Sept. 8, 1936. B. S. ELLIOTT 2,053,328

SORTING MACHINE

Filed Dec. 16, 1933 5 Sheets-Sheet 1

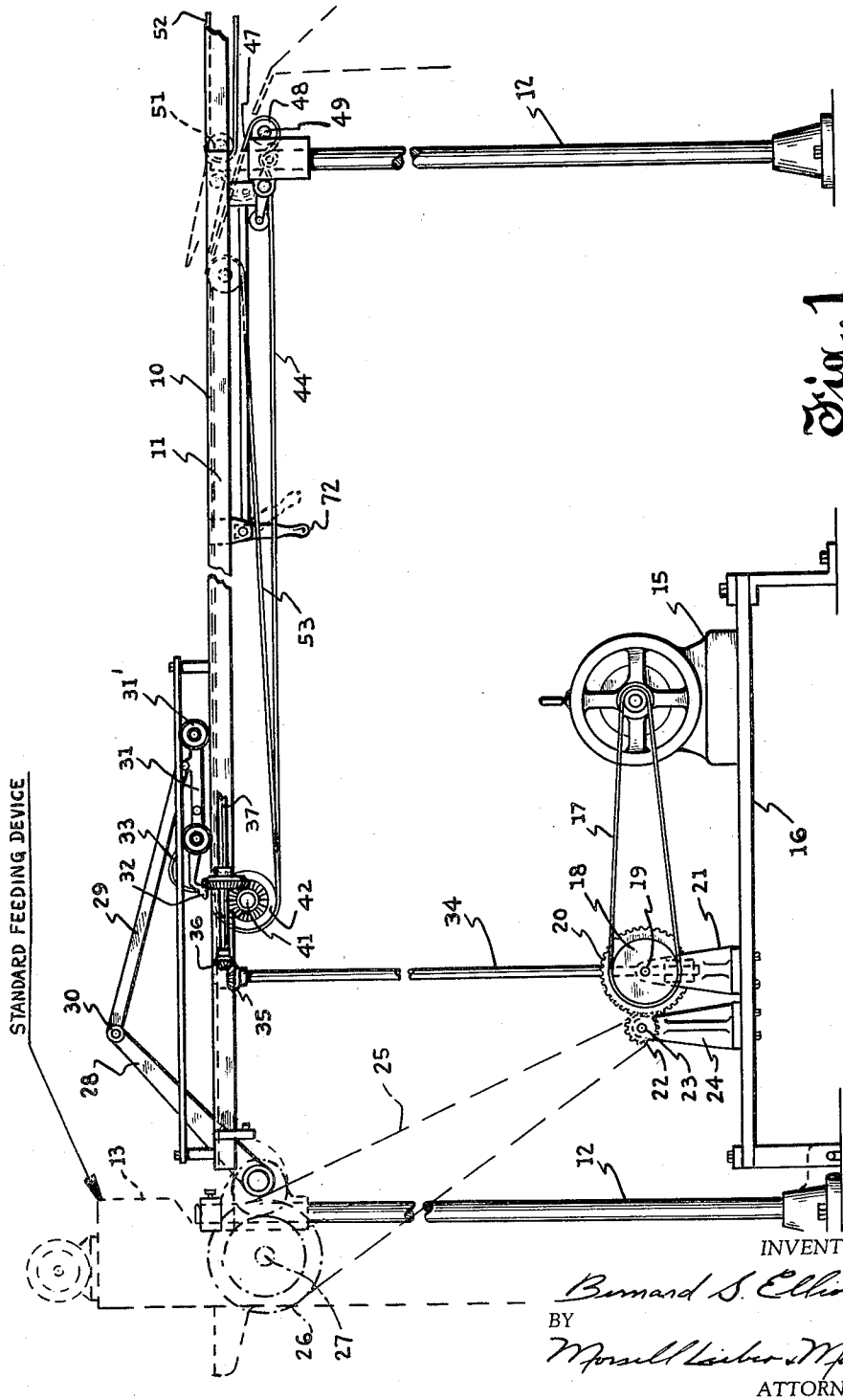


Fig. 1

INVENTOR.

Bernard S. Elliott

BY

Mosell Lieber & Mosell

ATTORNEYS

Sept. 8, 1936. B. S. ELLIOTT 2,053,328

SORTING MACHINE

Filed Dec. 16, 1933 5 Sheets-Sheet 2

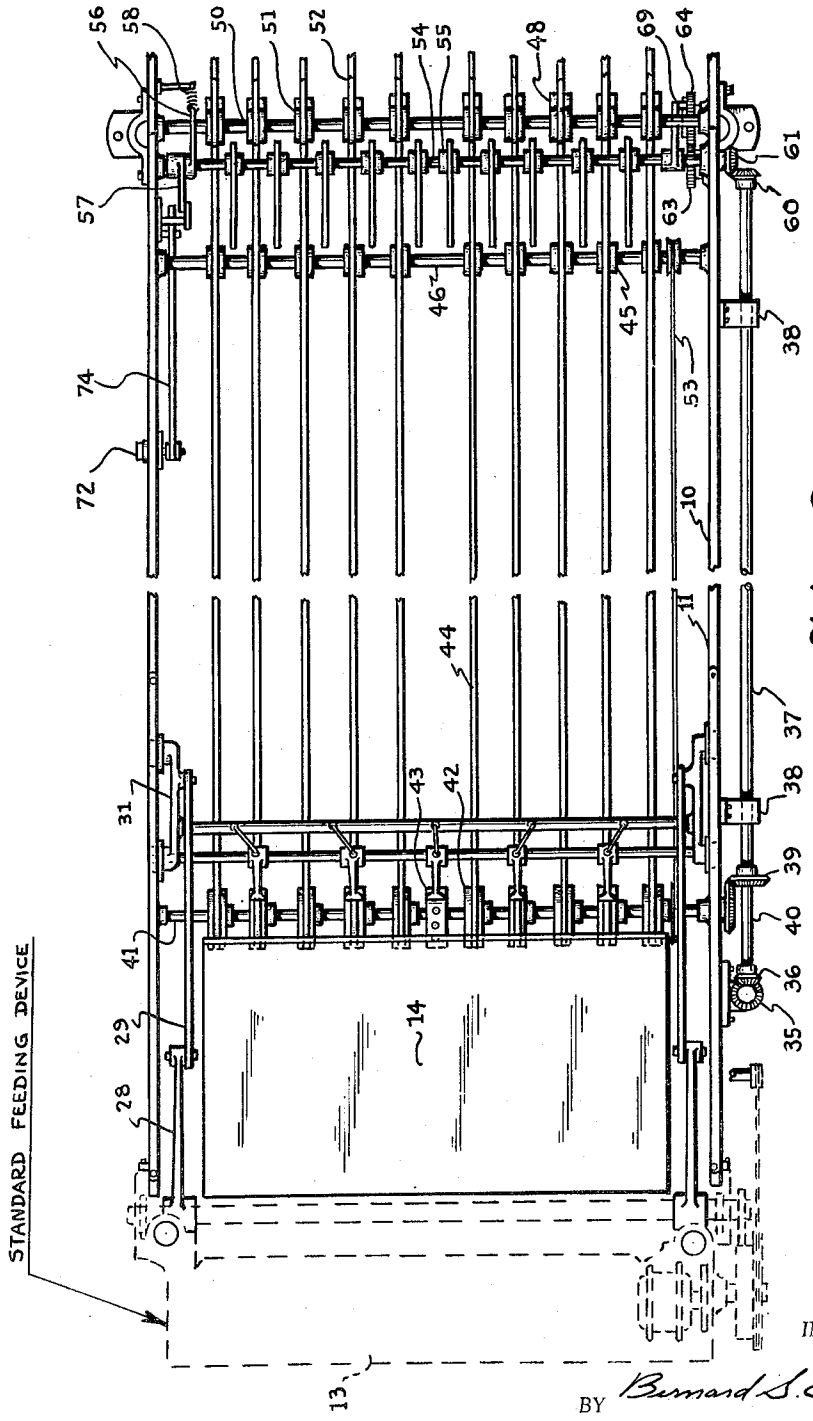


Fig. 2

INVENTOR.

BY Bernard S. Elliott

Morsell Luber & Morsell

ATTORNEYS

Sept. 8, 1936. B. S. ELLIOTT 2,053,328

SORTING MACHINE

Filed Dec. 16, 1933 5 Sheets-Sheet 3

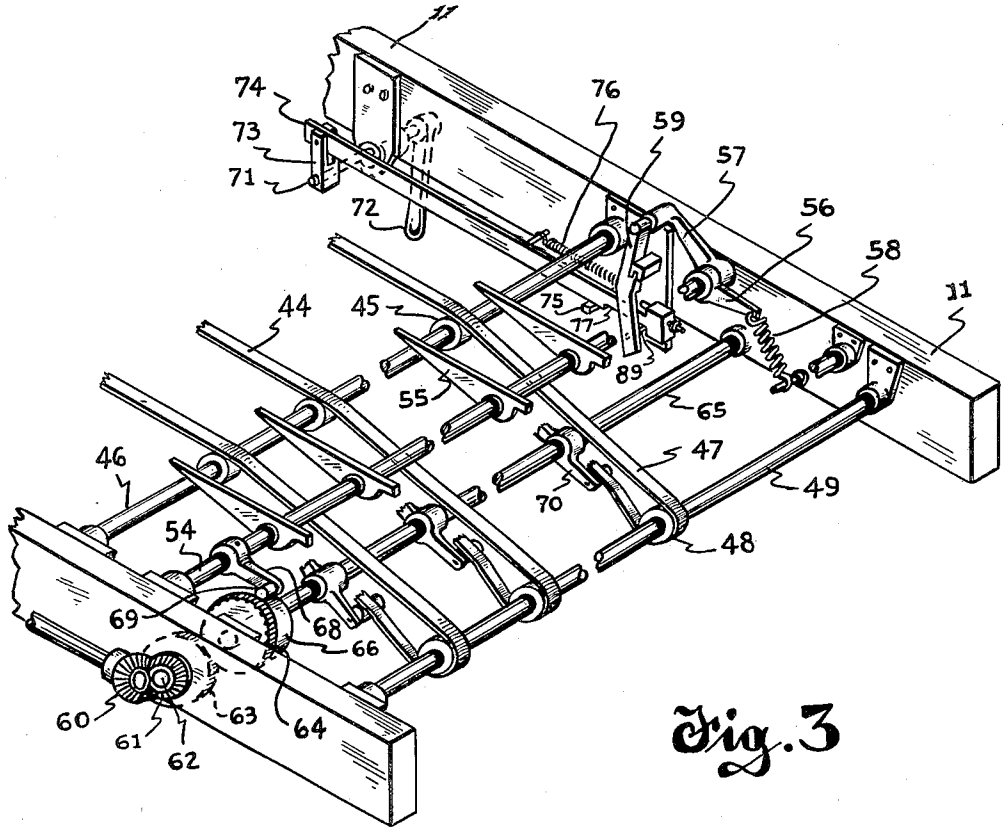


Fig. 3

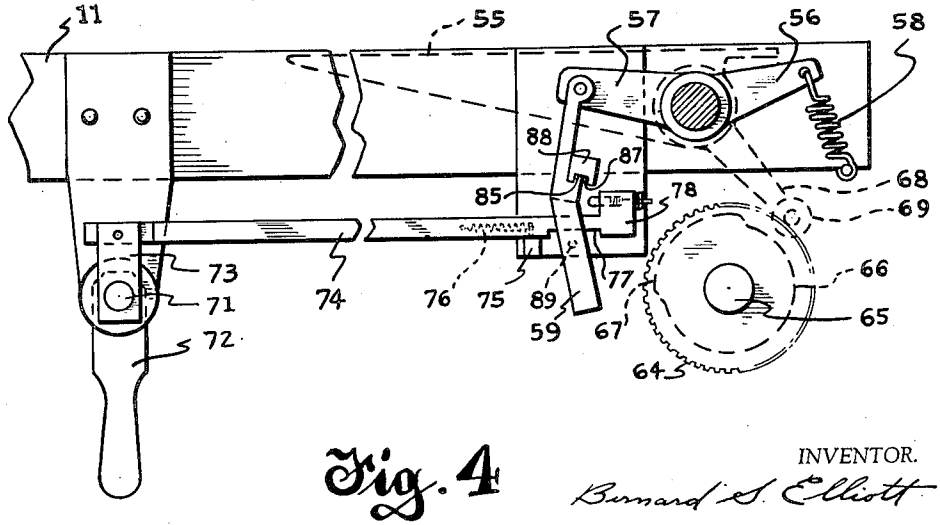


Fig. 4

INVENTOR.
Bernard S. Elliott
BY
Morsell Lieber & Morsell
ATTORNEYS.

Sept. 8, 1936. B. S. ELLIOTT 2,053,328

SORTING MACHINE

Filed Dec. 16, 1933 5 Sheets-Sheet 4

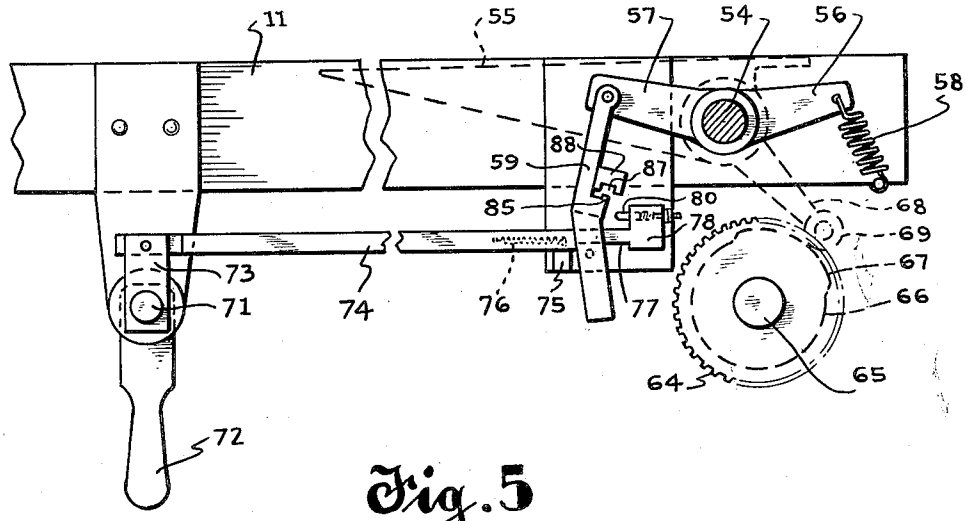


Fig. 5

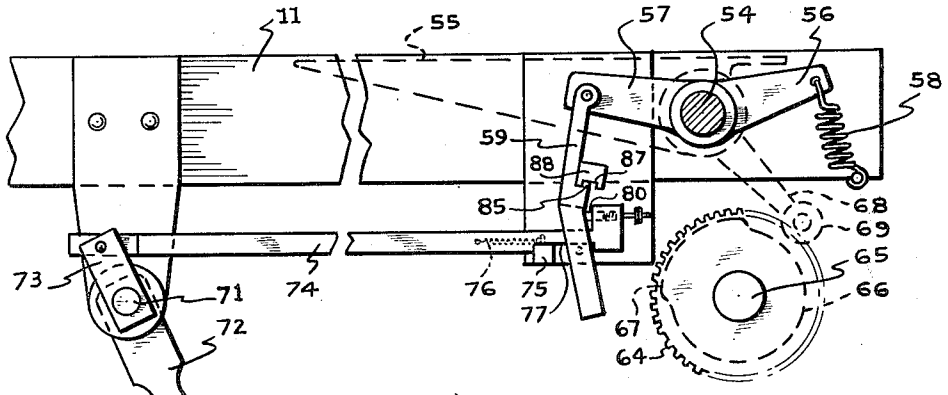


Fig. 6

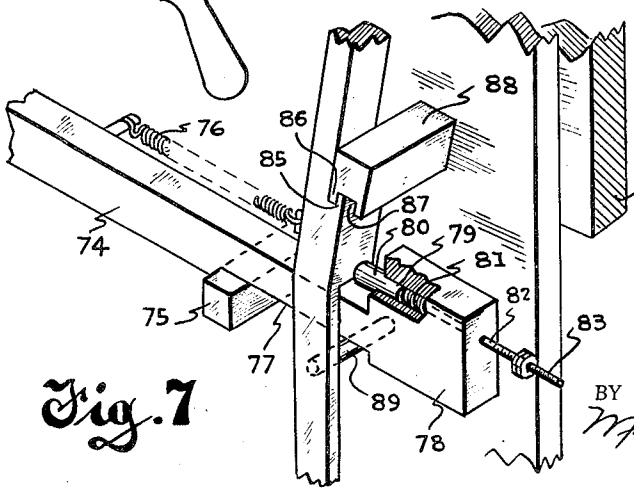


Fig. 7

INVENTOR.
Bernard S. Elliott
BY
Mosell Liebes & Mosell
ATTORNEYS.

Sept. 8, 1936. B. S. ELLIOTT 2,053,328

SORTING MACHINE

Filed Dec. 16, 1933 5 Sheets-Sheet 5

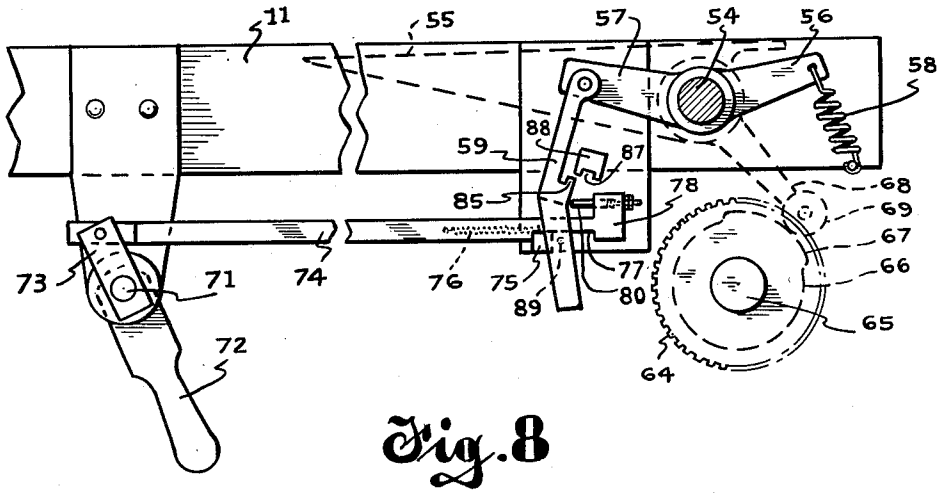


Fig. 8

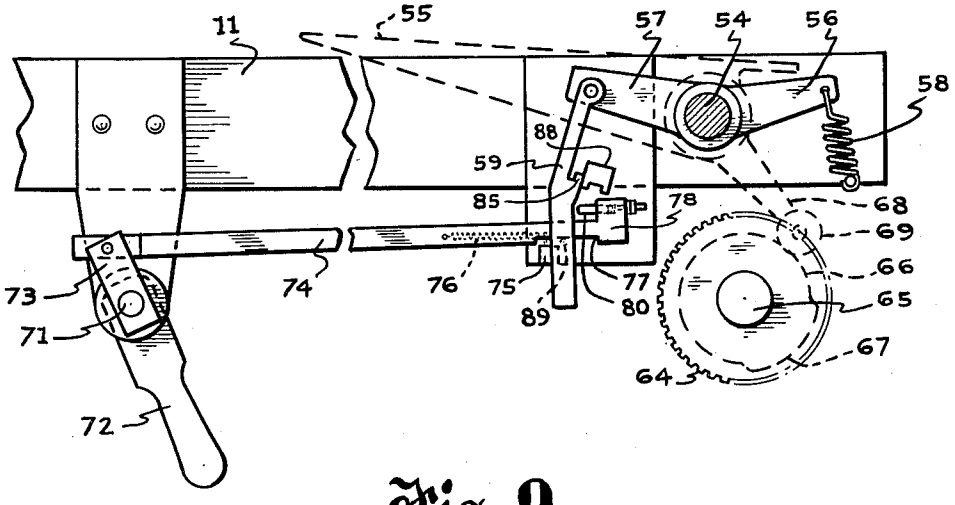


Fig. 9

INVENTOR.

Bernard S. Elliott

BY

Mosell, Lieber & Mosell

ATTORNEYS.

Patented Sept. 8, 1936 2,053,328

UNITED STATES PATENT OFFICE

2,053,328

SORTING MACHINE

Bernard S. Elliott, Milwaukee, Wis., assignor to Automatic Unit Corporation, a corporation of Wisconsin

Application December 16, 1933, Serial No. 702,709

10 Claims. (Cl. 214—11)

This invention relates to improvements in sorting machines.

In the manufacture of paper there are certain imperfections which occur on a relatively large percentage of the finished sheets, rendering the same unsuitable for many uses. This makes it necessary to sort the sheets into so-called "firsts" and "seconds". Heretofore, no suitable method has been devised for carrying out this work by mechanical means or even partially by mechanical means, with the result that sorting has been done manually; and it has been common practice to employ girls to "fan" the sheets one by one and manually separate the imperfect ones. Obviously, therefore, there is a demand for a device which will expedite this otherwise tedious and time-consuming work and at the same time accomplish the sorting in an efficient manner without injury to the sheets.

It is, therefore, one of the objects of the present invention to provide an efficient sorting machine capable of operation at high speed under the supervision of a single, inexperienced worker.

A further object of the invention is to provide a device of the class described which is capable of handling sheets of any desired weight.

A further object of the invention is to provide a sorting machine over which sheets are successively conveyed at high speed, having a scanning area with deflecting means at the end of said scanning area, said deflecting means being operable under the control of a worker seated near the scanning area to deflect desired sheets while permitting others to continue in their normal course of travel.

A further object of the invention is to provide in a device as above described, a conveyor for sheets of material, deflecting means, manually controlled mechanism operable at any time for initiating the operation of said deflecting means, and inter-related driving mechanism between said deflecting means and said conveyor operable to provide for operation of said deflecting means only at a particular time in the travel of each approaching sheet to be deflected regardless of when the initiating mechanism is set in operation during the passage of the sheet over the scanning area.

A further object of the invention is to provide a machine of the class described which is capable of use not only in sorting paper but in sorting any other material capable of being conveyed in successive formation and to provide a machine which is not only suitable for use in the deflecting of defective material but also in other types of separation such as the separation of "smut" sheets from a stack of printed matter.

With the above and other objects in view, the invention consists of the improved sorting machine and all its parts and combinations as set forth in the claims and all equivalents thereof.

In the accompanying drawings illustrating one complete embodiment of the preferred form of the invention in which the same reference numerals designate the same parts in all of the views:

Fig. 1 is a side elevational view of the sorting machine, parts being broken away, and standard parts not bearing upon the present invention being shown in dotted lines;

Fig. 2 is a plan view thereof;

Fig. 3 is a fragmentary perspective view showing the deflecting mechanism, parts being broken away;

Figs. 4, 5, 6, 8, and 9 are similar detail views showing a part of the deflecting mechanism in side elevation, other cooperating parts being shown by broken lines, and each view indicating a different position of the cooperating parts; and

Fig. 7 is a fragmentary perspective view showing the locking mechanism in a position corresponding to the position of Fig. 6.

Referring more particularly to the drawings, it will be seen that the numeral 10 designates a conveyor frame including parallel, spaced-apart side members 11 supported on legs or the like 12. Mounted adjacent one end of the conveyor frame is a standard type of feeding device 13 which may be of any construction capable of feeding sheets from a stack onto a table 14.

An electric motor or other prime mover 15, which is shown as mounted on a platform 16 below the frame but which may be mounted in any desired location, is connected by an endless driving belt 17 with a pulley 18 mounted rigidly on a shaft 19. Also mounted rigidly on said shaft 19 is a gear 20. The shaft 19 may be suitably journalled in bearings 21. The gear 20 meshes with a smaller gear 22 to drive the latter, the gear 22 being suitably mounted on a shaft 23 journalled in bearings 24. Motion may be suitably transmitted from the shaft 23 thru a driving belt or the like 25 and pulley 26 to a shaft 27, and the latter has the inner ends of arms 28 suitably driven thereby. Extension arms 29 have one end pivoted to the ends of the arms 28 as at 30 and have their other ends pivotally connected to a trolley device 31 which is movable on rollers 31'. The trolley carries a plurality of suction cups 32 which are suitably connected thru tubing

33 to a source of suction. Inasmuch as this part of the construction is not novel, the details will not be described. However, the driving connection to the arms 28 is such as to cause reciprocation of the trolley or carriage 30 so that the suction cups may act to move sheets from the platform 14 toward the conveying mechanism.

The shaft 19 is connected thru suitable bevel gearing with a vertical shaft 34 to drive the latter, and the shaft 34 has its upper end provided with a rigidly mounted bevel gear 35 engageable with a bevel gear 36 mounted on a shaft 37, which is journalled in bearings 38. The bearings 38 are carried by one of the side bars 11 of the conveyor frame. The shaft 37 also carries a rigidly mounted bevel gear 39 which is engageable with a bevel gear 40 to drive a shaft 41 extending transversely of the conveyor frame. The shaft 41 carries a plurality of rigidly mounted pulleys 42 and a suction wheel device 43, the said suction wheel device being of standard construction and capable of aiding the suction cups 32 in feeding sheets of material onto endless conveyor belts 44 which are driven by the pulleys 42.

The conveyor belts 44 extend over rollers 45 mounted on a shaft 46 and then downwardly at an angle, as at 47, and around rollers 48 mounted on a shaft 49.

Another shaft 50, journalled transversely of the conveyor frame and spaced somewhat from the shaft 46, carries pulleys 51 around which a second group of conveyor belts 52 operate, the upper portions of the conveyor belts 52 being in alinement with the upper portions of the conveyor belts 44.

The rollers 45 on the shaft 46 may be driven by means of an endless belt connection 53 with the shaft 41.

A shaft 54 journalled transversely of the conveyor frame between the shafts 46 and 50 rigidly carries a plurality of deflecting arms or levers 55, the said arms having their upper surfaces normally in alinement with the upper portions of the conveyor belts 44 and 52 but being movable on rocking of the shaft to the dotted line deflecting position shown in Fig. 1. Near one end of the shaft 54 is rigidly mounted a pair of oppositely extending arms 56 and 57, the arm 56 being connected by a coil spring or other yielding device 58 with the adjacent side member 11 of the conveyor frame and the arm 57 having a latch member 59 pivotally suspended therefrom (see Fig. 3).

The shaft 37 is further formed with a bevel gear 60 meshing with another bevel gear 61 mounted on a short shaft 62. The shaft 62 is also provided with a gear 63 which meshes with a gear 64 loosely mounted on a shaft 65. A cam roller 66, also loosely mounted on the shaft 65, is secured to one side of the gear 64 and is driven thereby, said cam roller being provided with a raised area 67 along its periphery. An arm 68 rigidly connected to the shaft 54 has a cam follower 69 in connection with its free end, said follower being adapted to ride along the periphery of the cam roller 66.

Belt tighteners 70 may be suitably mounted on the shaft 65 and are adapted to engage the lower portions of the conveyor belts 44.

A short shaft 71 extending thru one of the side bars 11 of the frame has a handle 72 rigidly mounted on one end thereof and a forked member 73 rigidly carried by the other end. A bar 74 has one end pivotally connected to the forked member 73 and has its other end slidable over a guiding projection 75, there being a spring 76 connected between said projection and said bar 74 to cause automatic return of the bar to normal position. Near its outer end the bar 74 has its lower surface recessed as at 77, and said recessed portion is adapted to engage over the guiding extension 75.

A block 78 carried by the extreme outer end of the bar 74 and projecting upwardly is formed with a bore 79 (see Fig. 7) within which a plunger 80 is slidable against the tension of a coil spring 81 surrounding a rod 82 which projects rearwardly from the plunger and which extends thru the end of the block 78, and said rod has its outer end threaded as at 83 to receive nuts 84 and said nuts may be manipulated to adjust the limit of movement of the plunger.

The latch 59 which depends from the arm 57 is formed intermediately of its length with an upwardly extending lug 85 spaced from the side of the latch member by a recess 86, and said lug 85 is engageable with a recess 87 formed in the lower surface of a latch block 88, said block being suitably mounted on the side of the frame in the manner shown in Fig. 7.

In operation of the device sheets of material are first fed by the standard feeding device 13 onto the table 14 where they are then advanced by the suction cups 32 and by the suction roller 43 onto the conveyor belts 44. The sheets thus advanced then travel in single file along the belts for a substantial distance until they reach the rollers 45 on the shaft 46. This distance between the table 14 and the rollers 45 is the scanning area and is of such length as to permit an operator seated alongside the conveyor to detect defective sheets as they pass over said scanning area.

The deflecting levers or arms 55 normally remain in non-deflecting position and permit the sheets to travel thereover onto the second section of conveyor belts 52, which latter lead to a point of discharge. As the sheets are traveling, the cam roller 66 is, of course, continuously rotating, but normally the coil spring 58 cannot rock the shaft 54 to let the cam follower 69 engage the depressed portion of the periphery of the cam because of the fact that the latch 59 when it is in engagement with the block 88 locks the shaft 54 against rocking movement to any great extent. The arrangement is such, however, that when the latch is in fully engaged position, as shown in Fig. 6, the cam follower 69 is slightly lower than the raised part of the cam roller. Thus, when the high part of the cam engages the follower, as shown in Fig. 5, there is a slight rocking of the shaft 54 or enough to slightly lower the latch so that the lug 85 is out of the recess 87 in the block 88. As soon as the cam follower 69 leaves the high side of the cam, however, the latch returns to the position of Fig. 6. Thus, with each revolution of the cam roller the latch is moved from the position of Fig. 5 to the position of Fig. 6. This slight movement, however, has no effect on the deflector levers 55, so that the same remain in normal non-deflecting position. The cam roller thru its inter-related driving mechanism with the conveyor belts 44 and sheet feeding mechanism is so timed that the latch is moved from the position of Fig. 6 to the position of Fig. 5 when each advancing sheet on the conveyor belt is within approximately three inches of the deflector arms 55. This exact timing can be varied as desired, but it is important that the action take place once for each sheet.

When the operator sees a defective sheet on the scanning area, she moves the handle 72 to the

position shown in Fig. 6. If the movement of the handle happens to take place at a time when the latch is in its lowered position of Fig. 5, this movement of the lever will immediately cause the latch to be pushed toward the left to the position of Fig. 8, so that it laterally clears the block 88. However, most of the time the lever will be pulled before the latch is lowered, and in such case it will merely cause a depression of the plunger 80 against the tension of the coil spring 81, as shown in Figs. 6 and 7. The lever is left in this position, and when the cam follower reaches the high side of the cam, the latch will be lowered to disengage the lug 85 from the recess 87 and the tension of the coil spring 81 will then serve to eject the plunger and cause the latch member to be moved toward the left to the position shown in Fig. 8. Then when the cam follower leaves the high side of the cam, as shown in Fig. 9, the spring 58 will exert a pull on the arm 56, raising the latch member to the position shown in Fig. 9 and at the same time raising the deflector arms to deflecting position, shown by dotted lines in said figure. As before mentioned, this raising of the deflector arms is timed to always occur at a particular time with respect to the position of the advancing sheet. The sheets will, therefore, not pass over the deflector arms 55, but will pass therebeneath over the angularly extending portions of the belts 44 between the rollers 45 and 51, and the defective sheets will be ultimately discharged below the conveyor frame into a suitable stacking device.

During the before-mentioned lifting of the latch lever to the position shown in Fig. 9, a pin 89 carried by said latch member will engage the lower side of the bar 74 and will lift the same so that the recess 77 is out of engagement with the guiding extension 75, permitting the coil spring 76 to automatically return the bar 74 and handle 72 to normal position. As soon as the cam follower again strikes the high side of the cam, the latch member will again be lowered and will swing to a position beneath the block 88 and into engagement with the recess thereof. This action, of course, automatically lowers the deflector arms. This lowering of the deflector arms takes place almost immediately after a sheet has been deflected, so that a closely following sheet may pass safely over the deflecting arms without jamming. It will thus be seen that the operator can pull the lever 72 at any time during passage of the sheet to be deflected over the scanning area and that regardless of the time when the lever is manipulated, the deflector arms will not operate until the particular sheet is within a fixed distance therefrom. It will also be seen that the deflector arms are quickly and automatically returned to normal position after they have served to deflect a sheet and that the handle 72 is automatically returned to normal position. Thus, no expert control of the machine is required as the automatic operations are so perfectly timed as to positively insure smooth operation.

It is also apparent that the device makes it possible for the operator to cause deflection of sheets as frequently or as infrequently as she may desire. Two or more successive sheets may be deflected one after the other or only one sheet in twenty or more may be deflected, as the occasion requires.

The device may also be advantageously employed in connection with the separation of smut sheets from a stack of printed matter. These sheets are usually of light weight material and are placed between each printed sheet to prevent smearing of the printing thereon. Sometimes, however, more than one smut sheet is accidentally placed over the same printed sheet. With the present invention this makes no difference as the device can be operated to deflect the two smut sheets in a row and permit the following printed sheet to pass along over the belts 52.

Altho only one form of the invention has been shown and described, it is obvious that various changes and modifications may be made therein without departing from the spirit of the invention. It is also obvious that there are other adaptations than those mentioned above, and it is contemplated that all of such changes and adaptations are included as may come within the scope of the following claims.

What I claim is:

1. A sorting machine comprising a conveyor for moving material in successive formation, a shaft extending transversely of said conveyor, deflecting means rigidly carried by said shaft, yielding means operable to urge said deflecting means in one direction, cam and follower mechanism cooperable with said shaft and with said yielding means to provide for automatic movement of the deflecting means into and out of deflecting position at regular intervals, means normally locking said deflecting means in non-deflecting position, and a manual control for said locking means, said locking means including a suspended latch in connection with said shaft movable vertically at regular intervals in response to said cam and follower to partly disengaged position and movable laterally to fully disengaged position in response to said manual control.

2. A sorting machine comprising a conveyor for moving material in successive formation, a shaft extending transversely of said conveyor, deflecting means rigidly carried by said shaft, yielding means operable to urge said deflecting means in one direction, cam and follower mechanism cooperable with said shaft and with said yielding means to provide for automatic movement of the deflecting means into and out of deflecting position at regular intervals, means normally locking said deflecting means in non-deflecting position, a manual control for said locking means, said locking means including a suspended latch in connection with said shaft movable vertically at regular intervals in response to said cam and follower to partly disengaged position and movable laterally to fully disengaged position in response to said manual control, and means in connection with said manual control for automatically moving the latch to fully disengaged position subsequent to operation of the manual control if the latter has been operated prior to said first-mentioned cam controlled movement of the latch.

3. A sorting machine comprising a conveyor for moving material in successive formation, a shaft extending transversely of said conveyor, deflecting means rigidly carried by said shaft, yielding means operable to urge said deflecting means in one direction, cam and follower mechanism cooperable with said shaft and with said yielding means to provide for automatic movement of the deflecting means into and out of deflecting position at regular intervals, a common drive for said cam and said conveyor, means normally locking said deflecting means in non-deflecting position, a manual control for said locking means, said locking means including a

suspended latch in connection with said shaft movable vertically at regular intervals in response to said cam and follower to partly disengaged position and movable laterally to fully disengaged position in response to said manual control, and means in connection with said manual control for automatically moving the latch to fully disengaged position subsequent to operation of the manual control if the latter has been operated prior to said first-mentioned cam controlled movement of the latch.

4. A sorting machine comprising a frame, a first section of conveying mechanism extending along said frame embodying endless means having an end extending angularly out of the general direction of travel of the conveying mechanism, a second section of conveying mechanism forming a continuation of the main portion of said first conveying mechanism in substantially the same horizontal plane therewith but spaced therefrom, deflecting means adjacent the end of said first section of conveying mechanism normally positioned in said horizontal plane to bridge the space between the end of the main portion of the first conveyor section and the beginning of the second conveyor section and permit material to continue along said second section, and means for operating said deflecting means to shunt material onto the angular extending portion of the first conveying mechanism.

5. A sorting machine comprising a frame, a first section of conveying mechanism extending along said frame embodying endless means having an end extending angularly out of the general direction of travel of the conveying mechanism, a second section of conveying mechanism forming a continuation of the main portion of said first conveying mechanism in substantially the same horizontal plane therewith but spaced therefrom, deflecting means adjacent the end of said first section of conveying mechanism comprising pivotally mounted levers normally positioned in substantially the same horizontal plane as the main portion of said first section of conveying mechanism to bridge the space between the main portion of the first conveying mechanism and the beginning of the second section of conveying mechanism and to permit material to continue along said second section, and means for operating said deflecting means to shunt material onto the angular extending portion of the first conveying mechanism.

6. A sorting machine, comprising, a conveyor for moving material in successive formation, a scanning area on said conveyor permitting observation of the advancing material, deflecting means at the end of said scanning area, means operable to cause automatic movement of said deflecting means into and out of deflecting position at a fixed time with respect to the passage of each sheet of material, control means normally preventing said automatic means from functioning, a manual operator for said control means operable at any time during the passage of the material over the scanning area, means for automatically holding said manual operator in operative position after it has been moved and until said control means has functioned to permit deflection of a sheet, and means for automatically releasing and returning said manual operator to inoperative position after a sheet has been deflected.

7. A sorting machine comprising a conveyor for moving material in successive formation, a shaft extending transversely of said conveyor, deflecting means carried rigidly by said shaft, yielding means operable to urge said deflecting means in one direction, cam and follower mechanism cooperable with said shaft and with said yielding means to provide for automatic movement of the deflecting means into and out of deflecting position at regular intervals, a common drive for said cam and said conveyor, a fixed latch, a movable latch connected to said cam mechanism normally locking the deflecting means in non-deflecting position and automatically moved by the cam mechanism at regular intervals into and out of engagement with said fixed latch, a manual control, and means between said manual control and said movable latch for causing movement of the latter to a position to permit operation of the deflecting means whenever the movable latch is out of engagement with the fixed latch and when said manual control has been operated.

8. A sorting machine comprising a conveyor for moving material in successive formation, a shaft extending transversely of said conveyor, deflecting means carried rigidly by said shaft, yielding means operable to urge said deflecting means in one direction, cam and follower mechanism cooperable with said shaft and with said yielding means to provide for automatic movement of the deflecting means into and out of deflecting position at regular intervals, a common drive for said cam and said conveyor, a fixed latch, a pivotally suspended latch normally locking the deflecting means in non-deflecting position and connected with said cam mechanism to be automatically moved vertically by the latter at regular intervals into and out of engagement with said fixed latch, a manual control, and means between said manual control and said pivotally suspended latch operable when said pivotally suspended latch is free of the fixed latch to cause lateral movement of the pivotally suspended latch to a position clear of the fixed latch and thereby permit operation of the deflecting means either simultaneously with or after said manual control has been operated depending upon whether or not the pivotally suspended latch is in engagement with the fixed latch at the time of movement of the manual control.

9. A sorting machine comprising a conveyor for moving material in successive formation, a shaft extending transversely of said conveyor, deflecting means carried rigidly by said shaft, yielding means operable to urge said deflecting means in one direction, cam and follower mechanism cooperable with said shaft and with said yielding means to provide for automatic movement of the deflecting means into and out of deflecting position at regular intervals, a common drive for said cam and said conveyor, a fixed latch, a pivotally suspended latch normally locking the deflecting means in non-deflecting position and connected with said cam mechanism to be automatically moved vertically by the latter at regular intervals into and out of engagement with said fixed latch, a manual control, and means including a yielding plunger between said manual control and said pivotally suspended latch operable when said pivotally suspended latch is free of the fixed latch to cause lateral movement of the pivotally suspended latch to a position clear of the fixed latch and thereby permit operation of the deflecting means either simultaneously with or after said manual control has been operated depending upon whether or not the pivotally suspended latch is in engagement with the fixed latch at the time of movement of the manual control.

10. A sorting machine comprising a conveyor for moving material in successive formation, a scanning area on said conveyor permitting observation of the advancing material, deflecting means at the end of said scanning area, timed mechanism operable to cause automatic movement of said deflecting means into and out of deflecting position at a fixed time with respect to the passage of each sheet, a manual control movable to set said timed mechanism in condition for deflecting operation, means for automatically holding said manual control in set position after it has been moved and until the timed mechanism has caused deflection of a sheet, and means for automatically releasing and returning said manual control to inoperative position after a sheet has been deflected.

BERNARD S. ELLIOTT.