the latter to exert sufficient pressure to dig into the stack and interfere with entirely accurate actuation of the table elevator.

In order to counterbalance the arm 75 and feeler arm 70, and to adjust the pressure exerted upon the top of the stack by the feeler, the shaft 73 is provided with an arm 77 extending laterally of and moving with the shaft 73, so as to swing as the shaft is rotated. The arm 77 extends between an adjusting screw 78 and an oppositely disposed spring 79, both of which are supported by a bracket 80 that extends from a journal bearing 81 that extends from the standard 10 and supports the shaft 73.

The feeder mechanism above set forth has many advantages. The provision of the readily adjustable variable speed drive from the main shaft, which drives the conveyor, to the feeder device permits an accurate adjustment of the spacing of sheets to be made while the machine is in operation. The spacing may be adjusted to the requirements of any particular job with great ease and may be accomplished irrespective of the size of the sheets being fed.

The arrangement of the table-elevating drive is such as to avoid wear on the parts, as ratcheting of the pawl tooth over the teeth of the ratchet wheel is avoided. This also tremendously increases the silence of the machine in operation. All motions are rotary, which results in a minimum loss from friction and permits use of superior bearings to avoid wear of the parts.

The arrangement of the system that controls the intermittent drive provides for great sensitivity to small changes in the level of the top of a stack, and the limited degree of raising motion imparted to the table at each operation results in a very nearly constant level being maintained for feeding. All interacting parts are readily adjustable so that the mechanism may be easily set in condition for proper feeding operation.

From the foregoing it is thought that the construction, operation, and many advantages of the herein described invention will be apparent to those skilled in the art, and it will be readily appreciated that changes in the size, shape, proportions and minor details may be resorted to without departing from the spirit of the invention as set forth in the accompanying claims.

I claim:

1. In a sheet feeder including a conveyor that comprises a power shaft and a plurality of conveyor tapes that extend around the shaft and to a point of delivery, and a rotary feeder for

successively feeding sheets to the conveyor from the top of a stack; a driving pulley rotated by the power shaft of the conveyor, a driven pulley arranged to rotate the feeder, intermediate driven and driving pulleys belted respectively to said driving and driven pulleys, said intermediate pulleys being mounted for rotation on a common center that is movable eccentrically about one and concentrically about the other of the first named pulleys, one of the pulleys that are relatively eccentric being arranged to vary in effective diameter according to the tension of the belt that connects it with the other such pulley.

2. In a sheet feeder including a conveyor that comprises a power shaft and a plurality of conveyor tapes that extend around the shaft and to a point of delivery, and a feeder operated by a rotary shaft extending parallel to and spaced from the power shaft for successively delivering sheets to the conveyor; variable speed driving means connecting the suction wheel shaft with the power shaft and comprising a driving pulley mounted adjacent and driven by the power shaft, an arm mounted for swinging motion about the center line of the pulley, a driven and a driving pulley journalled on said arm, said driven pulley being belted to the first mentioned pulley, a driven pulley secured upon the suction wheel shaft and belted to the driving pulley carried by the arm, said last mentioned belted pulleys being arranged to vary their ratio in accordance with the tension of the belt that connects them.

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