Dec. 8, 1953 L. J. CHAMBON 2,661,946

METHOD AND MACHINE FOR INTERLEAVING AND STACKING SHEETS OF PAPER AND SIMILAR MATERIALS

Filed Dec. 15, 1950 7 Sheets-Sheet 1

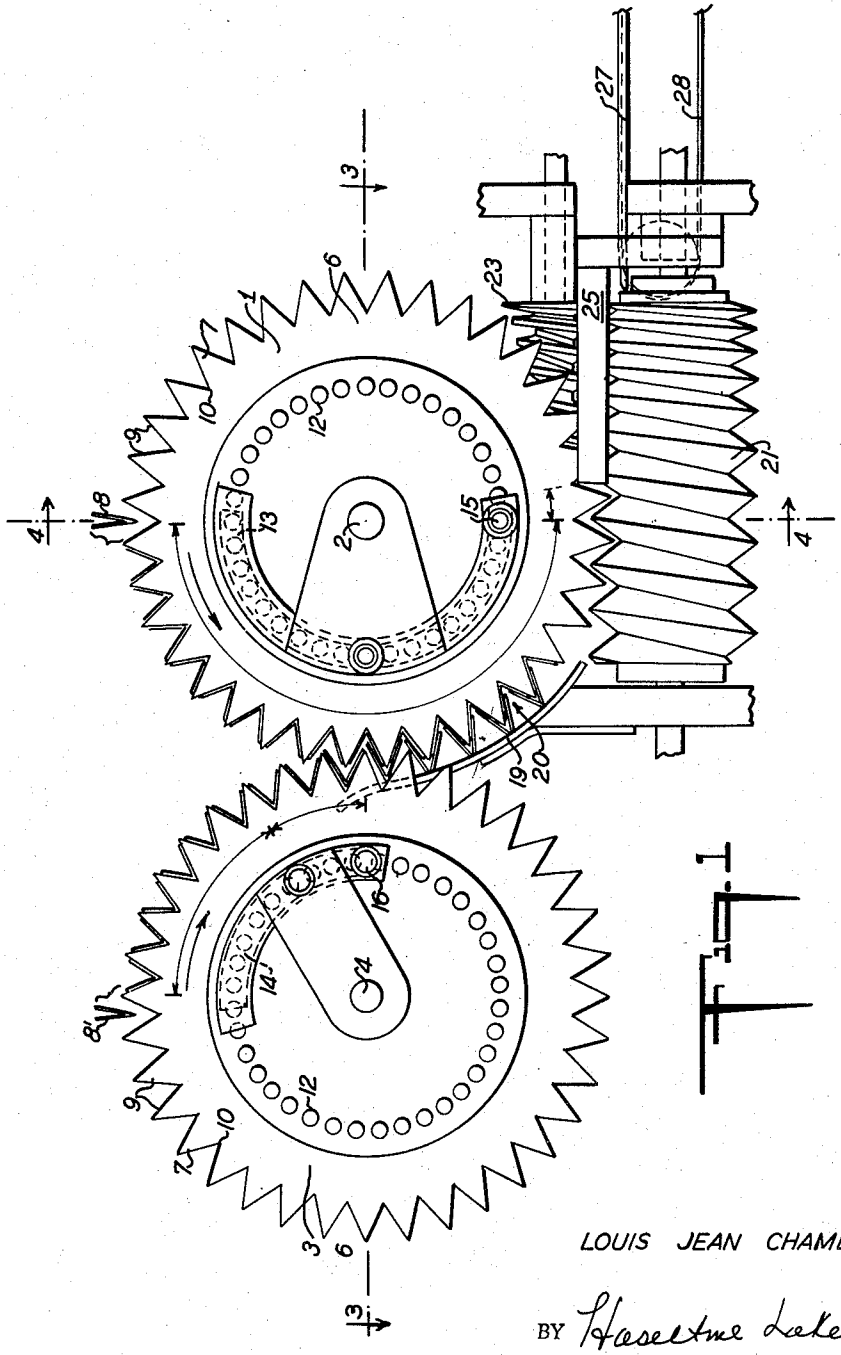


FIG. 1

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METHOD AND MACHINE FOR INTERLEAVING AND STACKING SHEETS OF PAPER AND SIMILAR MATERIALS

Filed Dec. 15, 1950 7 Sheets-Sheet 2

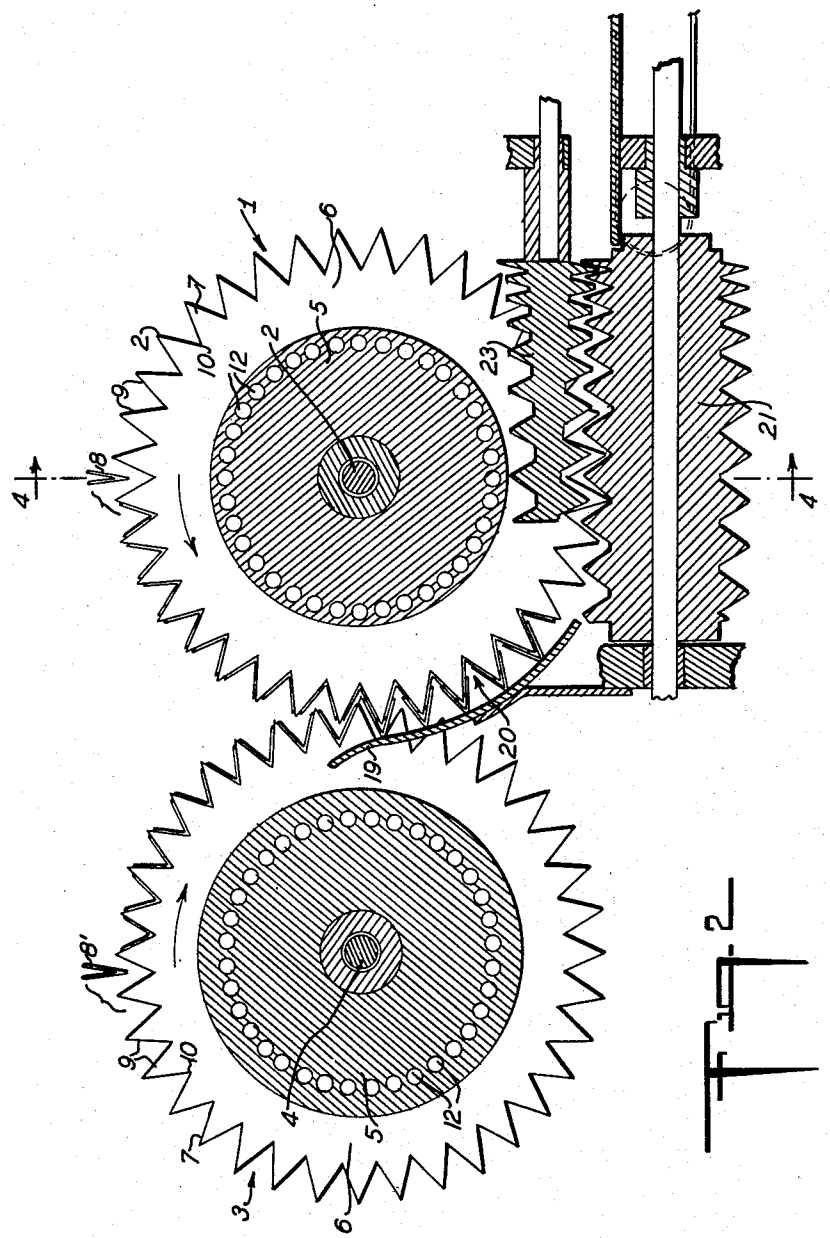


FIG. 2

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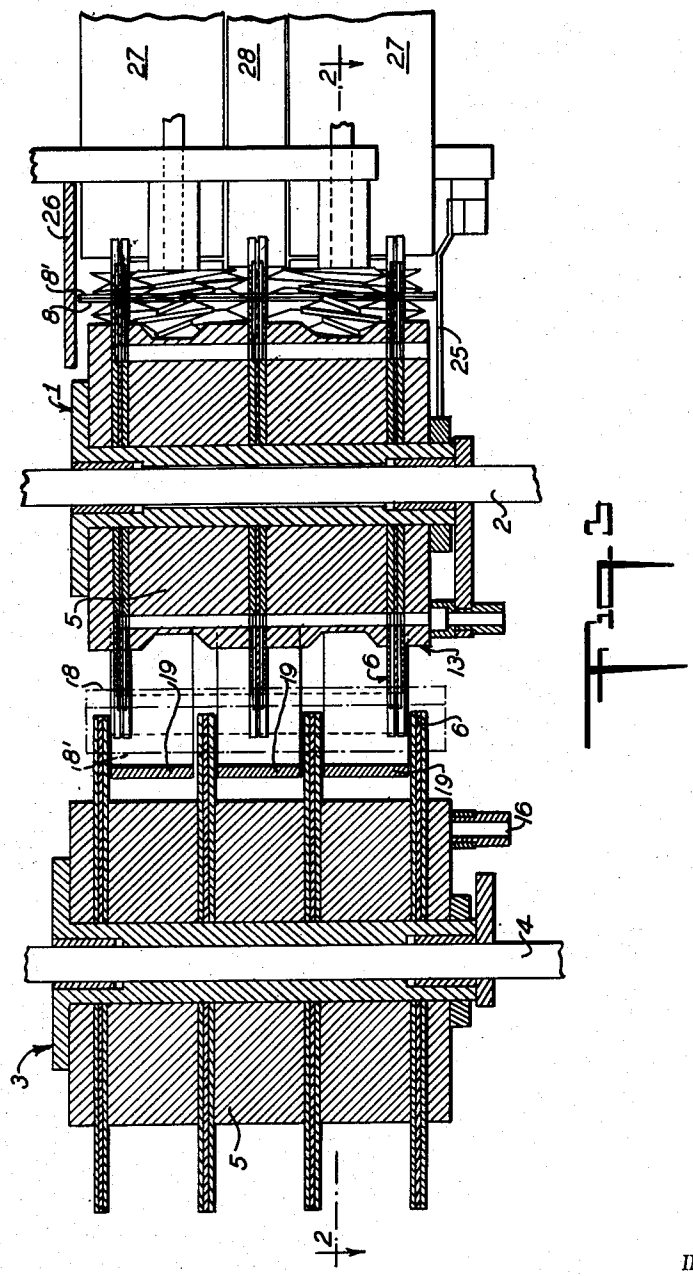
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METHOD AND MACHINE FOR INTERLEAVING AND STACKING SHEETS OF PAPER AND SIMILAR MATERIALS

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METHOD AND MACHINE FOR INTERLEAVING AND STACKING SHEETS OF PAPER AND SIMILAR MATERIALS

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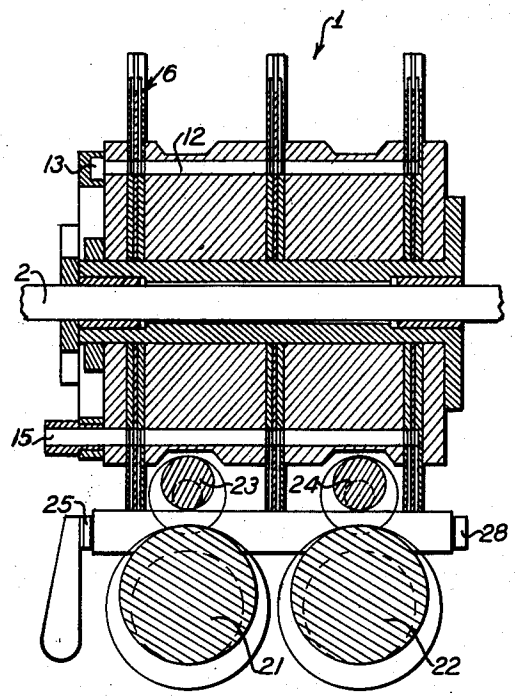


FIG. 4

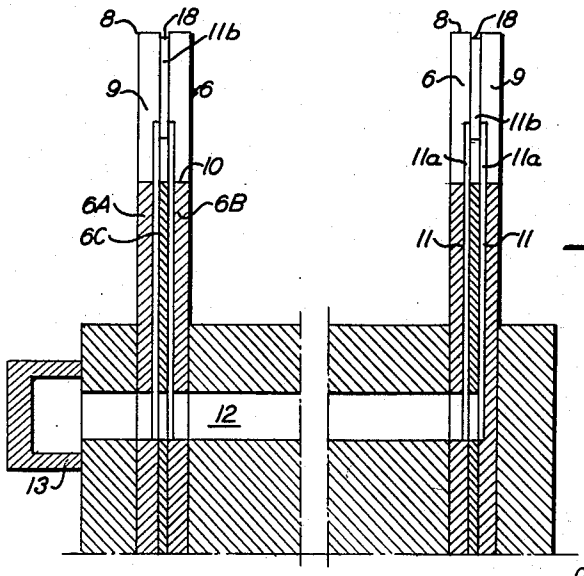


FIG. 5

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METHOD AND MACHINE FOR INTERLEAVING AND STACKING SHEETS OF PAPER AND SIMILAR MATERIALS

Filed Dec. 15, 1950 7 Sheets-Sheet 5

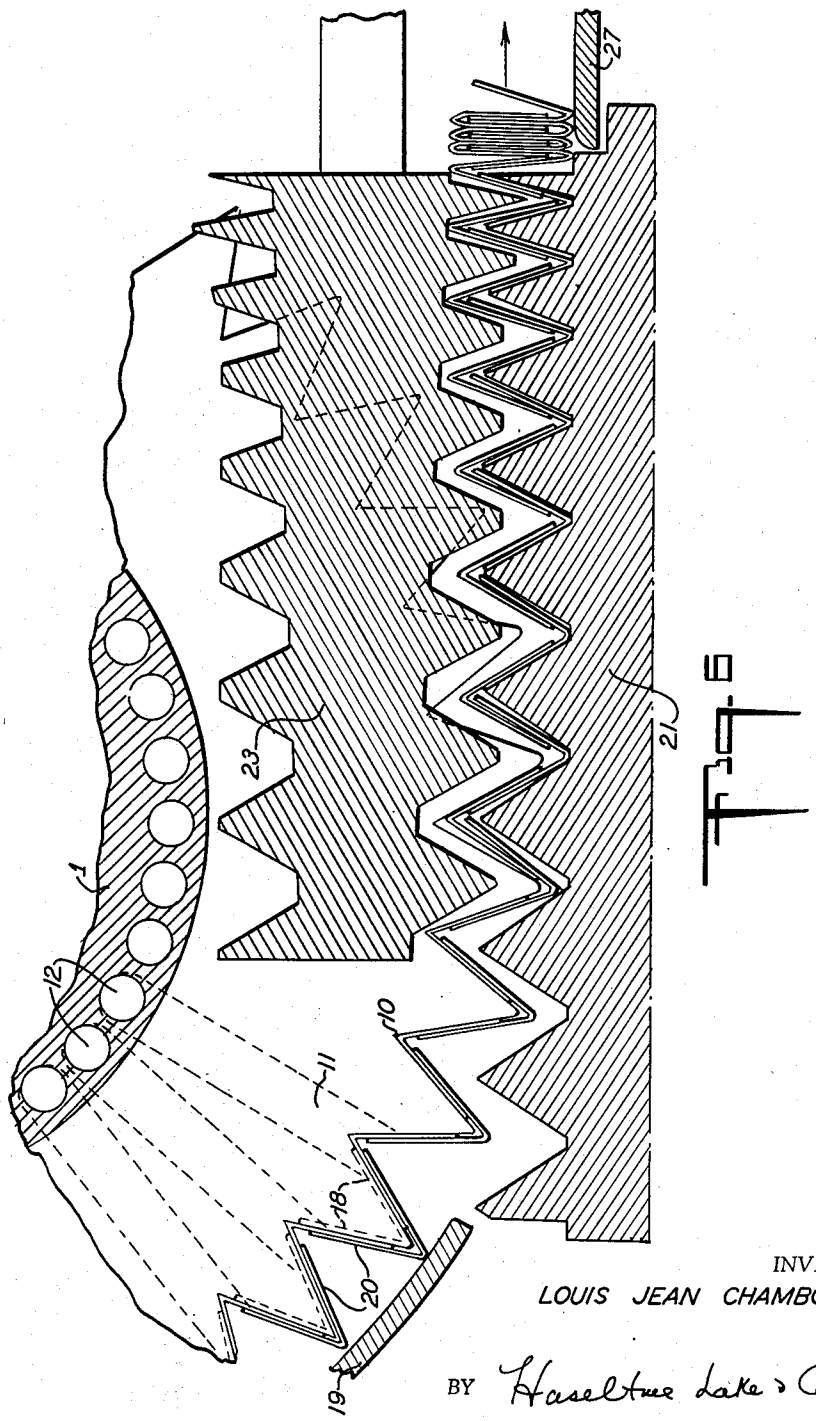


FIG. 5

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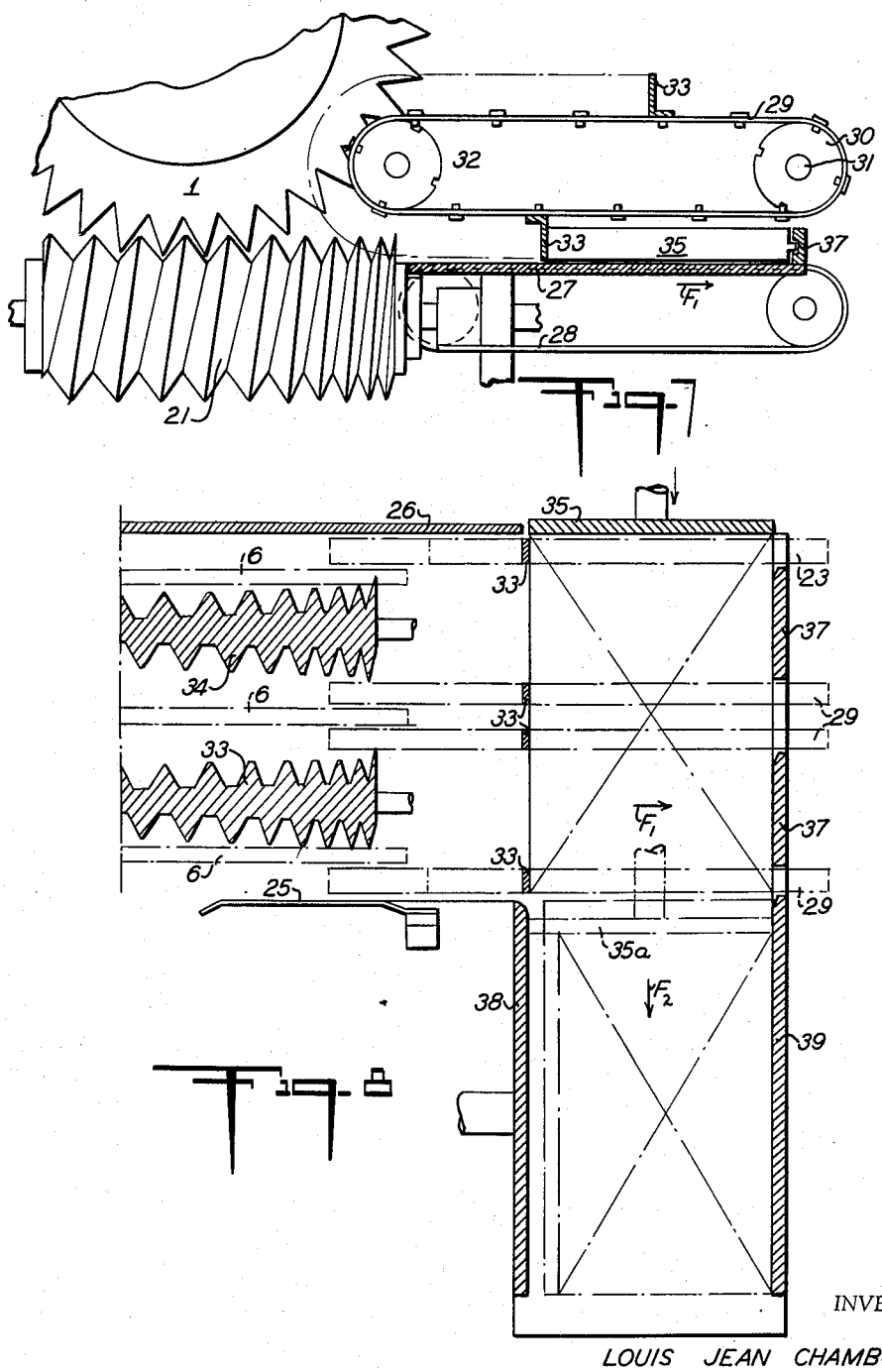
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METHOD AND MACHINE FOR INTERLEAVING AND STACKING SHEETS OF PAPER AND SIMILAR MATERIALS

Filed Dec. 15, 1950 7 Sheets-Sheet 6



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METHOD AND MACHINE FOR INTERLEAVING AND STACKING SHEETS OF PAPER AND SIMILAR MATERIALS

Filed Dec. 15, 1950 7 Sheets-Sheet 7

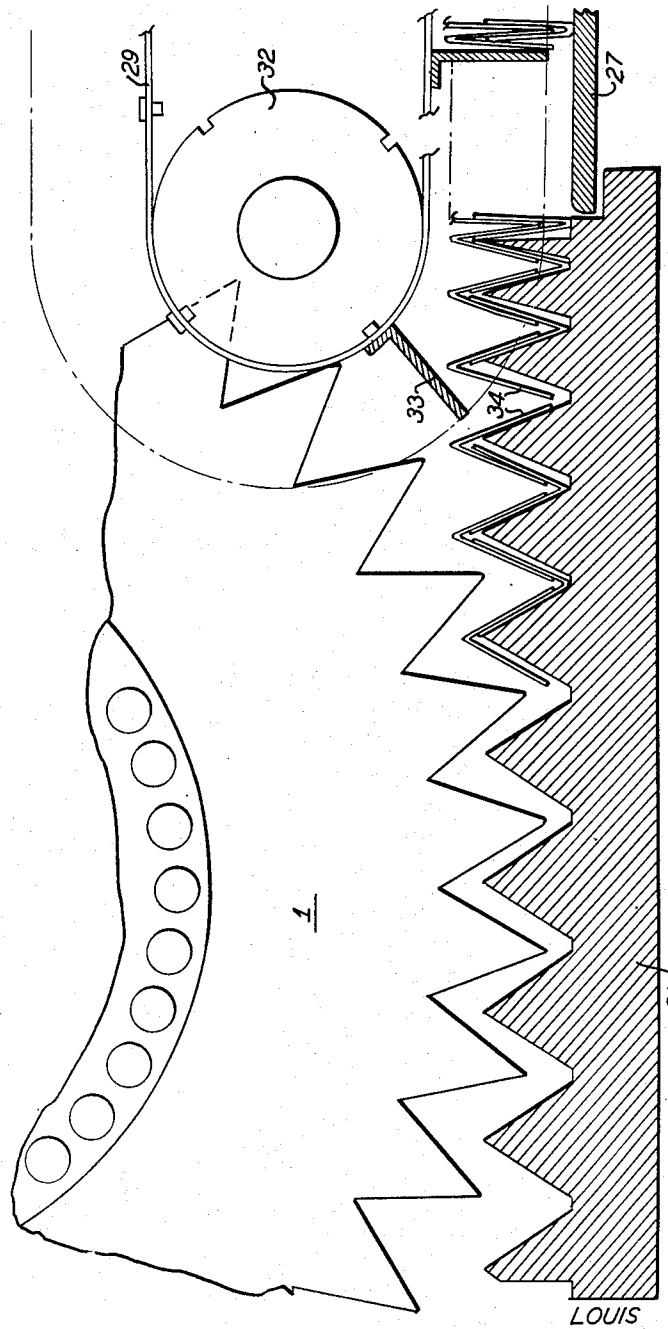


FIG. 1

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Patented Dec. 8, 1953 2,661,946

UNITED STATES PATENT OFFICE

2,661,946

METHOD AND MACHINE FOR INTERLEAVING AND STACKING SHEETS OF PAPER AND SIMILAR MATERIALS

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Application December 15, 1950, Serial No. 201,048

Claims priority, application France December 15, 1949

10 Claims. (Cl. 270—39)

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This invention relates to methods and machines for interleaving sheets of paper and similar materials, and more specifically to improved means in such machines for conveying the sheets to a receiving station on a horizontal or approximately horizontal plane.

In known sheet-interleaving machines, the cut and folded sheets are divided in two groups respectively inserted into the recesses of each of the sets of V-shaped teeth or serrations of a pair of interleaving rotors (such as continuously-rotated cylinders) so disposed relatively to each other that the recesses of one set of serrations cooperate with the apices of the other to cause a mutual penetration of the sheets of both groups into one another and thus produce their desired interleaved relationship, the interleaved sheets being immediately thereafter withdrawn from the interleaving means and collected in a continuous sequence.

In such known devices, the actual interleaving step is performed in a horizontal plane extending through one of the two members or rotors and hence at a point where the folds of the sheets are horizontal. To restore the sheets to a position in which the folds are vertical and in which the interleaved stack is consequently horizontal, the sheets are led out from the rotors through a vertical downward chute or channel. Only after this initial vertical travel, are the sheets deviated in a horizontal direction, either on a conveyer belt, or more simply by means of a bend in the chute.

The above-described vertical downward travel has made it necessary to support the lower-most sheet of the interleaved pack of sheets from below, and this was made difficult by the arcuate path which the pack of sheets had to follow.

The present invention provides a machine in which the interleaved sheets are adapted to be retained in the V-shaped recesses of the serrations until such time as they have reached the horizontal conveyer means.

According to another feature of the invention, the desired horizontal interleaved stack is compacted by the horizontal conveyer means itself.

According to a third feature, the interleaved sheet conveying and receiving means are so arranged as to produce easily and automatically a subdivision of the interleaved sheets into a plurality of separate packs.

The above and further objects, features and advantages of the invention will result from the ensuing description made with reference to the accompanying drawings which illustrate an example of embodiment of the invention and wherein:

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Fig. 1 is an outer front view of a machine according to the invention.

Fig. 2 is a section on line II—II of Fig. 3;

Fig. 3 is a horizontal section on line III—III of Fig. 1;

Fig. 4 is a section on line IV—IV of Fig. 1;

Fig. 5 is a view of one element of Fig. 4 on an enlarged scale;

Fig. 6 shows an element of Fig. 2 on an enlarged scale;

Fig. 7 shows means for dividing a pack of sheets into groups;

Fig. 8 is a plan view of the device shown in Fig. 7, and

Fig. 9 shows an element of Fig. 7 on an enlarged scale.

As shown in the drawings, the sheets of paper or the like are interleaved in conventional manner by a pair of cylindrical rotors 1 and 3 revolving about spaced horizontal shafts 2 and 4 and each consisting of a number of spacer hubs 5 alternating on the related shaft with toothed or serrated discs 6. The toothed discs in each rotor may be in the same plane as, or axially displaced from, the toothed discs in the other rotor (the latter arrangement being that shown in Fig. 3); in either case, the relative angular setting of the discs on the respective shafts should be such as to ensure the desired intermeshing of the respective serrations or teeth thereof as shown in Fig. 1 and 2. The two groups of sheets 8 and 8' to be interleaved, preliminarily each folded in the form of a V, are disposed in the recesses 10 between the teeth 7. The sides 9 of the inter-tooth recesses 10 are greater in depth than one half the width of the sheets 8 and 8' so that, the apices of the teeth remain uncovered when the sheets are in place in the recesses. Opening into the bottom of the recesses 10 are ducts 11 formed through the body of the toothed discs 6 and the ducts 11 are extended along the flat sides 9 of the teeth by grooves 11a and 11b running as far as the very tip or apex of each tooth. In practice, the ducts 11 may consist of grooves formed in the sides of each of a pair of semi-discs 6a and 6b spaced by an interposed spacer disc 6c. The ducts 11 deliver into a main duct 12 adapted, in the rotation of the rotors, to communicate alternately with a general collector or manifold 13 or 14 connecting with a suction device, and with another collector or manifold 15 or 16 connecting with a blower device.

The suction manifolds 13 and 14 are adjustable

in position so that they may be selectively located at the most favorable positions for timing the end of the suction phase and the beginning of the blowing phase.

The suction and blowing actions thus provided serve respectively to retain or repel the sheets in a manner to be later described.

Guide members 19 placed between the discs 6 of rotor 3 are provided to retain the sheets in case of failure in the suction system.

The receiver means shown in the drawings comprise a pair of worms 21 and 22 having triangular threads and a gradually decreasing pitch. These worms (which operate similarly except for the respective directions of rotation and inclination of the threads) are disposed below the main rotor 1 between a pair of discs 6 thereof in such a way that, in the vertical plane IV—IV, their pitch is the same as the pitch of the teeth 7 and moreover, that their valleys and ridges are aligned with the ridges and valleys, respectively, of the teeth of said discs, so as to provide, in the plane of Fig. 1, a kind of virtual worm and worm gear arrangement.

Above the worms 21 and 22 a further pair of worms 23 and 24 may be provided in which the variable decreasing pitch is the same as that in worms 23 and 24 and which are idle and serve as guides or retainers for the sheets. The screw threads of the worms 21 and 22 mesh with the threads of the overlying worms 23 and 24 respectively, with a certain amount of clearance (shown exaggerated in the drawing, Fig. 2) corresponding at least with the combined thickness of two sheets. The path of travel of the sheets beyond the worms is defined on one side by a fixed guide 26, and on the other by a small reciprocating tapper vane 25. The sheets are deposited on a table 27 whence they are discharged by the mechanism assembly 28 to 39 to be later described.

The above-described arrangement operates as follows:

The sheets 8, 8' are inserted by any suitable means into the recesses 10 as these successively reach the topmost point of each of the rotors 1 and 3. The sheets 8 and 8' are so folded and inserted that the apex of the angle of the fold in the sheet will accurately engage the lowermost point of the trough or recess 10 and the sides of the sheet accurately overlie the sides 9 of said recess. The sheets are thus inserted into each successive inter-tooth recess except at such times as it is desired to interrupt the interleaving operation and define a pack of a predetermined number of interleaved sheets, at which times the feed of sheets into either one of the rotors is suspended.

The sheets thus inserted are retained in place by the suction exerted through the ducts and grooves 11, 11*a*, 11*b*, and are coveyed by the rotation of each rotor to the point of meshing engagement therebetween, so that each sheet in either rotor will successively overlap the adjacent sides of a pair of sheets carried in an adjacent pair of recesses of the other rotor. This is the actual interleaving step, which occurs in the horizontal plane III—III containing the parallel axes of the rotors, in which the penetration of the teeth of each rotor into the recesses of the other rotor is deepest. At or shortly before the time each recess of the rotor 1 and tooth of the rotor 3 reach this horizontal plane, the suction exerted through the ducts 11 and 12 from the suction manifold 14, in the rotor 3 is sharply cut off, and instead, the connection is made with the blower manifold 16 over a small amount of angular travel of the rotor. This causes the sheet to be propelled onto the apex of the oppositely facing tooth of the rotor 1, and in which connection with the related suction manifold 13 is maintained. The small ducts or grooves 11*b* covered by the sheets 8 previously inserted into the recesses of the rotor 1 convey thereon the fold of the newly deposited sheet 8' to hold said sheet 8' in place. The sides of the sheets 8' deposited from the rotor 3 are applied upon the previously inserted sheets 8 thereon and are held by the suction exerted through said last-mentioned sheets.

Thus, the sheets of both sets 8 and 8' are now placed on the main or primary rotor 1 in the final position shown at 20 and are retained in position by suction. The guides 19 interposed between the discs of the rotor 3 guide the sheets and prevent their dropping away in case of failure in the suction means. The sheets may thus already at this time be collected in any desired way on a plane lying at any desired angle of inclination.

In the construction described, the sheets are collected as the sheets placed on the main rotor 1 have substantially reached the vertical plane IV—IV (i. e., as the stacks are lying in a horizontal plane). At this time the suction in rotor 1 is sharply cut off and replaced by the blowing effect from the blower manifold 15, which discharges the sheets on to the surface of worms 21 and 22. The sheets are thus caused to continue their straight horizontal path of travel, being placed upon the bottoms of the screw threads of the worms 21 and retained thereon by the overlying auxiliary worms 23 and 24. Beyond the vertical plane IV—IV in which the sheets are transferred from the rotor 1 to the worms 21 and 22, the screw-pitch of these worms gradually decreases while retaining a constant depth. This reduction in pitch results in a progressive closure of the sheets carried on the worms 21 and 22, or in other words in a compaction of the interleaved stack of sheets, while lateral registry of the sheets is ensured by the action of the vane member 25 which pushes the sheets laterally against the fixed guide 26. As the sheets are discharged from the worms, which terminate in a plane perpendicular to their axis, the interleaved sheets are pushed against one another on the table 27 whence they may be fed to some further station by the means now to be described (see Figs. 7, 8 and 9).

Flush with the surface of the table 27 there is provided a conveyer belt 28 supporting the weight of the sheets and fed continuously in the direction indicated by arrow F1. The sheets are delivered to the table 27 and the conveyer 28 in the form of a series of packs separated from one another by a break obtained during the insertion of sheets into the serrations of the rotor e. g. by skipping a serration. The packs are in turn grouped into groups successively conveyed in the transverse direction F2 by the following mechanism: A plurality of endless chains 28 are arranged to extend above the interleaved sheets as they are discharged from the worms 21 to 24. The chains 29 may consist of strips of rolled steel or interlinked chains passing around drums 30 and 32 rotatable on axes normal to the direction F1. The drums 30 are mounted on a shaft 31 driven by any suitable means to impart an

intermittent feed motion to the chains 29. The drums 32 are idle return drums.

Spaced along the chains 29 are projecting fingers 33 which are adapted, at suitable timed moments (see Fig. 9), to engage between the adjacent end sheets 34 of a consecutive pair of groups of packs delivered from the machine. As the fingers 33 are positioned between the end sheets 34, they push the last sheet of the foremost group of packs, the foremost sheet of which group has previously been brought against an abutment 37 by the preceding fingers 33 (Figs. 7 and 8).

After the entire group of packs has been brought adjacent the abutment 37, the motion of chains 29 and fingers 33 is arrested. A pusher member 35 then acts to drive the group of packs in the direction F2 to a position between a presser 38 and a backing surface 39 (the pusher 35 then assuming the dotted line position 35*a*). The pusher 35 is then restored to its initial position and the chain 29 resumes its feed, while the fingers, now engaging the initial sheet of the next group of packs, lead this group towards the abutment 37, then continue their movement, and so on, repeatedly.

It will be understood that modifications may be made in the details of the specific arrangements described without exceeding the scope of the invention, as defined in the ensuing claims.

What I claim is:

1. Apparatus for interleaving and stacking folded sheets which comprises in combination; a cooperating pair of intermeshing toothed interleaving rotors adapted to have folded sheets inserted into each inter-tooth recess at the respective tops thereof to interleave said sheets as they are brought into an interleaving zone defined by the area of intermeshing of said rotors, ducts in each rotor opening into each of said recesses, means associated with each of said rotors for selectively applying suction to the ducts of the related rotor during communication with said ducts, means associated with each rotor for selectively applying air-pressure to the ducts of the related rotor during communication with said ducts, said suction applying means associated with one of said rotors communicating with the ducts of said one rotor during the travel of the related inter-tooth recesses from the top location, at which the folded sheets are inserted in said recesses, to said interleaving zone, said air-pressure applying means associated with said one rotor communicating with the ducts of said one rotor only when the related recesses are at the end of said interleaving zone, said suction applying means associated with the other of said rotors communicating with the ducts of said other rotor during the travel of the related recesses from the top location, at which the folded sheets are inserted in said recesses, to the bottom of said other rotor, and said air-pressure applying means associated with said other rotor communicating with the ducts of said other rotor only when the related recesses reach said bottom of the other rotor so that the folded sheets inserted in the recesses of said one rotor are held on the latter to said interleaving zone and are interleaved with the folded sheets held on said other rotor and transferred to the latter at said interleaving zone and so that the interleaved folded sheets are carried by said other rotor from said interleaving zone to said bottom of the other rotor for discharge there under the influence of air pressure then applied through said ducts of the other rotor, and means for conveying said interleaved sheets tangentially away from the bottom of said other rotor over a generally horizontal path.

2. Apparatus as in claim 1 which further comprises guide means along the periphery of said other rotor from said bottom of the other rotor to said receiving zone to prevent said sheets from falling away in case of failure in said suction applying means associated with said other rotor.

3. Apparatus as in claim 2 wherein said ducts in each rotor comprise substantially radial ducts through said rotor opening at the base of said teeth, grooves extending from said ducts along the sides, and to the apex, of said teeth, and wherein said suction and air-pressure applying means associated with each of said rotors respectively include a suction manifold and an air-pressure manifold arranged to communicate with said ducts of the related rotor during preselected intervals in the rotation of the rotor.

4. Apparatus as in claim 3 wherein each rotor comprises toothed discs and spacer hubs fixed in alternating relation on a shaft, each disc consisting of a pair of grooved flanges providing a ducted disc, a circumferential set of main ducts, one for the aligned teeth of all said discs formed axially through all said discs and hubs, the radial ducts of said aligned corresponding teeth in all the discs communicating with a related one of said main ducts, and said main ducts adapted, in the rotation of said rotor, to communicate alternately and at timed intervals with said manifolds.

5. Apparatus as in claim 1 wherein the means for the teeth thereof, adapted to receive the interleaved sheets from said rotor into the thread recesses thereof and to convey them tangentially from said rotor over a generally horizontal path, and means positively driving said worm means in synchronism with said rotor.

6. Apparatus as in claim 5 wherein the screw-pitch of said worm means gradually decreases beyond said virtual meshing area in the direction in which the sheets are conveyed, for horizontally compacting the interleaved sheets as they are so conveyed.

7. Apparatus as in claim 6 further comprising auxiliary worm means overlying and loosely meshing with said first worm means and identical in pitch therewith to cooperate with said first worm means to retain the interleaved sheets on the latter during the horizontal conveying operation.

8. Apparatus as in claim 7 which further comprises an aligning stop associated with the discharge end of said conveyer worm on one side thereof, and a reciprocating aligning member on the other side thereof adapted to align said interleaved compacted sheets against said stop during the conveying and compacting operation.

9. In apparatus as in claim 7, endless belt means overlying said conveyer in vertically spaced relation thereto and fed parallel thereto, and fingers spaced along said endless chain and adapted to project therefrom towards said conveyer, and a fixed vertical backing surface upstanding from the outer end of said conveyer, said fingers being adapted to press a predetermined number of said sheets as discharged from said worm means against said backing surface preparatory to said number of sheets being pushed off said conveyor into said pressing zone by said pusher member.

10. Apparatus according to claim 5; further comprising continuously-fed, endless conveyer means aligned with the discharge end of said

worm means to receive the compacted and interleaved folded sheets therefrom, a pusher member reciprocable horizontally in a direction transverse to said horizontal path for pushing a predetermined number of interleaved sheets off said conveyor means into a pressing zone, and a cooperating vertical backing surface and presser member reciprocable horizontally in a direction parallel to said horizontal path to press the predetermined number of interleaved sheets delivered to said pressing zone.

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