Aug. 22, 1944. C. P. JOHNSON 2,356,244

SHEET PRESSING MACHINE

Filed Feb. 23, 1942 5 Sheets-Sheet 1

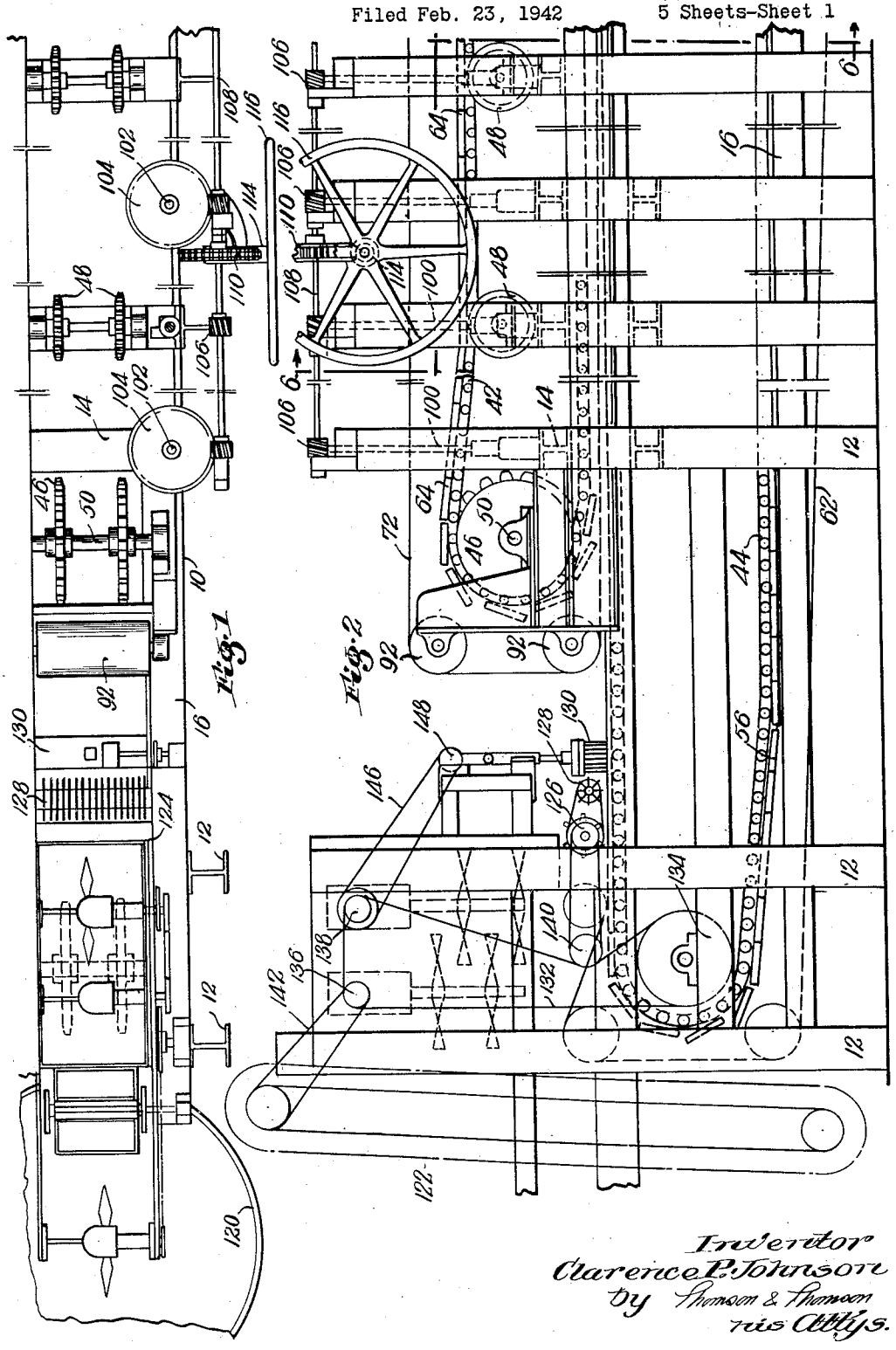

Fig. 1

Fig. 2

Inventor
Clarence P. Johnson
by Thomson & Thomson
his Attys.

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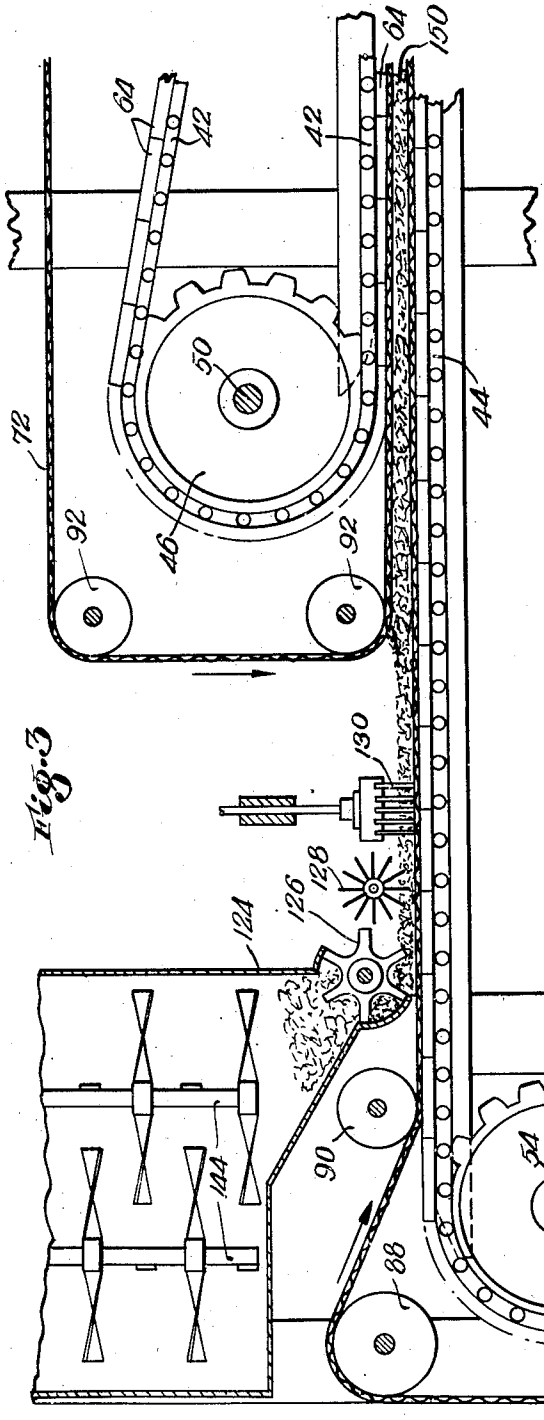

Fig. 3

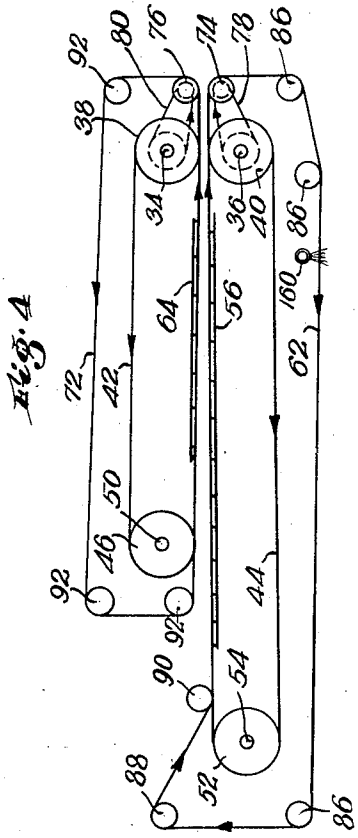

Fig. 4

Inventor
Clarence P. Johnson
by Thomson & Thomson
his Attys.

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SHEET PRESSING MACHINE

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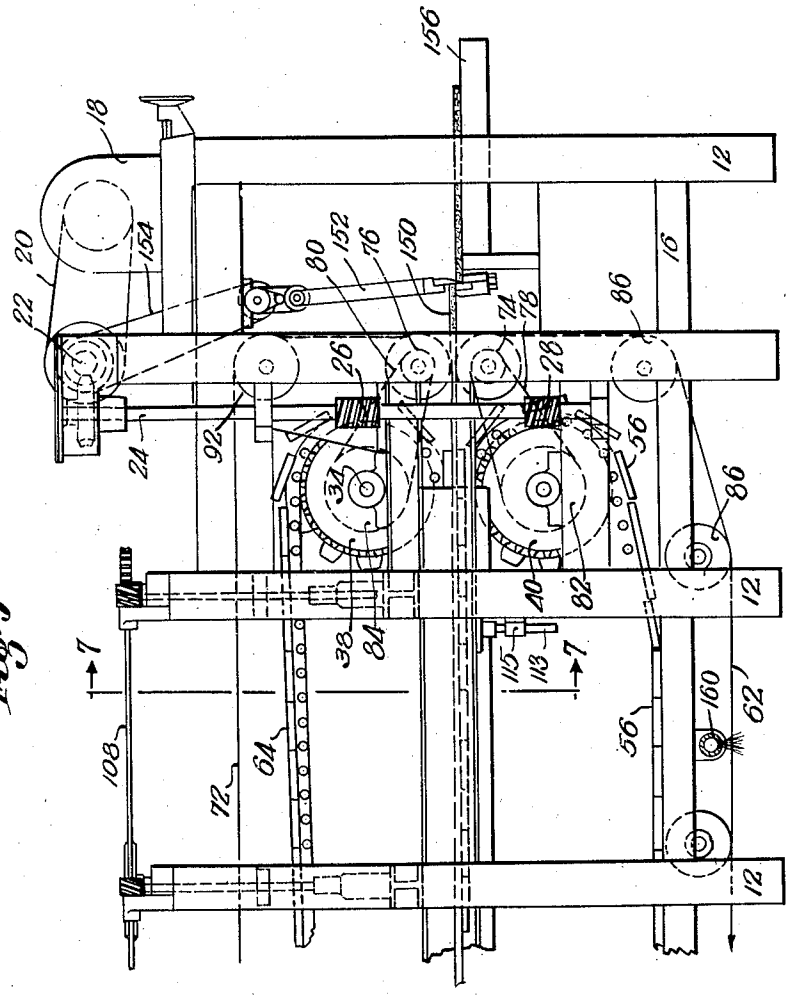

Fig. 5

Inventor
Clarence P. Johnson
By Thomson & Thomson
his Attys.

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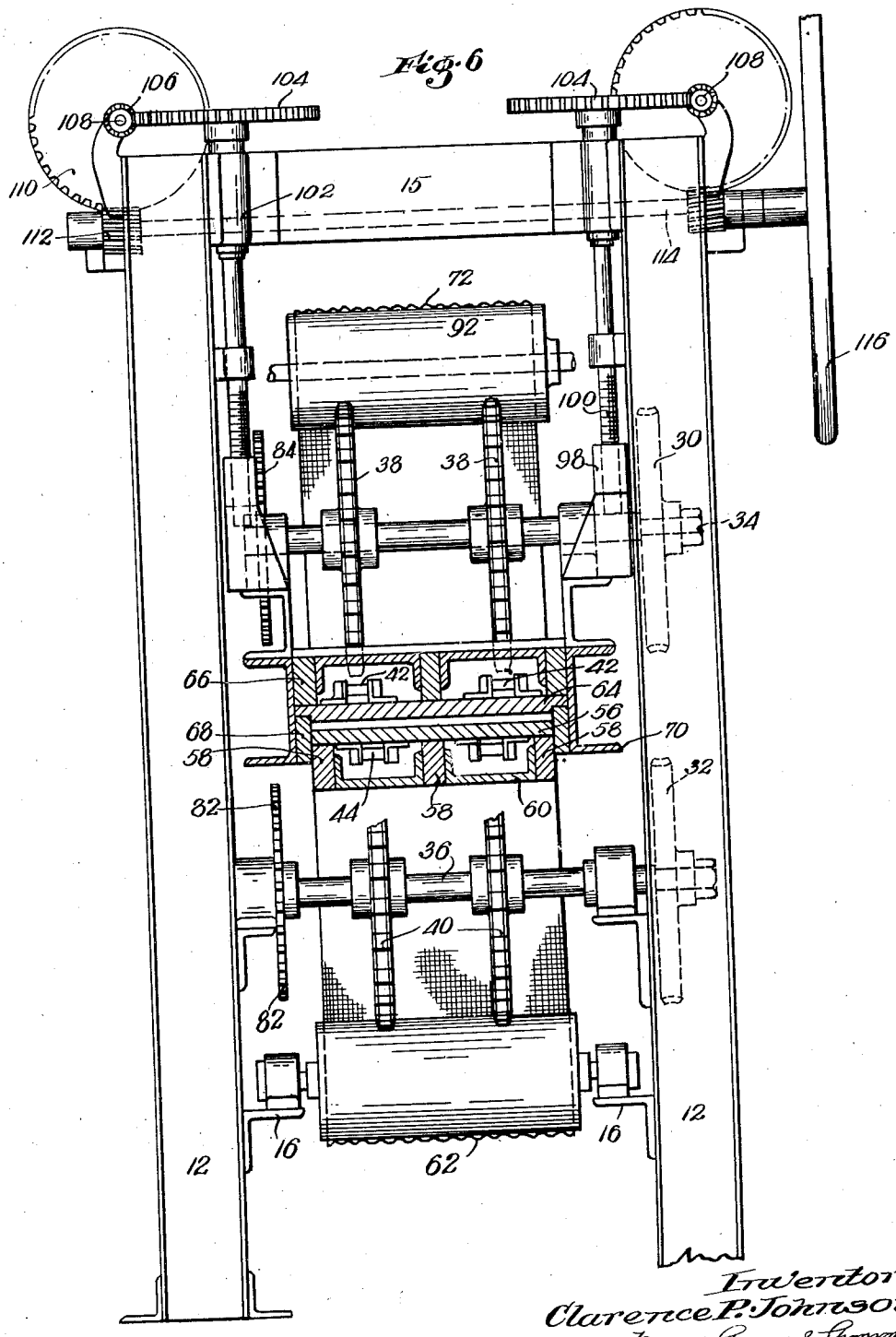
Fig. 6



Inventor
Clarence P. Johnson
by Thomson & Thomson
his Attys

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SHEET PRESSING MACHINE

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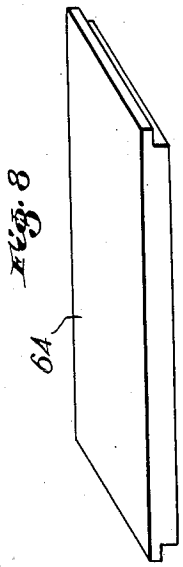

Fig. 8

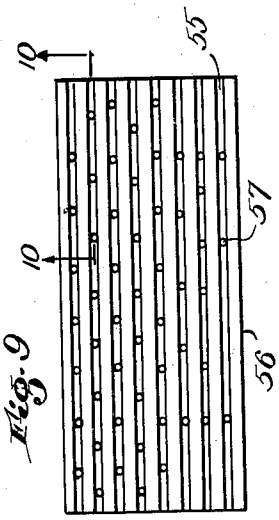

Fig. 9

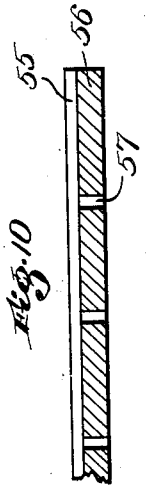

Fig. 10

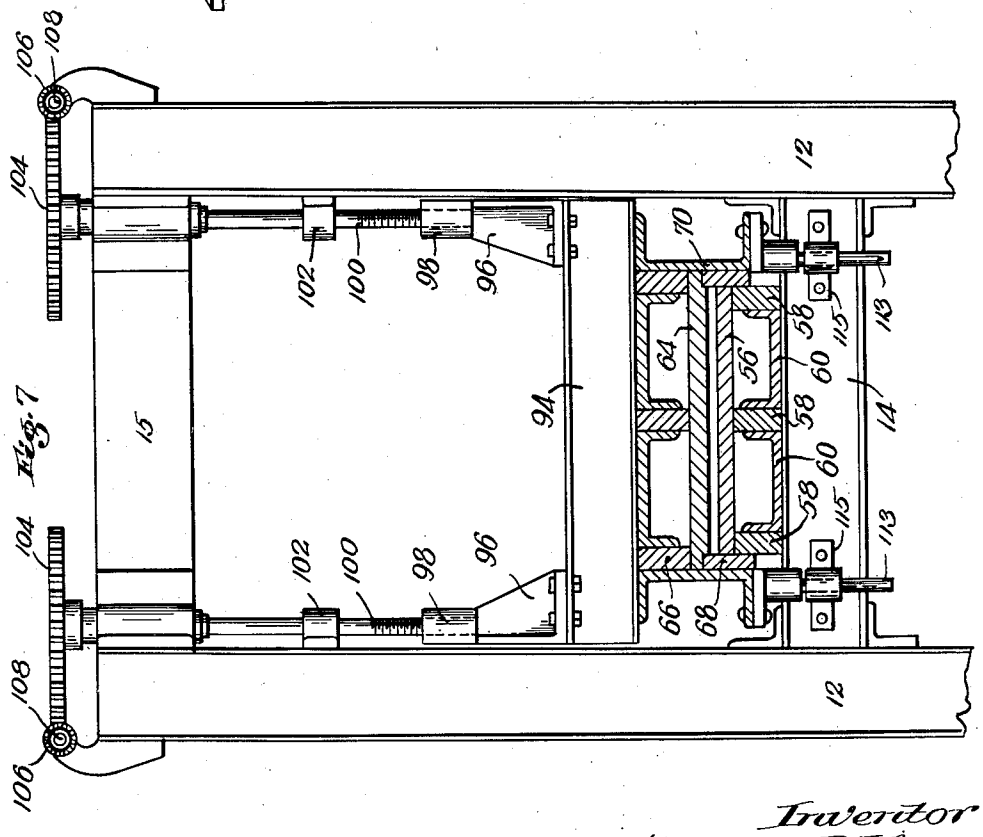

Fig. 7

Inventor
Clarence P. Johnson
by Thomson & Thomson
his Attys

Patented Aug. 22, 1944 2,356,244

UNITED STATES PATENT OFFICE

2,356,244

SHEET PRESSING MACHINE

Clarence P. Johnson, Auburndale, Mass.

Application February 23, 1942, Serial No. 431,965

2 Claims. (Cl. 92—39)

This invention relates to improvements in continuous sheet forming and pressing machines.

The improvements are particularly directed to machines for handling compositions of matter, the ingredients of which may consist of fibrous materials and suitable binders which are mixed in the presence of a quantity of water to thoroughly coat the fibres with the binder which compositions are fed in a sloppy mix to form a sheet which is subjected to pressure to condense the sheet, squeezing out the water and closing up any pockets or voids so that the finished sheet will be uniform in quality throughout its thickness. Such compositions have heretofore been handled in fixed presses in which the pressure may be gradually applied and maintained for a period of time sufficient to properly condense the composition into a solid block or sheet. It has been found that if the material is pressed too quickly that the binder or other ingredients will be squeezed out with the water, whereas the more gradual application of the pressure will allow the binder to set and grip the fibres while the water is being slowly removed from the mixture. It will be understood that automatic machines for carrying out the forming and pressing of the sheet would reduce the cost of production as compared with the forming of the material in fixed pressed. However, prior sheet forming machines, such as paper making machines, would not be satisfactory for this purpose as such prior machines do not provide means for applying a continuous and gradually increasing pressure as the sheet moves through the machine.

It is an object of the present invention to disclose improved apparatus for producing a continuous sheet of the finished product in which all the operations from the introduction of the raw material to the delivery of the finished product are automatically carried out, such apparatus including the provision of means for mixing the ingredients into a flowable composition which is delivered upon a moving screen to form a web or sheet, means being provided to subject the formed sheet to gradually increasing pressure as it moves through the machine.

It is further an object of the present invention to provide apparatus including upper and lower screens between which the material to be formed is introduced and to provide conveyers composed of sectional plate members which press against the screens from opposite sides so as to compress the material being formed into the sheet between the screens as it is moved along, the pressure gradually increasing up to the point at which the finished sheet is delivered from the machine.

Further objects and advantages of my improvements will be more readily apparent from the following description of a preferred embodiment thereof as illustrated in the attached drawings, in which:

Fig. 1 is a fragmentary plan view of the apparatus showing the feeding end of the machine;

Fig. 2 is a side elevation of the apparatus disclosed in Fig. 1;

Fig. 3 is an enlarged fragmentary view, partially in vertical section, showing the means for feeding the material;

Fig. 4 is a diagrammatic view disclosing the relative association of the lower conveyer which is fixed in position and the upper conveyer which is mounted for vertical movement with respect to the lower conveyer;

Fig. 5 is a fragmentary side elevation of the apparatus taken at the delivery end thereof;

Fig. 6 is a vertical sectional view taken on the plane indicated 6—6 in Fig. 2;

Fig. 7 is a vertical sectional view taken on the plane indicated 7—7 in Fig. 5;

Fig. 8 is a perspective view of one of the upper plates;

Fig. 9 is a plan view of one of the lower plates; and

Fig. 10 is a sectional view taken on the plane indicated 10—10 in Fig. 9.

The machine may be made of any desired size but it is preferred to have the machine relatively long; for example 40' or more. The width of the sheet which is to be delivered determines the width of the machine. Increasing the width of the sheet considerably adds to the expense of the machine. A suitable width of the sheet may be 16", although it will be understood that machines for wider or narrower widths of sheets may be readily designed.

The main frame 10 of the machine as disclosed in the drawings comprises a number of pairs of vertically disposed posts 12. These posts 12 are suitably spaced throughout the length of the machine and are tied together by transverse cross beams 14 and cross plates 15 between each pair of posts 12 and the horizontal rails 16. A suitable driving motor 18 is mounted on the frame at the delivery end of the machine to drive by belt 20 a cross shaft 22 from which motion is transmitted by suitable gears to the vertical shaft 24. The vertical shaft 24 has spaced worm gears 26 and 28 by means of which the gears 30 and 32 are driven. The gear 30 is fixed to one end of an

upper cross shaft 34 while the gear 32 is similarly fixed to one end of a lower cross shaft 36. The upper cross shaft 34 has a pair of sprocket gears 38 while the lower cross shaft 36 has a similar pair of sprocket gears 40. The gears 38 provide driving means for the upper pair of conveyer chains 42 while the sprockets 40 similarly drive a pair of lower conveyer chains 44.

At the feeding end of the machine the conveyer chains 42 are carried by the sprocket gears 46, idler gears 48 being provided as desired to support the top run of the conveyer chains as they pass from the delivery end back to the feeding end. The gears 46 are mounted on the cross shaft 50 supported as hereinafter to be described. The lower conveyer chains 44 are carried at the feeding end by the sprocket gears 52 mounted on cross shaft 54 which is suitably carried by the fixed frame.

The lower conveyer chains 44 are attached to the sectional plates 56. These plates 56, as hereinafter described, are screen plates to permit the passage of water therethrough. As shown in Figs. 9 and 10 the plates 56 may be formed with slots 55 and drain holes 57. The plates 56 throughout the top run of the conveyer chains 44 from the feeding to the delivery end of the machine are brought together into abutment to form a flat movable supporting table for the material handled by the machine. The plates 56 are supported by a lower track comprising the spaced rails 58, suitable channel members 60 being provided between the rails 58 to collect and receive the water that is squeezed from the material being pressed through the plates 56. The conveyer chains 44 together with the plates 56 are mounted within a screen 62 which forms a bed for the material as it is carried along on the moving table formed by the plates 56.

The upper conveyer chains 42 carry the sectional plates 64. These plates 64, however, need not be screen plates as are the plates 56, and as shown in Fig. 6 are carried in a track between the upper rails 66 and lower rails 68 which in turn are carried by the horizontal beams 70 which form part of the movable frame which carries the upper conveyer members as a whole as will be later described.

A flexible screen 72 extends around the upper conveyer made up of the chains 42 and the plates 64. The lower screen is driven by the drive roller 74 while the upper screen is similarly driven by the drive roller 76. The rollers 74 and 76 are suitably driven by chains 78 and 80, respectively, from the sprocket gears 82 and 84 which are mounted on the driving cross shaft 36 and 34. The lower screen 62 is guided by suitable idler and tensioning rollers 86. At the feeding end an idler roller 88 for the screen 62 is positioned to cause the screen 62 to move downwards towards the point at which it passes under the idler roller 90 where it meets the moving table made up of the lower plates 56. The upper screen is carried by suitable guide rollers 92.

The longitudinal channel beams 70 which carry the guide rails 66 and 68 for the upper conveyer plates 64 are carried by the under side of a plurality of cross beams 94. These cross beams 94 have brackets 96 fixed thereto having threaded adjustment bearings 98 for the rotatable vertical adjusting screw rods 100. The rods 100 are mounted in suitable bearings 102 fixed to the main frame and are provided at their upper ends with the gears 104 to which motion is transmitted from the worm gears 106 carried by the horizontal shafts 108, the shafts 108 having the gears 110 driven from the bevel gears 112 on a cross shaft 114 which may be turned by the pressure adjusting wheel 116. The movable frame including the beams 70 may be guided for vertical movement by the rods 113 fixed to the beams 70 which slide in bearings 115 carried by the fixed beams 14.

At the feeding end of the machine there is provided a mixing tank 120 from which the mixture is transferred by the conveyer 122 to a second mixing tank 124. The ingredients of the composition, after being properly mixed together, are delivered from the bottom of tank 124 by means of the feeding and depositing wheel 126. The wheel 126 delivers the material onto the screen 62 which rests on the flat table formed by the lower plates 56. Any suitable means may be provided such as the spreader wheel 128 and the tamper 130 to spread the more or less fluid mix in an even layer over the surface of the screen 62. Motion is transmitted to the movable parts at the feeding end of the machine from the shaft 54 which is driven by the conveyer chains 44. The drive may comprise, as shown, a belt 132 from a pulley 134 on shaft 54 which belt transmits movement to pulleys on the shafts 136, 138 and 140. The shaft 136 through the belt 142 transmits the drive to the bucket conveyer 122. The shafts 136 and 138 through suitable gears transmit motion to the vertical agitators 144 in the mixing tank 124. The shaft 138 transmits the drive through belt 146 to mechanism 148 by means of which the tamper 130 is reciprocated in a vertical direction.

The feeding mechanism does not form an essential part of this invention. Various means may be used for mixing the materials and delivering the mixture into a smooth layer on the conveyer screen 62. It will be understood, however, that I do intend that the mixing and feeding mechanism shall be immediately associated with the machine for automatic and continuous operation. Furthermore I prefer to use means for controlling the speed of the feeding wheel 126 with respect to the rate of movement of the conveyers.

After a smooth layer of the mixture has been formed on the screen 62, it passes beneath the lower run of the top screen 72 where it is subjected to pressure between the top plates 64 and the bottom plates 56. The adjustable frame which is moved up and down by the pressure adjusting wheel 116 carries with it the shafts 34 and 50 by means of which the chains 42 and the upper plates 64 are mounted. The top pressing table formed by the upper plates 64 is inclined with respect to the bottom pressing table formed by the plates 56 so that as the sheet which is being pressed moves along, it is subjected to gradually increasing pressure until it is delivered from between the pressing members. By turning the wheel 116 the thickness of the finished sheet may be controlled. Adjusting the movable frame, however, does not change the relative angle between the plates 64 and 56. At the delivery end of the machine the sheet 150 is fed from between the rollers 74 and 76 around which pass the screens 62 and 72. Automatic means may desirably be provided for cutting the sheet into sections as it is delivered. For example, I may provide the vertically reciprocable cutting-off knife 152 to which motion is transmitted by belt 154 from shaft 22. The sheets as they are cut off are delivered onto the table 156.

Means may be provided to adjust the operation of the cutting knife to cut the finished sheet in any desired lengths.

The ingredients of the mixture in suitable proportions are placed in the mixing tank 120 and after a batch has been properly mixed, it is lifted by the conveyer 122 and delivered to the feeding tank 124. The mixture in the feeding tank is continuously agitated so that the fibrous material of the mixture will remain in suspension and will be thoroughly coated with the binding ingredients. The mixture in the tank 124 contains a large quantity of water. The rate of delivery of the material from the feeding tank 124 is controlled by the speed of rotation of the feeding wheel 126. It will be understood that means will be provided to vary the speed of the wheel 126 with respect to the rate of travel of the conveyer to which the material is delivered by the wheel 126. The wheel 126 lays the mixture upon the surface of the screen 62 which is supported on the flat surface formed by the plates 56 of the lower conveyer. The spreader wheel 128 serves to level off the material while the tamper 130 distributes the material into an even sheet. Fig. 4 is a diagrammatic view which shows the relationship of the upper and lower conveyers, or more particularly the upper and lower plates 64 and 56. It will be noted that the opposed surfaces of the plates 64 and 56 incline towards each other towards the delivery end. Therefore, when the formed sheet first enters between the opposed plates 64 and 56, it is subjected to only a slight pressure; but as the sheet material is carried along between the plates, it is subjected to continuous and gradually increasing pressure. The thickness of the finished sheet is determined by the space between the plates 64 and 56 at the delivery end of the machine and the greatest pressure is applied at the delivery end. If it is found that a harder and more dense sheet is desired, more material is fed to the machine by increasing the speed of the feeding wheel 126 without changing the rate of travel of the conveyer or the space between the upper and lower plates 64 and 56. It will be understood that by delivering more material while still compressing the material to the same thickness that the finished sheet will be denser. If it is desired to change the thickness of the finished sheet this may be done by raising or lowering the frame which carries the upper conveyer and the upper screen. Referring to Fig. 4, it will be understood that the upper conveyer comprising the plate 64 carried by the chains 42, the screen 72 and the supporting wheel therefor all may be moved vertically with respect to the bottom conveyer without changing the relative angle between the plates 64 and 56. The rate of movement of the conveyer plates 56 and 64 may be suitably controlled so that the material is retained under pressure for the desired amount of time. Preferably the rate of movement will be slow, such as 5 to 10 feet per minute.

The character of the screens, particularly the size of the screen openings, is determined to some extent by the materials being handled in the machine. Ordinarily I prefer to have the lower screen of relatively fine mesh which will allow the water to run out while the solid material is held back. The screens are not under tension and therefore do not require a high degree of tensile strength and will last a considerable time in use as they are carried along between the plates 56 and 64. It is important, however, to keep the lower screen clean and it is preferred to clean the lower screen immediately after it leaves the delivery end of the machine and starts back towards the feeding end. This may be done by directing a strong spray of water from the pipe 160 (see Figs. 4 and 5) against the inner surface of the screen so that any material which has plugged the openings of the screen will be removed by the pressure of the water and all other material which has stuck to the screen will be washed off before it hardens thereon. It is also important to properly design the top surface of the lower plates 56 which act as drain plates. As disclosed, I prefer to make these plates by cutting slots 55 transversely with respect to the movement of the plates and to form drain openings 57 from the bottoms of the slots. The slots should not be so wide that the pressure causes the lower screen to be forced into the slots forming ridges across the screen.

I claim:

1. In a continuous sheet forming and pressing machine, a main frame, a lower sheet conveying member comprising a plurality of plates attached to a flexible chain, a horizontal track fixed to said frame for supporting the plates of said lower conveyer as they move through the machine from the feeding to the delivery end thereof whereby said plates form a flat table for supporting the sheet as it is fed through the machine, a frame mounted for vertical movement with respect to said main frame, the mounting for said movable frame comprising a plurality of vertical posts at spaced points throughout the length of said movable frame, adjustable means for raising and lowering said last named frame with respect to said main frame by turning said posts, an upper conveyer member carried by said second frame comprising a plurality of plates attached to a flexible chain, track means fixed to said second frame for guiding the movement of the plates of said upper conveyer as they move from the feeding to the delivery end of the machine, said track means being arranged to hold said plates against upward movement with respect to said second frame, said track means being inclined with respect to said horizontal track of the lower conveyer whereby the plates of the upper conveyer form a flat surface opposite to the flat surface formed by the lower plates to confine the sheet therebetween and whereby the sheet is subjected to gradually increasing pressure as the sheet travels towards the delivery end of the machine.

2. In a continuous sheet forming and pressing machine, a relatively long fixed main frame, a lower sheet conveying member comprising a plurality of plates attached to a flexible chain, horizontal track means fixed to said main frame for supporting the plates of said lower conveyer as they move through the machine from the feeding to the delivery end thereof, a movable upper frame suspended from said fixed main frame, an upper conveyer carried by said movable frame comprising a plurality of plates attached to a flexible chain, track means fixed to said movable frame for guiding the movement of the plates of said upper conveyer as they move from the feeding to the delivery end of the machine, said track means being arranged to hold said plates against upward movement with respect to the movable frame, said upper track means being inclined with respect to said horizontal track means of the lower conveyer whereby the plates of the upper conveyer form a flat surface opposed to

the flat surface formed by the lower plates to confine the sheet therebetween and subject the sheet to gradually increasing pressure as the sheet travels towards the delivery end of the machine, a plurality of vertically disposed screw members through which said movable frame is suspended from the fixed frame and means for simultaneously turning all of said screw members to raise or lower said movable frame with respect to said fixed frame while maintaining a predetermined degree of inclination between the tracks of the fixed and movable frames.

CLARENCE P. JOHNSON.