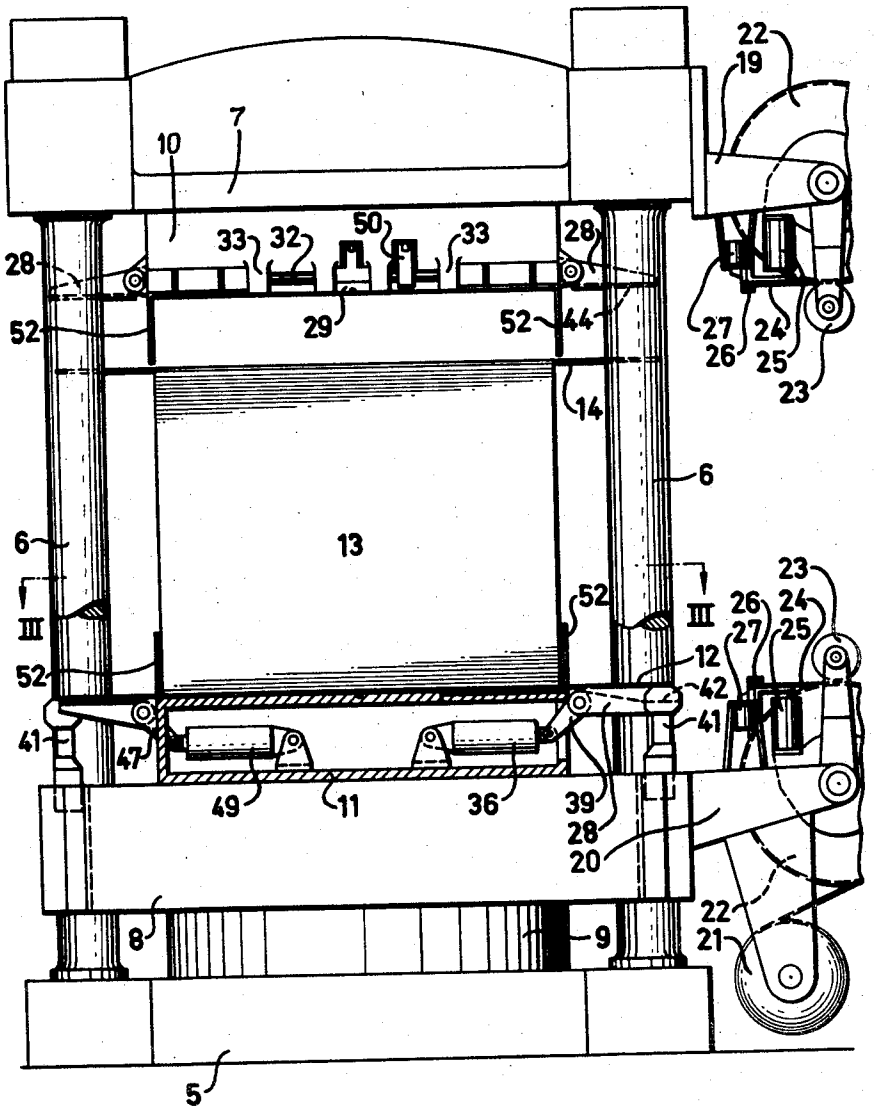
May 24, 1960 K. O. WIMAN 2,937,484

DEVICE FOR AUTOMATICALLY BUNDLING MATERIAL

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Fig. 1

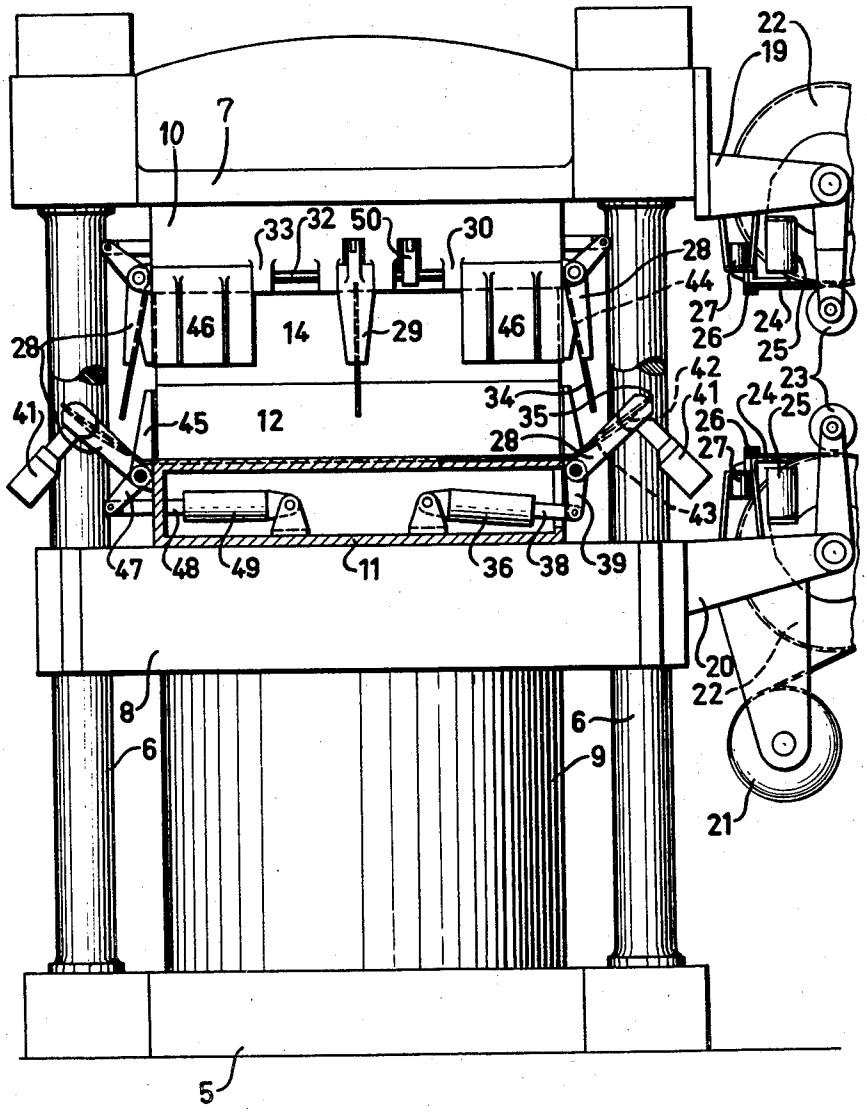


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DEVICE FOR AUTOMATICALLY BUNDLING MATERIAL

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Fig. 2

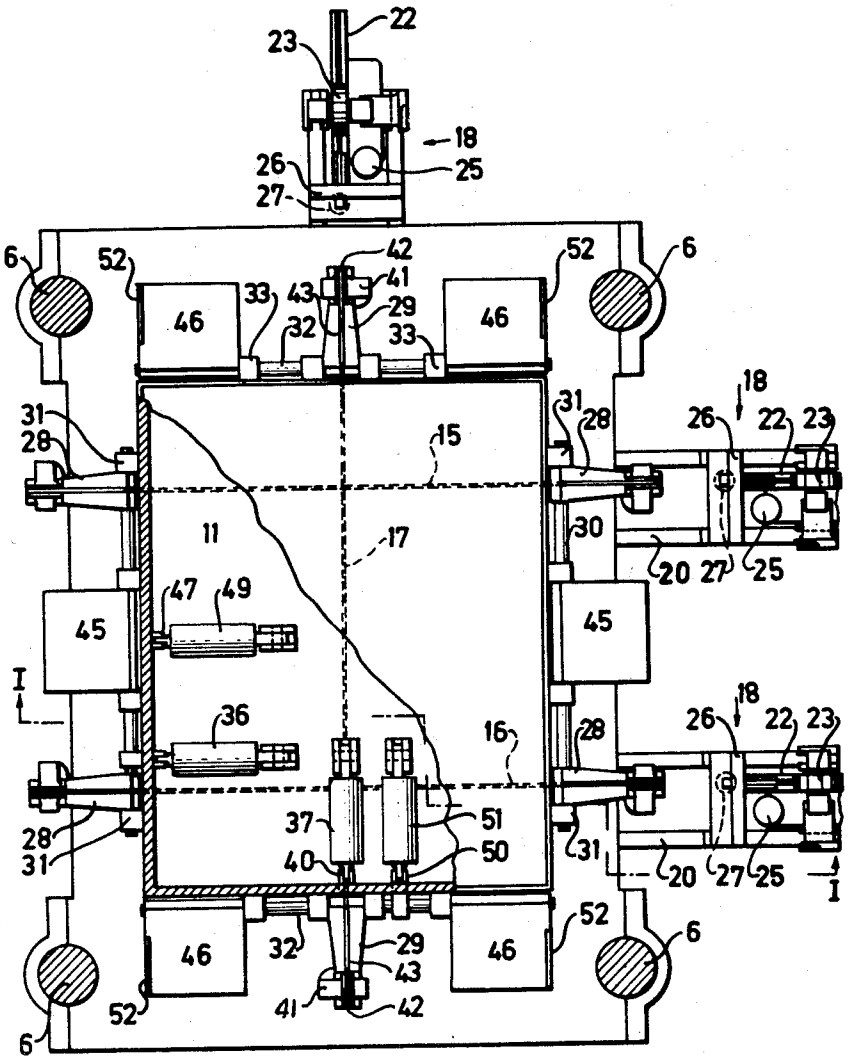


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DEVICE FOR AUTOMATICALLY BUNDLING MATERIAL

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Fig. 3

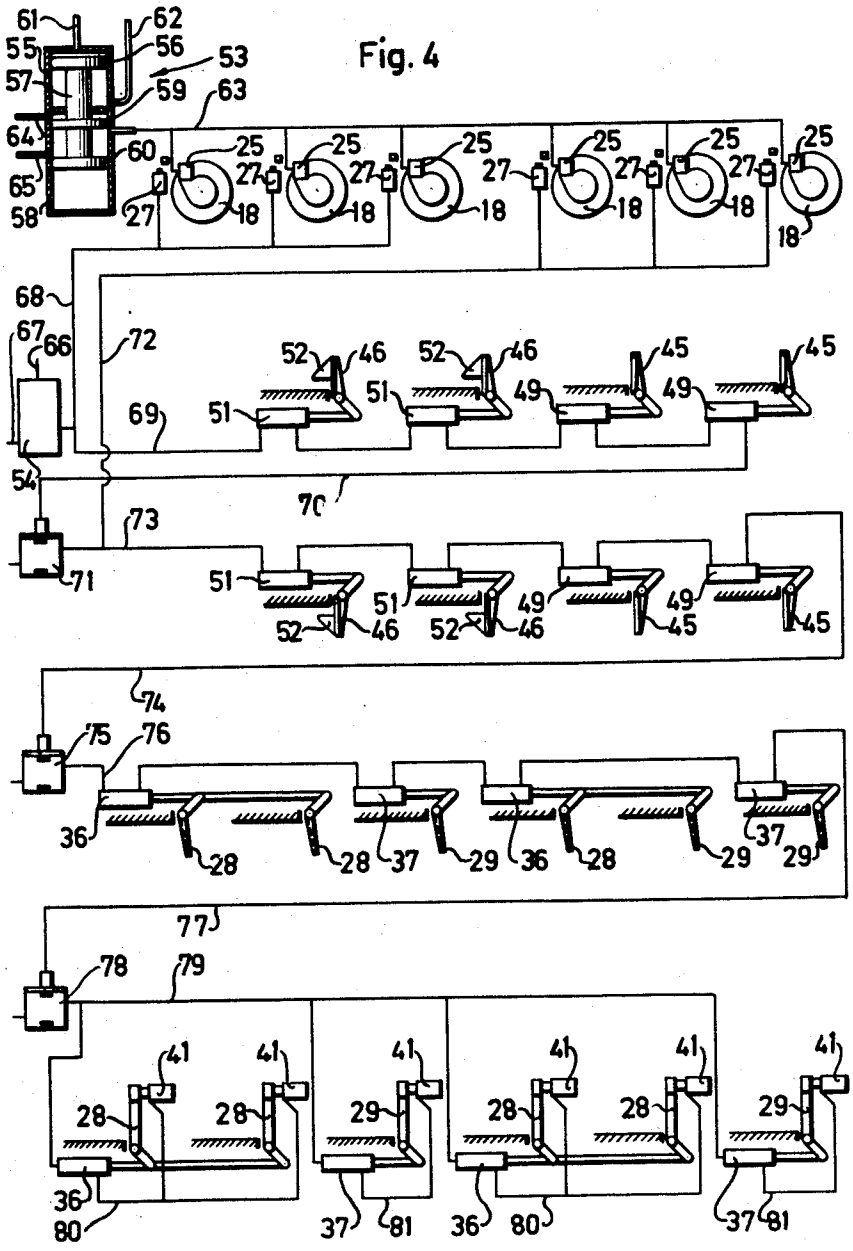


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DEVICE FOR AUTOMATICALLY BUNDLING MATERIAL

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Fig. 4



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# DEVICE FOR AUTOMATICALLY BUNDLING MATERIAL

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Claims priority, application Sweden Feb. 21, 1956

10 Claims. (Cl. 53—135)

The invention relates to a device for automatically bundling material, particularly sheet- or disk-shaped material such as sheets of pulp or fiberboard.

The packing and wrapping of pulp bales has hitherto mainly been carried out manually. The cut and piled pulp sheets are placed on a scale on which a wrapping paper has first been laid, and after adjusting the weight of the pile by adding or removing one or more sheets a wrapping paper is placed also on top of the pile. The pile is then transferred to a hydraulic press, where it is compressed to about half its original height, whereupon the two wrapping papers are folded by hand around the free side surfaces of the pile. While the pulp bale thus wrapped is still kept under full pressure, wires are introduced through grooves provided for this purpose in the surfaces of the two press plates, each wire having a length sufficient to allow it to be put in a coil around the compressed bale. Generally, one end of the wire is provided with a loop in which the other wire end is introduced and stretched, whereupon it is bent backwards and knotted to the wire coil. Generally, at least three such wire coils are laid in different planes around the pulp bale. When the pressure on the bale is then released, the wire coils will be subjected to a tension, whereby the bale or package is effectively held together. The packing described above involves a considerable amount of work which occupies several persons each shift, and often the work is so strenuous that the personnel must be relieved for instance every second hour.

The present invention has for its object to provide an automatically operating device by means of which the strenuous work described above can for the greater part be eliminated and thus considerable expenses may be saved.

The device is generally useful, with or without wrapping, for bundling preferably sheet- or disk-shaped material by means of wires which are stretched around the bundle in one or more separate coils, and according to the invention two separate wire feeding mechanisms are provided for each such coil and adapted to advance along two opposite side surfaces of the bundle in the same plane predetermined lengths of wire which are together somewhat longer than the circumference of the bundle in the plane in question. Movable folding means are provided to bend the ends of the two wire lengths towards each other, and further means for connecting the wire ends placed next to each other are movable to and from the side surfaces of the bundle for finishing the combining wire coil.

The accompanying drawings show an embodiment of the device according to the invention, mounted in connection to a hydraulic press intended for compressing pulp bales to be packed.

In the drawings:

Figure 1 shows a side view of the plant in the initial position, the lower part of the picture being shown in section along the line I—I in Fig. 3.



Figure 2 shows the plant from the same side as in Fig. 1 but in a later stage of the packing operation.

Figure 3 shows a horizontal section along the line III—III in Fig. 1.

Figure 4 shows a connection diagram for the various cooperating packing devices.

The visible part of the hydraulic press comprises four vertical pillars 6 resting on a support 5 and carrying an upper, stationary press head 7. The pillars also serve as guides for a movable, lower press head 8 which is mounted on top of a vertical piston 9 projecting from an underlying hydraulic cylinder, not shown. Cases 10 and 11 are mounted on the opposite surfaces of the two press heads 7, 8 to engage a pulp bale. The press surfaces of these cases are provided with grooves to make it possible to pass wire coils around a pulp bale placed in the press. In the embodiment shown, the cases are, however, also utilized for carrying certain automatic packing devices that will be described more in detail hereinafter.

In Figure 1, the press is shown in its initial position, the pressing piston 9 being located in the bottom position. A pile 13 of pulp sheets placed on an underlying wrapping paper 12 has been put on the lower pressing case 11 and another, equally large wrapping paper 14 has then been put on top of the pile. As previously mentioned, wires are introduced through the grooves provided in the cases 10, 11 for this purpose, and when the pile has been compressed to about half its height, as shown in Figure 2, the projecting portions of the two wrapping papers 12, 14 are folded around the vertical side surfaces of the pile, whereupon the wires are bent and their ends united.

At the packing described below, a rectangular bale (see Figure 3) is to be bound together by means of two spaced, parallel wire coils laid around the longitudinal sides and one coil laid around the ends of the bale perpendicular to said first coils. Thus, each of the two cases is provided with three grooves, as indicated by phantom lines 15—17 in Figure 3.

For introducing wires through these grooves there are three upper and three lower wire feeders, generally designated by 18 in Fig. 3. The upper wire feeders are mounted on brackets 19 (Figs. 1 and 2) suspended from the upper press head 7, whereas the lower wire feeders are mounted on brackets 20 projecting from the lower press head 8. The wire is unwound from a reel 21 (shown to the right in Fig. 1) and is conducted around a large disk 22 provided with a peripheral groove and rotatably journalled in the corresponding bracket 19 or 20. A smaller roller 23 engages the periphery of the disk to keep the wire in the groove of the disk. A horizontal ruler 24 supported by the bracket is provided with a longitudinal groove intended to guide the wire advanced by the disk and for this purpose directed tangentially from the disk 22 towards the corresponding groove 15—17 in the adjacent press case 10 or 11. The disk is preferably driven by means of a compressed-air motor, indicated at 25, over a movement transmitting mechanism of the type described in my copending application Serial No. 638,295, now Patent No. 2,831,356 granted April 22, 1958. Said mechanism is constructed to rotate the disk exactly one revolution on supply of compressed air to the motor, whereupon a particular checking device automatically stops the feeding. The circumference of the disk 22 is dimensioned such that the wire advanced during one revolution becomes somewhat longer than half the circumference of the compressed bale in the vertical plane in question.

Scissors known per se and only diagrammatically indicated at 26 are provided before the outer ends of the wire guiding rulers 24 to cut off the advanced wires,

The scissors are put into operation by compressed-air cylinders 27 to which compressed air is supplied at the desired moment.

Outside and in alignment with the above-mentioned grooves 15—17 in the press surfaces the vertical side surfaces of the cases 10, 11 carry wire folders in the form of pivotal flaps 28, 29, which are normally held in a horizontal position with their upper surfaces in the same plane as the adjacent press surface. The two wire folders or pivotal flaps 28 at either side of each case are secured to a common shaft 30 (Fig. 3) journalled in bearings 31 fixed to the case. At the ends of the cases the wire folders or pivotal flaps 29 (one at each side) are rotatable around shafts 32 journalled in bearings 33 fixed to the case. The wire folders can be swung inwards to the pulp bale to fold the ends of the upper and lower wires (34 and 35 in Fig. 2) downwards and upwards respectively towards each other, and they are driven by compressed-air cylinders 36, 37 located within the cases 10, 11. The two wire folders 28 at each side are controlled by a common compressed-air cylinder 36 the piston rod 38 of which is linked to the outer end of a lever 39 secured to the shaft 30 (see Figs. 1 and 2), whereas the wire folder 29 at each end is in the same way controlled by means of a compressed-air cylinder 37 (Fig. 3), the piston rod of which is linked to a bell crank 40 made integral with the wire folder itself. To render possible the movements of the piston rods and the levers corresponding openings are, of course, provided in the vertical sides of the cases.

Each of the lower wire folders carries at its outer end a wire twister 41 adapted to twist together the two ends 34 of the wire folded towards each other. The twister depends normally downwards and is preferably of a compressed-air driven type described in my copending United States application Serial No. 638,295, now Patent No. 2,831,356, granted April 22, 1958, said device being arranged to stop automatically after completed twisting. As shown in Fig. 3 and also indicated by a phantom line in Fig. 1, the wire twister 41 has a relatively deep gap 42 for receiving the wires. Said gap forms a continuation of a groove 43 provided in the upper surface of the wire folder in alignment with the adjacent groove in the surface of the case 11. The bottom of the groove 43 has the same depth as the gap 42 close to the latter and therefrom it rises rectilinearly to the surface at the inner end of the wire folder. The upper wire folders, which do not carry any wire twisters, may each be provided with a guiding groove 44 having the same depth throughout, in which case they are instead adapted to be swung an angle slightly less than 90° (Fig. 2).

As the gap 42 of the wire twisters must necessarily have a certain depth, as apparent from the above identified United States Patent 2,831,356, the ends of the wires will not be bent quite perpendicularly into contact with the side of the pulp bale. Nor is that necessary or even desirable. As the pressure is released on termination of the packing and the bale expands accordingly, the twisted wires are not only stretched but moreover subjected to a considerable tension. This tension must not be too great, so that the wires burst, which sometimes may happen at the manual packing owing to a too forceful tightening. An automatic joining of the wire ends ensures that the wire coils are always given a constant tension adapted to the tensile strength of the wire.

The folding and twisting together of the wires has been described above in sequence with the wire feeding but must of course be preceded by a folding of the wrapping papers, if such are used. For this purpose, pivotable, relatively broad flaps 45, 46, so-called wrappers, are provided around both cases 10, 11 to be swung from an initial, horizontal position in the plane of adjacent press surface at right angles to contact the vertical side surfaces of the bale, thereby simultaneously folding the projecting portions of the wrapping papers 12, 14. Such a wrapper 45 is placed at each of the sides of the cases 10, 11 between the two wire folders 28 and is rotatably journalled on the shaft 30. The wrapper 45 has an arm 47 (see to the left in Figs. 1 and 2) projecting at right angles and linked to the piston rod 48 of a compressed-air cylinder 49 placed within the case. At each end of the cases two wrappers 46 are fixed to the shaft 32 at either side of the wire folder 29 next to the corner of the case. The shaft 32 can be rotated by means of an arm 50 projecting radially from it and having its outer end linked to the piston rod of a compressed-air cylinder 51 mounted within the case (Fig. 3). The wrappers 46 are provided with flaps 52 projecting substantially perpendicularly (Figs. 1 and 3) and located substantially in the same vertical plane as the adjacent vertical sides of the cases. When the wrappers 46 are swung into operative position said flaps 52 pass outside the vertical edges of the pulp bale, thereby folding the corners of the wrapping papers into contact with the sides of the bale. Preferably the wrappers 46 are adapted to be put into operation first, whereupon the wrappers 45 finish the wrapping.

In the position shown in Fig. 2, wires 34, 35 have been introduced into their respective grooves 15—17 in the upper and lower press cases, whereupon the press has compressed the pulp bale to approximately half its original height. The wrappers have been swung into contact with the vertical side surfaces of the bale, which have thereby been covered by the wrapping paper 12, 14, and the upper wire folders have been swung downwards in folding the wires 34. The lower wire folders are just moving upwards with the wires 35 placed therein and in continuing their movement to contact with the side surfaces of the bale they also receive the upper wires 34. Thus, the two wire ends 34, 35 will lie close to each other in the gap 42 of the corresponding wire twister which is then started to effect the twisting. The packing of the pulp bale is now terminated and the pressure can then be released at the same time as the other movable members return to their initial positions.

In the embodiment described above all packing devices are driven by means of compressed-air cylinders performing a working stroke on supply of compressed air and then returned to their initial positions by the action of springs on release of the pressure. The control of these driving means may of course be fully or half automatic or be performed manually in many different ways. The connection diagram in Fig. 4 should, however, serve as a suitable example.

Two impulse valves 53 and 54 are adapted to be operated by means of the oil pressure in the hydraulic system of the press. These valves may be of the type diagrammatically shown for the valve 53 at the top and to the left in Fig. 4. A cylinder 55 contains a piston 56 having a rather thick rod 57 extending into an adjacent cylinder 58, where said rod carries two spaced plungers 59, 60. The space above the piston 56 is connected by means of a conduit 61 to a source of compressed air having a pressure of for instance 5 kg./cm.$^2$, whereas the space below the piston 56 is connected by means of a conduit 62 to the hydraulic system. When the oil is not under pressure, the piston 56 is located in its lower end position, and a conduit 63 extending from the space above the plunger 59 then communicates with an outlet 64, whereas the space between the plungers 59, 60 shuts off a conduit 65 connected to the source of compressed air. The lower surface of the piston 56 is dimensioned such that the piston aggregate is moved upwards when the oil pressure amounts to 10 kg./cm.$^2$, and then the space between the plungers 59, 60 connects the compressed-air conduit 65 to the conduit 63, as shown in Fig. 4, whereas instead the outlet 64 is closed.

In the same way as previously at manual packing the

operator adjusts a manually operated valve, not shown, for effecting a pressure in the hydraulic system, but when this has been done the device according to the invention operates fully automatically. Already when the oil pressure amounts to 10 kg./cm.², the valve 53 is switched over, as mentioned above, and compressed air is thus led through the conduit 63 to the cylinders 25 of the wire feeders 18, which are coupled in parallel to each other. As previously mentioned, the wire feeders are constructed to be automatically stopped when the required lengths of wire have been delivered.

The valve 54 which receives an impulse from the oil system through a conduit 66, is adapted to be reversed when full pressure, usually about 100 kg./cm.², has been reached. This causes a conduit 67 from the source of compressed air to be connected to a conduit 68 which supplies compressed air to the cylinders 27 of the lower scissors 26, whereby the lower wires are cut off. Another conduit 69 from the valve 54 simultaneously supplies air to the cylinders 51 and 49 of the lower wrappers 46, 45 respectively, which are coupled in series after each other. When the piston of the first cylinder 51 has been moved to its outer end position it uncovers an outlet communicating with the rear end of the next cylinder and so on, and the air escaping from the last cylinder 49 through a conduit 70 is utilized for adjusting a control valve 71 known per se. The valve 71 connects the source of compressed air with a conduit 72 to the cylinders 27 of the upper wire scissors and with a conduit 73 to the upper wrappers 46, 45 which are coupled in series in the same way as the lower ones. The air escaping from the last cylinder 49 through a conduit 74 is utilized as impulse air for the next control valve 75 which, when adjusted, connects the source of compressed air with a conduit 76 to which the four cylinders 36, 37 of the upper wire folders 28, 29 are coupled in series. The air from the last cylinder 37 of the series flows through a conduit 77 to a control valve 78 and adjusts it to connect the source of compressed air with a conduit 79 to which the cylinders 36, 37 of the lower wire folders are coupled in parallel. The air is led from said latter four cylinders 36, 37 through conduits 80, 81 to the cylinders of the six wire twisters 41, the wire twisters driven from each cylinder 36 being coupled in parallel.

The pistons of all the cylinders mentioned are now compressed-air actuated, i.e. they are in operative position, and the return to their initial positions occurs only after readjustment of the valve controlling the hydraulic system, in that the two impulse valves 53, 54 are then moved to vent the conduits 63 and 68, 69 respectively, when the oil pressure sinks. Although not shown, it is possible to automatize also said last readjustment, if desired. For instance, the wire folder 29 coupled last in the series can be arranged, when having reached its vertical position, to actuate a limit switch inserted in an electric circuit, and a current supplied through this circuit may cause the readjustment of the valve of the hydraulic cylinder over a relay acting with some delay.

The series connection of the cylinders shown in Fig. 4 has been chosen exclusively to make the circuit diagram surveyable. If desired, a knob may instead be provided on the piston rod of each cylinder to actuate an impulse valve supplying compressed air to the next cylinder. Also in this case it will of course be a kind of connection in series.

The construction described and shown in the drawing is of course only to be considered as an embodiment, and as pointed out in the introduction the device according to the invention is not restricted to the packing of pulp bales only but includes the bundling of various, preferably sheet- or disk-shaped materials, with or without a subsequent wrapping.

What I claim is:

1. A device for bundling a compressible pile of material, such as pulp sheets, comprising a stationary and a movable press head adapted to engage the bottom and top surfaces of the pile, at least one pair of grooves provided in the press surfaces of the two press heads in a common plane perpendicular to said surfaces, said grooves being adapted to receive wires, one wire feeding mechanism mounted before one end of each groove and adapted to supply a continuous length of wire from a roll, the mechanism mounted before a pair of grooves being arranged to advance predetermined lengths of wires together somewhat longer than the circumference of the compressed pile, in the plane of the grooves, stopping means arranged to stop the feeding mechanisms automatically when said predetermined wire lengths have been advanced, means provided to cut off said advanced wire lengths, folding means provided outside the ends of said grooves and movable to bend the ends of the two wires towards each other, and means for connecting the wire ends bent to each other, said connecting means being carried by one of two cooperating folding means on each side of the pile.

2. A device for packing a compressible pile of material, sheets of wrapping material being in advance placed under and on top of the pile to pack, comprising a press having a stationary and a movable press head adapted to engage the bottom and top surfaces of the pile, at least one pair of grooves provided in the press surfaces of the two press heads in a common plane perpendicular to said surfaces, said grooves being adapted to receive wires, folding means movably mounted on supports around the press surfaces and adapted to fold the wrapping sheets into contact with adjacent vertical side surfaces of the pile, the folding means located at the corners of the pile being angular in shape to fold the sheets around the vertical edges of the pile, one wire feeding mechanism mounted before one end of each groove in the press surfaces, the mechanisms mounted before a pair of grooves being arranged to advance lengths of wires together somewhat longer than the circumference of the compressed pile in the plane of the grooves, folding means provided outside the ends of said grooves and movable to bend the ends of the two wires towards each other, and means for connecting the wire ends bent to each other, said connecting means being carried by one of two cooperating folding means on each side of the pile.

3. A device for packing a compressible pile of material, sheets of wrapping material being in advance placed under and on top of the pile to be packed, comprising a press having a stationary and a movable press head adapted to engage the bottom and the top surfaces of the pile, at least one pair of grooves provided in the press surfaces of the two press heads in a common plane perpendicular to said surfaces, said grooves being adapted to receive wires, folding means movable mounted on supports around the press surfaces and adapted to fold the wrapping sheets into contact with adjacent vertical side surfaces of the pile, the folding means located at the corners of the pile being angular in shape to fold the sheets around the vertical edges of the pile, one wire feeding mechanism mounted before one end of each groove in the press surfaces and adapted to supply a continuous length of wire from a roll, the mechanisms mounted before a pair of grooves being arranged to advance predetermined lengths of wires together somewhat longer than the circumference of the compressed pile in the plane of the grooves, stopping means arranged to stop the feeding mechanisms automatically, when said predetermined wire lengths have been advanced, means provided to cut off said advanced wire lengths, folding means provided outside the ends of said grooves and movable to bend the ends of the two wires towards each other, and means for connecting the wire ends bent to each other, said connecting means being carried by one

of two cooperating folding means on each side of the pile.

4. A device according to claim 2 in which the press is operated by fluid pressure, means subjected to said fluid pressure being arranged to start motors driving the wire feeding means, when said pressure has reached a predetermined relatively low value.

5. A device according to claim 2, in which the press is operated by fluid pressure, means subjected to said fluid pressure being arranged to start motors moving the wire bending means, when said pressure has reached substantially its maximum value.

6. A device according to claim 1, in which one of the two cooperating wire folding means carries a mechanism for twisting the wire ends together.

7. A device according to claim 1, in which the wire folding means have surfaces turned to the wires and provided with grooves for guiding the wire ends.

8. A device according to claim 1, in which the press is operated by fluid pressure, means subjected to said fluid pressure being arranged to start motors driving the wire feeding means, when said pressure has reached a predetermined relatively low value.

9. A device according to claim 1, in which the press is operated by fluid pressure, means subjected to said fluid pressure being arranged to start motors moving the wire bending means, when said pressure has reached substantially its maximum value.

10. A device according to claim 2, in which the press is operated by fluid pressure, means subjected to said fluid pressure being arranged to start motors moving the wrapping paper folding means, when said pressure has reached substantially its maximum value.

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