May 4, 1954 H. T. BACKHOUSE ET AL 2,677,542

SHEET FEEDING APPARATUS

Filed Nov. 9, 1949 4 Sheets-Sheet 1

Fig. 1.

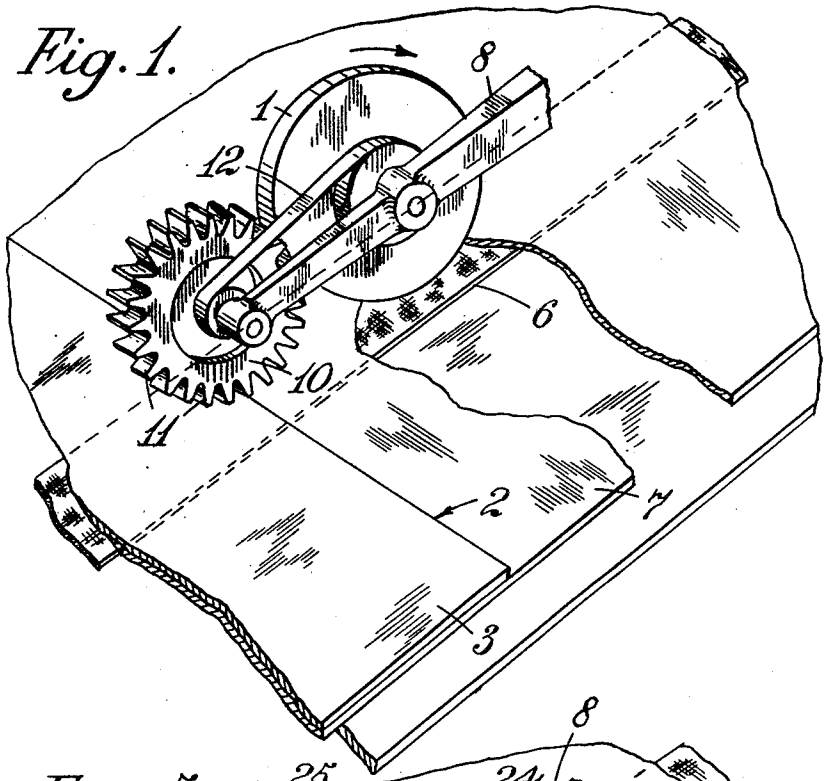
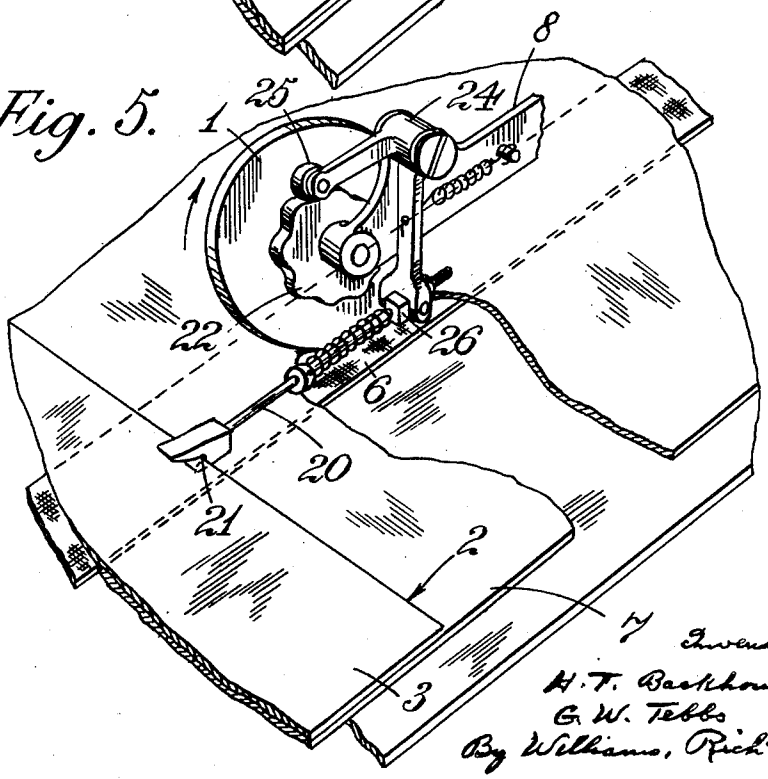


Fig. 5.



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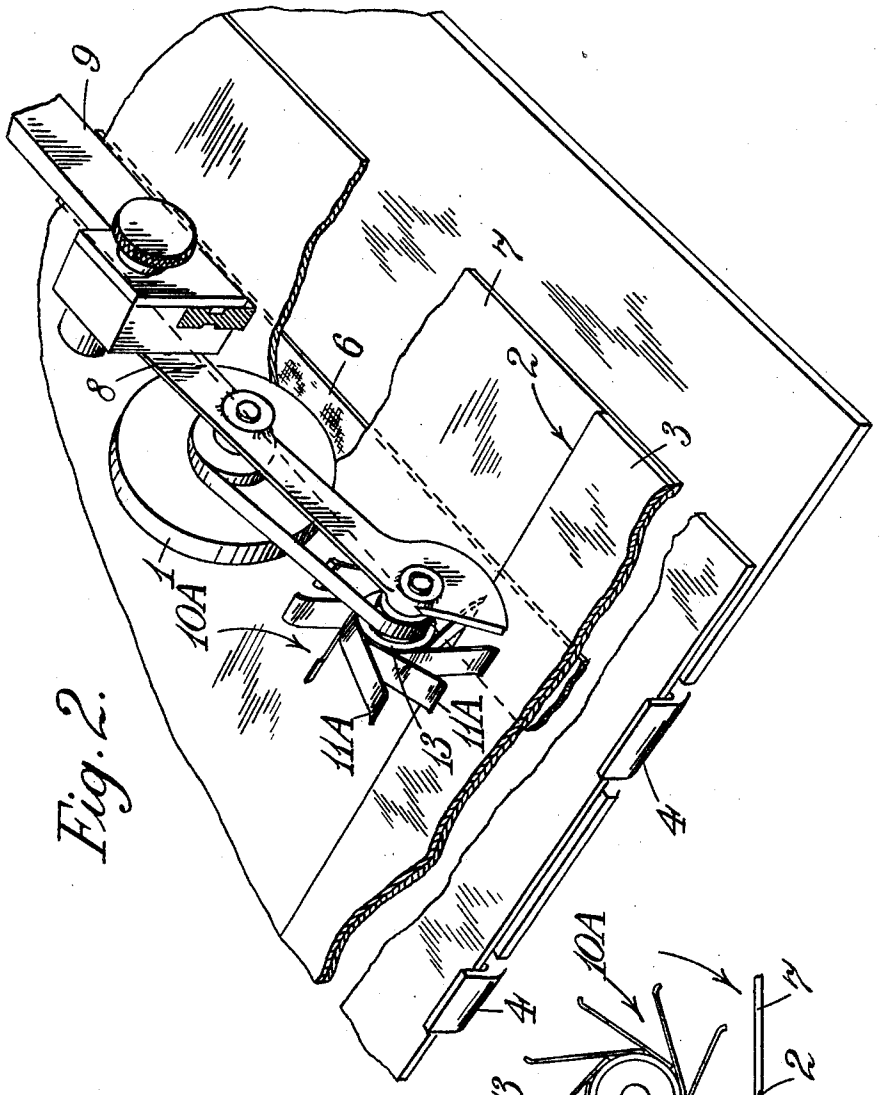


Fig. 2.

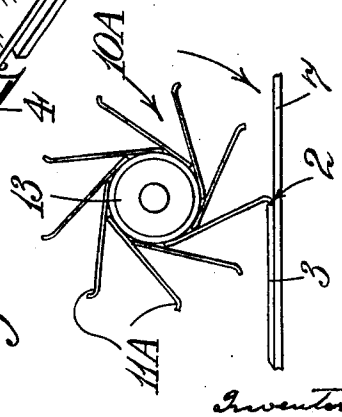


Fig. 3.

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SHEET FEEDING APPARATUS.

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Fig. 4.

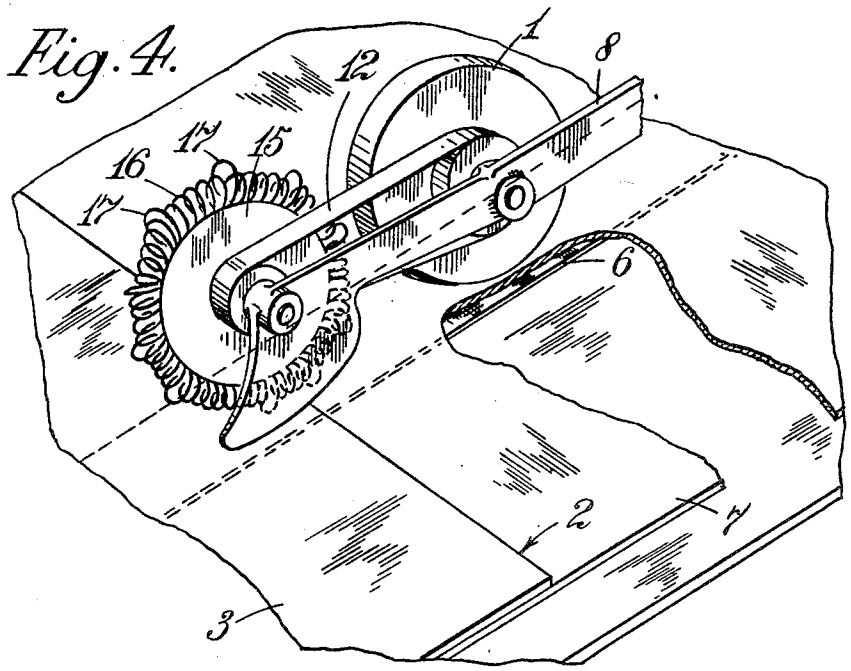


Fig. 6.

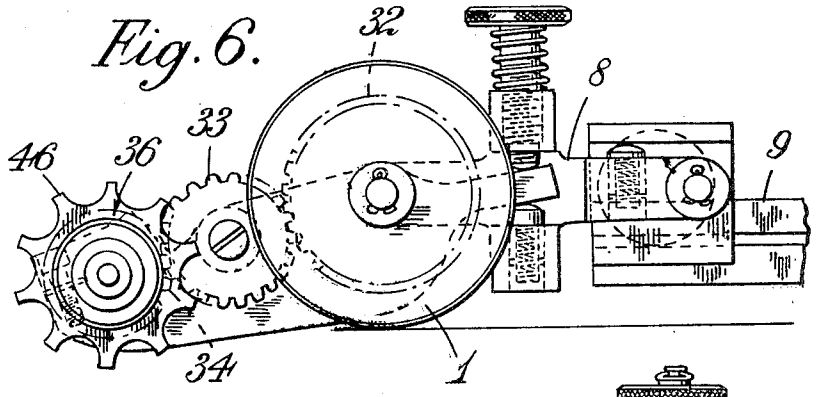
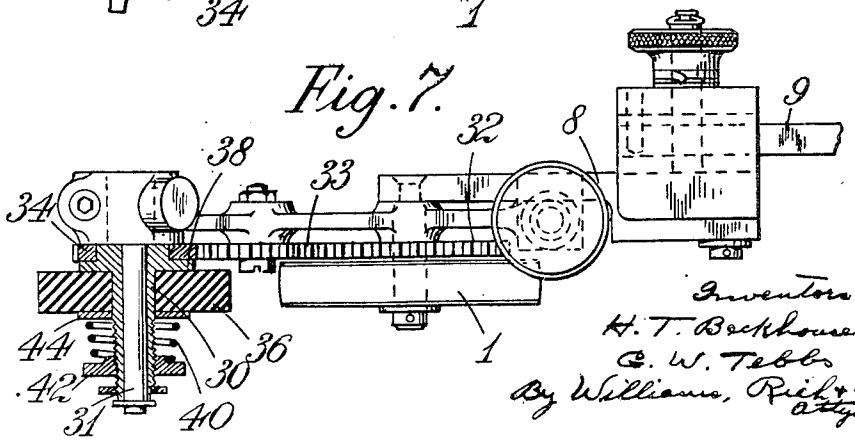


Fig. 7.



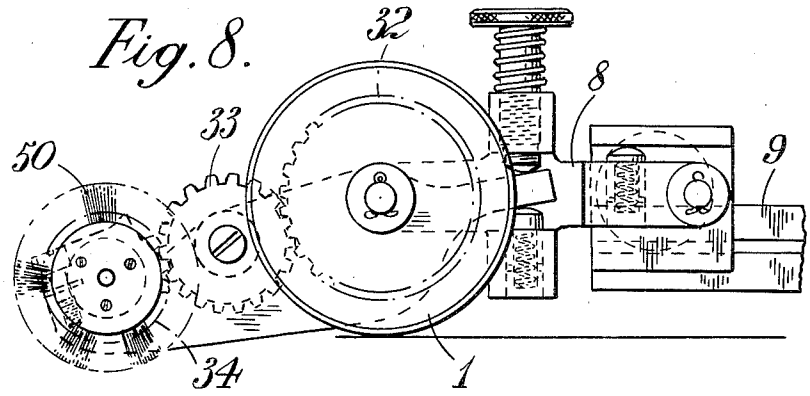
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SHEET FEEDING APPARATUS

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Fig. 8.



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UNITED STATES PATENT OFFICE

2,677,542

SHEET FEEDING APPARATUS

Headley Townsend Backhouse, Sunningdale, and George William Tebbs, Woodford Green, England; said Tebbs assignor to said Backhouse

Application November 9, 1949, Serial No. 126,263

Claims priority, application Great Britain November 12, 1948

9 Claims. (Cl. 271—8)

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The invention relates to sheet feeding apparatus of the kind (later referred to as the kind described) in which a succession of sheets are fed (e. g. by conveyor tapes from mechanism for separating the sheets from a pile) to a layboard on which each sheet in turn is registered in position by engagement of its front edge and a side edge with front and side registering lays or stops. It is usual, but not essential, in apparatus of the kind described first to effect the front registration and then to effect the side registration, and the present invention is especially, but not exclusively, concerned with apparatus in which this sequence of registration is adopted.

In apparatus of the kind described the sheets may reach the layboard independently or as a stream of partly under-lapping sheets (i. e. the front edge portion of each sheet underlies the rear edge portion of the preceding sheet) and the sheets, after registration, are removed from the layboard, for example, to a printing machine.

In practice the means for feeding the sheets to the front lays operate continuously and in order that they shall not press the sheets against the lays with sufficient force to buckle the sheets and also to enable the side-laying of the sheet to be effected it is necessary that when a sheet approaches the lays the grip of the feeding means on the sheet shall be reduced to such an extent that the feeding means may readily slip in relation to the sheet when the sheet reaches the lays. This arrangement has the disadvantage that should there be undue resistance to the travel of the sheet up to the lays, for example due to the action of smoothers on a wavy sheet of card or other stiff material, the feeding means may slip prematurely on the sheet and the sheet fail to arrive at the front lays at the proper instant in the cycle of operation of the apparatus. This, apart from other obvious disadvantages, may cause detector mechanism which is usually provided for detecting such an eventuality to operate to stop the apparatus. It is an object of the present invention to provide a simple and effective mechanism which does not require to be driven in timed relation with the apparatus for assisting or effecting the final feeding of the sheets to the front lays within the permitted latitude of lateness.

The invention consists in sheet feeding apparatus of the kind described characterised by the combination of a searching device continuously operable to search for the rear edge of a sheet at a position corresponding to the rear edge of a sheet of which the front edge is at or near the

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front lay and on finding such a rear edge to apply to it a succession of pushes or a sustained push in the feeding direction to carry the sheet up to the lays and if desired to hold it there during the side-laying operation and means for operating the searching device driven by frictional engagement with a succeeding sheet at a position behind the searching device and where the succeeding sheet will be subject to substantial driving grip by the feeding means.

The invention is particularly suited for use with apparatus operating on sheets of card, tinplate, stiff paper, and like sheets of substantial stiffness.

The provision of a searching device which applies a succession of pushes ensures that the sheet is pushed up to or kept up to, the front lays without interfering to a prejudicial extent with the operation of side-laying. In the case in which a sustained push is applied the grip of the searching device on the sheet will normaly permit of sideways movement of the sheet by slip against the searching device or the device may move sideways with the sheet during side-laying.

The invention may be applied with particular advantage to feeding apparatus in which running-in wheels cooperate with conveyor tapes to feed the sheets, the running-in wheels being positioned behind the rear edge of a sheet in position at the front lays and being above the sheets to apply substantial pressure to the sheets to press the sheets onto the tapes as the sheet approach the lays. This arrangement has the advantage that the running-in wheels do not interfere with the removal of the sheets after registration but suffers from the disadvantage—overcome or reduced by the invention—that although the tapes continue underneath the sheets at the lays they have not sufficient grip of the sheets in the absence of pressure wheels to maintain the sheet against the front lays. The running-in wheels are usually supported on arms pivoted to smoother bars for the sheets and the searching device of the invention may be supported from the same arms. Further a running-in wheel may be employed as the driving means for the searching device.

Some specific forms of the invention as applied to apparatus embodying running-in wheels as just set forth will now be described by way of example, and with reference to the accompanying diagrammatic drawings in which—

Figure 1 is a perspective view showing one arrangement of a pusher wheel driven by a running-in wheel.

Figure 2 is a perspective view of another ar-

rangement of a pusher wheel and showing the front lays and other parts.

Figure 3 is a side view of the pusher wheel shown in Figure 2.

Figure 4 is a perspective view showing a further arrangement of a pusher-wheel,

Figure 5 is a perspective view showing a pusher-rod.

Figure 6 is a side view of a further form of apparatus,

Figure 7 is a plan view of the apparatus shown in Figure 6, and

Figure 8 is a side view, corresponding to Figure 6, of a still further form of the apparatus.

In each of these examples the apparatus embodies two or more running-in wheels 1 behind the rear edge 2 of a sheet 3 in position for registration at front lays 4. The running-in wheels 1 cooperate with conveyor tapes 6 beneath the sheets 7, and are rotated by the movement of the sheets by the tapes, the wheels being supported by hinged arms 8 from smoother bars 9 and applying downward pressure to the sheets to maintain frictional engagement with the tapes.

In one form of the invention (shown in Figure 1), which is simple and convenient, the searching device comprises a pusher wheel 10 provided with resilient blades 11 adapted, as the wheel rotates, to engage in turn the rear edge 2 of the sheet 3, and to push the edge in the forwarding direction. The pusher-wheel is driven, in this example, by a belt 12 from the running-in wheel 1 and is positioned with its axis of rotation parallel to and above the rear edge 2 of the sheet being registered. The blades 11 of the pusher-wheel extend radially from the wheel and are of rubber or like flexible material. In an alternative construction shown in Figures 2 and 3, of the form just described the blades 11A are of spring metal strip and extend tangentially to the circumference of the body 13 of the wheel 10A in the trailing direction of the rotation of the wheel indicated by the arrow. The outer ends of the blades are turned outwardly to extend approximately radially of the wheel for the purpose of making a proper engagement with the rear edge of the sheet.

A still further form of pusher-wheel, shown in Figure 4, comprises a hub 15 having a "tyre" 16 composed of a helical spring wrapped circumferentially around the hub and having some of the turns of the spring displaced outwardly of the wheel to constitute "blades" 17. There may for example be about a dozen such displaced turns, equally spaced around the wheel.

It is desirable that the pusher-wheel shall have a peripheral speed greater than the surface speed of the conveyor tapes 6 and when the pusher-wheel is driven from a running-in wheel 1 as just described this result may be achieved either by a suitable gear ratio between the two wheels as shown or by making the diameter of the pusher-wheel greater than that of the running-in wheel. The diameter of the pusher-wheel is regarded as extending to the ends of the blades where they contact the sheet.

In another form of the invention shown in Figure 5, the pusher means comprise a rod 20 which is reciprocated in the direction of travel of the sheets and carries an abutment face 21 for engagement with the rear edge 2 of the sheet to be registered. In the preferred form of this arrangement shown, the rod 20 is positioned behind the rear edge 2 of the sheet 3 being registered, and the abutment surface 21 is carried on

the front end of the rod 20. This end of the rod 20 is constructed as a fork between the arms of which the rear edge portion 2 of the sheet 3 is engaged. The rod 20 is reciprocated by means of a multi-lobe cam 22 rotated by a running-in wheel 1, and for this purpose the rod 20 is attached to one arm of a bell crank 24 of which the other arm has a follower 25 engaging the cam 22 which 1 is secured to the running-in wheel for rotation therewith. The rod 20 is spring pressed in the forwarding direction to provide a resilient engagement with the sheet 3 and is supported from the bell crank 24 by means 26 permitting a limited degree of resilient movement of the abutment surface 21 in the sideways direction to permit the sheet to move sideways even during the period it is engaged by the fork. Alternatively, the rod 20 may itself be constituted by a helical spring permitting sideways movement.

In each of the above-described examples the pusher wheel or the cam is continuously driven and the blades or abutment surface make a substantial number of searching operations during each revolution of the running-in wheel 1 thereby assuring that the rear edge 2 of the sheet 3 will be engaged at the proper time and a rapid succession of pushes applied to it. In a modified form the pusher-wheel or the cam is driven from the running-in wheel 1 or other driving device through a friction drive (e. g. a friction clutch) arranged to slip when the rear edge 2 of the sheet 3 has been engaged thereby to provide a sustained push against the edge.

Figures 6 and 7 show a form of the apparatus in which a slipping friction clutch as just described is employed. In this example the running-in wheel 1 drives a sleeve 30 on a stub shaft 31 through a chain of gears 32, 33, 34, the sleeve being free to rotate on the shaft. The pusher wheel 36 is rotatable on the sleeve 30 and is normally driven by the sleeve through frictional engagement with a flange 38 on the sleeve, the wheel being pressed against the flange by a compression spring 40 acting between a nut 42 on the sleeve and a washer 44 bearing against the wheel and applying further frictional driving force thereto. The arrangement is that the pusher wheel is normally rotated but when one of the blades 46, which in this form are of rigid construction, engages the rear edge of a sheet and encounters considerably increased resistance to rotation the friction drive device slips and the wheel ceases to rotate or rotates at a reduced speed but continues to apply pressure to the edge of the sheet. Figure 8 shows another form of the invention, similar to Figures 6 and 7, in which the pusher-wheel is in the form of a brush 50.

It is to be understood that in a practical application of the invention there may be two or more pusher means positioned at spaced locations across the rear of the sheet to be registered.

We claim:

1. Sheet feeding apparatus of the kind comprising a layboard, a front lay, and a conveyor for frictionally feeding a succession of sheets on to the layboard and to cause the leading edge of each sheet in turn to approach the front lay, said conveyor having means for frictionally gripping the sheets against the conveyor surface to effect the feeding, the gripping means being positioned for operation behind the rear edge of a sheet of which the front edge is in position adjacent the front lay and so to release the grip on the sheet when the front edge of the sheet nears the lay, which apparatus is characterized

by a pushing device having at least one abutment surface, means for supporting the abutment surface for movement along a path extending in the feeding direction of the sheets so that it will engage and push in the feeding direction the rear edge of a sheet of which the front edge is near the front lay, and means for effecting repeated movements of the abutment surface along said path, which means for effecting repeated movements is driven by frictional engagement with the succeeding sheet, at a position behind the abutment surface, where the succeeding sheet is subject to driving grip by the friction means.

2. Sheet feeding apparatus as claimed in claim 1, in which the pushing device has a plurality of abutment surfaces movable in succession along the path aforesaid.

3. Sheet feeding apparatus as claimed in claim 1, in which the means for supporting the abutment surface comprise a lever, and a rod carrying the abutment surface, attached to the lever and extending in the direction of movement of the sheets and in which the means for effecting movements of the abutment surface as aforesaid comprise a rotatable cam arranged on rotation to oscillate the lever, a rotatable member to be driven by frictional engagement with the sheets, and a driving connection between the rotatable member and the cam.

4. Sheet feeding apparatus of the kind comprising a layboard, a front lay, a conveyor for frictionally feeding a succession of sheets onto the layboard and to cause the leading edge of each sheet in turn to approach the front lay and running-in wheels above the sheets for pressing the sheets into frictional engagement with the conveyor and arranged to be rotated by the moving sheets, the running-in wheels being positioned behind the rear edge of a sheet of which the front edge is in position at the front lay, characterized by a rotatable pusher-wheel having a plurality of circumferentially directed abutment surfaces, means for supporting the wheel for rotation about a horizontal axis above the sheets and transverse to the feeding direction of the sheets and positioned so that the abutment surfaces on the lower part of the wheel as the wheel rotates will engage and push in the feeding direction the rear edge of a sheet of which the front edge is near the front lay, and a driving connection between a running-in wheel and the pusher-wheel whereby rotation of the running-in wheel as aforesaid effects the rotation of the pusher-wheel.

5. Sheet feeding apparatus as claimed in claim 4, in which the driving connection aforesaid includes a friction clutch embodying resilient means for retaining the friction clutching faces in engagement with a pressure which permits slip to occur between the faces when the pusher-wheel encounters considerable increased resistance on engagement with the rear edge of a sheet so that the wheel applies a sustained push to the sheet.

6. Sheet feeding apparatus as claimed in claim 4, in which the pusher wheel is provided with resilient blades, of which the ends constitute the abutment surfaces aforesaid, the blades being arranged, as the pusher-wheel rotates, to engage in turn the rear edge of the sheet and to push the sheet in the forwarding direction.

7. Sheet feeding apparatus as claimed in claim 6, in which the blades of the pusher-wheel extend radially from the wheel and are flexible.

8. Sheet feeding apparatus as claimed in claim 6, in which the blades are of springy metal strip and extend tangentially to the circumference of the body of the wheel in the trailing direction of the rotation of the wheel and in which the outer ends of the blades are turned outwardly to extend approximately radially of the wheel.

9. Sheet feeding apparatus as claimed in claim 4, in which the pusher wheel is in the form of a brush of which the bristles provide the abutment surfaces aforesaid.

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