June 30, 1931. P. F. DENNER ET AL 1,812,201

PAPER SORTING MACHINE

Filed Aug. 30, 1928 3 Sheets-Sheet 1

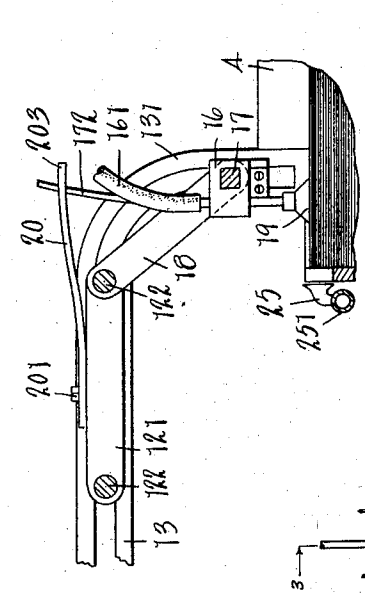
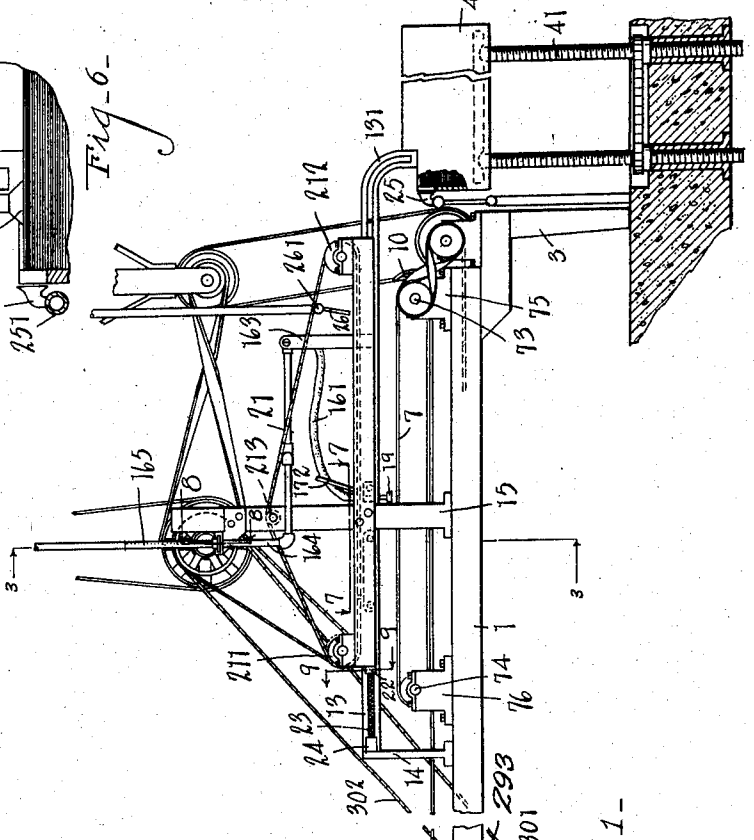


Fig. 6.



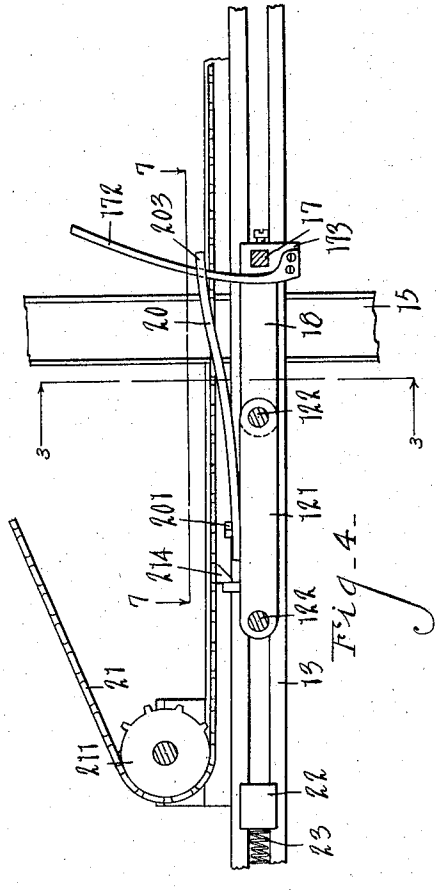


Fig. 4.

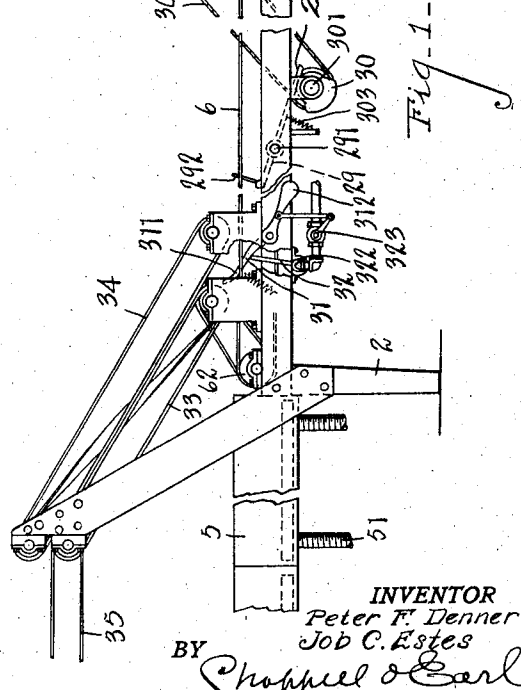


Fig. 1.

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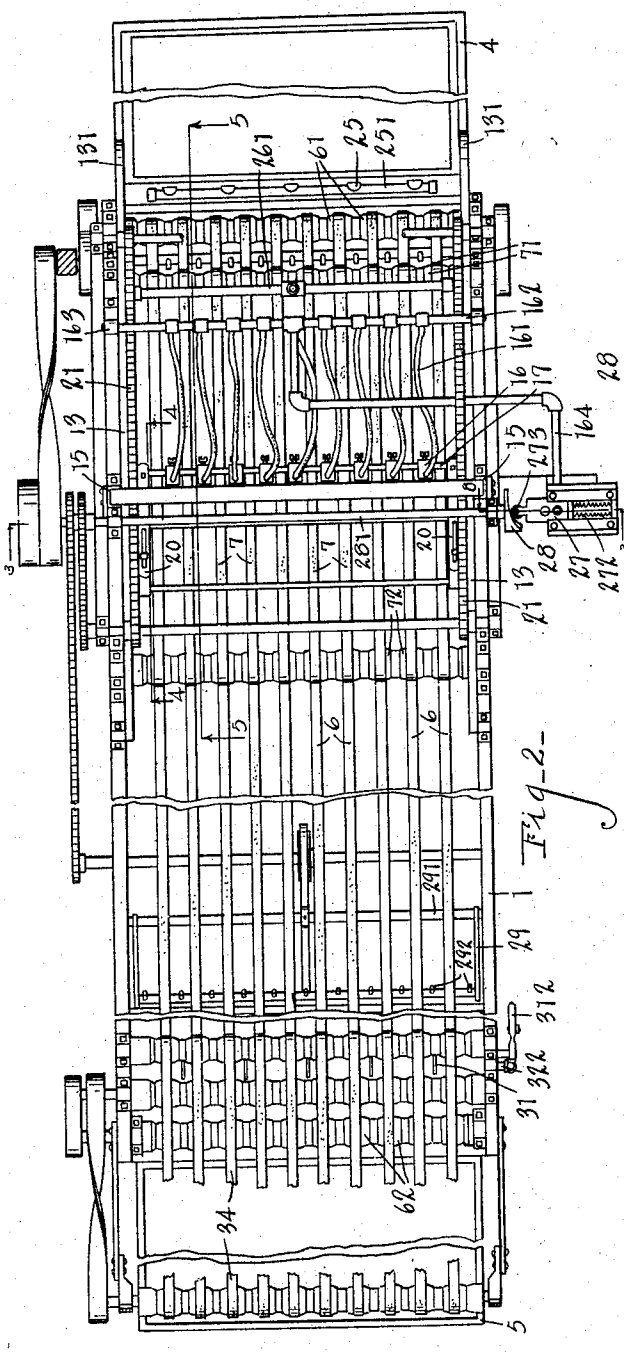

Fig-2-

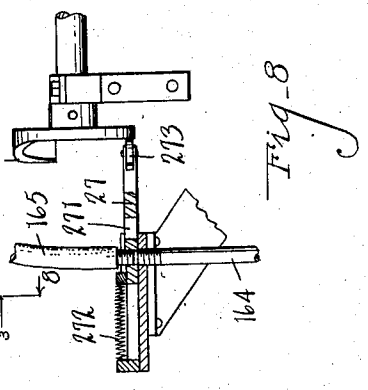

Fig-8

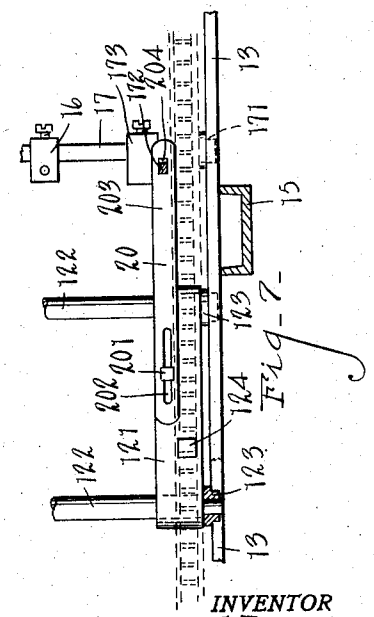

Fig-7-

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PAPER SORTING MACHINE

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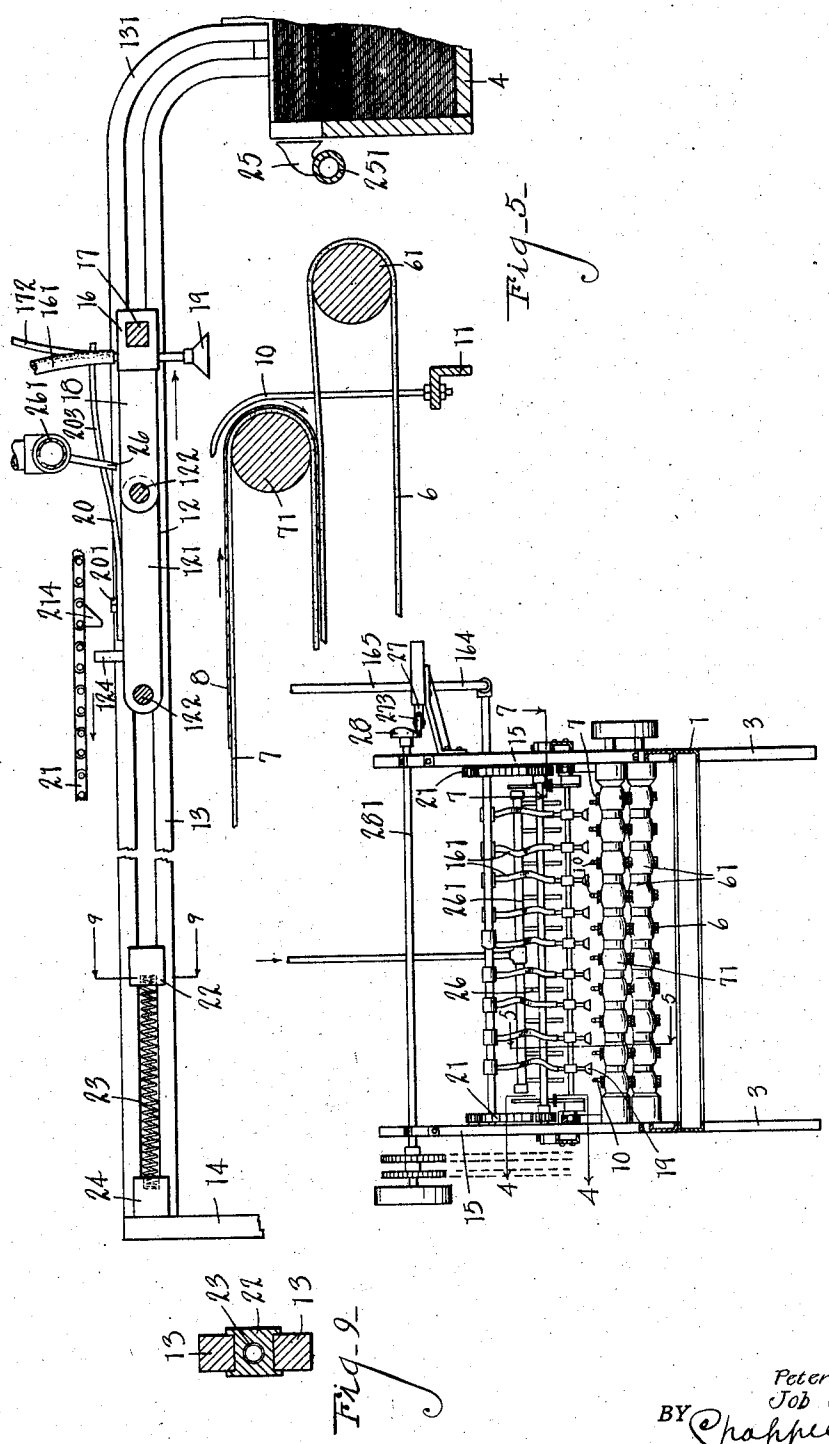

Fig. 3.

Fig. 5.

Fig. 9.

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Patented June 30, 1931 1,812,201

UNITED STATES PATENT OFFICE

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PAPER SORTING MACHINE

Application filed August 30, 1928. Serial No. 302,974.

This invention relates to improvements in paper sorting machines.

The objects of the invention are:

First, to provide a complete paper sorting machine which permits inspection of the sheet on both sides and a ready sorting of the same.

Second, to provide an improved paper sheet feed for such a machine.

Third, to provide improved reversing mechanism for turning the sheets bottom side up.

Fourth, to provide improved sheet rejecting and discard means.

Objects pertaining to details and economies will appear from the detailed description to follow. We have illustrated a preferred embodiment of the machine in the accompanying drawings, in which:

Fig. 1 is a side elevation view from the left hand side of a machine embodying the features of our invention, broken into sections, the suction and air supply and power means being only indicated by the presence of belts and the connecting pipes.

Fig. 2 is a plan view of the same also broken into sections, similar to the elevation view.

Fig. 3 is a detail transverse sectional elevation taken on line 3—3 of Figs. 1, 2 and 4.

Fig. 4 is an enlarged detail sectional elevation on line 4—4 of Figs. 2 and 3.

Fig. 5 is an enlarged detail sectional elevation, parts being broken away, taken on line 5—5 of Figs. 2 and 3, showing details of the carriage, of the pneumatic pick-up devices, and carrying means, the pneumatic pick-up being in an intermediate position and the return chain and wing link being a little separated to more clearly show the details. The reverse turning conveyor and the pneumatic auxiliary device therefor are also shown.

Fig. 6 is an enlarged detail sectional view similar to Fig. 5 with the pneumatic pick-up devices at the point of picking up a sheet, the guide means therefor being shown in that position.

Fig. 7 is an enlarged detail sectional plan taken on the plane of line 7—7 of Figs. 1, 3 and 4, carriage return chain being indicated by dotted lines, and the relation and details of the pick-up control means being shown.

Fig. 8 is an enlarged detail sectional elevation view on line 8—8 of Figs. 1 and 2 showing the control cam and valve means for controlling the suction to the pneumatic sheet pick-up means.

Fig. 9 is an enlarged detail sectional view on line 9—9 of Figs. 1 and 5 showing the spring plunger slide for returning the paper feed carriage to its initial position.

The parts will be identified by their numerals of reference which are the same in all the views.

1 is the frame of the machine, rectangular in form and carried by legs 2 and 3 at each end respectively. 4 is the sheet supporting table with screws 41 or other means for maintaining the same at proper height for the delivery of the sheets to be sorted. 5 is a similar table adjustable by screws 51 or other means for receiving the sheets that have passed inspection.

6 is the endless main carrier extending from end to end of the frame 1 and consisting of a number of parallel belts on carrier rolls 61 and 62 supported at opposite ends of the machine. 7 is an auxiliary reverse endless carrier comprising parallel belts supported on rolls 71, 72 which are provided with journals 73, 74 carried in journal bearing boxes 75, 76 supported on the side rails of the frame 1, in position so that the under run of the conveyor 7 is in close proximity to cooperate with the upper run of the conveyor 6 as seen particularly in Fig. 5.

8 is a sheet of paper being reversed and delivered from the auxiliary carrier 7 to the main carrier 6, see Fig. 5. Guide fingers 10 are carried on cross bar 11 and extend upwardly between the endless conveyor rolls of the main carrier 6 in close proximity to the delivery end of the conveyor 7, and insure the delivery of the sheets from the conveyor 7 to conveyor 6, as seen in Fig. 5.

Feed carriage 12 is provided for delivering the paper from the pile to be inspected to the machine. This carriage comprises end 121 connected by cross bars 122 which constitute

the axles for the carriage. Flanged wheels 123 are journalled on the ends of the axle.

13 is the track for the feed carriage made up of a pair of parallel bars which constitute a positive slotted guide for the said carriage at each side of the machine. These bars 13 are extended forwardly and curved down at 131, to guide the sheet pick-up means, (see Figs. 1, 5 and 6) hereafter to be described, and are supported by suitable standards 14 and 15 which join to the sides of the frame 1, 15 being a post which supports other devices as well.

The pneumatic pick-up heads 16 are supported adjustably upon the square rockshaft 17 (see Figs. 4, 5, 6 and 7). This rockshaft is carried by a pair of forwardly extending links 18 from the carriage 12 and is supported upon guiding carrying wheels or rolls 171 which travel on the track and between the guides 131, 131 already referred to. 19 are the suction tips carried by the suction heads and are required to point directly down in order to properly handle the sheets. They are maintained in parallel position by controlling the rockshaft 17. Fingers 172 are connected to blocks 173 on the rockshaft 17 for controlling the same, see particularly Figs. 4, 5, 6 and 7.

20 is an adjustable guide bar secured by screw 201 in slot 202 to the carriage end 121. Bar 20 is bent upwardly at 203 (see Figs. 4, 5 and 6) and is slotted at 204 and embraces and engages the upwardly projecting finger 172 for controlling the rockshaft 17 to maintain the suction tips pointing downward. The action will be very readily understood from a consideration of Figs. 4 and 5 in connection with Fig. 6 where it will be noted that although the rockshaft has dropped down to the engaging or pick-up position the suction tips are still in vertical relation.

Each suction head 16 is connected by flexible rubber pipe 161 to suction header 162 supported on posts 163 at each side of the frame considerably above the level of the feed carriage to permit free movement thereof. The suction is controlled by means hereafter to be described.

The feed carriage is actuated in the feeding direction by a pair of endless conveyor chains 21 carried on sprocket wheels 211, 212 and guide 213, the under run of which chain 21 travels parallel with the straight portion of the track 13 at a safe distance above the carriage. The same is provided at suitable intervals with wing links 214 (see Figs. 4 and 5).

The carriage ends 121 are provided with upwardly projecting lugs 124 in position to be engaged by the wing link 214. The engagement of these parts is shown in Fig. 4. The action of the endless chain carries the carriage to the left of Fig. 4 until the lug 214 is swung out of engagement with the lug 124. This carries the feed carriage to the left to the limit of its travel and when it is released the carriage is permitted to return. The track 13 is slightly inclined so that the action might be by gravity. The return is also insured by spring action.

A slide 22 is disposed between the guide rails 13, 13 and is backed up by compression spring 23 which abuts against block 24 (see Fig. 5) so that as soon as the wing link 214 has passed out of engagement with the lug 124, spring 23 shoots the carriage back to its initial position at a very high rate of speed, passing the feed carriage back to the initial position and delivering the suction tips down sharply against the top sheet of paper, when the suction picks it up and the feed operation is repeated, carrying the sheet forward onto the top run of conveyor 7, the suction being controlled to release the paper when it is advanced to the maximum position.

The paper on the feed table is kept agitated by what may be called the riffle nozzles 25 carried on the header 251 in position to blow against the front edge of the pile of sheets that is being inspected and sorted, the header being provided with air under pressure from any suitable source, suitably controlled to deliver the right amount to do the work intended. The delivery of the jets is constant.

It will be observed that as soon as the sheet is picked up a volume of air is delivered under it so that it cannot adhere to the sheet beneath and it will be very readily picked up at a high rate of speed without danger of tearing or of disturbing the next sheet.

Air nozzles 26 connected to header 261 deliver jets of air downwardly against the sheet as it is being fed in tending to force the sheet down into engagement with the top run of the conveyor 7, so that the sheet will be certainly delivered under the guide fingers 10 and thence between the under run of conveyor 7 and the top run of conveyor 6, consequently air pressure is also provided at the header 261 from the compressed air source, which, of course, may be a pump or a pressure tank or other supply as required, not necessary here to be illustrated.

Suction header 162 is connected by pipe 164 to the control valve means which controls the action of the suction pipe 165, (see Fig. 8) the suction pipe 165 being a flexible pipe connected to a vacuum pump or other vacuum producing means. The control is a slide valve 27 which carries the flexible end of pipe 165 at one end in position to connect to the pipe 164. Slide 27 is perforated at 271 to slide over the end of supply pipe 163 and open the same to the atmosphere, thereby breaking the suction. The slide valve 27 is pushed normally outward by a pair of compression springs 272. The slide valve 27 carries a cam follower roller 273. A face cam 28 is carried

on a cam shaft 281 which is an extension of the driven shaft to the machine.

The cam is timed to open the suction gradually as the paper reaches its feed delivery position and as soon as the paper has been dropped and carried out of the control of the suction tips, the slide snaps off the abrupt end of the cam, closing the suction, which immediately builds up ready to pick up the sheet when the carriage is carried to the initial position.

It will thus be seen that as a sheet is picked up by the suction tips, the sheet is agitated by the riffler jet a volume of air is delivered under the same at once it is raised, the sheet is carried to the auxiliary feed conveyor 7, the sheet is forced down onto the conveyor by air from the jets 26, which causes the sheet to adhere closely to the conveyor 7 and the sheet is thus reversed and passed on to the main conveyor 6, being turned over bottom side up in the process. The inspector is thus able to inspect the top side of the top sheet on the table, it is then picked up by the machine and turned the other side up, and as soon as it passes out from under the auxiliary reversing conveyor 7 the opposite side of the sheet can be inspected. Thus both sides of the sheet are inspected without any manual handling.

If the sheet passes inspection, it is allowed to pass along the conveyor 6 out to the receiving table 5. The sheet is held momentarily on the conveyor to permit such inspection. If the sheet does not pass inspection, means are provided for diverting it from the conveyor and sorting it as required.

The sheet is controlled on the conveyor 6 after it has been reversed by the rocker 29 on the rockshaft 291, the same being provided with upwardly projecting fingers 292 which project up between the belts of the conveyor 6 (see Fig. 1) to engage the sheet and detain it until it has been inspected. A finger 293 projects from the rocker and is acted upon by cam 30 which is provided with dwells both on the fat and lean side to hold the paper momentarily for inspection, deflect the retaining fingers 292 and hold the same depressed sufficiently long for the sheet to pass on if the sheet has passed inspection. The sheet may be rejected.

Cam shaft 301 is driven by chain 302 by suitable connection to the driving means timed to secure this result. Spring 303 is provided to hold the rocker finger in engagement with the said cam.

The sheet is deflected and discharged by the operation of a manual lever, by the operation of a rocker 31 having guide fingers 311 which are deflected up through the upper run of the conveyor 6 and deflect the sheet upwardly from the said conveyor 6. These fingers are controlled manually by the lever 312. The sheet is also deflected upwardly by jets of air through nozzles 32 on header 322. The air current is controlled by cock 323 which is connected to the manual lever 312. The rejected sheet is received between a pair of endless conveyor belts 33, 34 which are disposed to receive the sheet when it is deflected upwardly.

The rejected sheet is then delivered to conveyor 35 or to any receptacle that may be provided for the same as may be desired.

From this description the operation is clear. Two persons are necessary to properly inspect the paper handled by our machine. One person inspects the top side of the top sheet on the pile from which sheets are being delivered. Another person at the side of the machine inspects the sheet while it is stopped momentarily on the upper run of conveyor 6 after the sheet has been turned over, thus both sides are inspected. This second operator has the duty of manipulating the hand lever 312 to reject the defective sheets. It is only necessary to let the perfect sheet pass through. The sheet is picked up by the pneumatic tips, delivered onto the top of the conveyor 7 where it is forced down by air from the jet 26 into engagement with the said conveyor, then passed back under the guide fingers 10, turned bottom side up on the conveyor 6, delivered beyond the conveyor 7 on conveyor 6 for inspection, being detained by the stop fingers 292 which are automatically deflected by the cam 30. After the sheet has been stopped long enough for inspection, when the fingers are depressed, the cam 30 holds them down until the sheet has passed.

If the sheet does not pass inspection, the operator presses the lever 312 which opens the air jet 32 and deflects the sheet upward over the fingers 31 into the pair of conveyors 33, 34 where the sheet is conveyed out to the discharge conveyor 35 or to a discharge receptacle as the case may be.

An examination of our improved machine will show that it can be modified in many details without departing from our invention. Some of the features could be dropped, thus dropping their corresponding advantages.

We desire to claim the invention in the specific form in which we have it illustrated and also to claim it broadly as pointed out in the appended claims.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent, is:

1. In a paper sorting machine, the combination of a main frame with endless main conveyor of parallel conveyor belts extending from end to end thereof, a paper feed table with means for maintaining it at proper level and sheet reversing means above said main conveyor, a feed carriage, suitable guides to carry the said feed carriage from the paper feed table upwardly and forwardly to a point

above the said reverse means, actuating means for said carriage, pneumatic suction heads with suction tips for engaging the top sheet of the pile of paper being inspected, a header with suction connection for said suction heads and tips, automatic control means for the suction connection comprising a slide valve with a connection to the suction hose and having a port opening to break the suction, a timed cam for actuating the said slide valve, and means for deflecting sheets from said main conveyor after inspection, as specified.

2. In a paper sorting machine, the combination of a main frame with endless main conveyor of parallel conveyor belts extending from end to end thereof, a paper feed table with means for maintaining it at proper level and feed means for said sheets and reversing means for said sheets, a rocker with detent fingers with stops disposed to project between the bands of the upper run of the main conveyor to intermittently act to stop successive sheets for inspection, a cam means for actuating the rocker to raise it to successively and intermittently detain the successive sheets for inspection and lower it to permit the said sheets to pass, deflector fingers on a rocker beyond the said stop means and inspection space adapted to deflect a rejected sheet upwardly, a hand lever to operate the same, air nozzle means with header and supply, a cut-off valve therefor connected to said hand lever to deliver jets of air under the sheet simultaneously with its deflection, a pair of auxiliary endless conveyors above said main conveyor to engage the said deflected sheet and discharge it from the machine, as specified.

3. In a paper sorting machine, the combination of a main frame with endless main conveyor of parallel conveyor belts extending from end to end thereof, a paper feed table with means for maintaining it at proper level and feed means for said sheets and reversing means for said sheets, a rocker with detent fingers with stops disposed to project between the bands of the upper run of the main conveyor to intermittently act to stop successive sheets for inspection, a cam means for actuating the rocker to raise it to successively and intermittently detain the successive sheets for inspection and lower it to permit the said sheets to pass, deflector fingers on a rocker beyond the said stop means and inspection space adapted to deflect a rejected sheet upwardly, a hand lever to operate the same, a pair of auxiliary endless conveyors above said main conveyor to engage the said deflected sheet and discharge it from the machine, as specified.

4. In a paper sorting machine, the combination of a main frame with endless main conveyor of parallel conveyor belts extending from end to end thereof, a paper feed table with means for maintaining it at proper level and feed means for said sheets and reversing means for said sheets, a rocker with detent fingers with stops disposed to project between the bands of the upper run of the main conveyor to intermittently act to stop successive sheets for inspection, a cam means for actuating the rocker to raise it to successively and intermittently detain the successive sheets for inspection and lower it to permit the said sheets to pass, deflector fingers on a rocker to deflect a rejected sheet upwardly, a hand lever to operate the same, air nozzle means with header and supply, a cut-off valve therefor connected to said hand lever to deliver jets of air under the said sheet simultaneously with its deflection, a pair of auxiliary endless conveyors above said main conveyor to engage the said deflected sheet and discharge it from the machine, as specified.

5. In a paper sorting machine, the combination of a main frame with endless main conveyor of parallel conveyor belts extending from end to end thereof, a paper feed table with means for maintaining it at proper level and feed means for said sheets and reversing means for said sheets, a rocker with detent fingers with stops disposed to project between the bands of the upper run of the main conveyor to intermittently act to stop successive sheets for inspection, a cam means for actuating the rocker to raise it to successively and intermittently detain the successive sheets for inspection and lower it to permit the said sheets to pass, deflector means, a pair of auxiliary endless conveyors above said main conveyor to engage the said deflected sheet and discharge it from the machine, as specified.

6. In a paper sorting machine, the combination of a main frame with endless main conveyor of parallel conveyor belts extending from end to end thereof, a paper feed table with means for maintaining it at proper level and feed means for said sheets and reversing means for said sheets, a rocker with detent fingers with stops disposed to project between the bands of the upper run of the main conveyor to intermittently act to stop successive sheets for inspection, a cam means for actuating the rocker to raise it to successively and intermittently detain the successive sheets for inspection and lower it to permit the said sheets to pass, and deflector means, as specified.

7. In a paper sorting machine, the combination of a main frame with endless main conveyor of parallel conveyor belts extending from end to end thereof, a paper feed table with means for maintaining it at proper level and feed means for said sheets and reversing means for said sheets, deflector fingers on a rocker to deflect a rejected sheet upwardly, a hand lever to operate the same, air nozzle means with header and supply, a cut-off valve therefor connected to said

hand lever to deliver jets of air under the sheet simultaneously with its deflection, a pair of auxiliary endless conveyors above said main conveyor to engage the said deflected sheet and discharge it from the machine, as specified.

8. In a paper sorting machine, the combination of a main endless conveyor, an auxiliary endless conveyor having flat upper run of less length disposed above and in advance of the receiving end of the main conveyor, and connected to run in the opposite direction, means for delivering the sheets to the auxiliary conveyor and finger guide means for guiding them down against the main conveyor thence between the under run of the auxiliary conveyor and the upper run of the main conveyor, for reversing the sheet for inspection on said main conveyor, as specified.

9. In a paper sorting machine, the combination of a main frame with endless main conveyor of parallel conveyor belts extending from end to end thereof, a paper feed table with means for maintaining it at proper level and feed means for said sheets, deflector fingers on a rocker to deflect a rejected sheet upwardly, a hand lever to operate the same, air nozzle means with header and supply, a cut-off valve therefor connected to said hand lever to deliver jets of air under the sheet simultaneously with its deflection, a pair of auxiliary endless conveyors above said main conveyor to engage the said deflected sheet and discharge it from the machine, as specified.

In witness whereof we have hereunto set our hands.

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JOB C. ESTES.