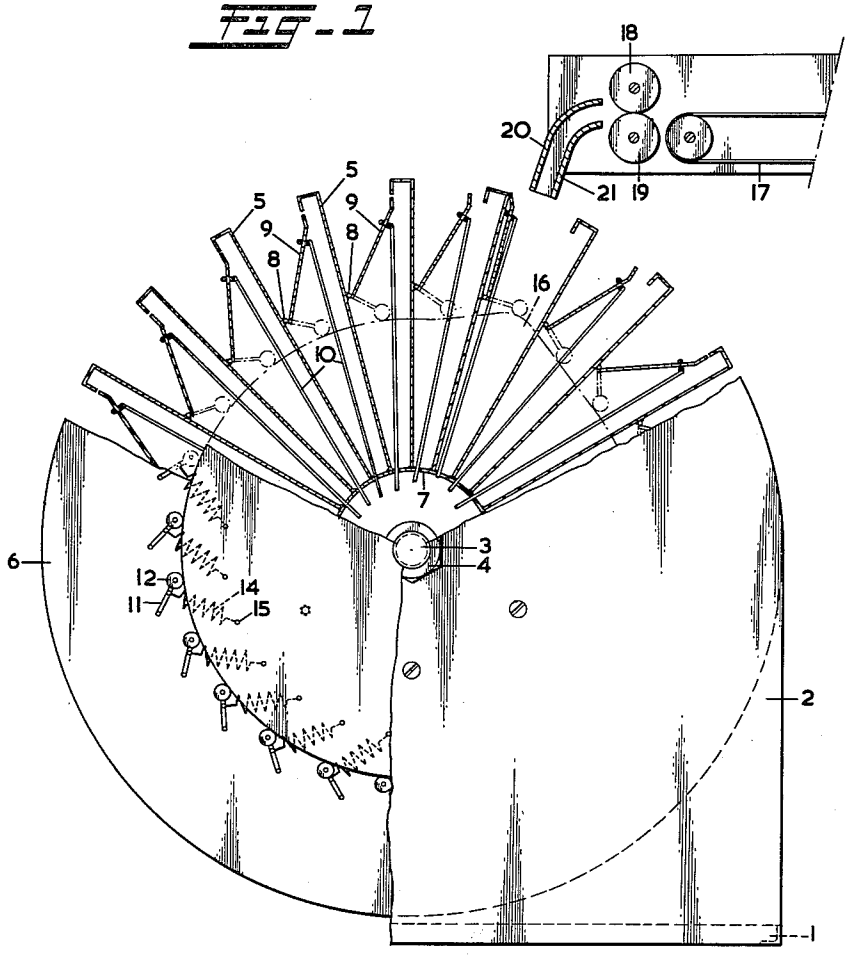
July 2, 1963 M. D. P. SWENKER ETAL 3,096,089

DEVICE FOR COLLECTING SHEETS OF LAMINAR MATERIAL

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Fig. 1



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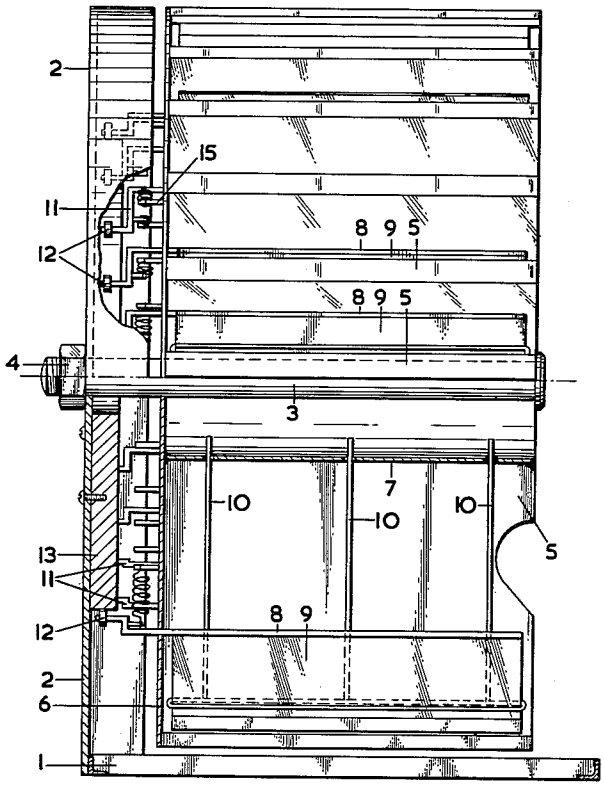
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July 2, 1963 M. D. P. SWENKER ETAL 3,096,089

DEVICE FOR COLLECTING SHEETS OF LAMINAR MATERIAL

Filed Nov. 20, 1961 3 Sheets-Sheet 2

Fig. 2



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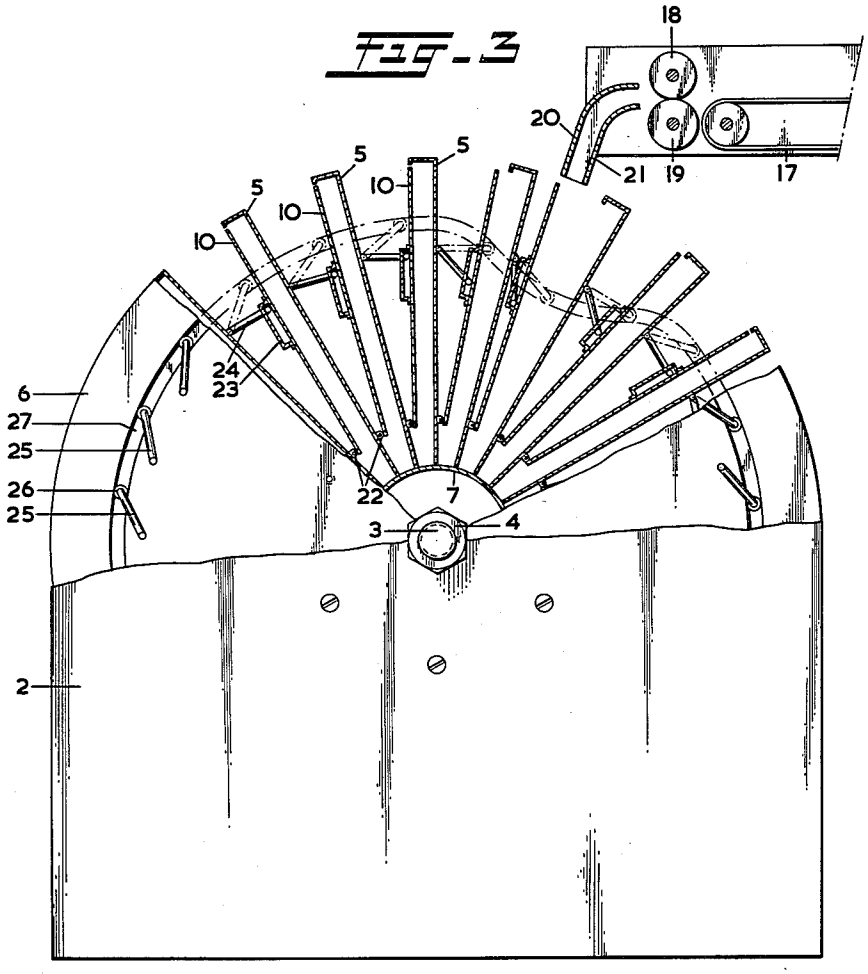
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DEVICE FOR COLLECTING SHEETS OF LAMINAR MATERIAL

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Fig. 3



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United States Patent Office

3,096,089

Patented July 2, 1963

3,096,089

DEVICE FOR COLLECTING SHEETS OF LAMINAR MATERIAL

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Filed Nov. 20, 1961, Ser. No. 153,536
Claims priority, application Netherlands Dec. 1, 1960
8 Claims. (Cl. 271—64)

The invention relates to apparatus for the assorted collecting of sheets of laminar material, which comprises a number of collecting compartments, which are delimitated by walls extending radially towards a horizontal shaft and which can be rotated about this shaft, in which apparatus each compartment is closed on the side turned towards the shaft and provided with an opening for feeding the sheets on the side turned away from the shaft, and in which each compartment is also provided with members for closing said opening at least partially, control members being present for keeping each compartment in its opened position through only a part (the so-called filling stage) of its path of movement.

Such apparatus, the compartments of which have been combined into a drum, while each compartment has a wedge-shaped cross-section, is known from United States Patent No. 2,936,167.

The size of the collecting compartments in such apparatus of course has to be adapted to the number of sheets to be collected in each compartment and to the size of these sheets. In said known apparatus the distance between the radially diverging walls on the side turned towards the shaft will always have to be slightly greater than the total thickness of the maximum number of sheets to be collected. Owing to its wedge shape the compartment is much wider on the side turned away from the shaft, and on this side there is considerable space between the collected sheets and the walls of the compartment.

The larger size of the compartment on the side turned away from the shaft offers the advantage that the feed opening can be relatively large, which facilitates the feeding of the sheets considerably. A large feed opening is particularly useful when the collected sheets are not perfectly flat, e.g. when they tend to curl.

The wedge-shaped cross-section of the compartment may, however, cause difficulties when the sheets collected in the compartment are made of limp material (such as paper of weight 80 g./m.^{2}) and are of a relatively large size (such as DIN A.3). In fact, when the compartment is approximately vertically below the shaft of the drum during its rotation, so that the collected sheets rest on their edges which are in the wider part of the compartment, the sheets will tend to bend and curl up owing to their limpness and under the influence of gravity. They may then get stuck in a bent position between the walls of the compartment. Consequently, when the compartment concerned reaches the filling stage again, any sheets which have thus got stuck between the walls may prevent the feeding of fresh sheets.

Apparatus of another type is known, in which again sheets of laminar material are collected in a drum comprising radially extending pockets (see United States Patent No. 2,936,168) and in which in each pocket the sheets are pressed against a wall of the pocket by pressure members. Owing to this pressing operation the bending of the sheets is naturally prevented; since the pressure members, however, also serve to prevent the sheets from falling out of the device during the rotation of the drum, they exert a considerable force on the sheets. In consequence the sheets may be damaged. Another disadvantage of this apparatus is that it is practically impossible to remove the sheets from the apparatus against the action of the pressure members; hence special means have been provided with which the pressure members can be released.

The apparatus according to the present invention does not have the disadvantages of the known apparatus; it makes it possible to collect thin and limp sheets and remove them from the compartments without any difficulty.

To this end each compartment is provided with a supporting member which is adapted to be moved between two end-positions and which extends inside the compartment from the side turned towards the shaft to the neighbourhood of the side turned away from the shaft and divides this compartment into an operative section and an inoperative section, in such a way that, while the stage in which the compartment is opened is traversed, the supporting member is in one end-position and the size of the operative section substantially corresponds with that of the compartment, whereas, while the rest of the path of movement is traversed, the supporting member is in the other end-position, and the distance between the supporting member and the wall which helps to delimit the operative section of the compartment is substantially equal at least on the said two sides and in the middle.

By this measure it is ensured that the sheets are collected in a space with a substantially rectangular cross-section, contained between a wall of the compartment and the supporting member. When the compartment is beyond the so-called filling stage, this space is only narrow and the collected sheets will not bend in it and thus will not get stuck in the compartment.

The distance at which the movable member has to extend from a wall of a compartment is dependent on the number of sheets that has to be collected in the compartment and on the thickness of those sheets. It has been found that, when the said distance is 2–3 cm., 150–200 sheets of paper of weight 80 g./m.^{2} can be collected in the compartment without difficulty.

As in the apparatus according to the invention the movable member does not exert any pressure on the collected sheets, the sheets can be easily removed from the apparatus, while the risk of damage to the sheets is extremely small.

Preferably each supporting member is so constructed that, when the corresponding compartment is beyond the filling stage, said member takes up a position in which it extends substantially parallel to and at a short distance from a wall of the compartment and closes the latter in combination with the closing member. In this case the supporting member may be made of a number of interconnected bars or of elastic wires.

The supporting member may be combined with the closing member, such as a flap, with which the feed opening of the compartment can be closed. The supporting member and the closing member may be rigidly connected together, or they may be coupled with each other by means of bars, hinges and the like, or they may not be coupled with each other, but may be controlled by synchronously operating control members. In such an embodiment of the apparatus the total weight of the collected sheets will rest temporarily on the closing member during the rotation of the compartment about the horizontal shaft. To obtain reliable operation also in those cases in which a large number of sheets have to be collected in one compartment, the closing member will have to be of relatively heavy construction, which is of course disadvantageous.

In a preferred embodiment of the invention this disadvantage is obviated by the feature that the wall of the

compartment facing the supporting member is provided with a fixed guard which serves to close the compartment partially on the side turned away from the horizontal shaft. The construction of such a fixed guard may be very simple. It may consist, for instance, of a doubled edge of the said wall.

To ensure that the sheets can be fed to the compartments without difficulty, the feed openings of the compartments have to be relatively wide. Hinges, coupling rods and the like in the vicinity of the feed openings may interfere with the feeding of the sheets in a troublesome manner. In a preferred embodiment of the invention, troublefree feeding of the sheets is obtained by mounting the supporting member pivotally in bearings in the vicinity of the horizontal shaft.

Specific embodiments of the apparatus according to the invention are illustrated in the accompanying drawings, in which:

FIGURE 1 is a diagram, partly in side elevation, partly in cross-section, of an embodiment in which there is mounted, inside each compartment, a flap adapted to close the compartment and a supporting member which is connected with said flap.

FIGURE 2 shows the front elevation (partly in cross-section) of the apparatus according to FIGURE 1.

FIGURE 3 is a diagram, partly in side elevation, partly in cross-section, of an apparatus in which the supporting member is mounted in bearings in the vicinity of the shaft of the device.

Referring to these drawings, in FIGURES 1 and 2, **1** is the base of the device, which is constructed, for instance, of steel sections, to which a vertically mounted frame plate **2** has been fastened. Secured to frame plate **2** by means of a nut **4** is one end of a threaded shaft **3**. Mounted rotatably in bearings on shaft **3** is a system of wedge-shaped collecting compartments (seen in cross-section), which consists of a number of plates **5** which are radially directed towards shaft **3**, a circular plate **6** perpendicular to shaft **3**, and a cylinder **7** surrounding shaft **3** concentrically.

Each collecting compartment is delimitated and closed breadthwise by plates **5**, and on the side turned towards shaft **3** by cylinder **7**. On the side turned towards the front in the figure each compartment is closed by the plate **6**; the side of the compartment turned towards the rear is open. Again on the side turned away from shaft **3** each compartment is open; the opening, however, is partially closed by an angularly bent edge of a plate **5**. Secured to the other plate **5** inside the compartment are hinges, in which the hinge shaft **8** of a flap **9** is movably mounted in bearings.

In each compartment a movable supporting member **10** is mounted, one end of which is pivotally connected with flap **9**, while the opposite end is adapted to slide in openings in cylinder **7**. The supporting member **10** divides the space in the collecting compartment into two sections, of which one section (the operative section) is situated between supporting member **10** and the plate **5**, whose angularly bent edge partially closes the opening of the compartment, while the other section (the inoperative section) lies between the supporting member and the other wall of the compartment.

By means of control members (to be shown hereinafter) each flap **9** and the supporting member **10** connected therewith is movable between two end-positions inside the compartment. In the one end-position the flap **9** closes the compartment on the side turned away from shaft **3** and the supporting member **10** extends substantially parallel to and at a short distance from the angularly bent wall of the compartment. When the machine is intended for collecting a maximum of 100 sheets of relatively thin photo-printing material, this distance between supporting member **10** and wall **5** will be about 2–3 cm. When other materials (such as card-board) or larger numbers of sheets are handled, this distance may be 5 cm. or more. The operative section of the compartment is then a narrow, closed space. In the other end-position the flap **9** takes up a position in which the side of the compartment turned away from shaft **3** is open and the supporting member **10** rests against the other wall of the compartment. The operative section then comprises practically the whole space inside the compartment.

On one side the hinge-shafts **8**, which are fixed to the flaps **9**, reach through openings in the plate **6**. Beyond plate **6** each shaft **8** is provided with a crank **11**, on which a wheel **12** is rotatably supported.

The wheels **12** press against a guide **13** surrounding shaft **3**, which guide is formed by the edge of a plate that is rigidly fixed to frame plate **2**. Springs **14**, which are stretched between the cranks **11** and pins **15** fastened to the plate **6**, keep the wheels **12** continuously in contact with the guide **13**. The guide **13** (partly indicated by dotted lines in FIGURE 1) is provided with a cam **16** indicated by dotted lines in FIGURE 1). The size and the position of the guide **13** have been so chosen that when the wheel **12** rests on the cam **16**, a crank **11** has been pushed away so far from the shaft **3** that the flap **9** and supporting members **10** connected with crank **11** are in the end-position in which the compartment is open on the side turned away from shaft **3** and that, when the wheels **12** rest on the guide **13** beyond the cam **16**, the cranks **11** take up a position such that the flaps **9** and supporting members **10** connected therewith are in the other end-position, the compartments concerned thus being closed.

The system of collecting compartments and the members mounted therein can be rotated about shaft **3** by driving members known per se (and not shown in the figure). During rotation the wheels **12** run along the guide **13**. The compartments are then opened in the part of their path of movement (the so-called filling stage) in which the wheels **12** move past cam **16**; through the rest of their path of movement the compartments are closed.

The apparatus described is combined with the apparatus delivering the sheets to be collected in such a way that the ejecting section of said apparatus opens out above the filling stage of the apparatus. The sheets delivered can then be fed into the collecting compartment present in the filling stage, via the feed opening.

In FIGURE 1 the ejecting section of a sheet-feeding apparatus is shown diagrammatically; it comprises a conveyor belt **17**, guide rollers **18**, **19** and guide plates **20**, **21**. The sheets to be collected are fed one by one while lying on the belt **17**, gripped by the rollers **18**, **19**, and then guided between the guide plates **20**, **21** towards the collecting compartment present underneath the guide plates **20**, **21** at that moment.

The speed and manner of rotation of the collecting compartments of course have to be adapted to the speed with which the sheets to be delivered are fed, to the size of those sheets, and naturally also to the way in which the sheets have to be assorted as they are being collected. The rotation of the compartments will preferably be controlled (in a manner known per se) with control impulses which are derived from the apparatus that delivers the sheets. Such impulses can be used advantageously to move the system of collecting compartments in a jerky manner, or to and fro, if desired, in such a way that whenever a sheet arrives between the guide plates **20**, **21**, the desired compartment is at a standstill underneath these guide plates.

Because as the sheets are fed the operative section occupies practically the whole space of the compartment, the sheets can be fed without difficulty, even when they are limp and/or tend to curl.

When the compartment with the sheets collected therein is moved beyond the filling stage, as a result of which the supporting member is moved towards the end-position in which the operative section is confined to a narrow

closed space, the collected sheets do not have enough room to bend in an inconvenient way. They thus remain practically flat.

The angularly bent wall of the compartment, in cooperation with the flap **9** and the supporting member **10** of course, prevents the collected sheets from falling out of the apparatus while the compartment is rotating. Since the sheets rest entirely on the flap and the supporting member during part of the roation of a compartment, the spring **14**, which keeps the flap **9** and the supporting members **10** in the desired position, has to be sufficiently strong to bear the weight of the sheets.

In the apparatus shown in FIGURES 1 and 2 the supporting member **10** consists of a set of straight supporting bars, extending at some distance from each other (such as 10 cm.). Instead of straight bars, undulatorily bent bars can also be used, or bars bent in such a way that they reach only with their middle section to the vicinity of the angularly bent wall of the compartment. Instead of bars, flat or curved plates or strips can also be used as supporting members.

The sheets collected in the compartments can be easily removed from the apparatus on the open side, which is turned towards the rear in FIGURE 1 (right side in FIGURE 2).

In FIGURE 3 apparatus similar in principle to that of FIGURE 1 is shown diagrammatically, though it has been constructed in a somewhat different way. In each collecting compartment of this apparatus there is mounted a supporting member which consists of a flat plate **10** which is pivotally supported in hinges **22** on the side of the compartment turned towards the shaft **3**. On the side of the supporting plate **10** turned towards the inoperative section of the compartment a brace **23** is fitted. Between the brace **23** and supporting plate **10**, one bent end of a crank **24** is adapted to slide. The crank **24** is also pivotally supported in the plate **6** and passes through this plate with a bent arm **25**. Arm **25** carries a small wheel **26**, which is supported in the double guide **27**. The guide **27**, which is rigidly connected with the frame of the apparatus (by means not shown), near the filling stage has a curvature turned towards the shaft. During the rotation of the collecting compartments the small wheels **26** run between the guide **27**. In the filling stage the small wheels, owing to the curvature of the guide, are forced towards shaft **3**. The cranks **24** and **25** then swing round, which results in supporting plate **10** being moved from one end-position to the other and the compartment concerned being opened.

In comparison with the apparatus according to FIGURE 1 the apparatus according to FIGURE 3 has the advantage that the supporting member is entirely smooth in the vicinity of the opening through which the sheets are fed, so that the feeding of the sheets cannot be interfered with by projecting parts, such as hinge-shafts, joints, and the like.

We claim:

1. An apparatus for the assorted collecting of sheets of laminar material, comprising movable support means, a multiplicity of walls spaced apart on said support means and carried thereby about a horizontal axis in substantially radial relation to said axis, each adjacent two of said walls continuously delimiting a wedge-shaped space widened at its radially outer end, a sheet-supporting member mounted swingably within each said space in spaced relation to one of said walls and forming with said one wall a sheet-collecting compartment, said member extending over a greater part of the radial extent of said one wall and having its inner end continuously spaced from said one wall by a distance corresponding to the desired sheet collecting depth of said compartment, and positioning means connected with each said supporting member and operative upon movement of said support means to move said member between (1) a normal position in which said member and said one wall form a relatively closed sheet-retaining compartment and (2) an open position in which said member is swung away from said one wall with its outer end lying adjacent the other of said two walls whereby said compartment is opened to nearly the width of said widened end of said space to receive a sheet fed thereinto or for the removal of sheets collected therein.

2. An apparatus according to claim 1, said supporting member when in said normal position having its outer end spaced from said one wall by approximately the same distance as its inner end.

3. An apparatus according to claim 1, said supporting member lying approximately parallel to said one wall when in said normal position.

4. An apparatus according to claim 1, said member and said one wall having cooperating means on their outer ends whereby said compartment is closed at its outer end when said member is in said normal position.

5. An apparatus according to claim 1, said one wall having on its outer end a lateral extension which extends across the outer end of said compartment but only partially across the widened end of said space.

6. An apparatus according to claim 1, each said supporting member being mounted near its inner end for swinging movement about an axis fixed in substantially parallel relation to said one wall and the aforesaid axis.

7. An apparatus according to claim 1, further comprising an inner circumferential wall fixed relative to said radial walls and closing the inner end of each said compartment, each said supporting member having an inner end portion extending slidably and swingably through a slot in said inner circumferential wall.

8. An apparatus according to claim 1, each said supporting member being hinged at its inner end to the other of said two walls.

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