

Aug. 25, 1959

H. KABELITZ

2,900,951

MACHINES FOR TREATING SHEET MATERIAL

Filed Feb. 7, 1955

7 Sheets-Sheet 1

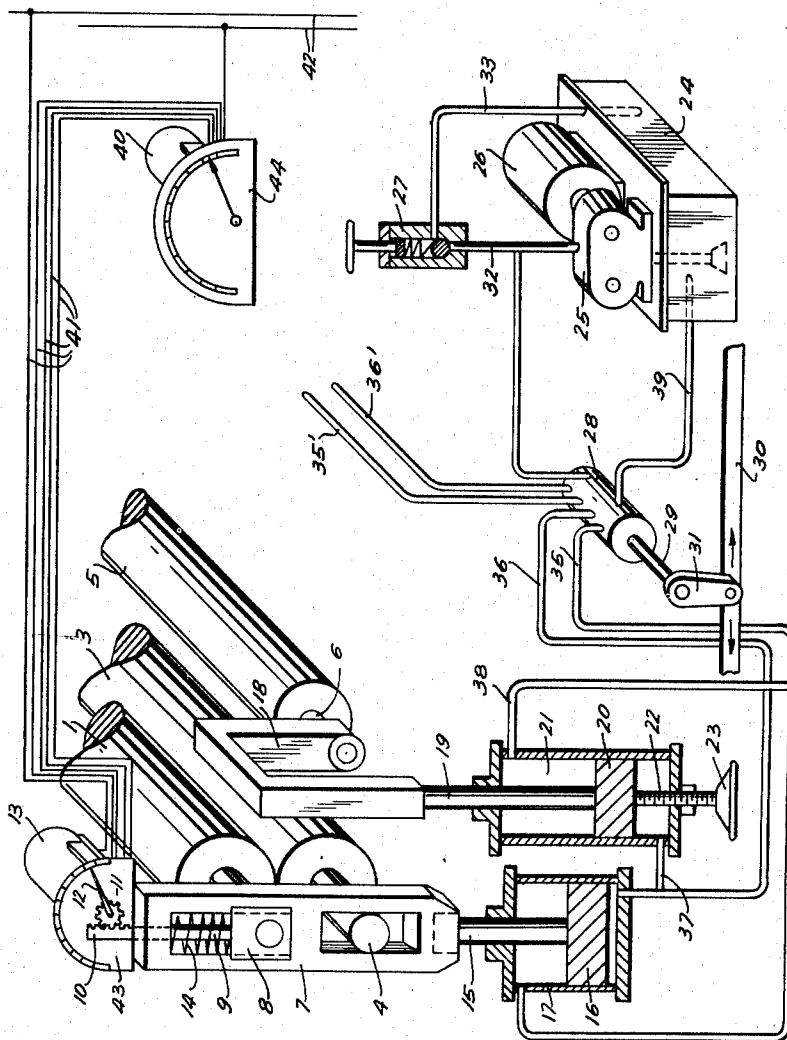


FIG. 1

INVENTOR.
Hans Kabelitz
BY Michael S. Sticker
ATTORNEY

Aug. 25, 1959

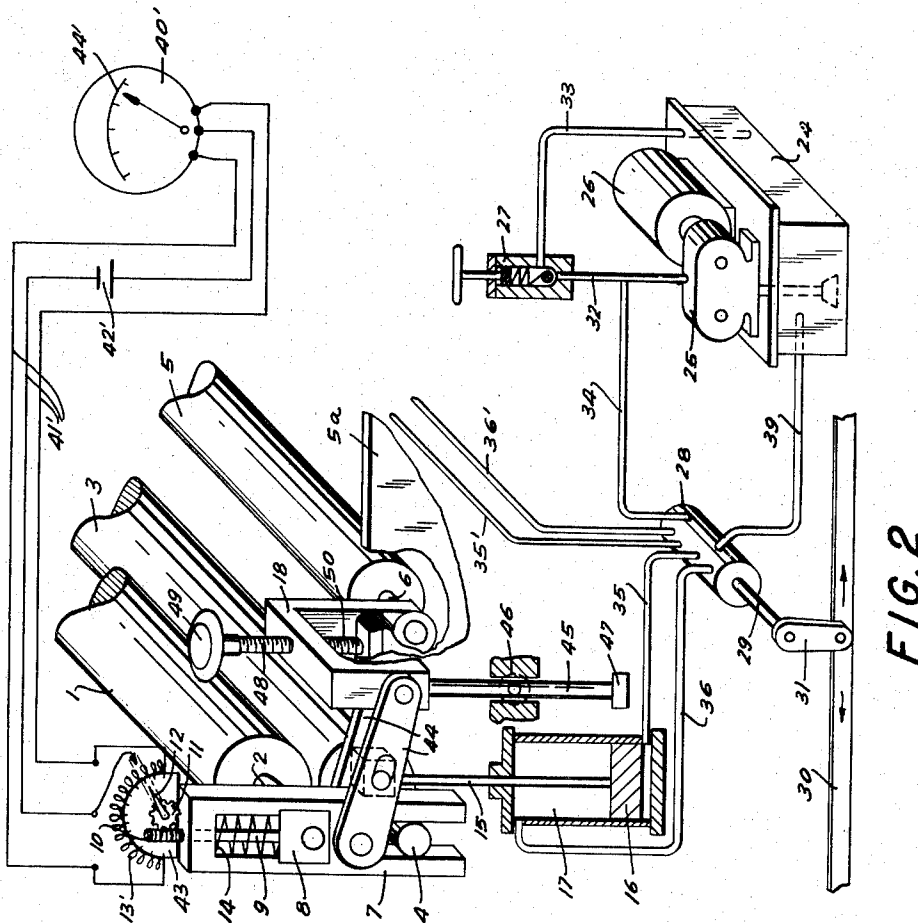
H. KABELITZ

2,900,951

MACHINES FOR TREATING SHEET MATERIAL

Filed Feb. 7, 1955

7 Sheets-Sheet 2



INVENTOR.
Hans Kabelitz
BY Michael L. Sticker
ATTORNEY

Aug. 25, 1959

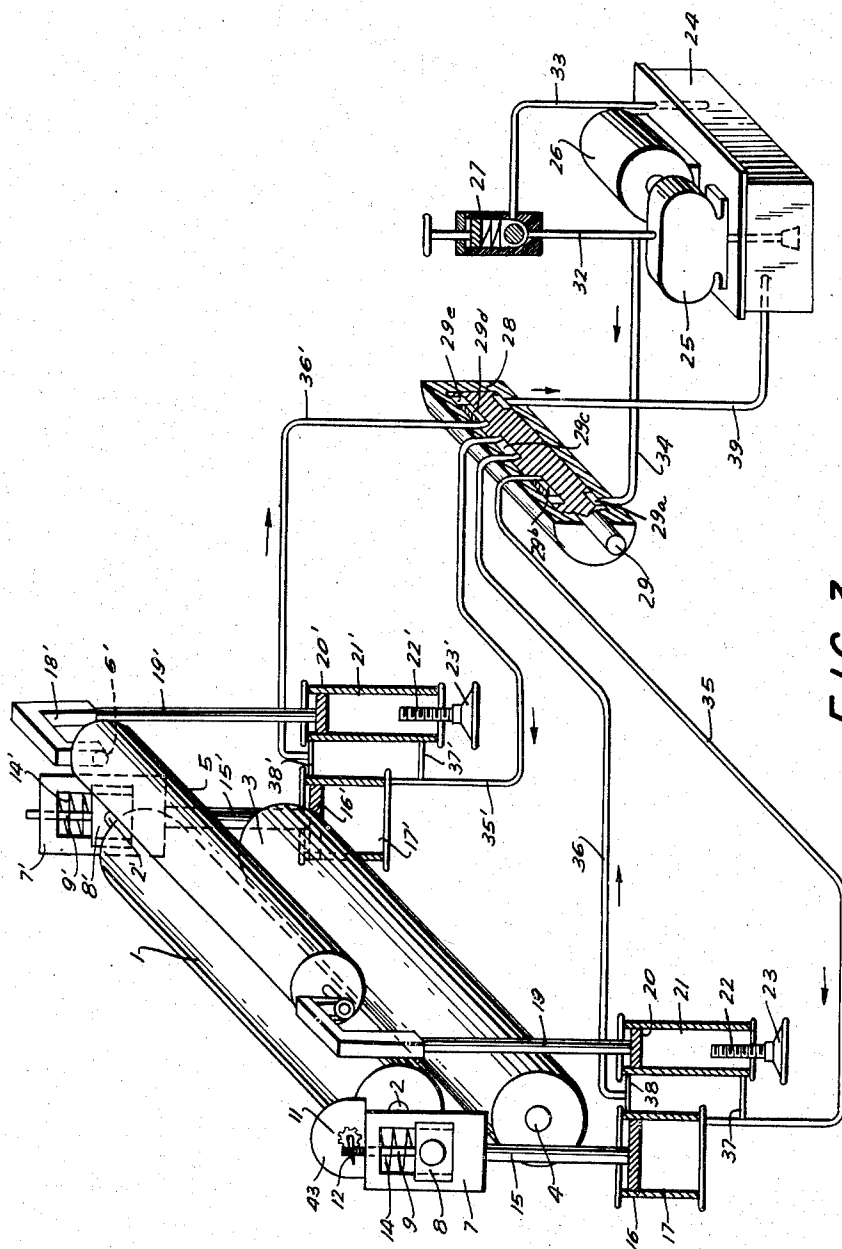
H. KABELITZ

2,900,951

MACHINES FOR TREATING SHEET MATERIAL

Filed Feb. 7, 1955

7 Sheets-Sheet 3



INVENTOR.
Hans Kabelitz
BY Michael L. Sticker
ATTORNEY

Aug. 25, 1959

H. KABELITZ

2,900,951

MACHINES FOR TREATING SHEET MATERIAL

Filed Feb. 7, 1955

7 Sheets-Sheet 4

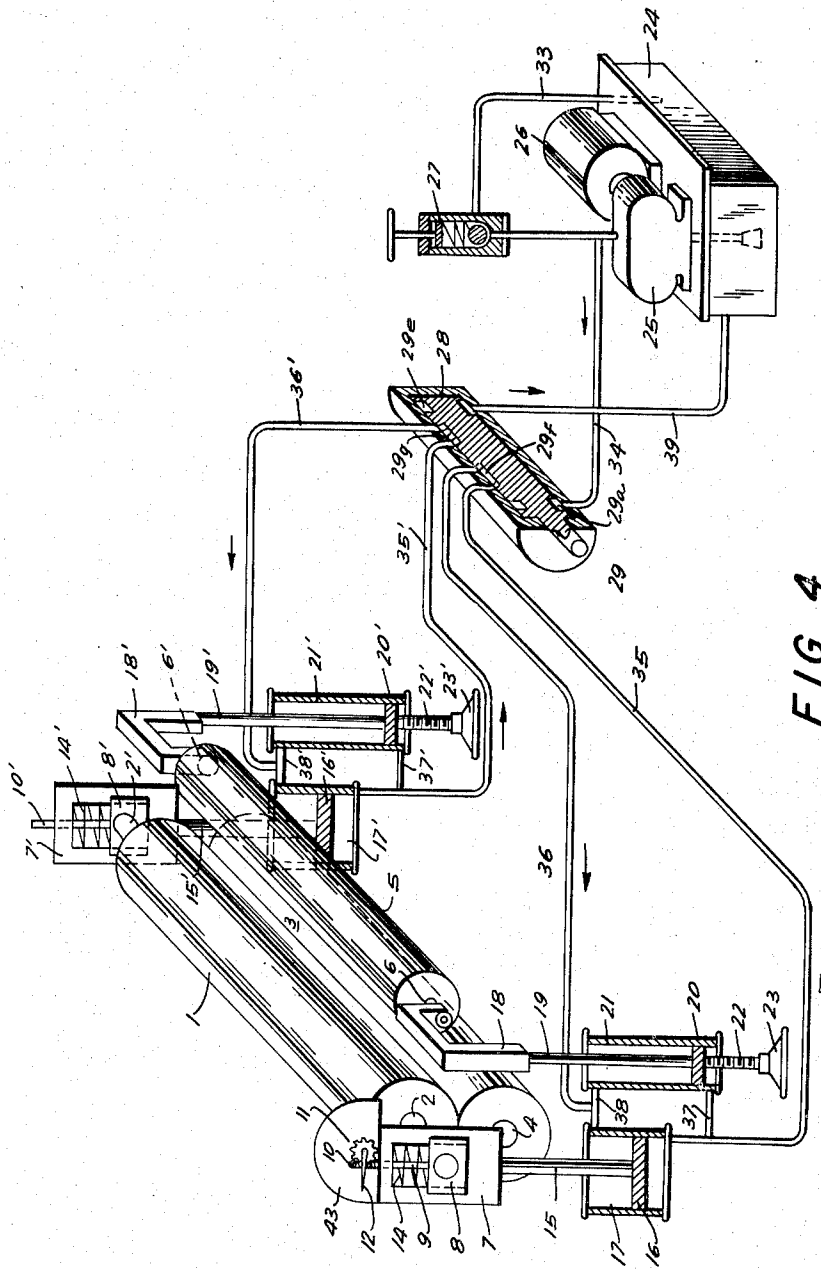


FIG. 4

INVENTOR.
Hans Kabelitz
BY Michael S. Striker
ATTORNEY

Aug. 25, 1959

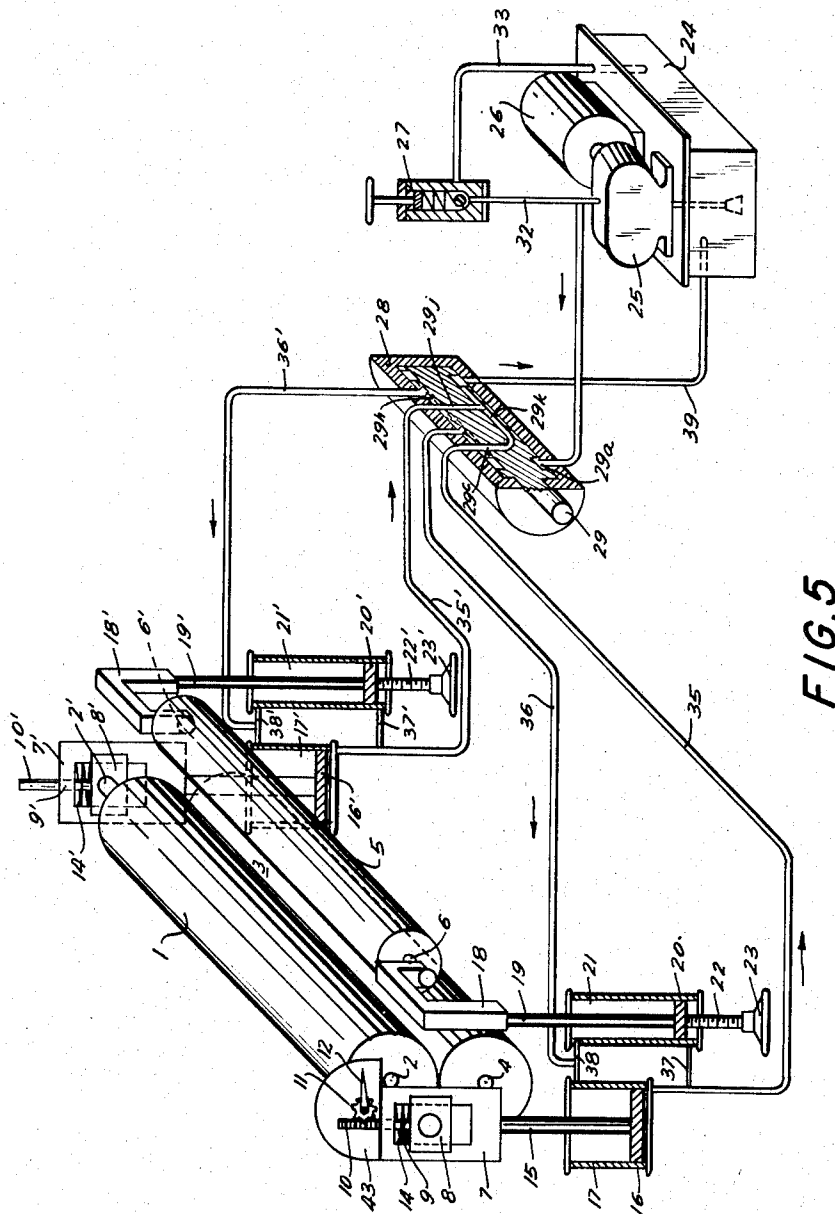
H. KABELITZ

2,900,951

MACHINES FOR TREATING SHEET MATERIAL

Filed Feb. 7, 1955

7 Sheets-Sheet 5



INVENTOR.
Hans Kabelitz
BY Michael S. Striker
ATTORNEY

Aug. 25, 1959

H. KABELITZ

2,900,951

MACHINES FOR TREATING SHEET MATERIAL

Filed Feb. 7, 1955

7 Sheets-Sheet 6

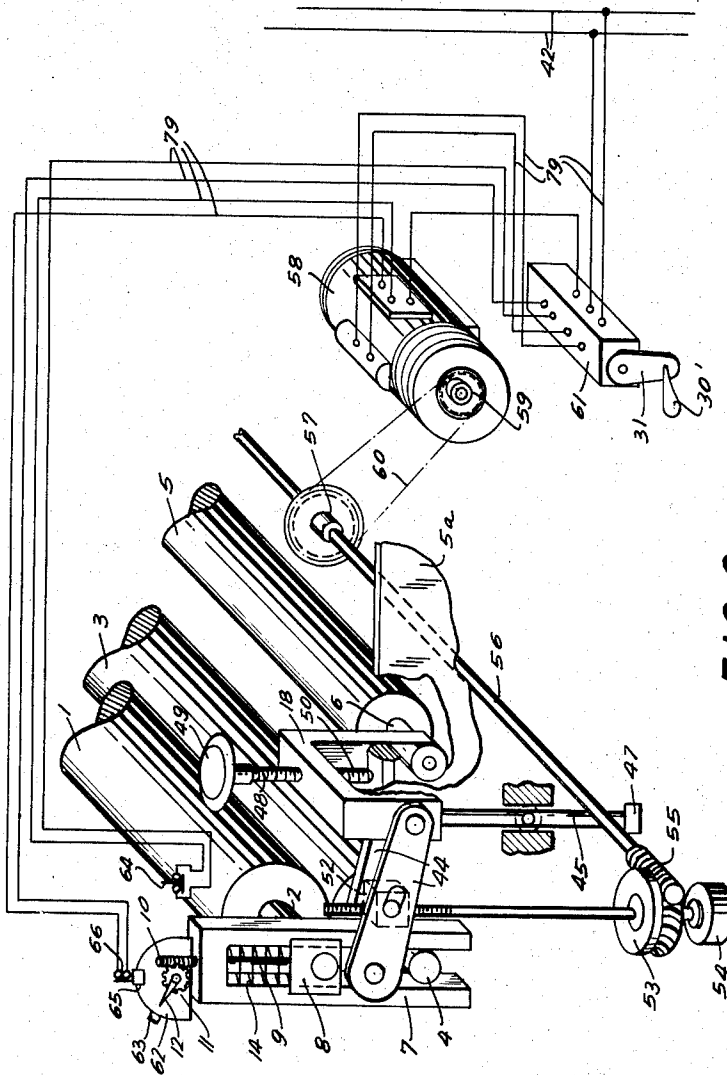


FIG. 6

INVENTOR.
Hans Kabelitz
BY Michael S. Striker
ATTORNEY

Aug. 25, 1959

H. KABELITZ

2,900,951

MACHINES FOR TREATING SHEET MATERIAL

Filed Feb. 7, 1955

7 Sheets-Sheet 7

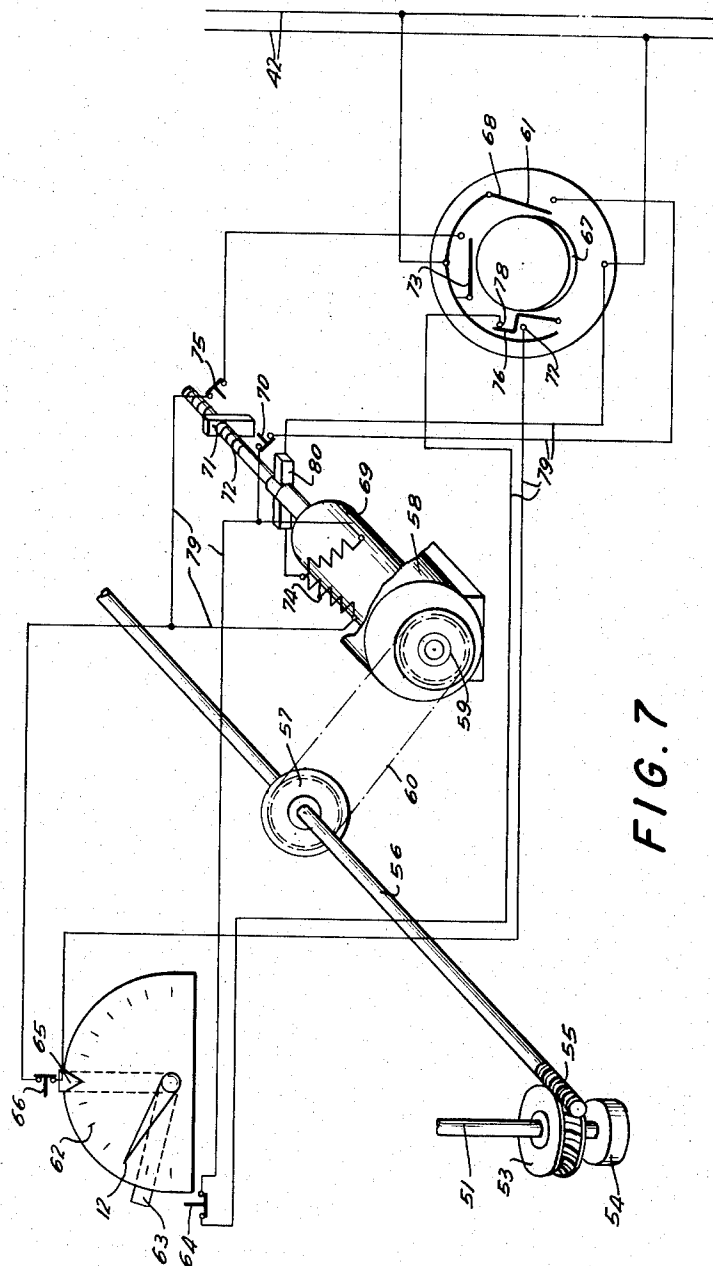


FIG. 7

INVENTOR.
Hans Habelitz
BY Michael S. Striker
ATTORNEY

1

2,900,951

MACHINES FOR TREATING SHEET MATERIAL

Hans Kabelitz, M.-Gladbach, Rhineland, Germany, assignor to Firma Gebrüder Sucker, G.m.b.H., M.-Gladbach, Rhineland, Germany

Application February 7, 1955, Serial No. 486,653

9 Claims. (Cl. 118—122)

The present invention relates to machines for treating sheet material.

In such machines, such as machines for treating webs of fabric, it is necessary at times to immerse the material being treated within a bath of impregnating liquid, for example, and to then pass the material through compression rollers which squeeze excess liquid therefrom. In order to obtain the best possible results with such machines uniform treatment of all parts of the material is essential and therefore not only is it necessary to accurately control the rollers which guide and compress the sheet material, but also it is important to be able to repeatedly obtain precisely the same setting of the rollers in order to have uniform treatment of the sheet material.

One of the objects of the present invention is to provide apparatus for shifting and controlling rollers of a machine of the above type in a simple and accurate manner.

Another object of the present invention is to provide manual controls for producing the desired results.

A further object of the present invention is to provide a machine which is capable of repeatedly obtaining precisely the same setting of the rollers.

An additional object of the present invention is to accurately control the pressure with which one pressure roller is urged toward a second pressure roller as well as to repeatedly provide precisely the same pressure of such a pressure roller.

It is also an object of the present invention to provide a means for moving a roller in such a way that the axis of the roller cannot become tilted so that the parallel relationship between a movable and stationary roller may be reliably maintained.

Furthermore, it is an object of the present invention to provide means for measuring the pressure which is applied to a given roller as well as to transmit the measurement to a place distant from the machine.

The objects of the present invention also include the provision of a process and apparatus capable of accomplishing all of the above objects and at the same time being relatively simple and inexpensive.

With the above objects in view the present invention mainly consists of a machine for treating sheet material and including a pressure roller and an immersion roller. A power means is operatively connected to the pressure roller for first moving the same from an idle position to an operating position, for then applying the pressure to this roller while it is in its operating position, for relieving this pressure after it is applied to the roller, and finally for returning the pressure roller from its operating position to its idle position. A manually operable control means is operatively connected to the power means for controlling the latter, and a manually adjustable limiting means is operatively connected to the power means for limiting the pressure applied by the power means to the roller. A moving means interconnects the power means with the immersion roller to shift the immersion roller when the pressure roller is shifted.

2

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a fragmentary, partly diagrammatic and partly schematic illustration of an apparatus for carrying out the present invention;

Fig. 2 is a view corresponding to Fig. 1 of a different embodiment of the invention;

Fig. 3 is a perspective diagrammatic view of the structure of Fig. 1 and illustrates the position of the parts at one time during the operation of the machine of the invention;

Fig. 4 shows the elements of Fig. 3 in a different position;

Fig. 5 shows the elements of Fig. 3 in a third position;

Fig. 6 is a fragmentary, partly diagrammatic, partly perspective view of a third embodiment of the invention; and

Fig. 7 is a wiring diagram illustrating electrical connections used in the embodiment of Fig. 6.

Referring now to the drawings, it is pointed out that Figs. 1, 2 and 6 show only part of the rollers 1, 3 and 5, and the structure connected to one end of these rollers. The identical structure is connected to the opposite ends of these rollers and is illustrated in Figs. 3-5 where the elements connected to the far ends of these rollers, as viewed in Figs. 3-5, have the same reference characters primed as the elements connected to the near ends of the rollers.

In Figs. 1-6 an upper, movable pressure roller 1 is provided to move vertically toward and away from a lower, stationary pressure roller 3. The upper pressure roller 1 has a pair of journals 2 and 2' coaxial therewith and respectively fixed to and extending from opposite ends of the roller 1, while the lower stationary roller 3 (stationary only in the sense that its only movement is rotation about its axis) is provided with a pair of journals coaxial therewith and respectively fixed to and extending from opposite ends thereof, only one of these journals 4 being visible in the drawings. The immersion roller 5, which is parallel to the pressure rollers 1 and 3, is adapted to move into and out of a container 5a (Fig. 2) which contains a treating liquid, and this immersion roller 5 becomes immersed at its lowermost operating position in the treating liquid so that a sheet material guided by roller 5 will pass through the treating liquid when the roller 5 is in its lowermost operating position. This roller 5 has a pair of journals 6 and 6' coaxial therewith and respectively fixed to and extending from the opposite end faces of the roller 5.

For the sake of clarity, the stationary bearings which support the journals of the roller 3 are not shown in the drawings. These stationary bearings are fixed to suitable stationary parts of the machine. The journal 4 and the opposite unillustrated journal of the roller 3 extend laterally beyond the journals 2 and 2' and beyond the frame members 7 described below into engagement with these stationary bearings.

A pair of bearings 8 and 8' turnably support the journals 2 and 2', respectively. The bearings 8 and 8' are respectively located within slots respectively formed in frame members 7 and 7' which are respectively located in planes normal to the axis of the movable pressure roller 1. These bearings 8 and 8' are respectively in slidable engagement with the frame members 7 and 7' and are movable along the slots thereof for a purpose described below. If desired, the bearings 8 and 8' may

be located beyond the frame members 7 and 7' and may be connected to turnable levers, respectively.

A pair of racks 9 and 9' are respectively fixed to the top faces of the bearings 8 and 8' and extends slidably through bores formed in the top portions of the frame members 7 and 7'. These racks 9 and 9' are provided with teeth 10 and 10', respectively, although the element 9' may simply be in the form of a pin provided with no teeth, so that only element 9 is in the form of a rack having teeth 10. This rack 9 meshes with a pinion 11 which is fixed to a pointer 12 for turning movement with the latter on a scale 43 carried by the frame member 7. If desired, this identical scale structure may be located on the frame 7' in which case the teeth 10' cooperate with a pinion corresponding to pinion 11. The pointer 12 may also be connected to a servomechanism, such as a Selsyn transmitter 13, in order to electrically transmit the measurement provided by the scale. The above-described measuring means measures the extent to which the springs 14 and 14' are compressed, these springs respectively being located within the slots of the frame members 7 and 7' and respectively engaging these frame parts as well as the bearings 8 and 8'. The springs 14 and 14' are in the form of coil springs which are coiled about the elements 9 and 9', respectively. If desired, the springs 14 and 14' may be replaced with other suitable structures capable of applying pressure and a measurement of the pressure.

As is shown in Figs. 1 and 3-5, piston rods 15 and 15' are respectively fixed to the bottom ends of the frame members 7 and 7', and these piston rods are respectively connected at their opposite ends to the pistons 16 and 16' which are respectively slidable within the diagrammatically illustrated cylinders 17 and 17', these cylinders being fixed to suitable stationary parts of the machine.

The journals 6 and 6' of the immersion roller 5 are turnably supported in bearings carried by members 18 and 18' which are substantially of an inverted U-shape. The inside legs of the members 18 and 18' carry the journals 6 and 6', respectively, while the outside legs of these members 18 and 18' are fixed to the top ends of piston rods 19 and 19', respectively. The piston rods 19 and 19' are fixed at their bottom ends to pistons 20 and 20' which are respectively slidable within stationary cylinders 21 and 21'. Screw members 22 and 22' extend threadedly through the bottom walls of cylinders 21 and 21', respectively, into the interiors of these cylinders, and handles 23 and 23' are connected to the screw members 22 and 22' so that the operator may adjust the extent to which these screw members extend respectively into the cylinders 21 and 21'. These screw members limit the downward movement of the pistons 20 and 20', respectively, so that in this way the extent to which the immersion roller 5 is immersed in a treating liquid may be controlled, as will be apparent from the description which follows.

In the illustrated example the pistons 16, 16', 20, and 20' are hydraulically operated with oil, for example, although if desired these pistons may be pneumatically operated with compressed air. The oil for moving these pistons is located within a tank 24 which carries a pump 25 communicating with the oil in the interior of the tank 24. A motor 26 on the tank is operatively connected to the pump 25 to operate the latter. The pump 25 pumps oil into a conduit 32 which communicates with an adjustable overflow valve 27 from which the oil may return along the conduit 33 back to the tank 24. Thus, by manually adjusting the valve 27 it is possible for the operator to adjust the maximum pressure of the oil which is pumped by the pump 25 to the cylinders. The oil flows to the cylinders along the conduit 34 which communicates with conduit 32 at a point between valve 27 and pump 25. The conduit 34 conveys the oil to a manually operable multi-way valve 28, 29, this valve including an outer cylindrical housing 28 within which

the valve member 29 is turnable, valve member 29 having an end extending beyond the housing 28 and fixed to a lever 31 which is in turn pivotally connected to a horizontally shiftable control bar 30 (Fig. 1). Thus, the operator need only shift bar 30 horizontally in order to set valve member 29 in one of a plurality of positions. Conduits 35 and 35' lead from the valve 28, 29 to the bottom ends of cylinders 17 and 17', respectively, while conduits 36 and 36' lead from the valve 28, 29 to the top ends of cylinders 17 and 17', respectively. Conduits 37 and 37' provide communication between conduits 35 and 35' and the bottom ends of cylinders 21 and 21', respectively, while conduits 38 and 38' provide communication between the conduits 36 and 36' and the top ends of cylinders 21 and 21', respectively. Thus, it will be seen that with this arrangement the cylinders 21 and 21' are respectively connected hydraulically in parallel with the cylinders 17 and 17'. It is thus evident that when the above-described hydraulic moving means is actuated to move the pressure roller 1, the immersion roller 5 will also be moved. A conduit 39 communicates with the valve 28, 29 and the tank 24 to return the oil to the latter.

In order to indicate to the operator the condition of the rollers at any given instant during the operation, the Selsyn transmitter 13 is electrically connected to an indicating means 40 through the several leads 41, and this indicating means 40 may be located distant from the rollers at a position convenient for the operator. The indicator 40 may be in the form of a Selsyn receiver connected electrically by the leads 41 to the Selsyn transmitter 13 and turning a pointer along a scale 44, as indicated in the drawings. Thus, with this arrangement it is possible for the operator to directly read the scale 43 which cooperates with the pointer 12 or to read the scale 44. As is pointed out above, a measuring and transmission means as described above may be located on the frame member 7' to cooperate with a rack 9'.

The operation of the above described structure is as follows:

With the oil pump 25 operating and with the bar 30 set in the idle position of the machine, the parts will be in their rest position where movable pressure roller 1 is raised from the stationary pressure roller 3 and where the immersion roller 5 is raised out of the bath. This condition of the parts is illustrated in Fig. 3 from where it will be seen that the valve member 29 is angularly positioned in the housing 28 so that the conduit 34 communicates through annular groove 29a of valve 29 with the axially extending bore 29b which in this position of valve member 29 communicates with the conduit 35 so that the oil flows through this conduit into the lower end of cylinder 17 to raise piston 16 and through conduit 37 into the lower end of cylinder 21 to raise piston 20. Furthermore, in the angular position of valve member 29 illustrated in Fig. 3 an axially extending groove 29c of the valve member 29 communicates with conduit 36 and with conduit 35'. Thus, as the pistons 16 and 20 move upwardly within the cylinders 17 and 21, respectively, the oil displaced thereby will move through conduit 36 to the groove 29c and from the groove 29c to the conduit 35', this conduit 35' delivering this oil to the bottom end of cylinder 17' and through conduit 37' to the conduit 21'. As the pistons 16' and 20' move upwardly they displace oil from the cylinders 17' and 21', respectively, along the conduit 36' to an axial bore 29d which communicates, in the angular position of valve member 29 shown in Fig. 3, with the conduit 36', this bore 29d also communicating with the annular groove 29e which communicates with the conduit 39.

Thus, it will be seen that with the position of the parts shown in Fig. 3 oil is not supplied from the pump 25 directly to the bottom ends of all of the cylinders. Instead, the cylinders 17' and 21' are hydraulically connected in series with the cylinders 17 and 21 to be sup-

plied with the fluid displaced from these latter cylinders by the upwardly moving pistons 16 and 20, respectively. This series interconnection of the hydraulic means at one end of the rollers with the hydraulic means at the opposite ends of the rollers is a particular feature of the invention. It has been found that where the hydraulic means at opposite ends of a given roller are connected in parallel so as to be independently supplied with oil for raising such a roller, for example, the axis of this roller becomes tilted and the roller does not always remain parallel with the stationary counter pressure roller. However, with the above-described arrangement shown in Fig. 3 the cylinders 17' and 21' receive only what is displaced from the cylinders 17 and 21 so that it is impossible for the pistons 16' and 20' to move ahead of or behind the pistons 16 and 20, and in this way tilting of the axes of the rollers 1 and 5 is reliably prevented.

Thus, Fig. 3 illustrates the starting position where the pressure rollers 1 and 3 are spaced from each other and the immersion roller 5 is raised out of a bath therebeneath. When the apparatus is to be set into operation, the rollers are set to provide only a creeping movement of the sheet material, and in order to bring this operation about the bar 30 is manually shifted to angularly turn the valve member 29 to the position illustrated in Fig. 4. It will be seen from Fig. 4 that in the illustrated angular position of valve member 29 the bore 29b has been turned away from conduit 35 so that this conduit 35 no longer communicates with the annular groove 29a and thus oil cannot flow from conduit 34 to conduit 35. In the same way, the bore 29d has been turned away from conduit 36' so that this latter conduit can no longer communicate through the annular groove 29e with the conduit 39. Thus, oil cannot flow to or from the cylinders from the pump with the angular position of valve member 29 shown in Fig. 4. On the other hand, an axial groove 29f of valve member 29 has been turned into communication with conduits 35 and 36 and an axial groove 29g of valve member 29 has been turned into communication with conduits 35' and 36', so that with the position of the parts illustrated in Fig. 4 the cylinders 17' and 21' are cut off from cylinders 17 and 21, and instead oil may pass from the lower ends of cylinders 17 and 21 to the top ends thereof and from the lower ends of cylinders 17' and 21' to the top ends thereof. Thus, when the valve member 29 is turned to the position shown in Fig. 4 the rollers 1 and 5 will simply move down by their own weight and the roller 1 will rest by gravity on the roller 3 while the roller 5 will rest by gravity through the pistons 20 and 20' on the top ends of the screws 22 and 22', respectively. In this position the roller 5 is immersed within the treating liquid.

The rollers 1, 3 and 5 turn simply by frictional engagement with the sheet material, although it is possible, if desired, to advance the sheet material by connecting a motor or the like to one of the journals 4. In actual practice an unillustrated roller will be turned to wind the material thereon, and the material will be advanced in this manner and will turn the receivers 1, 3 and 5 simply by engagement therewith.

Because of the greater weight of the roller 1 and the parts connected thereto as compared to the weight of the roller 5 and the parts connected thereto the roller 1 will reach its bottom operating position before the roller 5. The downward movement of this roller 5 immerses the sheet material into the treating liquid.

As is pointed out above the position of the parts shown in Fig. 4 is an intermediate starting position which is provided between the idle position shown in Fig. 3 and the normal operating position of the parts illustrated in Fig. 5. To place the parts in the normal operating position shown in Fig. 5, the manually turnable shifting bar 30 is shifted by the operator beyond the position which located valve member 29 in the position of Fig. 4 to a position which angularly turns the valve member 29 to

the position shown in Fig. 5. In this position an axial bore 29h in the valve member 29 which communicates with the annular groove 29a also communicates with the conduits 36 and 36' so that the fluid under pressure flows along these conduits to the top ends of the cylinders, and thus in this position of the parts the fluid under pressure lowers the pistons 16 and 16' to compress the springs 14 and 14', respectively, and the above-mentioned measuring means indicates the pressure applied to the roller 1 through the springs 14 and 14'. The pressure acting downwardly on the pistons 20 and 20' is also increased to prevent upward movement of the roller 5. It will be noted that before the pistons 16 and 16' are moved downwardly beyond the position of Fig. 4 the roller 1 is already resting by gravity on the roller 3 so that there is no danger of tilting the axis of roller 1. It is only when roller 1 is raised upwardly away from the roller 3 that such a danger exists. In the position of valve member 29 shown in Fig. 5, bores 29i and 29j which extend transversely across the valve member 29 are respectively in communication with the conduits 35 and 35'. The bore 29h of the valve member 29 is carefully formed so that it does not intersect the bores 29i and 29j. Thus, this axially extending bore 29h communicates through non-radial bores of valve member 29 which extend outwardly from bore 29h into communication with the conduits 36 and 36' in the position of the parts shown in Fig. 5 where the bore 29h is located behind the bores 29i and 29j. These bores communicate with an axially extending bore 29k which communicates with the annular groove 29e so that in this way the conduits 35 and 35' communicate with conduit 39. Thus as the pistons 16 and 16' of Fig. 5 move downwardly they displace the oil through conduits 35 and 39 to the tank 24. The valve 27 is adjusted to control the pressure which is applied to the pistons 16 and 16', and this pressure may be constantly maintained for any desired length of time. This pressure is released only when the operating bar 30 is shifted to return the parts to the position of Fig. 3, and it will be noted that by thus shifting the bar 30 it is possible to provide an extremely rapid, almost instantaneous, lifting of the rollers 1 and 5 which further contributes to the uniformity of the treatment which may be obtained with the process and apparatus of the invention. Also, if the valve 27 is not touched, when the apparatus is again set into the operating position shown in Fig. 5 obtaining of exactly the same pressure on the roller 1 is assured.

Thus, it is possible to operate the apparatus of the invention to carry out a process according to which:

(1) In the idle position of the apparatus the immersion roller is raised out of the bath and the upper pressure roller 1 is raised upwardly from the lower pressure roller;

(2) At the start of the operation the immersion roller is immersed in the impregnating liquid and the upper, movable compression roller moves downwardly and becomes located at its bottom operating position slightly in advance of the immersion roller;

(3) During normal operation the immersion roller remains in its operating position and the upper compression roller is urged toward the lower compression roller with a desired pressure which is preset (with the valve 27);

(4) In returning the parts to the idle position the parts necessarily move through the position shown in Fig. 4 where the pressure is released while the rollers 1 and 5 remain in their operating position simply by gravity; and

(5) Upon return to the idle position of Fig. 3 in order to interrupt the operation the immersion roller is first raised quickly from its operating position and the pressure roller 1 is quickly moved up from its operating position and lags slightly behind the immersion roller 5.

Fig. 2 of the drawings illustrates an embodiment capable of accomplishing the results of the above-described structure, but constructed somewhat differently. In the embodiment of Fig. 2 the cylinders 21 and 21' as well as

the parts associated therewith are omitted. Instead, elements 7 and 18, on the one hand, and their corresponding elements 7' and 18' at the opposite ends of the rollers (not shown in Fig. 2), on the other hand, are interconnected by links 44 as shown in Fig. 2. The linkage 44 is composed of a pair of links located at opposite side faces of elements 7 and 18, as shown in Fig. 2, and mounted in the same way on the opposite sides of the rollers not illustrated in Fig. 2, these links being pivotally connected to the elements 7 and 18. Between each pair of links 44 a block is pivotally mounted for movement along a slot of the links 44, as shown in Fig. 2, and this block is connected to the top end of the piston rod 15 at the side of the rollers shown in Fig. 2, while the corresponding block on the opposite side of the rollers is connected to the top end of the other rod 15. The elements 18 and 18' are each fixed to a rod 45 which is slidable through a block 46 pivotally carried by a stationary part of the machine for turning movement about an axis normal to that of the rod 45, as indicated in Fig. 2. At its bottom end each rod 45 is provided with a fixed enlargement 47 which acts as a stop by engaging the block 46 during upward movement of elements 18 or 18' to limit this upward movement. The downward movement of each of the elements 18 and 18' is limited by a screw member 48 threaded through the top wall of each of these members, carrying a hand wheel 49 at its top end, and having a bottom end which abuts against a stationary member 50 to limit the downward movement of the immersion roller 5.

Except for the above differences the embodiment of Fig. 2 is identical with that shown in Figs. 1 and 3-5. It will be noted that because the cylinders 21 and 21' of Figs. 1 and 3-5 are interconnected in parallel with the cylinders 17 and 17', when the cylinders 21 and 21' are omitted from Fig. 2 it is unnecessary to make any changes in the valve 28, 29. When the control bar 30 is set to locate the machine in its idle position the oil under pressure is located in the manner described above beneath the pistons 16 and 16' so as to maintain the pressure roller 1 in its topmost position. The upward movement of the piston rods 15 and 15' in addition to acting through links 44 on the frame member 7 also acts through these links on the members 18 and 18' which carry the immersion roller 5. In the idle position of the immersion roller 5 the stops 47 engage the blocks 46. When the control bar 30 is set in the position of Fig. 4 to start the operations the compression roller 1 simply rests by gravity on the stationary roller 3 and the immersion roller 5 lags slightly behind the roller 1 and moves downwardly into the treating liquid to a depth which is controlled by the screws 48. Of course, the material to be treated is moved together with the immersion roller 5 into the treating liquid. When the control member 30 is moved to the position of normal operation corresponding to the position shown in Fig. 5, the compression roller 1 is urged toward the roller 3 with a force controlled by the setting of the valve 27 in the same way as was described above, and the measurement of this pressure is transmitted and readable in the same way as was described above.

It should be noted that with the embodiment of Fig. 2 the immersion roller 5 is coupled to the pressure roller 1 so as to be forced to operate in a predetermined manner with respect to the pressure roller 1. The operation of the embodiment of Fig. 2 is substantially the same as that of Fig. 1. However, with the embodiment of Fig. 1 it is possible by changing the valve 28, 29 to easily vary the operation of the embodiment of Fig. 1 when changes in the operation are desired, and in this respect the embodiment of Fig. 1 is more flexible than that of Fig. 2.

In the embodiment of Fig. 2 the part 13' is in the form of a potentiometer electrically connected to the meter 40' whose pointer cooperates with the scale 44' to indi-

cate the pressure of the springs, the battery 42' being connected to one of the leads 41' which interconnect the potentiometer 13' with the meter 40'.

Fig. 6 of the drawings shows an embodiment of the invention which is operated electrically rather than hydraulically. In the embodiment of Fig. 6 the immersion roller 5 is coupled to the pressure roller 1 in the same way as in the embodiment of Fig. 2. However, instead of piston rods connected to the blocks between each pair of links 44, each block 52 is formed with a threaded bore through which a threaded portion of a shaft 51 threadedly extends, as indicated in Fig. 6. Each shaft 51 (the structure at the side of the rollers not illustrated in Fig. 6 being identical with that shown in Fig. 6) is coaxial with and fixed to a worm wheel 53 carried by a thrust bearing 54 mounted on a stationary part of the machine so that when the worm wheels 53 turn, the shafts 51 turn therewith and through their threaded connection with the blocks 52 raise and lower these blocks to raise and lower the rollers 1 and 5 in the manner described above in connection with Fig. 2. Worms 55 are respectively in turnable engagement with the worm wheels 53, and these worms 55 are fixed to a common shaft 56 turnably carried by suitable bearings not shown and having a pulley or sprocket wheel 57 fixed thereto, as shown in Fig. 6. A chain or belt 60 cooperates with the sprocket wheel or pulley, respectively, 57 to turn the latter, this element 60 passing about a sprocket wheel or pulley 59 driven by the motor 58. The motor 58 is of a known construction and is reversible so that it may be controlled to turn the shafts 51 in opposite directions. The motor 58 is controlled by a switch 61 having a turnable switch member fixed in the same way as valve member 29 to a lever 31. However, in the embodiment of Fig. 6 a handle 30' is fixed to the lever 31 to form a crank therewith for turning the switch member of switch 61, and a pawl and ratchet mechanism is provided within the switch 61 to permit crank 30', 31 and the switch member of the switch 61 to turn only in a counterclockwise direction, as viewed in Fig. 6. Current is supplied through the switch 61 to the motor as well as to the pressure indicating means shown on the top of frame member 7 by leads 79 two of which are connected to the lines 42 to derive current therefrom. This pressure indicating means includes the pointer 12 described above which is connected through pinion 11 and teeth 10 of rack 9 to the block 8 in the same way as was described above. However, with the embodiment of Figs. 6 and 7, the pointer 12 in addition to cooperating with the scale 62 is connected to a movable switch operating member 63 located on the rear side of scale 62 and turnable together with the pointer 12, this switch operating member 63 opening the switch 64 when the pointer 12 arrives at one end of the scale 62 and opening a switch 66 when the pointer 12 moves in a counterclockwise direction, as viewed in Fig. 6, through a predetermined adjusted distance, the switch 66 being carried by a support 65 whose location on the scale 62 may be adjusted so that the switch 66 will be opened when elements 12 and 63 are at a given position on the scale 62.

The operation of the structure of Fig. 6 may be understood in connection with the wiring diagram shown in Fig. 7. When the machine is in its idle position a turnable cam 67 within the switch 61, this cam being connected to the lever 31 to turn therewith, is positioned by elements 30' and 31 so that the cam 67 engages the movable switch member 68 to close the switch 68 shown at the right portion of switch 61 in Fig. 7. Thus, in this idle position of the machine the current flows from the lines 42 through the switch 70 to the field winding 69 and from the latter back to the lines 42 as is evident from the wiring diagram of Fig. 7. In this manner the motor 58 runs and drives elements 59, 60, 57, 55, 53 and 51 until the rollers 1 and 5 are in their uppermost idle positions,

the roller 1 lagging slightly behind the roller 5 during this upward movement of these rollers to their idle position. The upward movement of rollers 1 and 5 is limited by the member 71 which opens the switch 70 when the rollers 1 and 5 have reached their uppermost positions. Element 71 is in the form of a nut guided with suitable stationary guides for movement only along the axis of screw 72 which is threaded through the nut 71, these guides preventing the nut 71 from turning about the axis of the screw 72. When the rollers 1 and 5 are being raised to their idle position, the springs 14 have their minimum pressure and the pointer 12 and switch operating member 63 are positioned at that part of the scale 62 which causes the switch operating member 63 to open the switch 64. Thus, since the switch 64 is open when cam 67 engages switch member 68, current cannot flow through the winding 69 through the switch 64 and thus the opening of switch 70 will definitely stop the operation when the rollers 1 and 5 reach their uppermost position. The location of switch 70 may be adjusted in any suitable manner so that the elevation of the rollers 1 and 5 in their idle position may be adjusted in this way.

As was pointed out above the crank 30', 31 can be turned only in a counterclockwise direction, so that after the cam 67 closes the switch 68, the cam 67 can be turned only in a counterclockwise direction to then close the switch 73. Thus, from the idle position the operator can only open switch 68 and close switch 73. Closing the switch 73 completes a circuit through the switch 75 and the field winding 74 which turns the motor in the opposite direction. Since the springs 14 are not placed under pressure at this time the switch 64 remains open, and the screw 72 is turned by the motor in that direction which advances the nut 71 until it engages the switch 75 to open the same, the structure of Fig. 6 operating at this time to lower the rollers 1 and 5. Because of the coupling between the rollers 1 and 5 the latter lags slightly behind the roller 1 during the downward movement of these rollers. The switch 75 is positioned so as to be opened by the nut 71 when the roller 1 engages the roller 3, and in this position there will be no compression of the springs 14 while the roller 5 is immersed and the roller 1 is located on the roller 3. The nut 71 is provided with a convex surface which engages the switch 75 so that the nut 71 is capable of moving to the right, as viewed in Fig. 7, beyond the switch 75 and in the opposite direction beyond the switch 75 to the switch 70, the nut 71 maintaining the switch 75 opened only when it is in engagement with the switch 75.

Assuming now that the operator wishes to compress the springs 14 to apply pressure to the roller 1, then the operator turns the crank 30', 31 so as to move the cams 6 and 7 away from the switch 73 to open the latter, and into engagement with switch member 76 to move this switch member out of engagement with contact 78 and into engagement with contact 77. Thus, at this time the current will flow through the switch 66 and the winding 74 to continue the rotation of the motor in that direction which advances the nut 71, to the right as viewed in Fig. 7, and in this way the frames 7 and 7' are lowered to compress the springs 14 and 14', respectively. The switch 66, as was pointed out above, is carried by a member 65 which is adjustable on the scale 62, and this member 65 is located at the part of the scale 62 which indicates the desired pressure. As the frames 7 and 7' move downwardly to compress the springs the pointer 12 moves along the scale and the switch operating member 63 moves away from the switch 64 to close the latter and approaches the switch 66. It is pointed out that the arrangement of the switches 64 and pointer 12 and switch operating member 63 are reversed in Fig. 7 as compared with Fig. 6 only for the sake of convenience. Of course with the arrangement as shown in

Fig. 7 the rack teeth 10 would engage the opposite side of the pinion 11 from that shown in Fig. 6 so that the downward movement of the frame 7 will turn elements 12 and 63 in a clockwise direction as viewed in Fig. 7, while these elements are turned in a counterclockwise direction as viewed in Fig. 6. Inasmuch as contact 78 is no longer engaged by switch member 76 current cannot flow through the closed switch 64, and thus, the motor continues to lower the frame member 7 and 7' and continues to advance the nut 71 to the right until the pointer 12 becomes located opposite the pointed end of the adjustable member 65 shown in Fig. 7. At this time the switch operating member 63 engages switch 66 to open this switch, and thus current can flow no longer through the winding 74 and the parts remain in the position where the springs 14 are compressed to provide the desired pressure indicated on the scale 62.

Assuming now that the operator wishes to return the parts to the position where roller 1 simply engages roller 3 and where the springs 14 are not compressed, then the operator turns the crank 30', 31 further in a counterclockwise direction until the cam 67 is located in the position shown in Fig. 7. With this position of the parts the switch member 76 engages contact 78 and moves out of engagement with the contact 77. Thus, the current will flow through the field winding 69 to cause the motor to turn in the reverse direction which advances the nut 71 to the left, as viewed in Fig. 7, and which causes the screws 51 to raise the block 52 so as to raise the frames 7 and 7' and thus release the springs 14 and 14', respectively. With the switch member 67 in the position shown in Fig. 7 the frame members 7 and 7' will continue to be raised until the pointer 12 again reaches the position showing minimum pressure at which time the switch operating member 63 again opens the switch 64, and the parts will remain in this position. It should be noted that at this time the nut 71 has returned to the position where it engages the switch 75 to open the latter. When the operator wishes to raise the rollers 1 and 5 to repeat the above-described operations he then simply continues to turn the switch member 67 to close the switch 68, and the above-described operations is repeated.

It is possible to interconnect the measurement engaging means of Figs. 6 and 7 with structure for transmitting the measurement to a desired location in a manner described above in connection with Figs. 1-5. It is possible, of course, to provide means for operating valve 29 or switch 61 from points distant therefrom, if desired. As for the valve 29, the connections of the conduits to the housing 28 and the arrangement of grooves and bores in the valve member 29 may take any desired arrangement to produce any desired operations. The same is true of the arrangement of switches within the switch 61.

The common connection of the windings 69 and 74 is connected to an electrically conductive member 80 having a sleeve portion insulated from the screw 72 and through which the screw 72 freely extends so that this screw 72 may be turned with respect to the member 80 which is connected to the line 42 in the manner shown in Fig. 7.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of sheet material treating machine differing from the types described above.

While the invention has been illustrated and described as embodied in manually controllable sheet material treating machine, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully

reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. In a machine for treating sheet material, in combination, a stationary pressure roller; a movable pressure roller parallel to said stationary roller; a pair of journals coaxial with and respectively fixed to opposite ends of said movable roller; a pair of frame members respectively located in planes normal to the axes of said rollers and respectively formed with elongated slots into which said journals respectively extend; a pair of bearings respectively supporting said journals for turning movement and respectively located in said slots in slidable engagement with said frame members for movement along said slots; a pair of springs respectively located in said slots and engaging said frame members and bearings for urging the latter and said movable roller therewith toward said stationary roller; first moving means operatively connected to said frame members for simultaneously moving the same at the same speeds and directions respectively along paths perpendicular to the axes of said rollers; an immersion roller parallel to said pressure rollers; and second moving means connected to said first moving means to be operated thereby and connected to said immersion roller for moving the latter when said movable pressure roller is moved by said first moving means.

2. In a machine for treating sheet material, in combination, a roller having opposite ends; first fluid pressure means operatively connected to one of said ends of said roller for shifting said one end thereof along a first path normal to the axis of said roller, said first fluid pressure means including a first cylinder and a first piston slidable therein; second fluid pressure means operatively connected to the other of said ends of said roller for shifting said other end thereof along a second path normal to said roller axis and parallel to said first path, said second fluid pressure means including a second cylinder and a second piston slidable therein, said pistons each having a pair of opposite end faces and moving said roller in one direction when fluid pressure is applied to one of said end faces and in an opposite direction when fluid pressure is applied to the other of said end faces; first conduit means communicating with an interior portion of said first cylinder which communicates with said one end face of said first piston for leading fluid to and from said one end face of said first piston; second conduit means communicating with an interior portion of said first cylinder which communicates with said other end face of said first piston, said second conduit means leading from said first cylinder to said second cylinder and communicating with an interior portion of said second cylinder which communicates with said one end face of said second piston, so that when fluid is supplied to said first cylinder by said first conduit means fluid flows from said first cylinder to said second cylinder to be supplied thereto by said second conduit means; and third conduit means communicating with an interior portion of said second cylinder which communicates with said other end face of said second piston for leading fluid to and from said other end face of said second piston.

3. In a machine for treating sheet material, in combination, a stationary pressure roller; a movable pressure roller parallel to said stationary roller; a pair of journals coaxial with and respectively fixed to opposite

ends of said movable roller; a pair of frame members respectively located in planes normal to the axes of said rollers and respectively formed with elongated slots into which said journals respectively extend; a pair of bearings respectively supporting said journals for turning movement and respectively located in said slots in slidable engagement with said frame members for movement along said slots; a pair of springs respectively located in said slots and engaging said frame members and bearings for urging the latter and said movable roller therewith toward said stationary roller; moving means operatively connected to said frame members for simultaneously moving the same at the same speeds and directions respectively along paths perpendicular to the axes of said rollers; a scale carried by one of said frame members; a pointer turnable on said scale; a pinion connected to said pointer for turning movement therewith; and a rack meshing with said pinion, carried by said one frame member for slidable movement with respect to the same, and fixed to the bearing in the slot of said one frame member.

4. In a machine for treating sheet material, in combination, a stationary pressure roller; a movable pressure roller parallel to said stationary roller; a pair of journals coaxial with and respectively fixed to opposite ends of said movable roller; a pair of frame members respectively located in planes normal to the axes of said rollers and respectively formed with elongated slots into which said journals respectively extend; a pair of bearings respectively supporting said journals for turning movement and respectively located in said slots in slidable engagement with said frame members for movement along said slots; a pair of springs respectively located in said slots and engaging said frame members and bearings for urging the latter and said movable roller therewith toward said stationary roller; first hydraulic moving means operatively connected to said frame members for simultaneously moving the same at the same speeds and directions respectively along paths perpendicular to the axes of said rollers; and immersion roller parallel to said pressure rollers; and second hydraulic moving means hydraulically connected in parallel with said first hydraulic moving means to be operated thereby and connected to said immersion roller for moving the latter when said movable pressure roller is moved by said first moving means.

5. In a machine for treating sheet material, in combination, a stationary pressure roller; a movable pressure roller parallel to said stationary roller; a pair of journals coaxial with and respectively fixed to opposite ends of said movable roller; a pair of frame members respectively located in planes normal to the axes of said rollers and respectively formed with elongated slots into which said journals respectively extend; a pair of bearings respectively supporting said journals for turning movement and respectively located in said slots in slidable engagement with said frame members for movement along said slots; a pair of springs respectively located in said slots and engaging said frame members and bearings for urging the latter and said movable roller therewith toward said stationary roller; first hydraulic moving means operatively connected to said frame members for simultaneously moving the same at the same speeds and directions respectively along paths perpendicular to the axes of said rollers; an immersion roller parallel to said pressure rollers; second hydraulic moving means hydraulically connected in parallel with said first hydraulic moving means to be operated thereby and connected to said immersion roller for moving the latter when said movable pressure roller is moved by said first moving means; first valve means forming part of said first moving means for controlling the operation thereof; and second valve means forming part of said first moving means for limiting the pressure of the fluid of said first moving means so as to limit the

13

extent to which said springs are compressed and thereby control the pressure with which said movable pressure roller is urged toward said stationary pressure roller.

6. In a machine for treating sheet material, in combination, a stationary pressure roller; a movable pressure roller parallel to said stationary roller; a pair of journals coaxial with and respectively fixed to opposite ends of said movable roller; a pair of frame members respectively located in planes normal to the axes of said rollers and respectively formed with elongated slots into which said journals respectively extend; a pair of bearings respectively supporting said journals for turning movement and respectively located in said slots in slidable engagement with said frame members for movement along said slots; a pair of springs respectively located in said slots and engaging said frame members and bearings for urging the latter and said movable roller therewith toward said stationary roller; an immersion roller parallel to said pressure rollers; linkage means interconnecting said frame members with said immersion roller; moving means operatively connected to said linkage means for shifting the latter so as to simultaneously shift said movable pressure roller and said immersion roller; an electric motor operatively connected to said moving means for actuating the same; and manually adjustable switch means operatively connected to said motor for controlling the operation thereof.

7. In a machine for treating sheet material, in combination, a pair of parallel pressure rollers; first means operatively connected to one of said pressure rollers for moving the same as close as possible to the other of said pressure rollers and for then urging said one pressure roller toward said other pressure roller with a predetermined pressure; an immersion roller parallel to said pres-

14

sure rollers; and second means connected to said first means to be operated thereby and connected to said immersion roller for moving the latter when said first means moves said one pressure roller.

8. In a process for treating material, such as sheet material, with a liquid treating medium, the steps of starting the process by immersing the material in the liquid medium and initially pressing the immersed material with a given initial pressure while providing only a creeping movement of the material; and then, during normal operation after the process has started, pressing the normally moving material with a controlled pressure which is greater than said initial pressure and which removes from the sheet material the amount of liquid medium required to leave the sheet material uniformly treated with the liquid medium.

9. In a process as recited in claim 8, said given initial pressure being derived solely from the weight of a pressure roller and said controlled pressure being derived from a pressure force in addition to the weight of the pressure roller.

References Cited in the file of this patent

UNITED STATES PATENTS

Re. 13,923	Brady	June 8, 1915
987,389	Meves	Mar. 21, 1911
2,138,397	Cannity	Nov. 29, 1938
2,365,621	Bender	Dec. 19, 1944
2,397,873	Kuhn	Apr. 2, 1946
2,479,759	Merchant	Aug. 23, 1949
2,564,725	Rusca	Aug. 21, 1951
2,674,222	Messinger	Apr. 6, 1954
2,686,413	Roubloff	Aug. 17, 1954