Jan. 24, 1956 A. D. SIMPSON 2,732,296

METHOD AND APPARATUS FOR FORMING A CONTINUOUS SHEET OR STRIP OF ASBESTOS-CEMENT COMPOSITION OR OTHER LIKE MATERIAL

Filed July 28, 1952 6 Sheets-Sheet 1

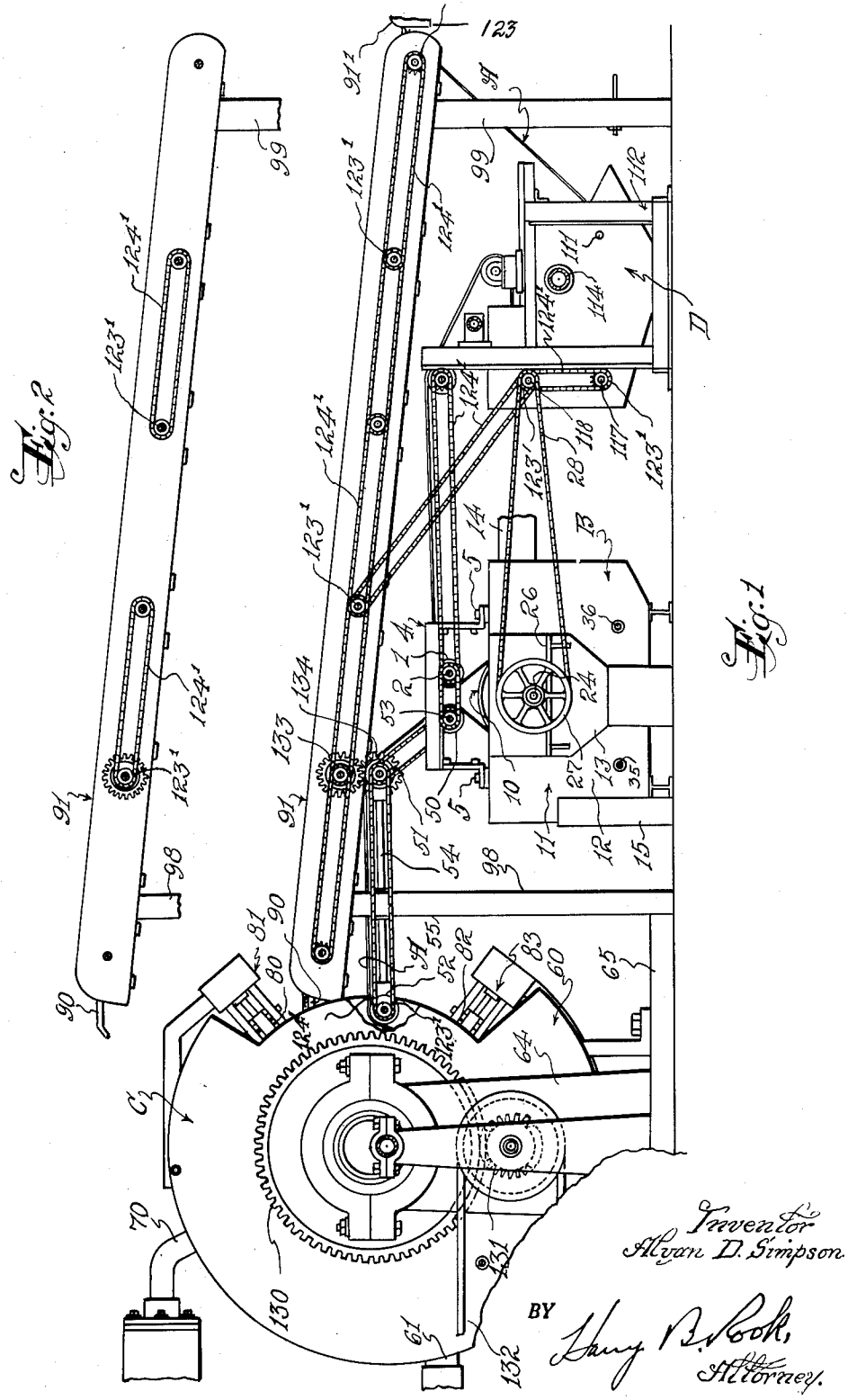


Fig. 2

Fig. 1

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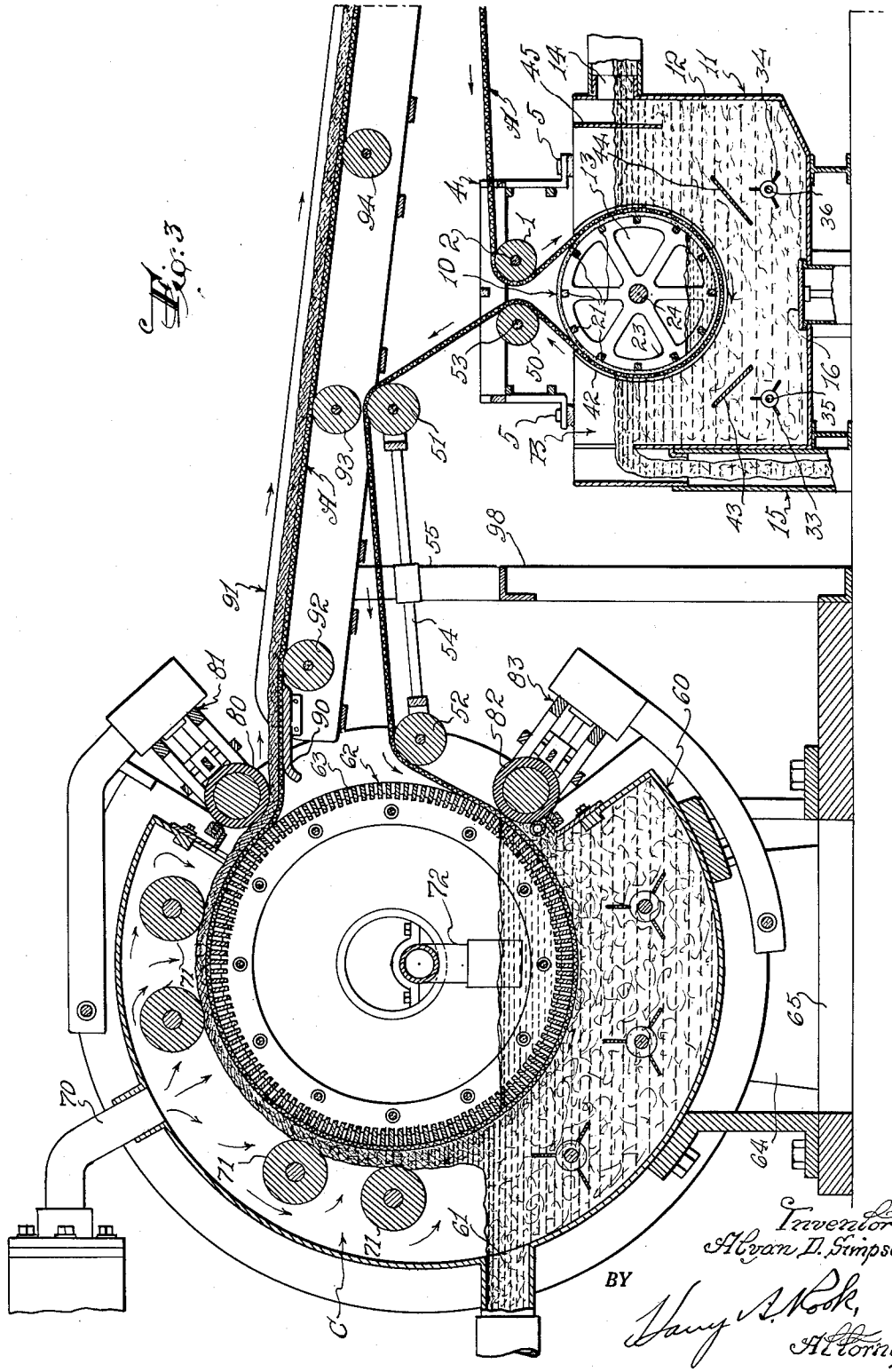
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METHOD AND APPARATUS FOR FORMING A CONTINUOUS SHEET OR STRIP OF ASBESTOS-CEMENT COMPOSITION OR OTHER LIKE MATERIAL

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Fig. 3

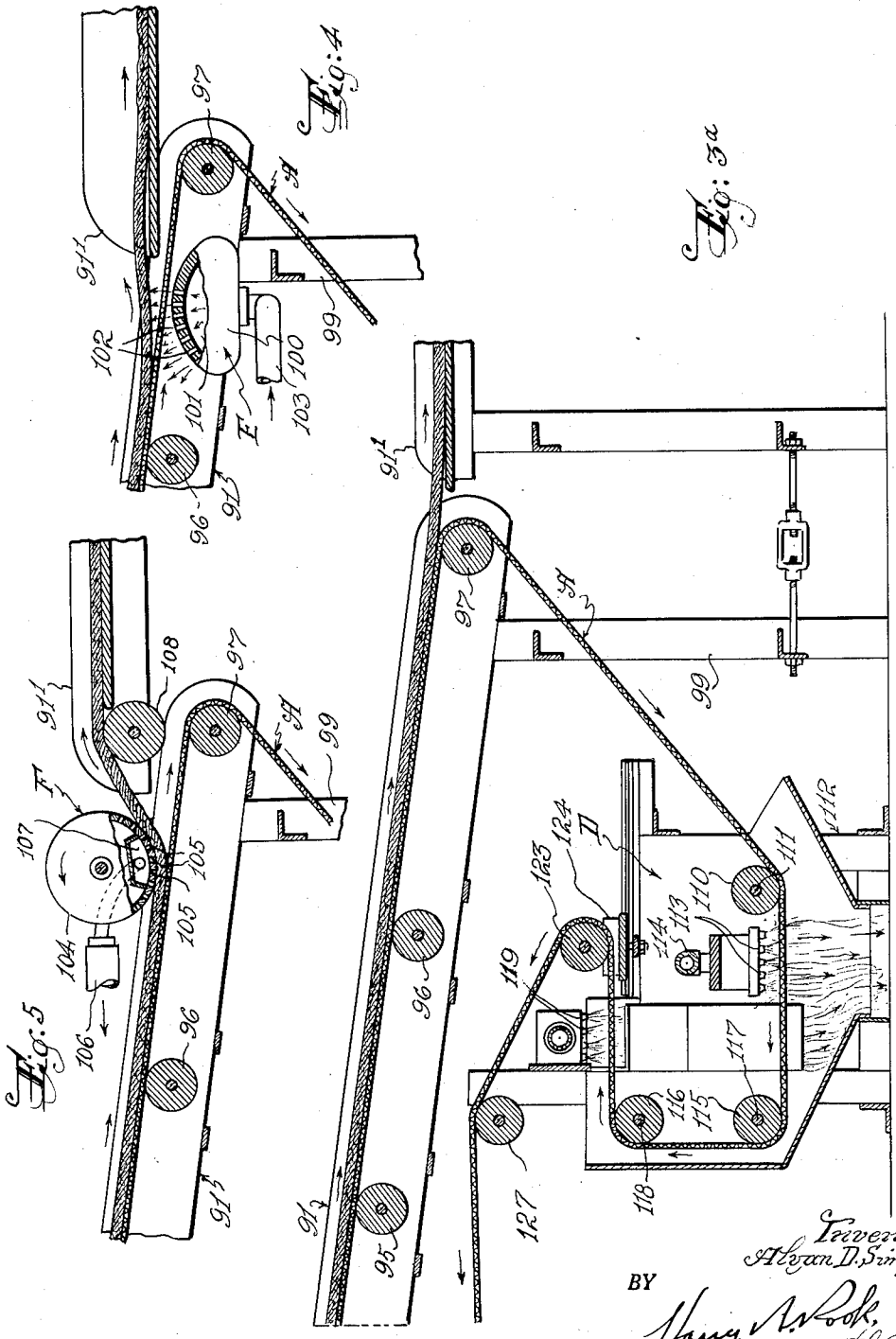


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METHOD AND APPARATUS FOR FORMING A CONTINUOUS SHEET OR STRIP OF ASBESTOS-CEMENT COMPOSITION OR OTHER LIKE MATERIAL

Filed July 28, 1952 6 Sheets-Sheet 3



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METHOD AND APPARATUS FOR FORMING A CONTINUOUS SHEET OR STRIP OF ASBESTOS-CEMENT COMPOSITION OR OTHER LIKE MATERIAL

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Fig: 6

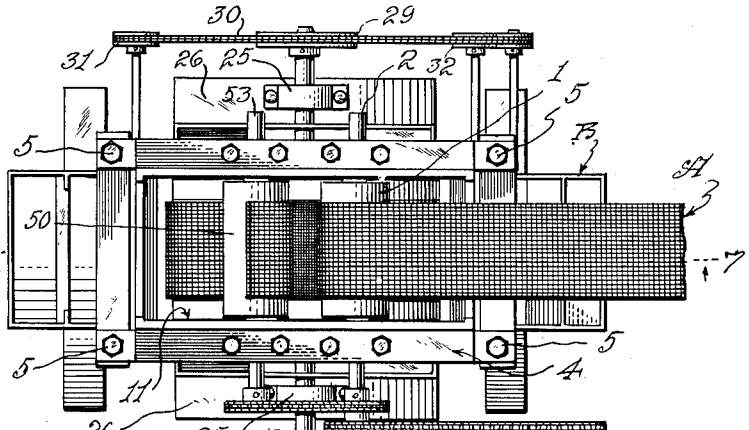


Fig: 8

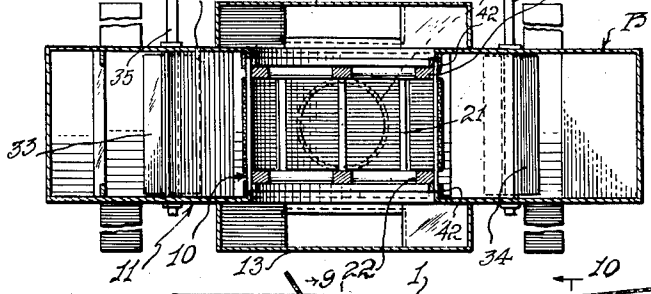
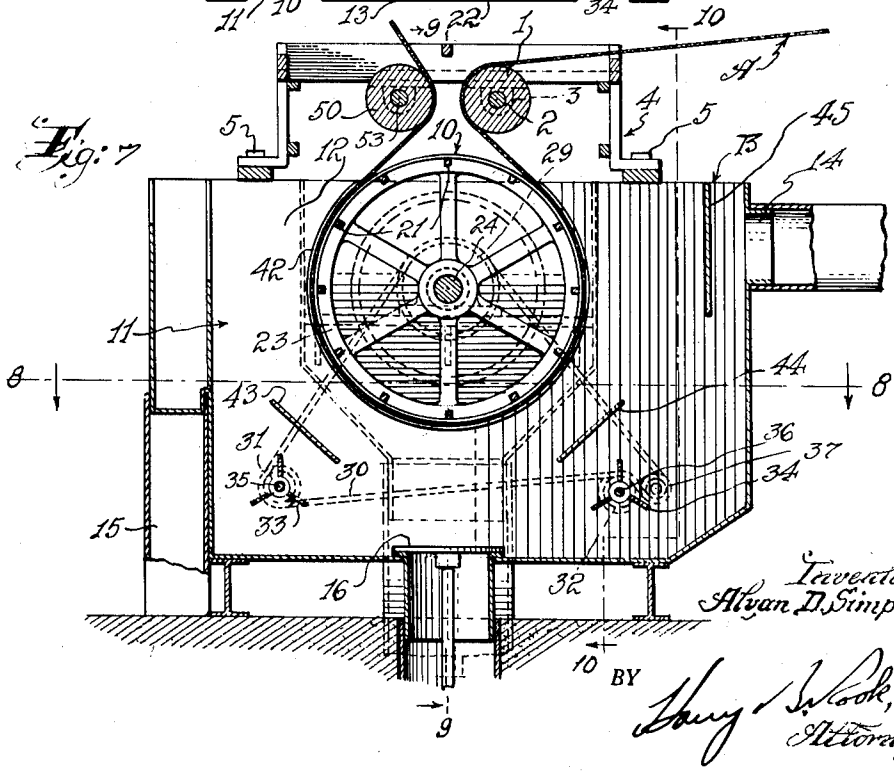


Fig: 7



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METHOD AND APPARATUS FOR FORMING A CONTINUOUS SHEET OR STRIP OF ASBESTOS-CEMENT COMPOSITION OR OTHER LIKE MATERIAL

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Fig. 9

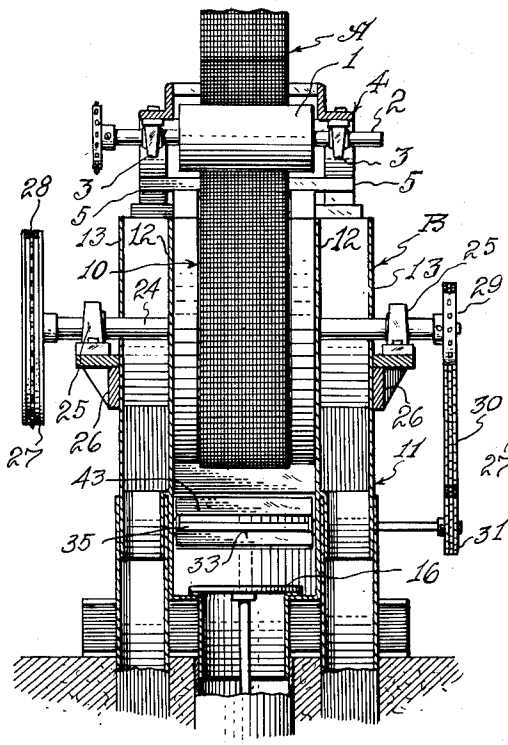


Fig. 10

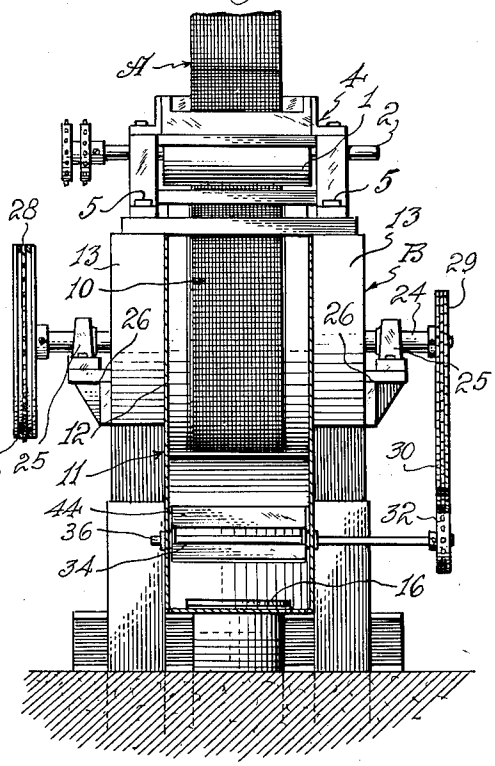


Fig. 11

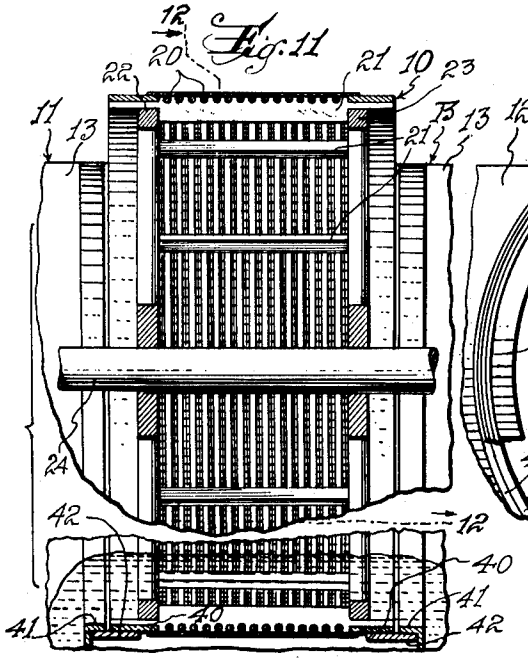
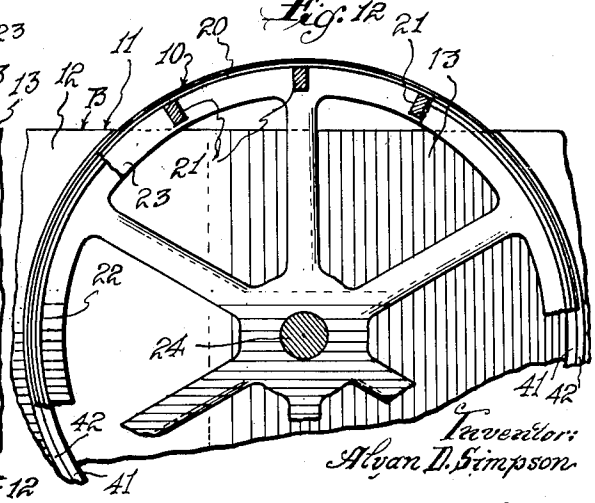


Fig. 12



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METHOD AND APPARATUS FOR FORMING A CONTINUOUS SHEET OR STRIP OF ASBESTOS-CEMENT COMPOSITION OR OTHER LIKE MATERIAL

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Fig: 13

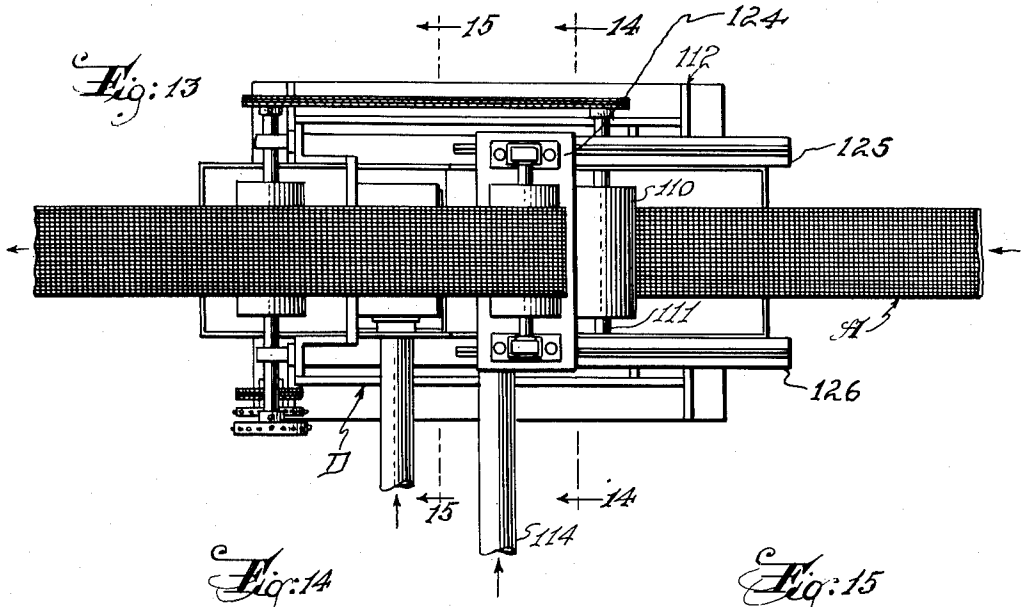


Fig: 14

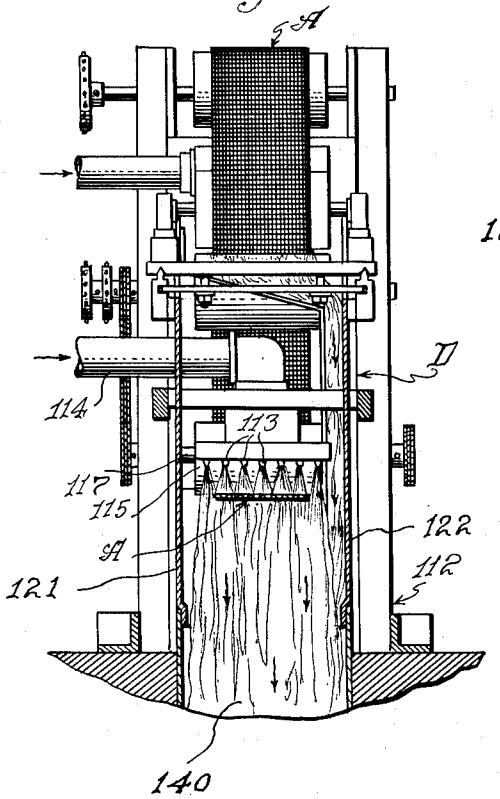
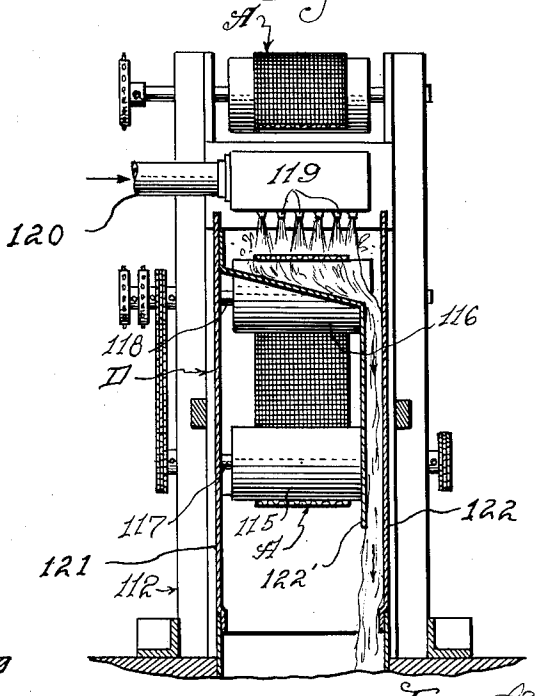


Fig: 15



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United States Patent Office 2,732,296 Patented Jan. 24, 1956

2,732,296

METHOD AND APPARATUS FOR FORMING A CONTINUOUS SHEET OR STRIP OF ASBESTOS-CEMENT COMPOSITION OR OTHER LIKE MATERIAL

Alvan Doswell Simpson, Plainfield, N. J., assignor to The Forming Machine Company of America, Inc., Bound Brook, N. J., a corporation of Delaware

Application July 28, 1952, Serial No. 301,184

7 Claims. (Cl. 92—39)

My invention relates to a method and to apparatus for forming a continuous sheet or strip of asbestos-cement composition or other like material. More particularly, my invention relates to a method and to apparatus for forming such sheet or strip on a perforated screen by depositing the solid material of a wet mix thereon while the liquid of the mix is forced through the screen.

It is an object of my invention to provide a novel and improved method and apparatus of the character described wherein a preliminary film of material is first formed upon the screen without forcing such material into the interstices of the screen, and a subsequent deposit of material is made thereafter over the preliminary film to produce a sheet or strip of the desired thickness.

It is another object of my invention to provide novel and improved apparatus of the described type including a continuous screen-like belt which is fed successively through a first forming machine where a preliminary film of material is deposited upon the belt, a second forming machine where additional material is deposited and the sheet or strip completely formed, and a washer where the belt is cleansed of adhering material after the completed sheet or strip has been removed from it.

It is a further object of my invention to provide in such apparatus a suitable blower or suction element to facilitate removal of the sheet or strip from the belt.

According to my invention a continuous screen-like belt is fed into a first forming machine wherein a preliminary film of material is deposited out of a wet mix onto the belt without forcing such deposited material into the interstices of the belt, such deposit being made under the static head of the wet mix and no pressure in excess of atmospheric pressure being applied to the surface thereof. The belt with the preliminary film thereon is thereafter fed into a second forming machine where additional material is deposited out of another wet mix onto the belt and a strip or sheet of the requisite thickness formed. The wet mix within the second forming machine is exposed to pressures in excess of atmospheric pressure so that the additional material may be rapidly deposited. However, the preliminary layer already formed on the belt prevents the material from such wet mix from being forced into the interstices of the belt. After leaving the second forming machine, the finished sheet or strip is removed from the belt and the belt is fed through a washer to remove any material clinging to it. Upon leaving the washer, the belt is fed again into the first forming machine to repeat another operative cycle. A blower or suction element may be used to facilitate removal of the finished strip from the belt.

In the accompanying drawing:

Figure 1 is a side elevational view of my apparatus showing the driving connections for the various portions of the apparatus;

Figure 2 is a fragmentary side view showing only certain of the driving connections;

Figure 3 is a longitudinal vertical sectional view of a portion of my apparatus including the first and second forming machines;

Figure 3*a* is a longitudinal vertical sectional view of the remaining portion of the apparatus including the washer;

Figures 4 and 5 are views showing the blower and suction elements respectively for removing the sheet or strip from the belt;

Figure 6 is a top plan view of the first forming machine;

Figure 7 is a vertical longitudinal sectional view of the first forming machine taken on the plane of the line **7—7** of Fig. 6;

Figure 8 is a horizontal sectional view of the first forming machine taken on the plane of the line **8—8** of Fig. 7;

Figure 9 is a transverse vertical sectional view of the first forming machine taken on the plane of the line **9—9** of Fig. 7, the wet mix having been omitted in each of Figs. 6, 7, 8, 9 and 10 to more clearly show the details of the machine;

Figure 10 is a transverse vertical sectional view of the first forming machine taken on the plane of the line 10—10 of Fig. 7;

Figure 11 is an enlarged transverse sectional view of the drum of the first forming machine;

Figure 12 is a view of the drum taken on the plane of the line **12—12** of Fig. 11;

Figure 13 is a top plan view of the washer;

Figure 14 is a transverse vertical sectional view of the washer taken on the plane of the line **14—14** of Fig. 13; and

Figure 15 is a transverse vertical sectional view of the washer taken on the plane of the line **15—15** of Fig. 13.

Referring to the specific embodiment of my invention for producing a continuous strip or sheet of asbestos-cement composition or other like material, such specific embodiment being shown in Figs. 1–15 inclusive of the accompanying drawings, reference A designates a continuous screen like belt which is fed successively through first forming machine B, second forming machine C and washer D. In manufacturing the aforesaid continuous strip or sheet of asbestos-cement composition or other material, a preliminary film of material from which the sheet is to be formed is deposited on the belt A in first forming machine B, the deposit being made in such a manner that the preliminary layer is formed without driving the material into the interstices of the screen-like belt. Additional material is deposited on the screen and a sheet or strip of the requisite thickness formed in second forming machine C. The sheet or strip is removed from the belt in some suitable manner and the belt is moved through the washer D to remove any material adhering to the belt. A blower element E or suction element F may be used to facilitate removal of the completed sheet or strip from the belt.

Belt A is fed into first forming machine B over roller **1**. Roller **1** is fixedly mounted on a shaft **2** which is rotatably mounted in journal bearings **3**, journal bearings **3** being secured to a supporting structure **4** which is mounted in any suitable manner as at **5** on the top of the machine.

Belt A enters machine B to engage the periphery of a hollow cylindrical drum **10**. The belt is moved through the machine by rotation of the drum which for the most part is housed within a tank **11** having an inner casing **12** and an outer casing **13**. There is contained in the tank within inner casing **12**, a wet mix of the asbestos-cement composition or other material from which the sheet or strip is to be formed. Inner casing **12** is provided with an inlet **14** and an outlet **15** for maintaining the wet mix a desired level, and a valve **16** is provided in the bottom of the tank to facilitate draining the wet mix out of the tank as, for example, when the tank is to be cleaned.

Drum **10** has a porous periphery formed from a plurality of spaced wire coils **20** which are fitted into suitable

grooves in horizontal cleat pieces 21. Cleat pieces 21 connect at opposite ends to wheel-like end pieces 22 and 23 respectively. End pieces 22 and 23 are fixedly secured upon a shaft 24 extending transversely through tank 11 which shaft is rotatably mounted in journal bearings 25, journal bearings 25 being secured in a suitable manner upon supporting members 26 which are secured upon outer casing 13. Secured on one end of shaft 24 is a sprocket wheel 27 which is engaged by a chain 28 for rotating the drum, and secured on the other end of the shaft is another sprocket wheel 29 which is rotated with the drum. Wheel 29 is engaged by a chain 30 which also engages sprocket wheels 31 and 32 for rotating mixing elements 33 and 34 located in tank 11 within inner casing 12, the said pulley wheels and mixing elements being secured on opposite ends of shafts 35 and 36. Chain 30 is led over an idler 37 to engage wheel 32 on a side opposite from which it engages wheel 31 whereby the mixing elements are caused to rotate in opposite directions. Mixing elements 33 and 34 are provided to stir the wet mix within the tank so that a reasonably uniform consistency is obtained in the mix at all times.

Drum 10 is located within the tank so that at least a portion of its periphery is submerged in the wet mix to provide for the flow of liquid from the mix through the interstices of the screen-like belt and porous periphery of the drum due to a pressure differential maintained on opposite sides of the belt, thereby causing a deposit of some of the solid material in the mix on the belt as the drum is rotated and the belt moved through the mix. The wet mix is exposed to atmospheric pressure, no additional gaseous pressure being applied to the surface of the wet mix; and the drum is submerged in the wet mix only to the extent necessary to provide for an effective deposit on the belt. Excessive pressures are purposely avoided in the wet mix so that the solid material in the wet mix is merely deposited on the belt without such material being forced into the interstices in the belt.

Water which passes through the periphery of the drum during the deposit upon the belt is removed from the drum at a rate such that the pressure differential on opposite sides of the belt as determined by the static head of the mix and the static head of the water in the drum is effective to form a preliminary film on the belt in the manner described, that is without forcing the material into the interstices of the belt. In this connection it is to be noted that the interior of the drum communicates with the space between outer casing 13 and the ends of the drum, thus permitting the water to flow from the drum into this space as shown in Fig. 11 from whence it may be discharged. A watertight connection is maintained at each end of the drum between the drum and the walls of inner casing 12. As shown, the drum and walls of inner casing 12 are provided with flanges 40 and 41 respectively spaced oppositely each other, and a packing 42 of leather or other suitable material is provided to seal the space between the flanges.

Baffle plates 43 and 44 are provided in the mix between mixing elements 33 and 34 and the drum to prevent undue turbulence in the region of the periphery of the drum and a consequent interference with the formation of the preliminary filament on the screen. A baffle plate 45 is also provided in front of inlet 14 for the same purpose.

The belt with the preliminary film formed thereon in machine B is moved out of tank 11 and over rollers 50, 51 and 52 and thence into machine C. Roller 50 is mounted over the top of machine B in a similar fashion to roller 1, being secured upon a shaft 53 rotatable in journal bearings which are suitably secured to supporting structure 4. As shown, rollers 51 and 52 are mounted on opposite ends of an elongated member 54 which is secured in a suitable manner upon stanchion 55.

Machine C may be of any suitable type wherein additional material may be deposited on screen belt A out of wet mix which is subjected to gas pressures in excess of atmospheric pressure. Machine C may, for example, be constructed in a similar manner to the pressure machine for forming continuous strips of asbestos-cement composition and the like shown and described in Letters Patent No. 2,581,210 of Alvan D. Simpson issued January 1, 1952.

As shown, machine C includes a tank 60 that is approximately circular in cross section and has an inlet 61 for admitting a wet mix of the asbestos-cement composition or other material from which the finished sheet or strip is to be formed. Rotatably mounted about a horizontal axis in the tank is a hollow cylindrical drum 62 having a porous peripheral surface 63 which dips into the wet mix in the tank. The drum may be rotatably mounted in any suitable manner as in bearings 64 which project upwardly from a base 65 upon which the tank is mounted. Belt A engages the periphery of the drum and is moved through the wet mix by rotation of the drum.

Gas under pressure in excess of atmospheric pressure is supplied through inlet pipe 70 to the tank above the level of the mix from a suitable pump for continuously exerting pressure on the mix to cause the flow of liquid in the mix through the belt and drum and the deposit of solid material from the mix on the preliminary film as in machine B while the drum and belt are moved through the mix. The preliminary film prevents the fibers from being driven and wedged into the interstices of the screen when the open or clean screen first enters the wet mix, the solid matter or fibers in the mix being deposited on the preliminary film which is porous enough to permit the water from the mix to be forced through it so that the fibers can be deposited on the film. The gas pressure within the tank also forces liquid from the deposited layer of material on the drum above the level of the mix, and suitable finishing rollers 71 journaled in the tank contact with and depress such deposited layers and the preliminary filament formed on the belt in machine B to press, smooth and shape such layers into a finished sheet or strip. Water flowing through the periphery of the drum during the process of depositing solid material on the belt is removed from the interior of the drum through pipe 72 which is connected to a suitable suction pump (not shown).

Suitable means are provided for sealing tank 60 so that the requisite pressure may be maintained therein, which means include sealing roller 80 under which belt A must pass as it leaves the tank. Roller 80 is operatively associated with a suitable mechanism 81 which is effective to maintain roller 80 in firm contact with the material formed upon the belt and to maintain such material in firm contact with the periphery of the drum to prevent the escape of gas from the tank at this point. Another sealing roller 82 is provided below the level of the mix at the point of entrance of the belt into the tank which roller cooperats with a mechanism 83 and functions in a manner similar to roller 81 to prevent the escape of water in the mix from the tank at such entrance point.

Upon leaving machine C, the belt passes over guide bar 90 fixed upon inclined member 91 and then successively over rollers 92, 93, 94, 95, 96 and 97 which are rotatably mounted on member 91. Member 91 is supported by supporting stanchions 98 and 99 which are secured thereto. The asbestos-cement composition or other material formed upon the belt is removed from the belt as a continuous sheet or strip beyond roller 97 and is deposited on a table 91'. Suitable means, interposed between roller 97 and the table, such as blower element E or suction element F may be provided to assist the removal of the sheet or strip from the belt.

As shown, blower element E is disposed beneath belt A and comprises a casting 100 of any suitable form enclosing an air chamber 101 which casting has a plurality of openings 102 in its upper surface through which air may pass from the air chamber into the region outside the casting. Casting 100 is connected by a pipe 103 to a pressure pump for supplying compressed air to the cham-

ber which compressed air is ejected from the air chamber through openings **102** to blow the sheet or strip of asbestos-cement composition or other material from the belt. Suction element F is disposed above belt A and comprises a rotatable hollow cylindrical drum **104** the lower portion of which contacts the sheet formed on the belt. The drum is provided with openings **105** disposed around its periphery and includes a chamber **107** in the lower portion thereof which is connected by a pipe **106** to a suction pump for creating a vacuum in the air chamber and the openings in the lower portion of the drum. The creation of such vacuum causes a rush of air from the region outside the casting into the chamber through openings **105** which rush of air acts to separate the sheet or strip from the belt. To prevent the sheet from being torn, preferably the sheet passes beyond that portion of the drum wherein suction is applied through the openings **105** before being entirely separated from the outer periphery of the drum to pass over a roller **108** and thence onto table **91'**.

The belt, after separation of the finished sheet or strip therefrom passes into washer D. The belt enters the washer over a roller **110** secured upon shaft **111** which is rotatably mounted in frame **112**. The belt passes under a plurality of spray nozzles **113** which are connected by suitable conduit means including pipe **114** to a pressure supply of water. Water is supplied from such pressure supply to the nozzles, and ejected therefrom in the form of a spray to wash away any material clinging to the belt. The belt then passes successively over rollers **115** and **116** secured upon shafts **117** and **118** respectively which are rotatably mounted in frame **112**. After passing over roller **116** the belt passes under other nozzles **119** connected by suitable means including pipe **120** to a pressure supply of water for supplying water to the nozzles, the water being ejected from the nozzles in a spray to wash away any particles of material which may remain upon the belt after the first washing. The water from nozzles **113** and the material washed from the belt A by the spray issuing therefrom is channeled between side walls **121** and **122** to a discharge outlet **140** while the water from nozzles **119** which nozzles are located near the top of machine D is channeled with the material washed from the belt by the spray issuing from such nozzles between side wall **122** and deflecting wall **122'** and thence into the space between side wall **121** and **122**.

After the final washing the belt passes over roller **123** which is rotatably mounted on a supporting member **124**. Member **124** is slidably mounted upon tracks **125** and **126** fixed on frame **112** so that the roller may be moved to vary the tension upon the belt. From roller **123** the belt passed over roller **127** rotatably mounted in frame **112** and thence to roller **1** and first forming machine B to repeat the cycle already described.

Belt A is driven by drum **62** which is connected through suitable means including intermeshing gear wheels **130** and **131**, and belting **132** to a source of power. To provide for uniformity in the motion of belt A, various pairs of successive rollers travelled by the belt are interconnected by suitable driving means. For this purpose the following pairs of rollers are interconnected by suitable sprocket and chain driving means including sprocket wheels **123'** and chains **124'**; rollers **92** and **93**, **93** and **94**, **94** and **95**, **95** and **96**, **96** and **97**, **115** and **116**, **116** and **94**, **127** and **1**, **1** and **50**, **50** and **51**, and **51** and **52**. A geared connection including intermeshing gear wheels **133** and **134** which are mounted on shafts of rollers **93** and **51** is also provided for this purpose. As shown sprocket wheel **27** is connected by chain **28** to a sprocket wheel **123'** on shaft **118** for rotating the drum of machine B.

It will be apparent now that I have provided a method and apparatus for forming a continuous sheet or strip of asbestos-cement composition or other material wherein a preliminary film of the material of the sheet or strip is first deposited out of a wet mix on a screen-like belt while maintaining a pressure differential on opposite sides of the belt such that the deposit is made without forcing the material into the interstices of the belt. Additional material is thereafter deposited on the preliminary film in a similar manner but at a pressure differential substantially in excess of the pressure differential maintained during the deposit of the preliminary film. The preliminary film prevents material from being forced into the interstices of the screen during the deposit at the larger pressure differential. A sheet or strip formed in this manner, that is without the material forced or wedged into the screen may be easily removed from the screen when completely formed. Further, the screen may be easily washed since no fibres of material are embedded therein, and the finished sheet is relatively free of screen marking and is smooth, without projecting fibers on the screen side of the sheet which would be present if the preliminary film had not been present when the final deposit was made.

It is to be understood that various changes and modifications may be made in applicant's structures as herein described within the scope of the appended claims without departing from the spirit and scope of the invention.

What I claim is:

1. In apparatus for forming a continuous strip or sheet of asbestos-cement composition or other like material, the combination of a first forming machine including a tank containing a wet mix of such material, a hollow cylindrical drum rotatable in said tank and having a porous cylindrical wall a portion of the periphery of which is disposed below the mix level in the tank with the interior of the drum subject to atmospheric pressure, a perforated screen belt partially encircling said drum in contact with said portion of the periphery of the drum, and means for removing at least a portion of the water which passes from the wet mix into the interior of the drum through the belt and said porous wall, the pressure differential due to the static head of the wet mix at one side of said belt and atmospheric pressure at the other side of said belt being such as to produce a preliminary film of said material out of the wet mix on said belt without forcing said material into the interstices of the belt; a second forming machine including a tank containing a second wet mix of material, and having an opening therein to the atmosphere, a hollow cylindrical drum rotatable in said tank and having a porous cylindrical wall a portion of which is disposed below the mix level in the tank, said belt encircling and engaging said portion of the periphery of the drum and exposing another portion of said periphery of the drum through said opening, means for raising the pressure in the tank above the mix substantially above atmospheric pressure independently of the static head of the mix, and other means for removing at least a portion of the liquid which passes from the second wet mix into the interior of the drum, whereby an additional layer of material is deposited on said preliminary film from said second mix.

2. The combination as set forth in claim 1 with the addition of a washer through which the screen belt is processed after removal of the finished sheet or strip therefrom to cleanse the screen of any adhering material.

3. The combination as set forth in claim 2 with the addition of pneumatic means for forcibly removing the finished sheet or strip from the belt.

4. In a method for forming a continuous sheet or strip of asbestos-cement composition or other material, the steps comprising forcing a body of a wet mix of said material into contact with one side of a foraminous screen under the static pressure of the mix while subjecting the other side of the screen to atmospheric pressure and removing the liquid that is forced through the screen, thereby depositing a preliminary film of the material out of the mix without forcing the material into the interstices of the screen, disposing said screen with the preliminary film thereon with the one side of the film in contact with a body of a second mix while applying to said body of second mix a pressure substantially greater than atmospheric pressure independently of the static head of the

mix and at the same time subjecting the side of said film opposite to said mix to atmospheric pressure and removing the liquid that is forced through said film and said screen thereby depositing a layer of material from said second mix upon said preliminary film.

5. In a method as defined in claim 4 the additional step of pneumatically actuating said layer out of contact with said screen.

6. In a method as defined in claim 4, the additional step of directing a blast through said screen against the second mentioned side of said film to actuate the deposited film and layer out of contact with said screen.

7. In apparatus for forming a continuous strip or sheet of asbestos-cement composition or like material, the combination of a first forming machine including a tank containing a wet mix of such material, a porous wall, a foraminous screen in contact with one surface of said wall, means disposing said porous wall and said screen with one side of the screen in contact with said mix and subject to the static pressure of the mix and with the other side of the screen subject to atmospheric pressure, and means for removing at least a portion of the liquid which passes from the wet mix through said screen and

said porous wall, the pressure differential at opposite sides of said screen and said wall being such as to produce a preliminary deposit of said material out of said mix without forcing the material into the interstices of the screen; a second forming machine including a tank containing a second wet mix of material, a porous wall one surface of which engages said screen with the preliminary film formed thereon, means disposing said wall and said screen to cause contact of said film on said screen with said second mix, means applying a pressure to said mix substantially greater than atmospheric pressure independently of the static head of the mix and at the same time subjecting the other side of said screen to atmospheric pressure, and other means for removing at least a portion of the liquid which passes from the second wet mix through said film and said wall.

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