Oct. 25, 1949. R. NEBOLSINE 2,486,196

OVERHEAD SHEET TRANSPORTING AND DISCHARGE DEVICE

Filed April 9, 1947 3 Sheets-Sheet 1

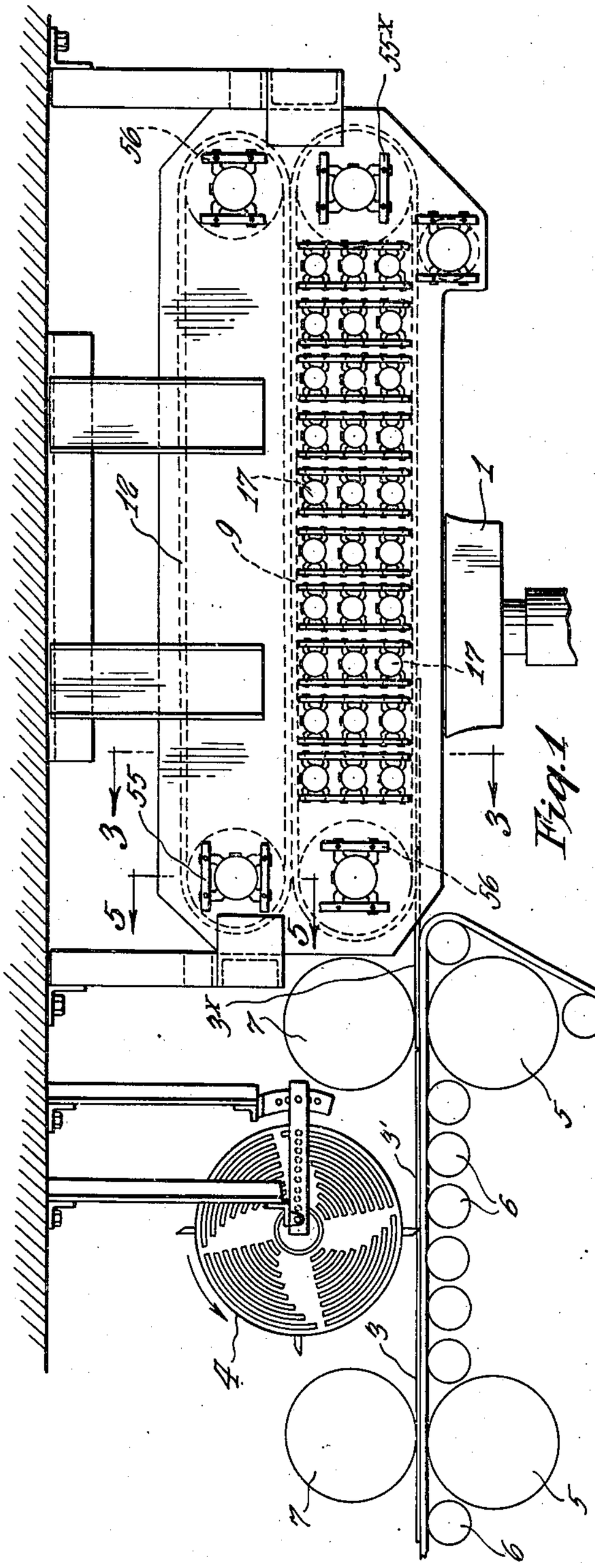

Fig. 1

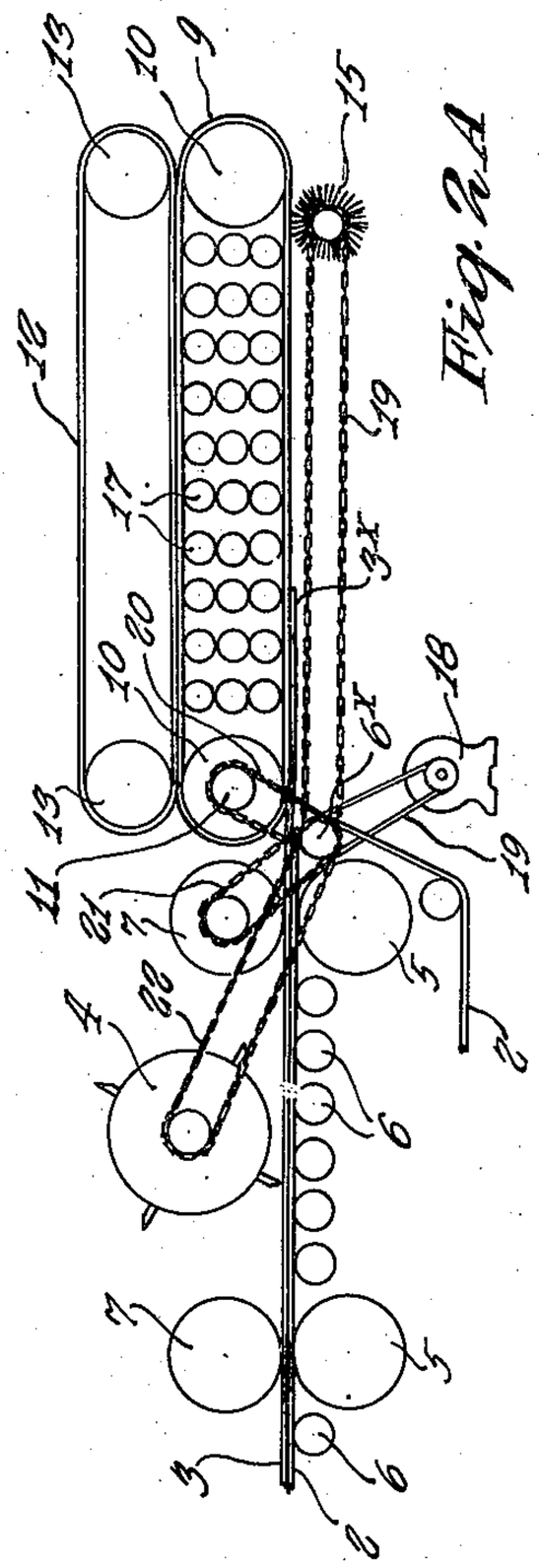

Fig. 2A

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OVERHEAD SHEET TRANSPORTING AND DISCHARGE DEVICE

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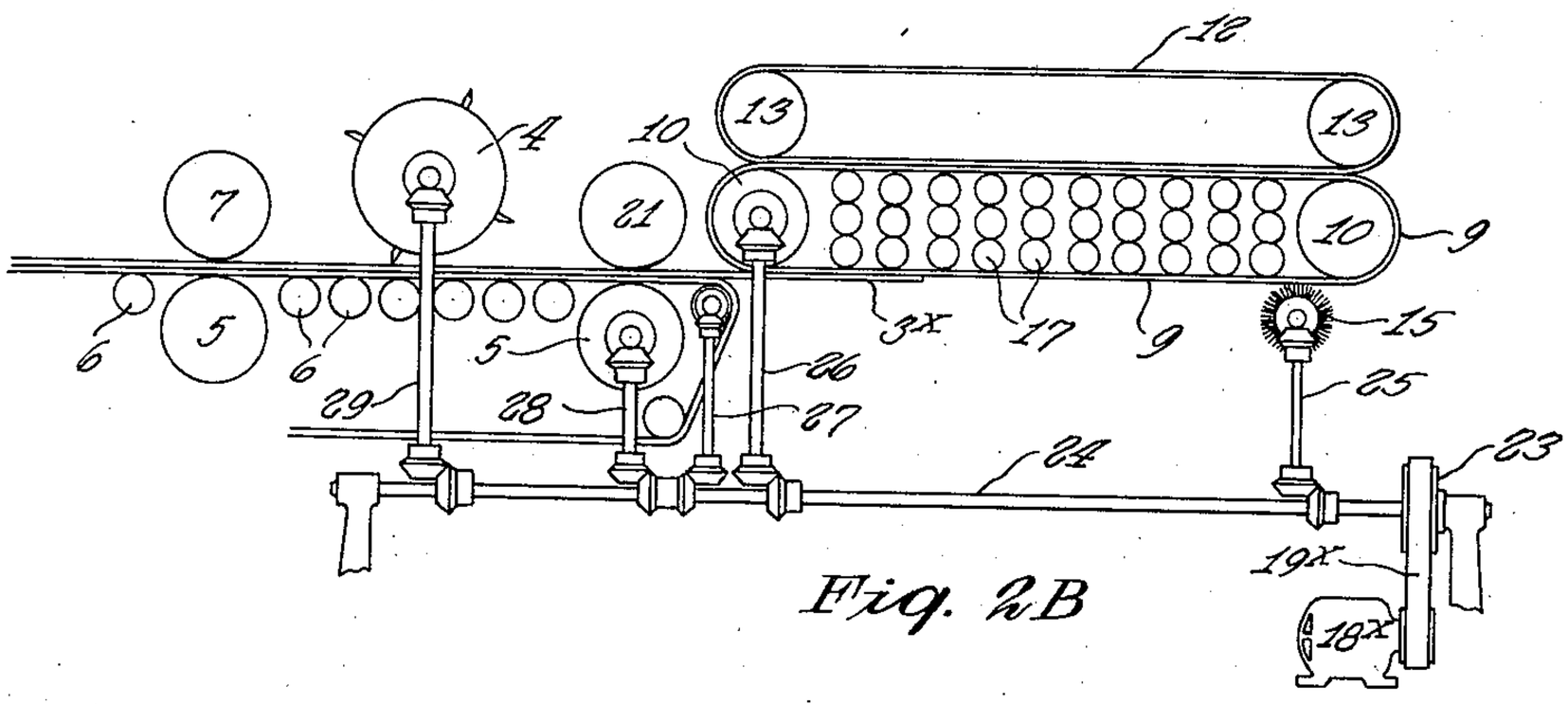

Fig. 2B

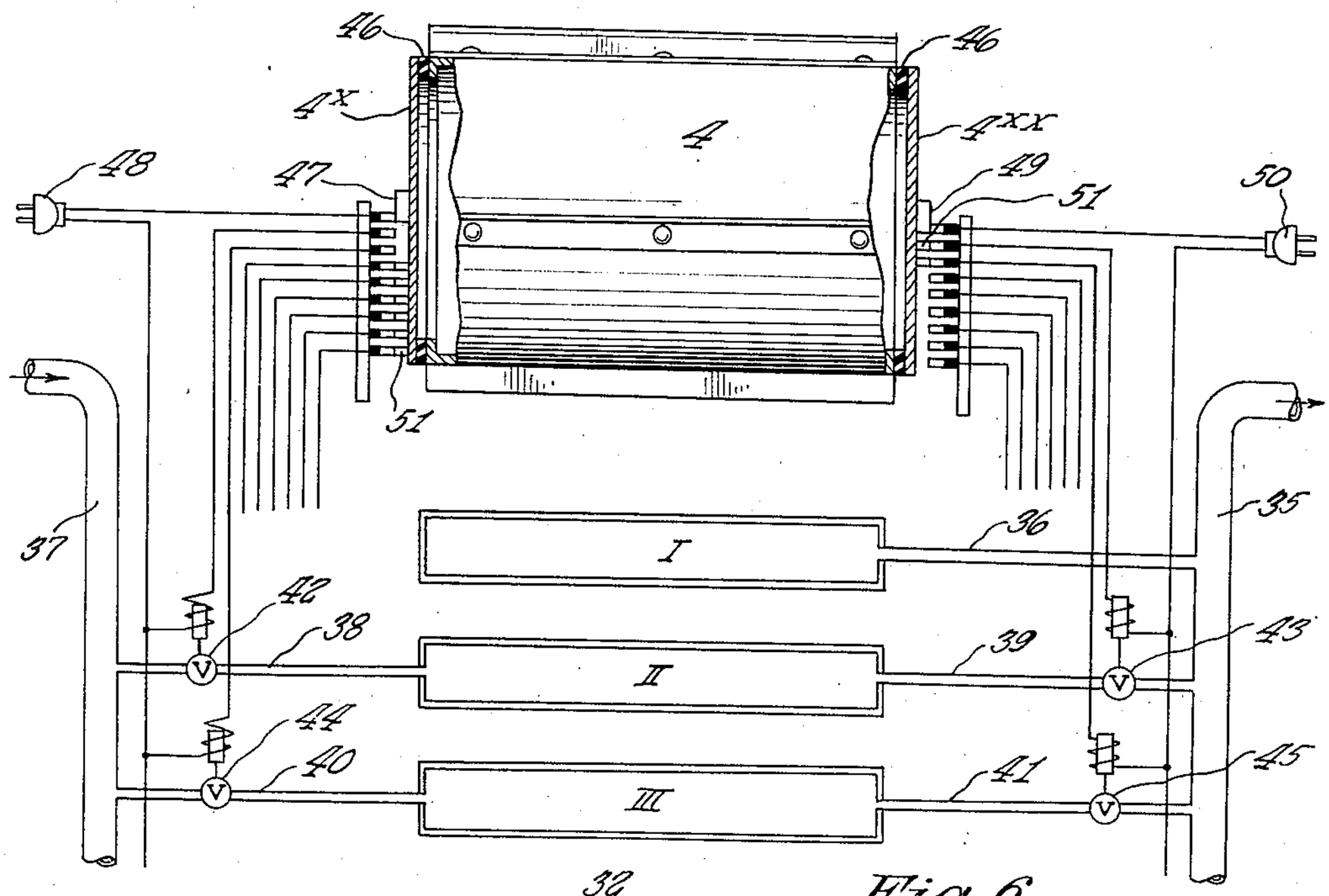

Fig. 6

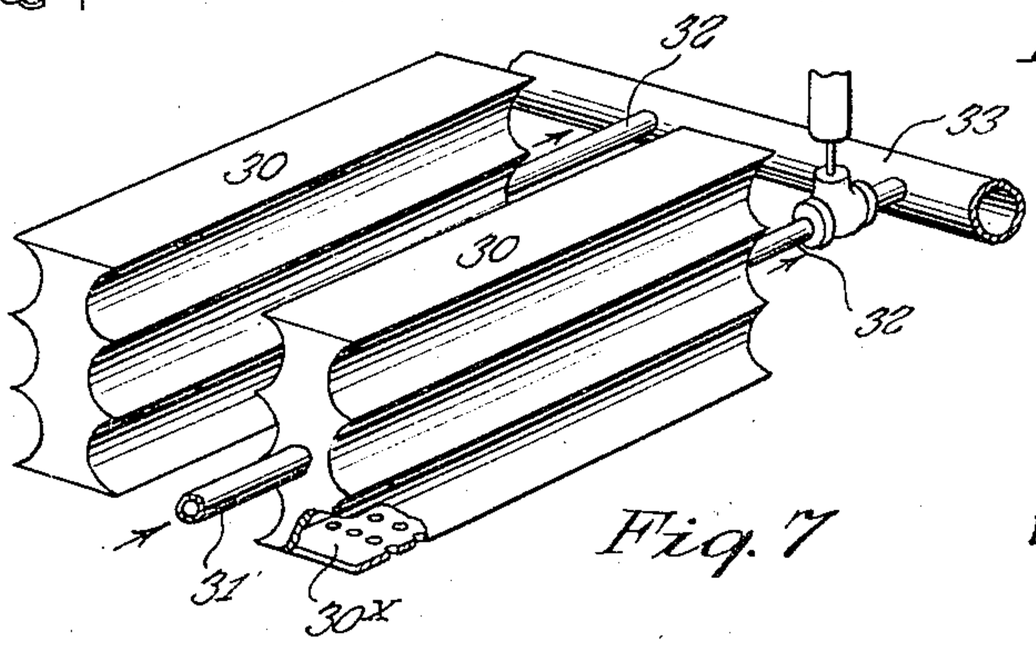

Fig. 7

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OVERHEAD SHEET TRANSPORTING AND DISCHARGE DEVICE

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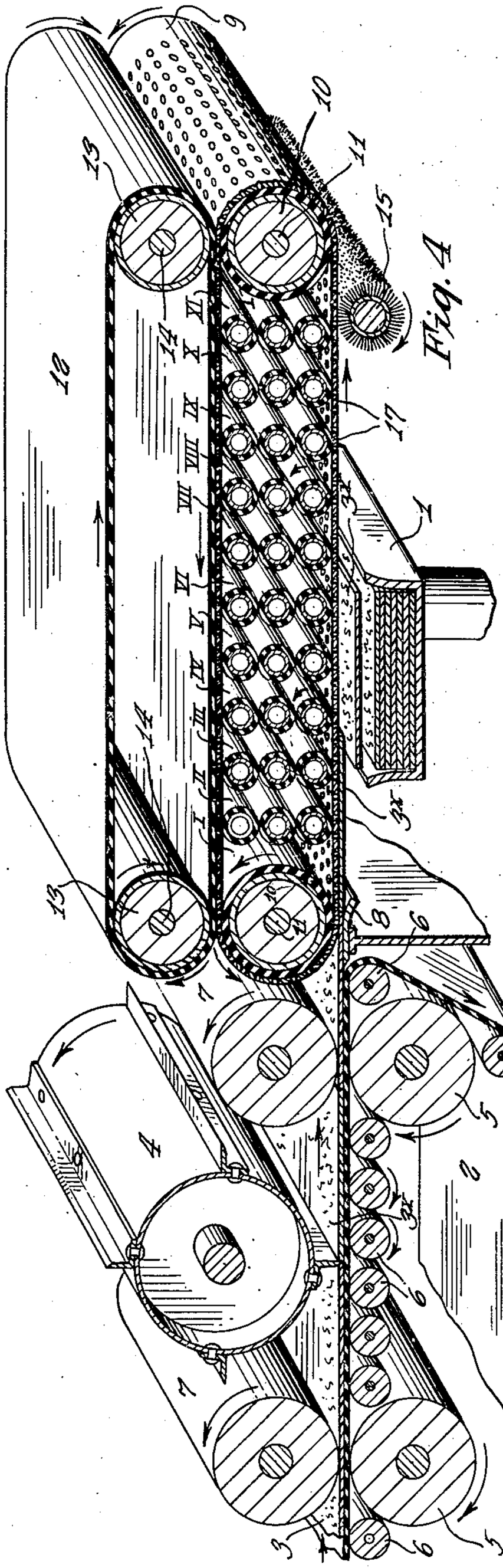

Fig. 4

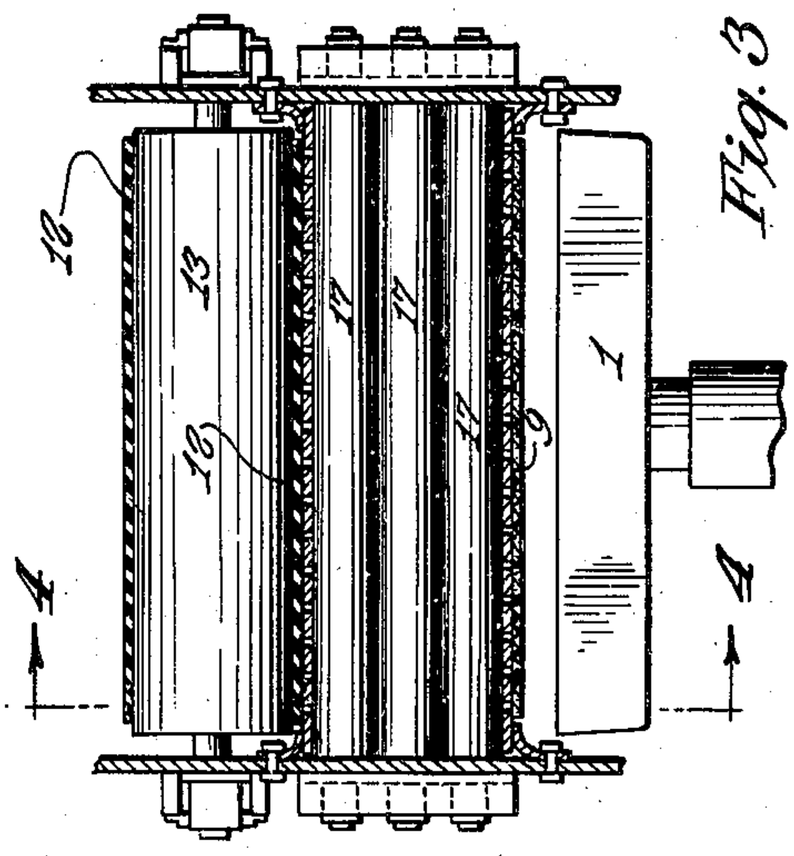

Fig. 3

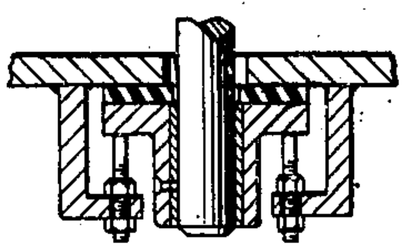

Fig. 5

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UNITED STATES PATENT OFFICE

2,486,196

OVERHEAD SHEET TRANSPORTING AND DISCHARGE DEVICE

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Application April 9, 1947, Serial No. 740,329

3 Claims. (Cl. 271—74)

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This invention relates to an overhead or overhanging belt conveyor for feeding and discharging sheets, and particularly sheets of low cohesiveness and strength. The device employs both vacuum and pressure, being adapted to feed under vacuum and to discharge under pressure, and the device is adapted to so discharge as to stack the sheets.

The device is entirely automatic. In the form illustrated in the drawings, a plurality of laterally spaced chambers are provided within a perforated or foraminous feed belt, which is sealed at its upper length by a suitable means, as for example, a continuous top idler belt. Automatic means is provided for timing the effect of alternate vacuum and pressure in a plurality of chambers to permit progressive feed action upon a sheet, by vacuum within certain of the chambers, synchronously with the movement of each sheet until the release point of each sheet is reached, the vacuum then being broken and pressure simultaneously applied within the appropriate chamber or chambers for positively discharging the sheet into a stack or to any other suitable reception point.

In the embodiment illustrated in the drawings, the chambers are laterally bounded by a plurality of continuously rotating and mutually contacting rollers, the surface of which are provided with such material as to seal passage of air or gas between them and the outermost of the rollers are in abutment with the endless foraminous belt.

In a modification, the vertical sets of rollers are separated by vacuum-pressure boxes. These various arrangements and the invention, as a whole, will be described with reference to the accompanying drawings, in which:

Fig. 1 is a view in elevation, partly broken away, illustrating an embodiment of the invention.

Fig. 2A is a schematic view in elevation to illustrate the driving connection.

Fig. 2B is a schematic view in elevation showing a modified form of drive.

Fig. 3 is a transverse sectional elevation taken on the line 3—3, Fig. 1.

Fig. 4 is an isometric view of the primary elements illustrated in Fig. 1, and in longitudinal section.

Fig. 5 is a fragmentary section on line 5—5, Fig. 1.

Fig. 6 is a plan view partly in section, and schematically showing the primary wiring elements.

Fig. 7 is an isometric view showing the vacuum-pressure box modification.

Referring to the drawings, and particularly to Figs. 1, 3 and 4, it will be seen that the embodiment therein illustrated consists of a cut-sheet receiving and stacking device 1, which may be of any suitable construction and which is only schematically illustrated, a belt feed 2 for the sheet to be fed, cut and stacked, the sheet being

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shown at 3, a rotary cutter 4, and various elements which make up the vacuum-pressure elements to effect withdrawal and stack discharge of the cut-sheet sections.

The feed belt 2 is supported by spaced lower pressure rollers 5 and a train of idler rollers 6. Above the lower pressure rollers 5 are driven top pressure rollers 7 and the rotary cutter 4 is mounted between the driven pressure rollers 7. Thus the sheet 3 as it is fed to the right in the drawing embodiments is roll-pressed and cut into sections, the latter in turn being roll-pressed.

The cut-sheet sections are pushed to a throat consisting of the transversely extending lip 8 and the lower length of a perforated endless belt 9. This belt runs over spaced rollers 10 on shafts 11, the rollers being surfaced with rubber or other yielding material. Between the upper and lower lengths of perforated endless belt 9 are provided vacuum-pressure chambers which are separated by sets of vertically arranged mutually engaging rollers, idlers being sufficient, the latter being surfaced with rubber or other yielding material so as to effect a tight seal between their surfaces and between them and the endless perforated belt 9.

Above perforated endless belt 9 is an endless top idler belt 12 which may be of rubber. The rollers 13 are mounted on shafts 14 and the lower length of belt 12 seals off the upper length of the perforated belt 9. For automatically cleaning the latter so as to insure that its perforations will be left open and not clogged by particles from the sheet sections 3^x, a continuously rotating brush 15 may be employed.

In addition to the vacuum-pressure chambers provided between the sets of idler rollers within perforated belt 9 which rollers are generally indicated at 17, the arrangement of Fig. 4 will show that vacuum-pressure chambers are provided between the end sets of rollers 17 and the rollers 10 over which perforated belt 9 is led.

In Fig. 2A I have shown a suitable drive for the elements above specified. A motor 18 is connected by belt 19 to a pulley 6^x on the forward idler rollers 6. This pulley will have a plurality of laterally spaced sprocket surfaces one for a chain 19 running to the brush 15, one shown at 20 for a sprocket on shaft 11 in order to drive the perforated endless belt 9, a third as shown at 21 for driving the rear pressure rollers 7, and a fourth, shown at 22 for driving the rotary cutter 4.

In Fig. 2B a modified form of drive is shown, chains and sprockets being substituted by shafts and gearing. The motor 18^x is connected by belt 19^x to a pulley 23 on a drive shaft 24 having a series of beveled gears connecting the drive shaft rotationally with a stub shaft and drive connections 25 for the brush 15, a second shaft and drive connections 26 for the forward roller 10, another shaft 27 and drive connections for the forward

roller-shaft 11, and like drive elements 28 and 29 for the lower and rear pressure roller 5 and the rotary cutter 4.

In the construction of Fig. 7, which is a modification, the vacuum-pressure chamber separation effected by the sets of rollers 17 is substituted by box chambers 30 consisting of closed boxes having perforated base plates 31. Each box will be provided with a pressure inlet pipe 31 and with a suction pipe 32 and the latter may lead to a vacuum manifold 33. It will be understood that feed rollers will be interposed between the vacuum-pressure boxes 30, in the sense that they need only be idlers for contact with the cut-sheet sections, and hence the major faces of the boxes have been shown channeled for clearance of the rollers. Although three clearances are shown at each face, a single clearance may be provided, or none at all. Either one roller or three may be employed between the boxes.

Reference to Fig. 4 will show that by Roman numerals I have indicated the chambers between the sets of rollers 17 and between the end sets and the rollers 10 for the perforated belt 9 as I to XI inclusive. It will also be seen that a cut-sheet 3^x has been released and is about to drop into the stacker 1, whereas an immediately preceding sheet 3^x lies under vacuum-pressure chambers I, II and III. In ordinary practice, chamber I need not have pressure turned into it. In other words, it may be under constant vacuum so as to draw each cut-sheet 3^x under the perforated belt 9. The required condition is a drawing movement of each cut-sheet 3^x so that it will move to the right in the position of Fig. 4 until it lies over the stacker, whereupon the cut-sheet is released by shutting off the vacuum and simultaneous application of pressure. Thus in the movement of the cut-sheet 3^x to its position with the front margin thereof slightly over the stacker, as shown in Fig. 4, an operative sequence of conditions within the chambers may be a maintenance of vacuum in chambers I and II followed by vacuum in chamber III. Thereupon vacuum is effected in chamber IV, and also in chamber V if desired, whereupon the cut-sheet will have been moved away from chambers I and II and pressure may be placed in chambers III, IV and V to discharge the sheet into the stacker. I have found that in practice, using the embodiment of Fig. 4, it is feasible to employ a vacuum in chamber I at all times.

It will be understood that the number of vacuum pressure chambers will be varied in accordance with the length of the cut-sheet sections, and that correspondingly different areas will be provided at the receiving end of the stacker.

A typical cycle for the construction shown in Fig. 4 may be as follows:

Typical cycle

Chamber	1	2	3	4	5	6	Time Interval
I	V	V	V	V	V	V	V
II	V	V	V	V	P	V	V
III	O	V	V	V	P	O	V
IV	O	O	V	V	P	O	O
V	O	O	O	V	P	O	O
VI	Used for larger sheets. For size of sheets indicated no pressure or vacuum required.						
VII							
VIII							

NOTE: V—Vacuum. P—Pressure. O—Neutral (no connection with pr. or vacuum lines).

The diagrammatic view, Fig. 6, shows that the end plates for the rotary cutter 4 may be employed as switch-actuating members to effect the opening and closing of circuits for solenoid valves operative to control pressure in vacuum within the chambers. Three of the chambers have, in that figure, been diagrammatically shown as chambers I, II and III, and inasmuch as chamber I may, if desired, be continuously under vacuum, valves therefor have been omitted. Chamber I communicates with suction manifold 35 by means of pipe 36. Chamber II is connected to pressure manifold 37 by means of pipe 38, and with suction manifold 35 by means of pipe 39. Chamber III is connected to pressure manifold 37 by pipe 40 and with suction manifold 35 by pipe 41. In each of the pipes 38 to 41 is a solenoid valve. Chamber II is controlled by pressure-controlling solenoid valve 42 and suction-controlling solenoid valve 43. Chamber III is controlled by pressure control solenoid valve 44 and suction-control solenoid valve 45.

The rotary cutter carries at its ends conductor discs or plates 4^x and 4^{xx}, which plates are well insulated as by insulation rings 46. Plate 4^x receives current from an axial conductor 47 leading to socket plug 48, and disc 4^x carries spaced brush contacts which are adapted to move into engagement with brush switches leading to the pressure-controlled solenoid valve so as to make and break the circuit through them in accordance with the conditions required in the vacuum-pressure chambers.

Rotary cutter disc 4^{xx} is provided with an axial contact 49 for a lead connecting with the socket plug 50 and the disc also carries a plurality of brush contacts so that at the proper times they will engage brush contacts electrically connected to the solenoid valves, which control the securing of vacuum within the chambers. The brush contacts carried by discs 4^x and 4^{xx} are simply designated 51 in Fig. 6. Inasmuch as timing by spaced movable brush contacts for successive and sometimes simultaneous energization and breaking of circuits through types of electrical controls, have been highly developed and are well known in the art, the arrangement in this respect has been diagrammatically illustrated only.

By means of my invention, an overhead vacuum-pressure automatic conveyor and stacker is provided which is capable of conveying sheets at high speed and which is particularly adapted for fragile and other sheets which are difficult to handle, means being provided for discharging the sheets at predetermined positions and time intervals. It will be understood that various modifications may be made in the form and the arrangement of the elements constituting the embodiment illustrated in the drawings without departure from the spirit of the invention. It will be understood that means should be provided for adjusting the positions of the rollers of each set of rollers 17 to compensate for wear of their surfaces, and also that similar means should be provided for the belt rollers 10 and 13. The diagrammatic adjusting means 55 is for endwise adjustment of belt 12 and the diagrammatically illustrated adjusting means 55^x is for endwise adjustment of belt 9. The adjusting means 56, is, in each case, for vertical adjustment. Also each roller 17 is mounted for vertical adjustment as diagrammatically indicated in Fig. 1. The specific adjusting means may be as desired and hence is not illustrated in detail.

Having described my invention, what I claim

and desire to secure by Letters Patent is as follows:

1. In overhead sheet transporting and discharging devices, an endless porous belt and means for driving the same, sealing means for the upper face of said belt, end rollers for spacing the lengths of the belt and for sealing it at the end areas in its passage from an upper length to a lower length, and vice versa, a plurality of sets of vertically positioned rollers within said belt, said last named rollers bounding chambers which are sealed by the mutual contact of said rollers, as to each set, from lateral passage of gases, and automatic means applied to a plurality of the chambers for successively effecting vacuum and break of vacuum therein.

2. In overhead sheet transporting and discharging devices, an endless porous belt and means for driving the same, sealing means for the upper face of said belt, end rollers for spacing the lengths of the belt and for sealing it at the end areas in its passage from an upper length to a lower length, and vice versa, a plurality of sets of vertically positioned rollers within said belt, said last named rollers bounding chambers which are sealed by the mututal contact of said rollers, as to each set, from lateral passage of gases, and automatic means applied to a plurality of the chambers for successively effecting vacuum and pressure therein.

3. In overhead sheet transporting and discharging devices, a traveling porous belt, means for effecting and breaking suction upon sheets depending from the belt, and also for imposing pressure upon said sheets by fluid action, said means comprising a plurality of side-by-side chambers along a length of the belt, suction conduits leading from said chambers, an electrically controlled valve for each of a plurality of said conduits, suction means leading to said valves, a plurality of pressure leading to said chambers, an electrically controlled valve for each of said pressure conduits, fluid pressure means leading to said last named valves, an electric circuit leading to each of said electrically controlled valves, and automatic means for closing and opening the circuits at predetermined times.

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