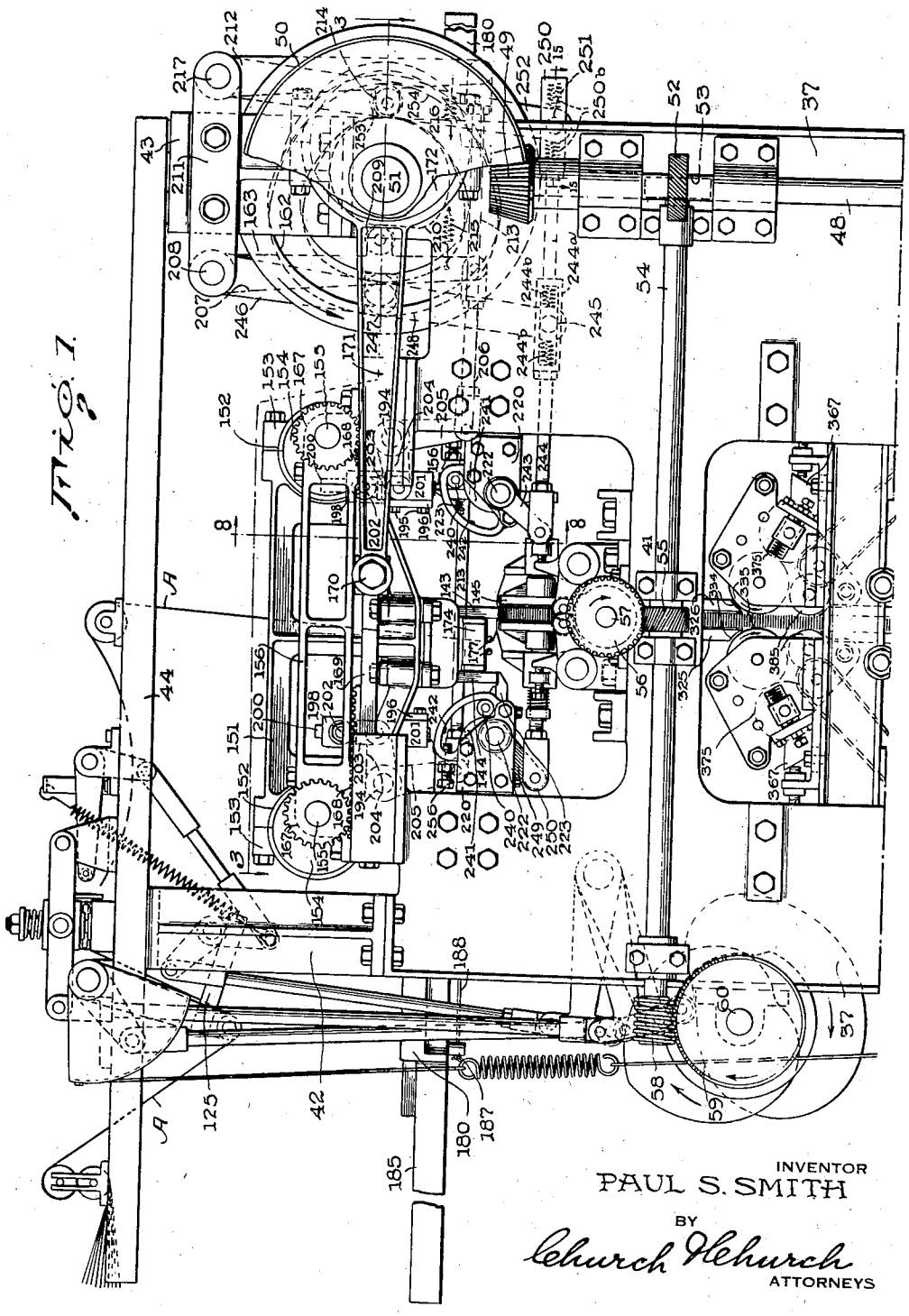
June 20, 1944. P. S. SMITH 2,352,131

STRIP FEEDING MECHANISM

Original Filed July 15, 1940 10 Sheets-Sheet 1

Fig. 1.



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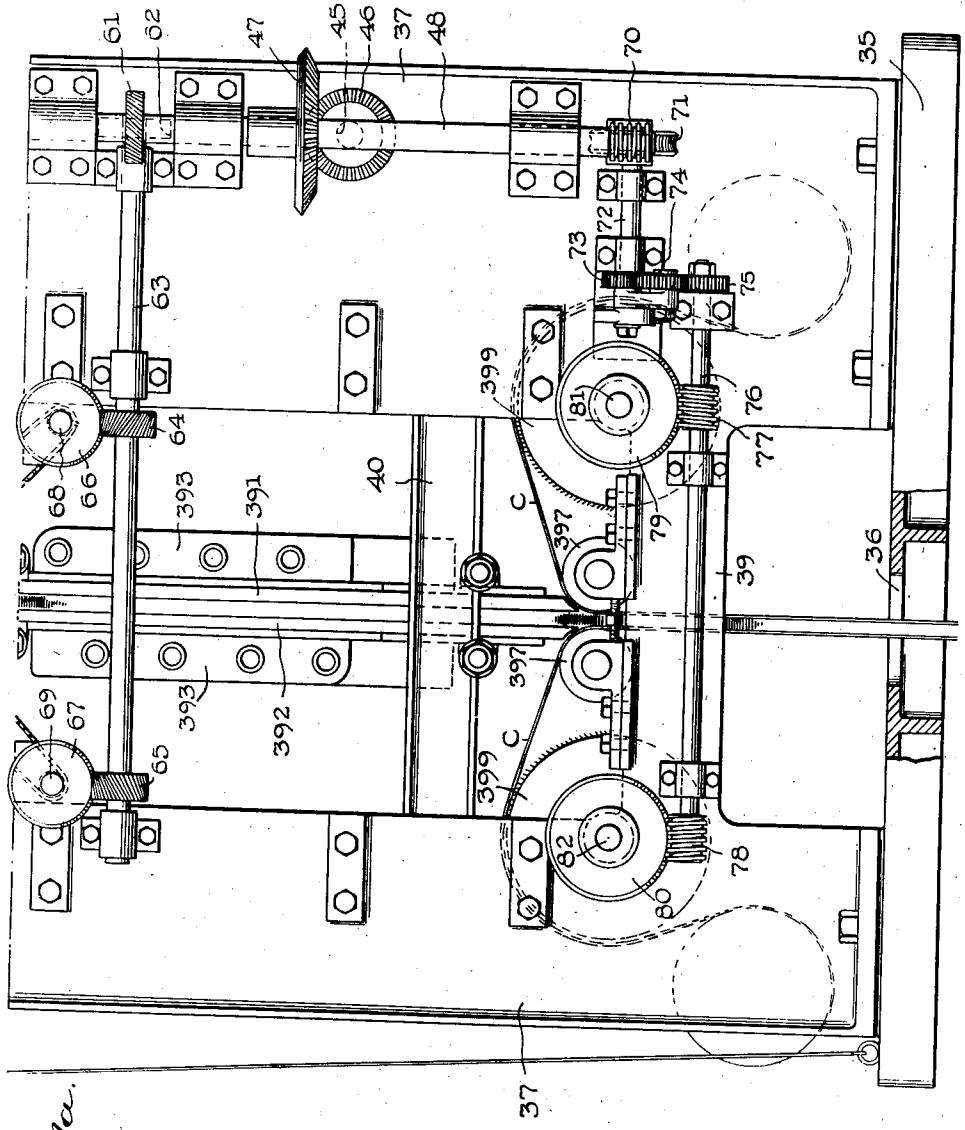


Fig. 1a.

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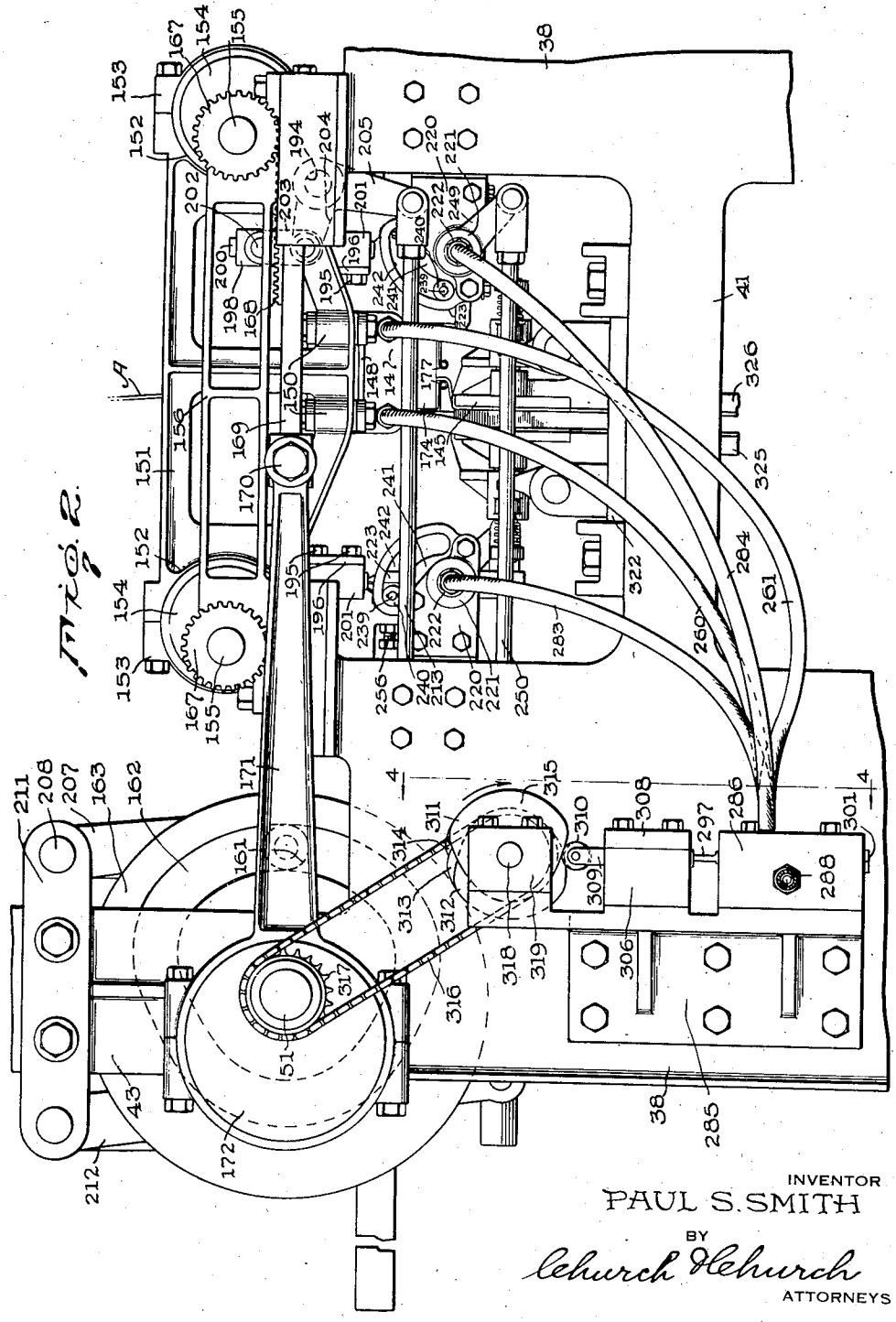


Fig. 2.

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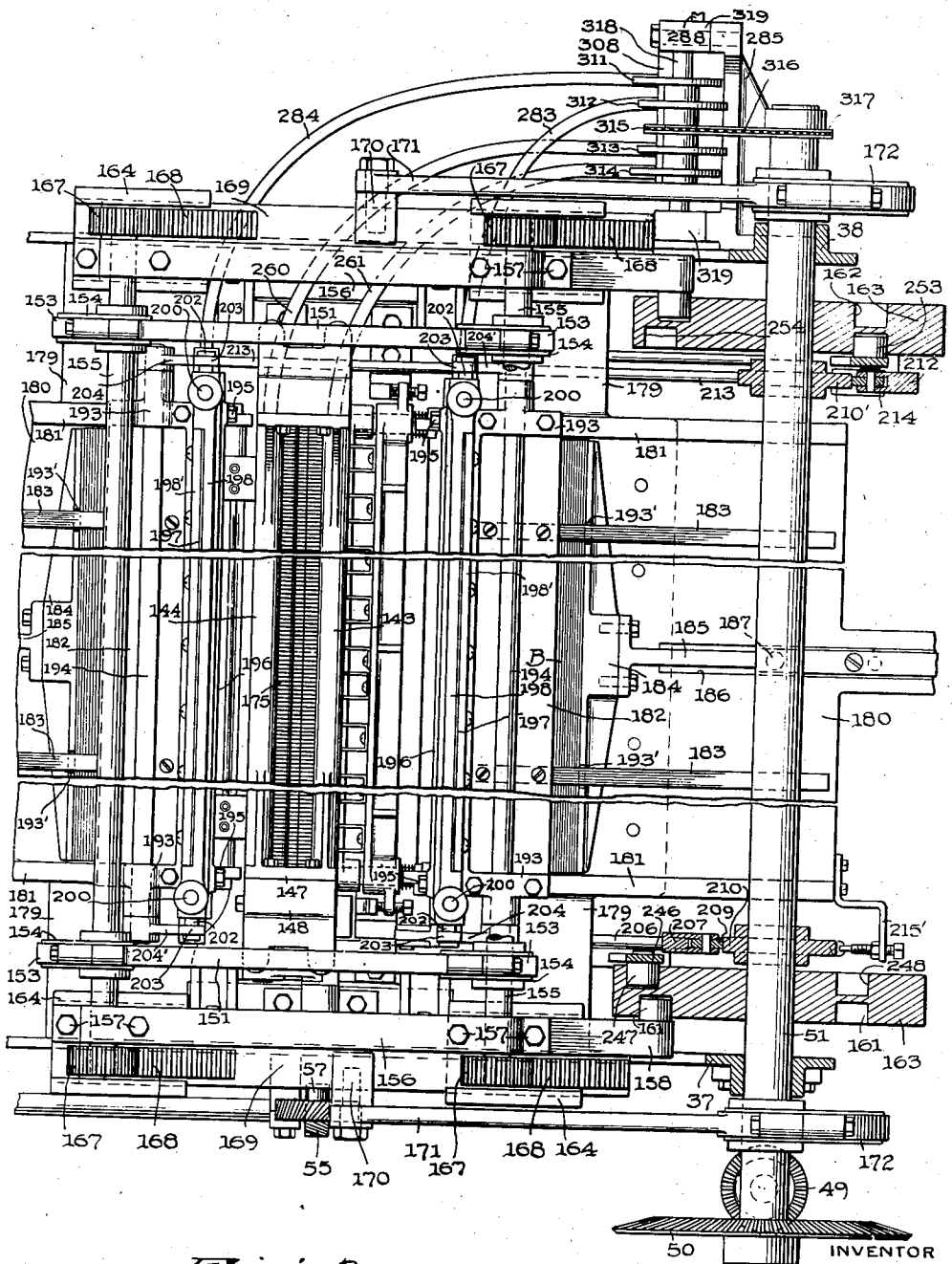


Fig. 3.

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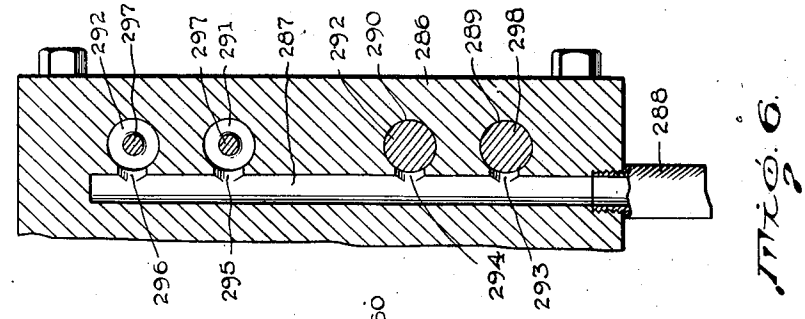


Fig. 6.

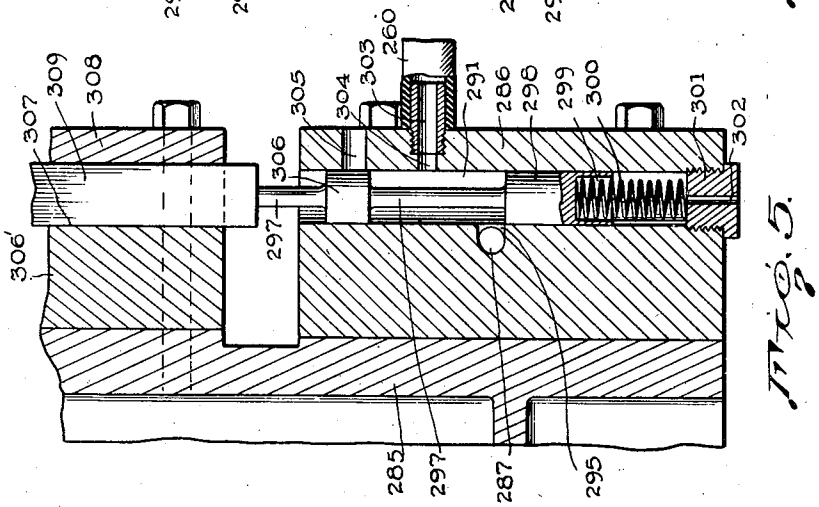


Fig. 5.

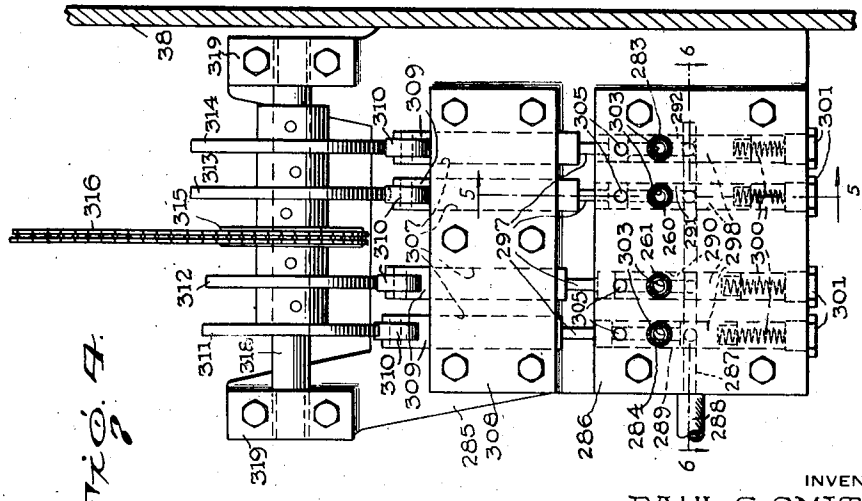


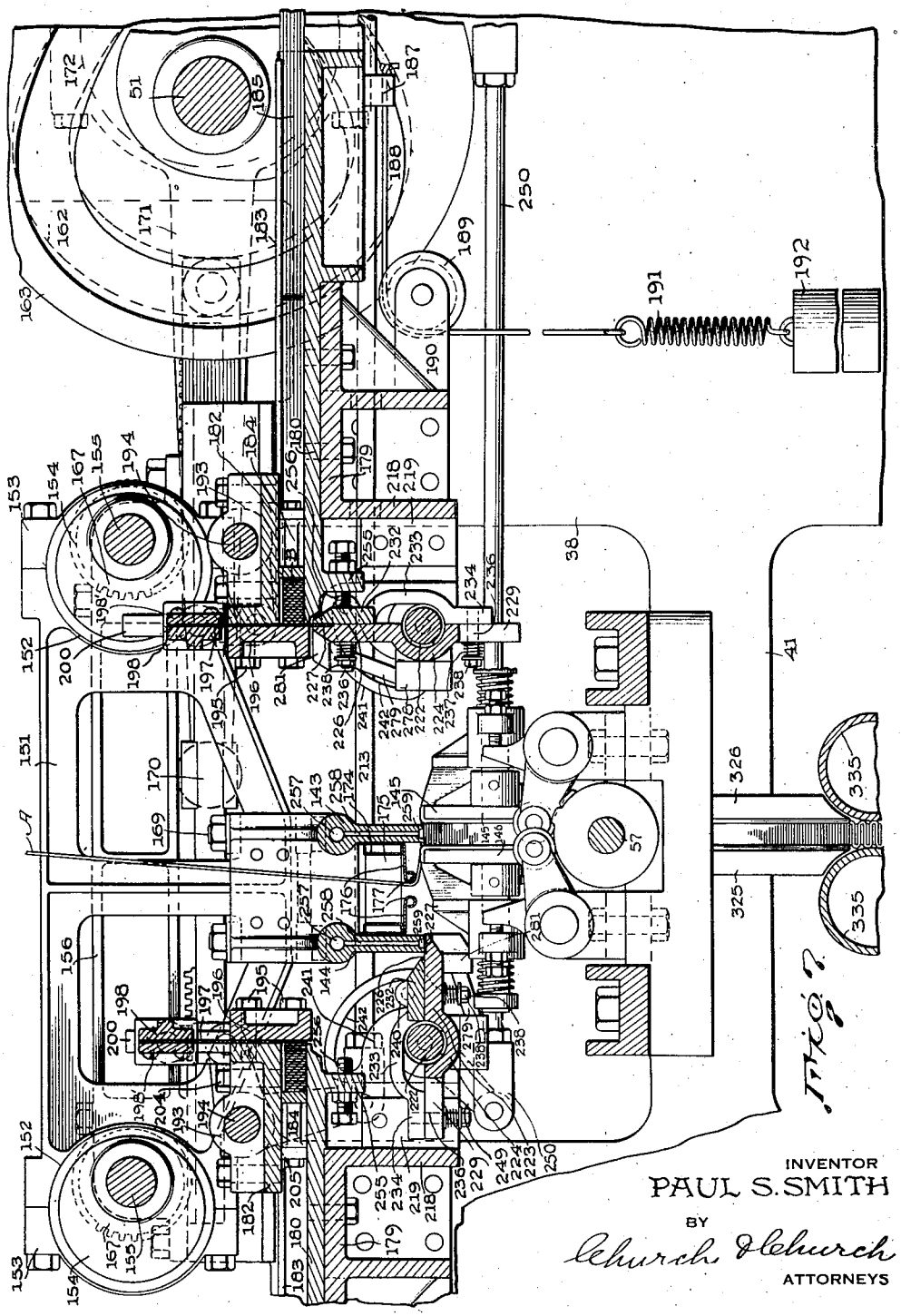
Fig. 4.

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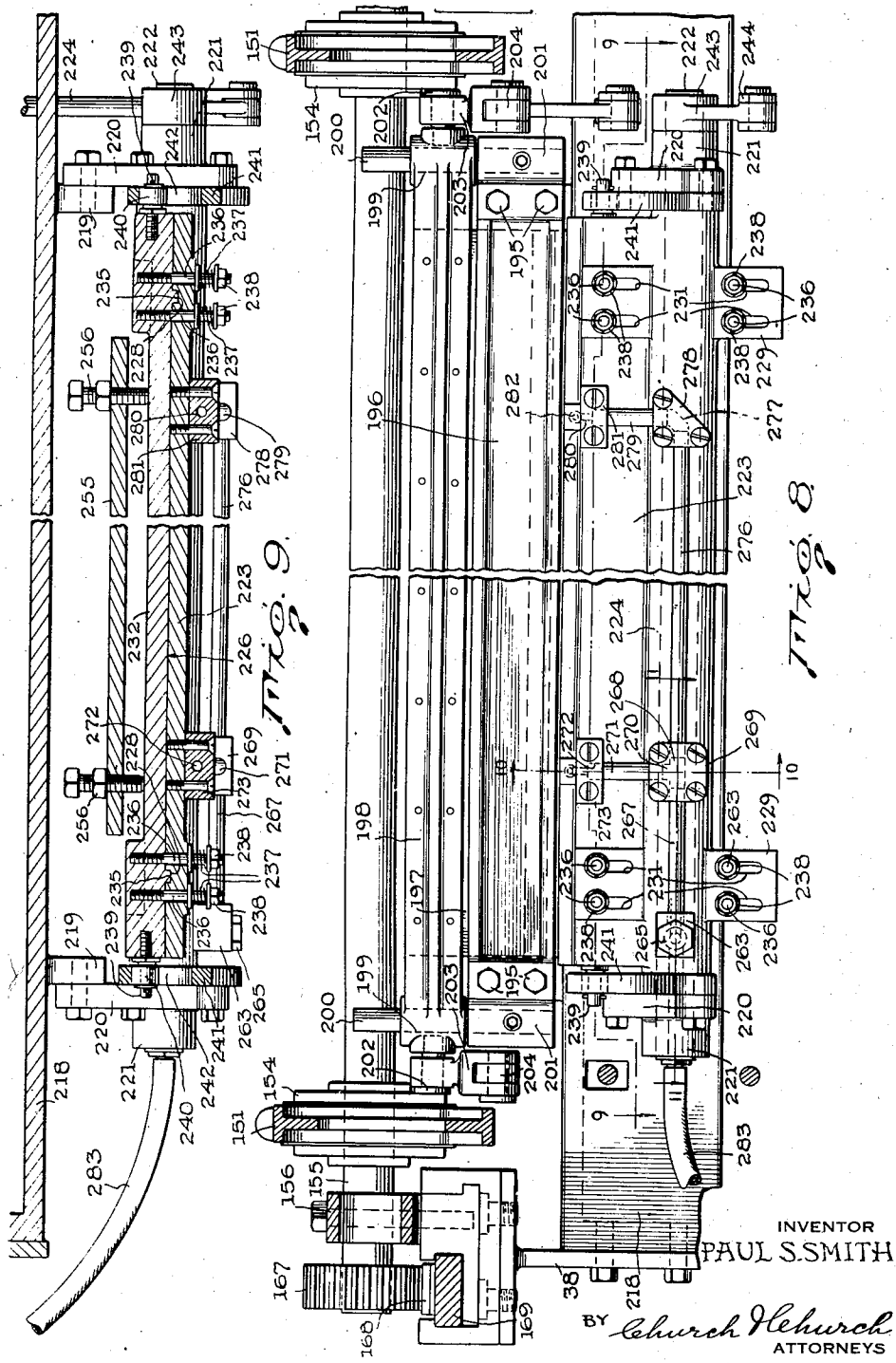


Fig. 9.

Fig. 8

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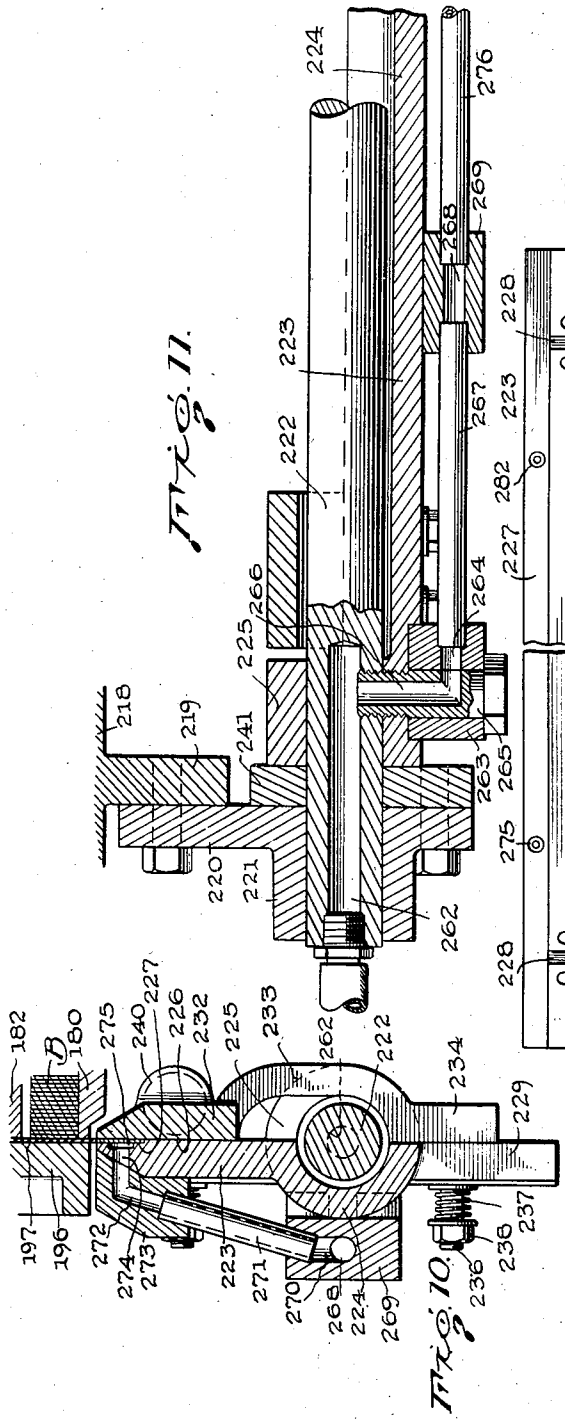


Fig. 10.

Fig. 11.

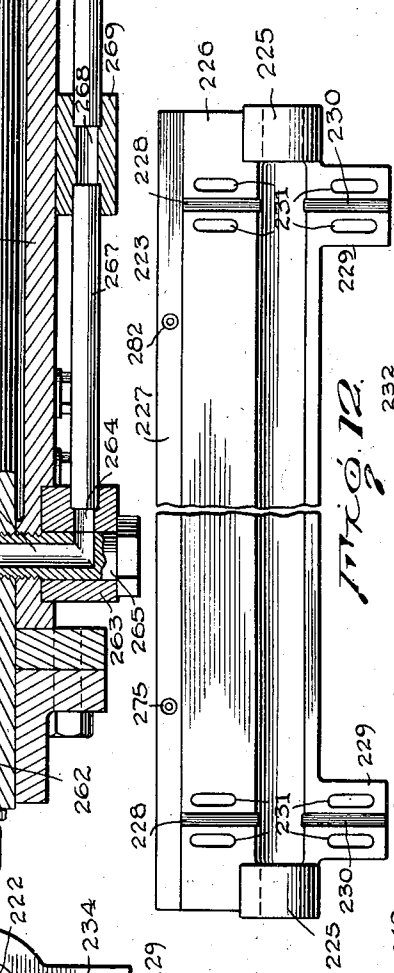


Fig. 12.

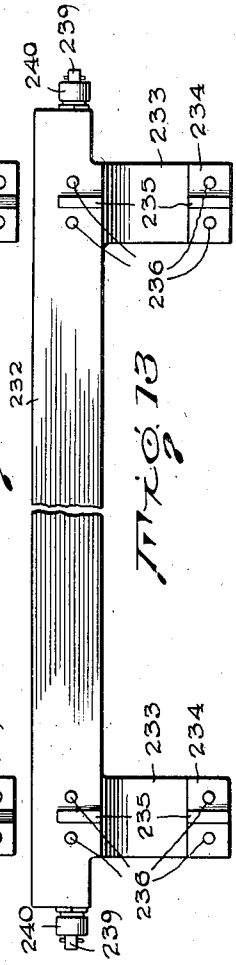


Fig. 13.

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STRIP FEEDING MECHANISM

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Fig. 14.

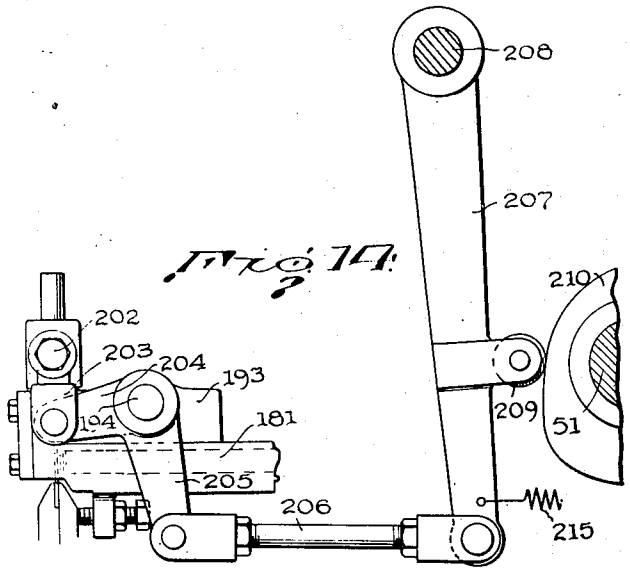


Fig. 15.

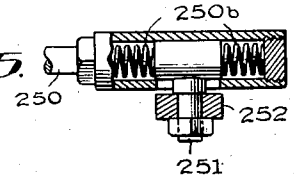
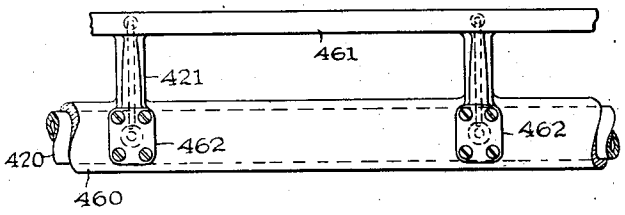


Fig. 17.



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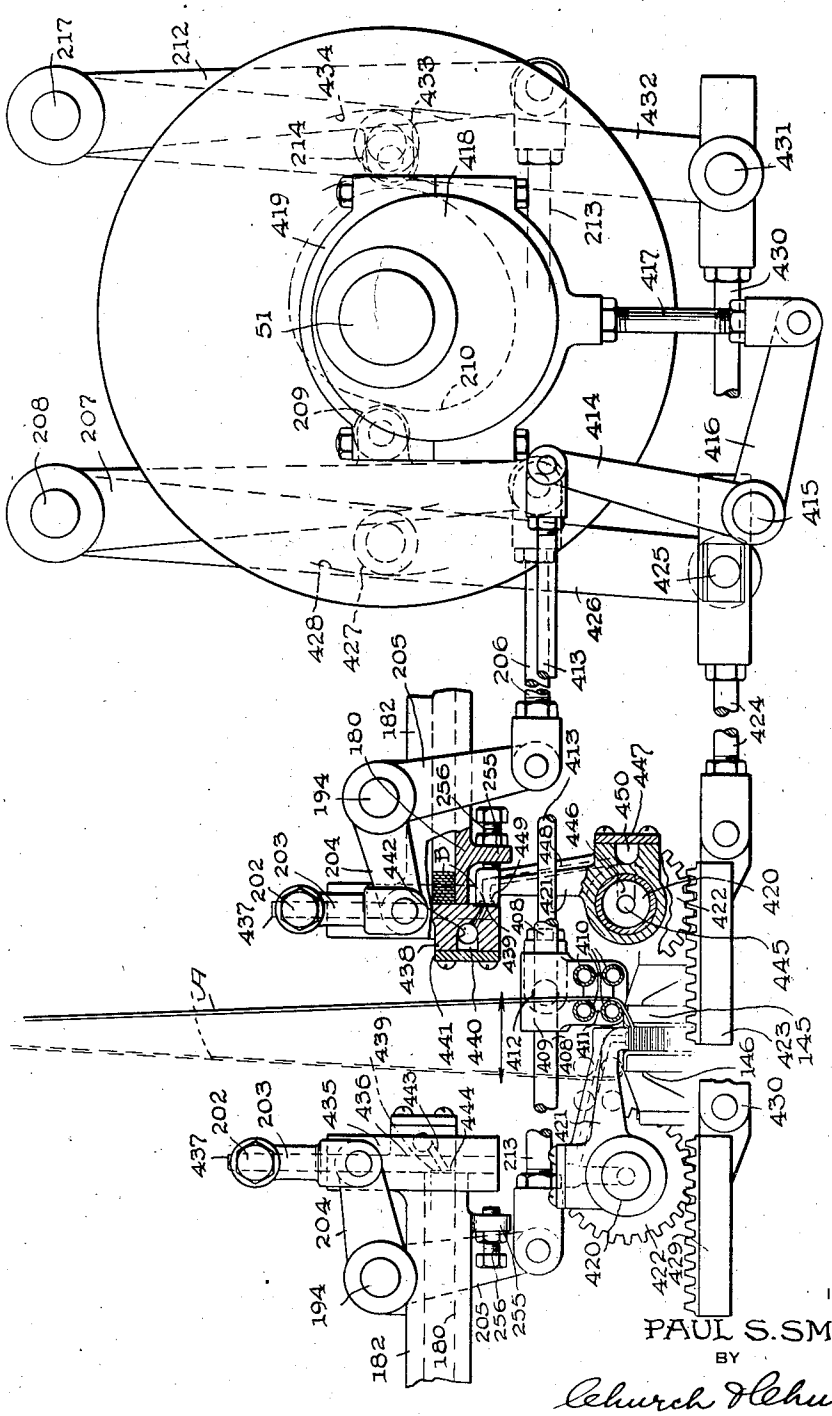


Fig. 16.

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Patented June 20, 1944

2,352,131

UNITED STATES PATENT OFFICE

2,352,131

STRIP-FEEDING MECHANISM

Paul S. Smith, Rockford, Ill., assignor, by mesne assignments, to Ellen Bertha Allen, Birmingham, Mich.

Original application July 15, 1940, Serial No. 345,448. Divided and this application April 17, 1942, Serial No. 439,440

2 Claims. (Cl. 154—1)

This application is a division of my co-pending application, Serial No. 345,448, filed July 15, 1940, Patent No. 2,302,722, dated November 24, 1942, for apparatus for making cemented pile fabric, that is to say, apparatus for use in the manufacture of that type of pile fabric in which the fibers forming the pile are attached to a backing fabric by cementing material. The invention of said application relates to improvements upon the apparatus disclosed and claimed in United States Letters Patent, No. 2,050,740, patented to me on August 11, 1936, and the apparatus forming the subject-matter of said application is useful in carrying out the method disclosed and claimed in United States Letters Patent, No. 2,051,010, also patented to me on August 11, 1936. The present application relates to improvements in strip-feeding mechanism forming a part of said apparatus.

It has long been known that pile fabric may be manufactured by cementing the fibers forming the pile to a backing sheet, or fabric, and the usual practice has been to attach such fibers to the backing sheet in looped form with the loop portions of the pile fibers cemented to the backing sheet. Such fibers may be applied either in the form of yarn or as unspun fibers. The principal object of the invention forming the subject of my said application, Serial No. 345,448, was to provide an improved apparatus by means of which such cemented pile fabric can be manufactured at a lower cost than is possible by apparatus heretofore proposed for use.

In said apparatus, a warp of yarns or unspun fibers is plaited about separator strips which are successively deposited in the mouth of a confining passage, in which a plaited structure is formed from said strips and the warp. The principal object of my present invention is to provide an improved strip-feeding mechanism for feeding the separator strips from a magazine, one by one, so that they may be delivered successively to the plaiting mechanism for the formation of the plaited structure.

A further object of my present invention is to provide an improved mechanism for feeding separator strips from a supply, means for transferring these strips one by one to the mouth of the confining passage in which a plaited structure is built up from separator strips and a warp, and means for plaiting the warp about the separator strips as they are deposited in said passage.

Further objects, and objects relating to details of construction and economies of manufacture, will definitely appear from the detailed description to follow. In one instance, I have accomplished the objects of my invention by the devices and means set forth in the following specification. My invention is clearly defined and pointed out in the appended claims. A structure constituting a preferred embodiment of the invention is illustrated in the accompanying drawings, forming a part of this specification, in which:

Figures 1 and 1A, taken together, are a view in front elevation of my improved machine for making cemented pile fabric;

Fig. 2 is a view, in rear elevation, of the plaiting section of the machine;

Fig. 3 is a view of the plaiting section of the machine, taken on the line 3—3 of Fig. 1;

Fig. 4 is a vertical, sectional view, taken on the line 4—4 of Fig. 2, and illustrating the cam-actuated valve mechanism for controlling the application of suction to various parts of the plaiting mechanism;

Fig. 5 is a detail sectional view taken on the line 5—5 of Fig. 4;

Fig. 6 is a detail sectional view taken on the line 6—6 of Fig. 4;

Fig. 7 is a vertical sectional view through the plaiting mechanism;

Fig. 8 is a vertical sectional view, taken on the line 8—8 of Fig. 1, and illustrating one of the strip-feeding devices and its cooperating strip-transfer device for removing an individual separator strip from a supply and presenting it to the plaiting frame for the purpose of delivery to the mouth of the confining passage;

Fig. 9 is a horizontal sectional view, taken on the line 9—9 of Fig. 8;

Fig. 10 is a vertical sectional view, taken on the line 10—10 of Fig. 8;

Fig. 11 is a detail sectional view, taken on the line 11—11 of Fig. 8;

Fig. 12 is a view, in side elevation, of the main jaw member of one of the strip-transfer devices;

Fig. 13 is a view, in side elevation, of the secondary jaw member of said device;

Fig. 14 is a detail, vertical sectional view illustrating the cam-actuated connections for operating the strip-feeding device;

Fig. 15 is a detail sectional view, taken on the line 15—15 of Fig. 1;

Fig. 16 is a view, partly in side elevation and partly in vertical section, corresponding in general to Fig. 7, but illustrating a modified form of plaiting mechanism, and

Fig. 17 is a fragmentary view in side elevation of one set of strip-transfer arms shown in Fig. 16.

In the drawings, the same reference numerals

indicate the same parts throughout the several views and the sectional views are taken looking in the direction of the arrows at the ends of the section lines.

The improved strip-feeding mechanism forming the subject-matter of my present invention is illustrated as part of an apparatus for use in carrying out the method of making cemented pile fabric which comprises plaiting either a warp of spun yarn, or a web or bat of unspun fibers, about a series of separator strips, so that the warp will pass around the edge of one strip, over that strip and around the opposite edge of the strip next above it, over the face of that strip and around the opposite edge of the one next above it, and so on, thus folding the fibrous warp alternately about the spaced separator strips. The function of these separator strips is to hold the fibers in proper relation to each other while they are cemented to a backing sheet, or sheets, and, in order to facilitate the removal of these separator strips at a certain stage in manufacture, they should be formed of a material which can be severed readily. The plaited structure, comprising these severable separator strips and the fibers plaited about them, is formed in a confining passage and, as it emerges from this passage, a cementing material is applied to opposite faces thereof. This cementing material is then dried and webs of cemented base fabric are applied to opposite faces of the plaited structure and vulcanized thereto, after which the plaited structure is split longitudinally, giving two identical webs of cemented pile fabric, each of which may be subjected to a beating operation for the purpose of removing any remaining pieces of the separator strips, a combing or tigering operation to arrange the pile fibers in substantial parallelism, and a final shearing operation by which such fibers are cut to give a pile of the desired depth.

The machine illustrated includes a pair of spaced plates defining a passage in which the plaited structure is formed, confined and advanced. My present invention relates to improved means for feeding separator strips one by one from suitable magazines and delivering said strips to transfer devices, and the machine includes, also, means for actuating the transfer devices to transfer the strips so delivered to strip-delivering position, and means for taking the strips so delivered and depositing them one by one in the mouth of the confining passage at the same time plaiting a warp of spun yarn, or a web or bat of unspun fibers, about the separator strips to form the plaited structure.

In the apparatus for making cemented pile fabric disclosed herein, one form of plaiting mechanism consists of a plaiting frame carrying a pair of parallel plaiting bars. This plaiting frame is moved to and fro in a semi-elliptical path, so that the plaiting bars are alternately effective to take up a separator strip and carry it to and deposit it in the mouth of the confining passage, in which the plaited structure is to be formed. I have provided an improved strip-feeding mechanism, forming the subject-matter of my present invention, which feeds the separator strips one by one from a supply and delivers them to a point at which they may be taken up successively by the plaiting frame for depositing in the mouth of said confining passage. I find it desirable, when using a warp of yarn, to provide, a reed, or warp guide, through which the individual yarns of the warp run. This warp guide may well be mounted between the plaiting bars and comprises partitions, which separate the individual yarns of the warp, so as to maintain their lateral spacing, and parts having rounded or smooth edges which bear against the yarns of the warp to plait them about the severable separator strips, as they are deposited. To give the plaiting frame the required movement, I provide a pair of shafts which are journaled in slidable bars and carry eccentrics bearing on the plaiting frame and the eccentric shafts are rotated, while the slidable bars in which the shafts are journaled are reciprocated, so that, as the result of these two actions, the lower edges of the plaiting bars trace semi-elliptical paths.

In order to provide a plaiting mechanism which will operate at high speed without involving large unbalanced forces, I have found it desirable to cut down the weight of the moving parts. To that end, I have proposed to provide transfer arms to which strips are successively fed by the strip-feeding mechanism from a strip supply, and which transfer the strips to, and deposit them in, the mouth of the confining passage, while a warp guide is reciprocated across the mouth of said passage to plait the warp about the strips so deposited.

Referring to the numbered parts of the drawings, upon the base **35**, which is provided with a central opening **36**, through which the plaited structure passes to the vulcanizer, there are mounted two side members **37** and **38**. Each of these side members consists of a pair of vertical pillars connected by cross members, as at **39** and **41**. The side members, **37** and **38**, are tied together by the base **35**, and by various cross members, as will be pointed out hereinafter. Mounted upon the upper ends of the pillars of side members **37** and **38**, are transverse yokes **42** and **43**, which tie said side members together. Secured to the tops of yokes **42** and **43** are the horizontal parallel rails **44**, which support the yarn-supplying mechanism.

The power for operating the machine is transmitted to it by the main drive shaft **45**, which has a bevel gear **46** secured to one end thereof, meshing with a bevel gear **47** upon the vertical shaft **48**. On the upper end of shaft **48**, there is a bevel pinion **49** meshing with the bevel gear **50**, which is secured to the shaft **51** for operating the plaiting mechanism, whereby that shaft is driven. Secured to shaft **48** is a spiral gear **52** meshing with a spiral pinion **53** on a cross-shaft **54**. Shaft **54** carries another spiral pinion **55** meshing with a spiral gear **56** secured to retaining finger release shaft **57**, whereby it is driven. A worm **58** is also secured to shaft **54** and meshes with a worm gear **59** secured to yarn-supplying cam shaft **60**, whereby that shaft is driven to actuate the cams for the yarn-supplying mechanism.

A spiral gear **61**, fast on shaft **48**, meshes with a spiral gear **62** fast on a transverse shaft **63**. The letter has secured thereto two spiral pinions **64** and **65**, which mesh with spiral gears **66** and **67** fast on the stub shafts **68** and **69**, respectively. These shafts drive the mechanism by which cement is applied to opposite faces of the plaited structure as it emerges from the confining passage in which it is formed.

A worm **70** fast on the lower end of shaft **48**, meshes with worm gear **71** fast on a shaft **72** journaled in suitable bearings on the frame member **37**. A pinion **73**, fast on shaft **72**, meshes with an idler pinion **74**, which, in turn, meshes

with pinion 75 fast on the end of the transverse shaft 76. Worms 77 and 78, fast on shaft 76, mesh with worm gears 79 and 80, which are fast on the shafts 81 and 82. These control the mechanism for applying cemented base fabric to opposite faces of the plaited structure.

The plaiting mechanism, by which severable separator strips are successively delivered to the mouth of a confining passage, and by which the warp of yarns is plaited about said strips in the mouth of said passage, comprises a plaiting frame which supports a pair of spaced, parallel, plaiting bars 143 and 144, Figs. 1 and 7. The upper end of the confining passage, in which the plaited structure is formed by the plaiting of the warp A about the separator strips B, is defined by the plates 145 and 146. The plaiting frame is given a movement in a semi-elliptical path, so that first one, and then the other, of the plaiting bars is caused to enter slightly the mouth of the passage defined by the plates 145 and 146. As shown in Fig. 7, the plaiting bar 143 is entered slightly into the mouth of said passage. As the shaft 51 turns through 90°, in the counter-clockwise direction, the plaiting frame is moved upwardly and to the right from the position shown in Fig. 7. During the next 90° of movement of shaft 51, the plaiting frame continues its movement downwardly and to the right to a position in which the plaiting bar 144 is entered slightly into the mouth of the passage formed by the plates 145 and 146. During the next 90° of movement of shaft 51, the plaiting frame moves upwardly and to the left from said position, and, during the next 90° of movement of said shaft, the frame continues its movement to the left and downwardly to the position shown in Fig. 7 in which the plaiting bar 143 has, again, entered slightly into the mouth of the passage formed by the plates 145 and 146. As will be described hereinafter more fully, the plaiting bars 143 and 144 take separator strips from strip-transfer devices, one at each side, and deposit said strips, one by one, in the mouth of the passage formed by the plates 145 and 146, and, at the same time, plait the warp A about the strip last deposited in the mouth of said passage. To impart to the plaiting frame the motion necessary to cause the plaiting bars to travel in the semi-elliptical paths heretofore described, each side member 151 of said frame has, at each end, a semi-circular recess 152, and a cap member 153 bolted thereto provided with a similar recess, which recesses receive eccentrics 154 fast to the transverse shafts 155. The transverse shafts 155 are rotatably mounted in the ends of journal bars 156, one of which is provided at each side of the machine. Said journal bars are slidably mounted and connections are provided whereby they are reciprocated by the cam race 162 of the double box cam 163 fast on cam shaft 51. Pinions 167 are secured on each end of each of the transverse shafts 155 and mesh with rack portions 168 on slides 169. Each of said slides 169, adjacent its mid point, carriers a connecting pin 170, journaled in one end of a connecting rod 171, the other end of which is enlarged and formed to embrace an eccentric 172 fast on cam shaft 51.

Referring to Fig. 1, it will be seen that, as cam shaft 51 turns through 90° in the direction of the arrow from the position shown in Fig. 1, the rack slides 169 will be moved to the left, whereas the journal bars 156, carrying shafts 155, will be moved somewhat to the right. These combined movements result in a 90° clockwise rotation of each shaft 155 on which the eccentrics 154 are mounted, as well as in a horizontal translation of said shafts, thereby causing the plaiting frame 151 to move upwardly and to the right from the position shown in Fig. 1. During the next 90° rotation of shaft 51, the rack slides 169 are moved still further to the left, whereas the journal bars 156 are moved still further to the right, the combined movements resulting in another 90° clockwise rotation of each of the eccentric shafts 155 and in further translation of said shafts to the right, so that the plaiting frame is moved downwardly and to the right until plaiting bar 144 is entered slightly into the mouth of the confining passage. During the next 180° of rotation of cam shaft 51, the rack slides 169 are moved to the right, whereas journal bars 156 are moved to the left, thus imparting a counter-clockwise rotation of 180° to shafts 155, exactly reversing the movement of the plaiting frame just described, and returning the parts to the positions shown in Fig. 1.

A reed or yarn guide 174 is detachably mounted between the plaiting bars 143 and 144, and includes a series of transverse partitions 175, extending from one side wall to the other of the yarn guide and forming a reed through which the yarns of the warp A pass, and by means of which they are kept properly spaced with respect to each other. Flanges 176 extend toward each other from the lower edge of each side wall of the yarn guide and the adjacent edges of these flanges are curled at 177 to form smooth surfaces against which the yarns bear as they pass through the yarn guide.

The plaiting bars 143 and 144 not only serve in their movement to plait the warp A about severable separator strips deposited in the mouth of the confining passage formed by the plates 145 and 146, but each of the plaiting bars, when it is away from the mouth of the passage, picks up one of the severable separator strips and transfers it to the mouth of the passage, where it is deposited and released by the plaiting bars.

My present invention relates to the mechanism for feeding strips to this plaiting mechanism which will now be described. There are two magazines for holding supplies of severable separator strips, one at each side of the machine, each serving one of the plaiting bars, as shown in Figs. 3 and 7. Cross-members 179 are connected to, and extend between, the side members 37, 38, of the frame, and these cross-members are located on opposite sides of the central portion of the machine. To each of them there is secured a bed plate 180 on which a supply of severable separator strips B is stacked on edge. This bed plate 180 has side flanges 181 to which a top plate 182 is bolted. Strips 183, secured to the top plate 182, extend laterally therefrom above the upper edges of the supply of strips. A follower 184, located on each of the channel-shaped bed plates 180, is provided with notches 193' through which the strips 183 extend as guides. A tail member 185 is fastened to the follower 184 and extends laterally therefrom. A lug 187, fastened to this tail member, extends downwardly through a slot 186 in the bed plate 180, and the end of a cable 188 is fastened to the lug 187. The cable passes over a pulley 189 journaled in a bracket 190 secured to the cross-member 179, and a weight 192 is connected to the lower end of the cable 188 by means of a spring 191. It will be seen that the spring and the weight tend to move the follower 184 toward the center of the machine, thus press-

ing the supply of severable separator strips B toward the feeding point. The follower 184 and the separator strips B move in the channel defined by the bed plate 180, top plate 182 and the guide strips 183.

There are two strip-feeding devices, one for each of the two magazines. Each comprises a transverse shaft 194 journaled in brackets 193 formed in the ends of top plate 182. Cap screws 195 secure a front plate 196 to the front faces of top plate 182 and bed plate 180, the front plate being so formed as to leave a passageway of about the thickness of one of the separator strips between itself and the top and bed plates for the passage of a blade 197, which reciprocates in the channel thus formed. When the blade 197 is in its upper position, as shown at the left of Fig. 7, the supply of separator strips is forced by weight 192 against the corresponding front plate 196, so that the foremost separator strip B is beneath the lower edge of blade 197. When this feeding blade moves downwardly from the position shown at the left of Fig. 7, to the position shown at the right of that view, the foremost separator strip B is pushed down through the channel into the jaw of the strip-transferring device, which is at that time in position to receive said strip. The upper portions of blade 197 are clamped between transverse bars 198 and 198', the former of which have, at each end thereof, vertical bores 199 (Fig. 8), in which the vertical posts 200 are received. Thus, the bars 198, 198' and blade 197 are guided in their vertical reciprocations. The lower ends of posts 200 are secured within bosses 201 formed at the ends of end plate 196.

Horizontal pins 202, extending from the ends of bars 198, are journaled in the upper ends of links 203. The lower end of one of these links is pivotally connected to arm 204 of a bell-crank lever secured to shaft 194 (Fig. 14), while the lower end of the opposite link 203 is pivotally connected to the end of an arm 204' (Fig. 3), also secured to shaft 194. The other arm 205 of said bell-crank lever is connected, in the case of the feeding device at the right (Fig. 1), to one end of a link 206, the opposite end of which is connected to the lower end of a lever 207 journaled on a shaft 208 carried by a bracket 211 (Fig. 1), secured to the frame member 43. Lever 207 carries a roller 209, engaging the edge of cam 210 fast on cam shaft 51. A spring 215, connected at one end to lever 207 and at the other to a spring support 215' (Fig. 3), draws lever 207 to the right, Fig. 14, holding roller 209 in engagement with the edge of cam 210 and tending to move blade 197 to its lowermost position. Bell-crank 204, 205, is on the front end of the right-hand shaft 194, and a similar bell-crank is provided on the rear end of the left-hand shaft 194. Similar connections are provided for actuating blade 197 at the left of Fig. 7, and comprise lever 212 pivoted on shaft 217 carried by bracket 211, which lever carries a roller 214 engaging the edge of a corresponding cam 210' fast on cam shaft 51. The lower end of lever 212 is connected to one end of a link 213, the opposite end of which is connected to the bell-crank arm 205 corresponding to that shown in Fig. 14, but at the rear, and secured to shaft 194 to actuate blade 197, shown at the left of Figs. 1 and 7. A spring 216 tends to draw the lower end of lever 212 toward the left, so as to hold its roller 214 in engagement with the edge of cam 210', and tends to lower blade 197 connected thereto. It will be seen that, as cam shaft 51 revolves, the blades 197 will be reciprocated alternately so as to feed alternately a strip from one or the other of the two magazines, each holding a supply of separator strips.

Extending inwardly toward the center of the machine (Figs. 7 to 13) from the innermost leg 218 of each of the cross members 179, are lugs 219. To each of the lugs 219 there is bolted a bracket 220 having a boss 221. In the bosses 221 of the alined brackets 220, there are journaled shafts 222 extending transversely of the machine. There is a strip-transferring device mounted on each of these shafts for use in transferring a separator strip from the adjacent strip-feeding device to the adjacent plaiting bar. Each strip-transferring device includes a main jaw member 223, having a semi-cylindrical portion 224 concentric with shaft 222. At each end of member 223, concentric with the semi-cylindrical portion 224, are integral sleeves 225 which embrace shaft 222 and are secured thereto. Diametrically in alinement with the shaft 222, member 223 has a flat bearing surface 226, in which there is formed a depressed seat 227, which is the width of one of the severable separator strips, and is adapted to receive said strip from the strip-feeding device. Extending at right angles to this seat through the portion 226, there is a pair of parallel guideways 228, and in the extended portions 229 of the member there are similar guideways 230, which are in line with guideways 228. Slots 231 are formed in the portion 226 and in the extended portions 229, as shown in Fig. 12. The other member of the device consists of a secondary jaw member 232, the main portion of which is slidable upon, and in engagement with, the portion 226 of member 223. The member 232 is provided with extended portions 233, which are arched so as to pass around the shaft 222, and which terminate in seats 234 adapted to engage the flat extended portions 229 of the main member. Feathers 235 are formed on the slidable member 232, which fit in the guideways 228 and 230 of the main member. Threaded studs 236, carried by the secondary jaw member, extend through the slots 231 of the main jaw member, and have thereon springs 237 compressed between the back of the main jaw member and nuts 238 threaded on the studs, so that the springs yieldingly hold the slidable secondary jaw member in engagement with the main jaw member.

Rollers 240 are journaled on pins extending from each end of the secondary jaw member 232, and work in cam slots 242 formed in plates 241 bolted to the brackets 220. The cam slots are of such shape that, as cam 222 is rocked to carry the strip-transferring device from the vertical position, as shown at the right of Fig. 7, to a horizontal position, as shown at the left of Fig. 7, the secondary jaw member will be caused to retract, that is, move towards shaft 222, so as to occupy the position with respect to the main jaw member indicated at the left of Fig. 7. Thus, the slidable secondary jaw member is in its extended position when the device occupies a vertical position, so that a separator strip forced downward by the blade 197 will enter the seat 227 between the fixed and slidable jaws. Then, as the shaft 222 is rocked through 90°, so as to present the seat 227 and the strip thereon in a horizontal position, the cam slots 242 will force the secondary jaw member to slide upon the main jaw member and uncover the strip in seat 227, so that said strip may be engaged by the corresponding plaiting bar, which is to remove the strip from the

strip-transferring device and carry it over and deposit it in the mouth of the confining passage in which the plaited structure is to be formed.

Referring to Fig. 1, the right-hand strip-transferring device has an arm 243 fast on the front end of shaft 222, which arm is connected to one end of a link 244. The other end of link 244 carries a housing 244a in which are lodged two springs 244b engaging on opposite sides of pin 245 on the lower end of a lever 246 pivoted on the shaft 208. Lever 246 carries a roller 247 engaging in the cam race 248 of the double box cam 163 fast on shaft 51. The left-hand strip-transferring device has an arm 249 fixed to the rear end of shaft 222, which arm is connected at its lower end to one end of a link 250, the other end of which link is resiliently and pivotally connected at 251 to the lower end of a lever 252, pivoted on the shaft 217, and carrying a roller 253, which engages in the race 254 of the double box cam 163 (shown at the right in Fig. 3) fast on shaft 51. Link 250 is connected to lever 252 through springs 250b engaging pin 251, as shown in Fig. 15. These resilient connections between links 244, 250 and levers 246, 252, result in the strip-transferring devices being moved yieldingly to their limiting positions. This enables me to secure precise registry between the strip-transferring device in vertical position and the blade of the strip feeder and, also, permits of a yielding of the strip-transferring device, when in horizontal position, under pressure exerted by the plaiting bar when it engages a strip on the strip-transferring device. The latter action facilitates the transfer of separator strips to the plaiting bar.

A flange 255, depending from each bottom plate 189, carries a pair of threaded, adjustable, stop screws 256, which are engaged by the back of the secondary jaw member 232 of the strip-transferring device, when it is moved to vertical position, so that seat 227 will be in accurate alinement with the corresponding blade 197, and so that that blade may force a severable separator strip B into said seat.

In order that each severable separator strip shall be retained upon the plaiting bar 143 or 144, while it is being carried by the plaiting bar from the corresponding strip-transferring device to, and is being deposited in, the mouth of the confining passage in which the plaited structure is formed, I have provided suction connections for each of these plaiting bars. In each plaiting bar there is a longitudinally-extending passage 257 (Fig. 7), closed at one end. Lateral passages 258 lead from the central passage to cup-shaped recesses 259 in the lower face of the plaiting bar. A flexible tube 261 (Fig. 2) is connected to the open end of the central passage 257 of plaiting bar 143, and a similar flexible tube 260 is connected to the similar passage 257 in the plaiting bar 144. Thus, when the tubes 260 and 261 are connected with a source of reduced pressure, suction is applied at the cup-shaped recesses 259, thus holding a separator strip against the lower face of the plaiting bar. When the tube 260, or 261, is disconnected from the source of suction and connected with atmosphere, the suction will be broken and the strip released from the plaiting bar.

It is also necessary to provide means for retaining a separator strip upon the main jaw member of the strip-transferring device while the device is being rotated from its vertical, strip-receiving position to its horizontal, strip-delivering position. Accordingly, I have provided suction connections for each of the strip-transferring devices for accomplishing this purpose. The longitudinal passage 262 (Fig. 11), closed at one end, is formed in the shaft 222. A block 263 having a lateral passage 264 therein is secured to the back of the semi-cylindrical portion 224 of the main jaw member by a cap-screw 265 screwed through said block, through said semi-cylindrical portion and into the shaft 222. The cap-screw 265 has an angular passage 266 communicating with the central passage 262 in the shaft 222, and registering with the lateral passage 264 in the block 263. Passage 264 is connected by tubing 267 to the horizontal portion 268 of a T-shaped passage formed in a block 269, which is secured to the back of the semi-cylindrical portion 224 of the main jaw member. The vertical portion 270 of the T-shaped passage in said block is connected by a short tube 271 (Fig. 8) to an angular passage 272 (Fig. 10) in another block 273, which is secured to the back of the portion 226 of the main jaw member. The angular passage 272 communicates with a short passage 274 in the upper portion of the main jaw member, which passage leads to a cup-shaped recess 275 formed in the seat 227 of said member. The passage 268 in block 269 is also connected by tubing 276 with an angular passage 277 formed in another block 278 secured to the back of the semi-cylindrical portion 224 of the main jaw member. This passage 277 is connected by tube 279 with a passage 280 in a block 281 fixed to the main jaw member, which passage communicates with a cup-shaped recess 282 formed in the seat 227 of said member. Thus, it will be seen that, by the tubing and passages described, the cup-shaped recesses 275 and 282 in the seat 227, on which the separator strip rests while it is being transferred, may be connected with a source of suction through a flexible tube 283, which is connected to the open end of the passage 262. The strip-transferring device at the other side of the machine is provided with similar passages leading to cup-shaped recesses in the seat 227 of the main jaw member, and these passages are connected to a flexible tube 284.

An angle bracket 285 (Figs. 2 and 4), attached to the side frame member 38, supports a valve body 286 in which is formed a longitudinal passage 287, closed at one end, and communicating at the open end with a tube 288 connected to a suitable source of reduced pressure. In the valve body 286 there are formed four valve cylinders 289, 290, 291 and 292, connected with the longitudinal passage 287 by lateral passages 293, 294, 295 and 296, respectively. A piston valve is slidable in each of the cylinders 289, 290, 291 and 292, and each such valve comprises a valve stem 297 carrying at one end a piston 298, and, intermediate of its length, a piston 306. The outer end of the piston 298 is provided with a cup-shaped recess 299, which houses the upper end of a spring 300, the lower end of which engages a plug 301, which is screwed into the lower end of the valve cylinder, and which is provided with an air vent passage 302. Nipples 303 are screwed into the front of the valve body and connect with passages 304, leading to the valve cylinders 289, 290, 291 and 292, respectively. The tubes 260, 261, 283 and 284 are connected to the nipples 303. Vents 305 are formed in the valve body 286, near the upper end thereof, and also communicate with the valve cylinders 289, 290, 291 and 292, said vents being located adjacent the

pistons 306, so that they may be opened and closed thereby as the valve stems 297 reciprocate.

A block 306' is also secured to the bracket member 285, and is provided with guide-ways 307 of rectangular cross-section, and in line with valve cylinders 289, 290, 291 and 292 in the valve body 286. A plate 308, secured to the front of the block 306', closes the open sides of said guide-ways, and these ways serve to guide the slides 309. Above the block 306' the slides 309 are bifurcated and carry rollers 310, which, under the pressure of springs 300, engage the edges of the corresponding cams 311, 312, 313 and 314, which cams are fast to a shaft 318 journaled in bearings 319 on said bracket. Also secured to the shaft is a sprocket 315, connected by chain 316 to a sprocket 317 fast on cam shaft 51.

It will be observed that sprockets 317 and 315 are of the same size, so that shaft 318 will be driven at the same rate as cam shaft 51. Pistons 298 and 306 are so spaced with reference to the ports 295 and the vents 305 that, when the valve stem 297 is depressed against the pressure of spring 300, piston 306 closes air vent 305, and piston 298 uncovers the port 295 connecting the valve cylinder with the longitudinal passage 287, so that nipple 303 and the tube connected thereto are cut off from the atmosphere and connected with the source of suction, as shown in Fig. 5. On the other hand, when valve stem 297 is permitted by the cam to rise under the pressure of spring 300, the piston 298 covers the port 293, 294, 295 or 296, connecting the suction passage 287 with the corresponding valve cylinder, and piston 306 uncovers the air vent 305, so that the nipple 303 is connected with atmosphere through said air vent.

Cams 311, 312, 313 and 314 are of such contour and so located around shaft 318 that the tubes 260, 261, 283 and 284 are connected with suction during the proper periods of the cycle, and are connected with atmosphere during the remaining portions of said cycle. For instance, each of the tubes 260 and 261, which are connected to the plaiting bars 143 and 144, is to be connected to the source of suction while the plaiting bar is traveling from its position adjacent the strip-transferring device to its position in the mouth of the confining passage formed by the plates 145 and 146, and is to be disconnected from suction and connected to atmosphere during its return motion. Likewise, the tubes 283 and 284 connected with the strip-transferring devices are to be connected with suction so that it is applied at the cup-shaped recesses 275 and 282 in the seats 227 while the corresponding strip-transferring device rotates from its vertical to its horizontal position, and the suction is then to be broken, so that a plaiting bar making contact with a strip on the main jaw member of the strip-transferring device, as shown at the left-hand portion of Fig. 7, may remove the strip from said jaw member and carry it over to its position in the mouth of the confining passage. Accordingly, the valve-actuating cams are so formed and located on the shaft which carries them that the tubes 283 and 284 will be connected with a source of suction during that part of the cycle in which the corresponding strip-transferring device is rotating from the vertical to the horizontal position, and will be released from suction and connected to atmosphere during the remaining part of the cycle.

Plates 145 and 146, which form the upper portion of the confining passage, are carried by a pair of parallel plates 325, 326, which form an extension of the confining passage for the plaited structure and extend vertically. The lower ends of plates 325 and 326 are cut away at 334 so as to approach more closely to the peripheries of rollers 335 to be mentioned hereinafter.

At the lower end of the confining passage formed by plates 325 and 326 there is located the mechanism (Fig. 1) for rubberizing the opposite faces of the plaited structure as it emerges from this confining passage. This comprises rolls 335 for applying a rubberizing compound, such as rubber latex, or a compound thereof, or other cementing material, to said opposite faces of the plaited structure, and other rollers which friction the cementing compound into the opposed surfaces of the plaited structure. These rolls 335 are mounted in frames one at each side of the machine, and each frame supports a pan 367 containing the cementing compound, such as rubber latex, or a compound thereof. Each frame also supports a roller 375 dipping in the cementing compound in the corresponding pan 367. Roller 375, which dips in the rubberizing compound in pan 367, makes approximate contact with the roller 335, so as to transfer said compound thereto, and the latter applies it to the surface of the plaited structure. There are also provided rollers 385 engaging the rubberized surfaces of the plaited structure, and the gearing driving said rollers is such that each of them runs at a materially higher speed than that of the corresponding applying rollers 335, thus serving to friction the applied cement into the bights of the yarn loops. The applying roller 335 rotates in such a direction that, where it makes contact with the plaited structure, its periphery is moving in the same direction with it. Its peripheral speed also substantially exceeds the rate of movement of the plaited structure, so that it has a wiping action upon the latter. The direction of rotation of the supply roller 375 is opposite to that of the applying roller 335 with which it is associated, and the gearing connecting these rollers is such that the supply roller 375 rotates at a substantially higher speed than does the applying roller 335, the result being that an excess of cement is carried upward from the trough 367 on the surface of the roller 375 into the nip between the latter and the roller 335, whose surface as it leaves the nip thus becomes coated uniformly with a film of cement which it carries to the point of application to the plaited structure.

There is one of these cement-applying units on either side of the plaited structure, so that there is a pair of cement-applying rollers 335 engaging opposite faces of the plaited structure as it emerges from the confining passage, and turning in opposite directions so that their peripheral portions in contact with the plaited structure move in the direction of feed of such structure. There is also a pair of friction rollers 385 engaging opposite faces of the plaited structure below the cement-applying rollers and turning so that their peripheral portions in contact with the plaited structure move in a direction opposed to the feed of said structure.

Below the cement-applying mechanism, I have provided a pair of spaced parallel plates 391, 392 (Fig. 1A), forming another confining passage in which the plaited structure, opposite faces of which have now been rubberized, is confined while the cementing compound is being dried thereon. Associated with the plates 391, 392, is

a drier 393, by means of which warm air may be applied to the rubberized surfaces of the plaited structure to dry them. This drier is not described or illustrated in detail, since it may be substantially the same as that illustrated in Figs. 12 and 13 of my Patent No. 2,050,740, issued August 11, 1936, to which reference is hereby made.

At the lower ends of plates 391, 392, webs of cemented base fabric C are applied to the opposite faces of the plaited structure. Rollers 397 guide the coated surfaces of the webs C of cemented base fabric into pressure contact with the opposite coated faces of the plaited structure as it emerges from the lower end of the passage formed by the plates 391, 392. The webs come from suitable sources of supply (not shown) and pass over let-off rolls 399, which are covered with card clothing of such a nature and so applied as to prevent the webs of base fabric in contact with it from slipping circumferentially in the direction of rotation of the rolls.

After the application to the plaited structure of the webs C of cemented base fabric, it passes through the opening 36 in the base plate 35 of the machine, and thence to a vulcanizing apparatus, which is substantially the same as that covered by my Patent No. 2,051,011, issued August 11, 1936, to which reference is hereby made for details of construction of the vulcanizing apparatus. After leaving the vulcanizer, the plaited structure is split in two by a splitting knife, as indicated diagrammatically in my Patent No. 2,050,740, and the separate webs so formed, after removal of the severed separator strips, are subjected to the usual beating, tigering and shearing operations.

The operation of my improved apparatus should be apparent from the foregoing description but will be summarized briefly. The yarn-supplying mechanism operates to create and maintain a slack supply of yarn or warp A from which the plaiting mechanism draws as needed. The severable separator strips B are stacked on edge in the two magazines, one at each side of the machine, on the base plates 180. The warp A passes downward through the yarn guide 174 of the plaiting frame, the individual yarns of the warp being separated by partitions 175, and between the beaded edges 177 of flanges 176 to the mouth of the confining passage formed by plates 145, 146. Strips B are fed, one by one, from the magazine by reciprocating blades 197, which are so timed that, when the blade descends to feed a strip from the magazine, the corresponding strip-transferring device is in vertical position beneath the blade, so that the strip is inserted into the seat 227 between the main jaw member 223 and the secondary jaw member 232. As soon as the strip is delivered to the strip-transferring device, the cam-actuated valve mechanism is effective to apply suction at the cup-shaped recesses 275 and 282 to hold the strip in the seat 227 while transfer takes place. The blade 197 now moves upwardly to its upper position preparatory to feeding another strip from the magazine, whereupon the strip-transferring device rocks from its vertical to its horizontal position, the secondary jaw member sliding on the main jaw member to uncover the strip held on seat 227. When the strip-transferring device is in its horizontal or strip-delivering position, one of the plaiting bars, 143 or 144, at the end of its semi-elliptical path, descends on the strip B, now presented horizontally in seat 227, and engages the same. At this instant, the cam-actuated valve mechanism acts to break the suction at recesses 275 and 282, and to apply it at recesses 259 of the plaiting bar. Thus, the strip is released by the strip-transferring device and adheres by suction to the plaiting bar which is to carry it to the mouth of the confining passage. The strip-transferring device now returns to its vertical position preparatory to receiving another separator strip from the strip-feeding device.

As the plaiting frame moves, the plaiting bar which made contact with strip B, and removed it from the strip-transferring device, returns along its semi-elliptical path, carrying the strip from seat 227 to, and depositing it in, the mouth of the confining passage formed by plates 145 and 146. At the same time, the beaded edge 177 engages the warp and deflects it to one side, folding it over the strip B last deposited in the mouth of the confining passage. As the strip on the plaiting bar enters the mouth of the passage, cams act to withdraw retaining fingers so that strip B may enter the confining passage. At this instant, the cam-actuated valve mechanism breaks the suction of recesses 259, so that the strip is released from the plaiting bar, which leaves the mouth of the passage on its return movement.

The plaiting frame comprises a pair of plaiting bars and there is a strip magazine, strip-feeder and strip-transferring device on each side of the machine, serving one of the plaiting bars. These devices are timed so as to work alternately and, consequently, first one and then the other of the plaiting bars receives a separator strip from its strip-transferring device and carries it to, and deposits it in, the mouth of the confining passage, at the same time plaiting warp A over the strip B last previously deposited.

The action of the plaiting mechanism results in the formation of the plaited structure in the confining passage and the feeding of it downwardly therein. As the plaited structure emerges from the lower end of the confining passage, the cement-applying rollers 335 apply the cementing compound to opposite faces of the plaited structure, which compound is frictioned in by rollers 385. The cement is then dried and webs of base fabric applied, as already described.

In Fig. 16, I have shown a modified form of plaiting and strip-transferring mechanism, which is particularly adapted to high speed operation because the weight of moving parts has been greatly reduced. In this modified form of my invention, the plaiting bars have been eliminated and the strip-transferring devices transfer the strips from the strip-feeders and themselves deposit them one by one, in the mouth of the confining passage, while a yarn guide, through which the warp A of yarn passes, moves back and forth over the mouth of the passage, plaiting the warp about the severable separator strips as they are deposited. The strip-transferring devices, one of which is arranged at each side of the mouth of said passage, work alternately, first one and then the other depositing a separator strip on top of the warp which the yarn guide has plaited over the separator strip last previously deposited in the mouth of the confining passage.

The yarn guide has bearing members 439 at each end thereof, which are slidably mounted on suitably supported rods 408. The yarn guide comprises four tubes or rods 410, extending between and carried by the bearing members 439, said rods being arranged at the four corners of

a rectangle, as shown in Fig. 16. Partition plates 411 are supported by and extend between rods 410 forming a reed through which the yarns of warp A pass. These partitions serve to prevent lateral displacement of the yarns and keep them spaced properly relative to each other. Links 413, one at each side of the machine, are pivotally connected at 412 to the bearing members 409, and the other ends of said links are pivotally connected to arms 414 of bell-crank levers pivoted at 415, the other arms, 416, of which are pivotally connected to the lower ends of pitmans 417. The upper ends of said pitmans, together with the cap pieces 419 secured thereto, embrace eccentrics 418 fast on shaft 51, so that, as said shaft revolves, the bell-cranks 414, 416, are rocked, and the links 413 reciprocated, thus carrying the yarn guide back and forth over the mouth of the confining passage, formed by plates 145 and 146, in which the plaited structure is formed.

One extreme position of the yarn guide is shown in full lines in Fig. 16, and the position which it occupies at the other extreme of its movement is shown in dotted lines in said figure. It will be noted that one or the other of the vertical pairs of tubes or rods 410 bears on the yarns of the warp as the yarn guide moves across the mouth of the confining passage, depending upon the direction of movement, and thus the warp of yarns is laid across the severable separator strip B last deposited in the mouth of the passage. Another separator strip B is then deposited in the mouth of the passage on the warp so laid over the preceding strip, and, as the yarn guide moves back, the warp A is bent around one edge of, and laid across the upper face of, the separator strip so deposited.

Extending across the machine, and located one at each side of the mouth of the passage formed by plates 145 and 146, there are journaled two hollow shafts 420, on each of which is fast a cylindrical sleeve 460 provided with a plurality of integral, equally-spaced arms 421. The arms on the one sleeve are formed reversely to those on the other, as shown in Fig. 16, and their outer ends terminate in, and are connected by, continuous integrally-formed bars 461, as shown in Fig. 17, adapted to receive a severable separator strip B and to transfer it to the mouth of the confining passage. Gears 422 are secured to shafts 420, one such gear being secured to the rear end of the shaft shown at the left in Fig. 16, and a corresponding gear being secured to the front end of the right-hand shaft. The gear 422 on the right-hand shaft meshes with a slidably supported rack 423, which is connected by link 424 and pin 425 to the lower end of a lever 426, pivoted at 208. Lever 426 carries a roller 427, which works in the race 428 of a cam fast on shaft 51. Gear 422 on the left-hand shaft 420 meshes with a slidably supported rack 429 connected by link 430 and pin 431 to the lower end of lever 432, pivoted at 217. Lever 432 carries a roller 433 engaging in the race 434 of a cam fast on shaft 51. Thus, as shaft 51 revolves, the shafts 420 will be oscillated in proper timing, so that first one and then the other of the bars 461 will move from the strip-receiving position, shown at the right in Fig. 16, to the strip-depositing position, shown at the left, and back.

Each of the two strip magazines is substantially the same as shown in the preferred embodiment of my invention, comprising a bottom plate 180 and a top plate 182. The bottom plate has a depending flange 255, carrying adjusting screws 256 for so limiting the bars 461, at one extremity of their movement, as to bring them to rest accurately in strip-receiving position. The separator strips B in said magazine are fed forward under the pressure exerted on them by the weight 192 (Fig. 7). Instead of the blade 197 and associated parts of the strip-delivering mechanism of the first described embodiment of my invention, a slide 437 is provided, whose end portions are adapted to slide in grooves 436 in guides 435 attached to the top plate 182 of the magazine. At its lower edge the slide 437 is provided with a recess or seat 439, adapted to receive a separator strip B from the supply in the magazine and present it to the bar 461.

The slides 437 are reciprocated, in proper timing, by mechanism such as that shown in Fig. 1 for reciprocating blades 197. Thus, each slide 437 carries pins 202 connected by links 203 to arms 204 of bell-cranks pivoted at 194, the other arms 205 of which are connected, in the case of the right-hand strip-feeder, by link 206 to the lower end of lever 207 pivoted on the frame at 208. Lever 207 carries a roller 209 engaging a cam 210 fast on shaft 51. In the case of the left-hand strip-feeder, bell-crank arm 205 is connected by link 213 to the lower end of lever 212 pivoted at 217 and carrying a roller 214 engaging cam 215 fast on shaft 51.

The separator strips B are held against the seats 439, or the faces of the bars 461, and released therefrom at the proper stages of the cycle, by the controlled application of suction. To that end, cavities 440 are formed in the heads 438 which are closed by plates 441 secured to the heads. Inlets 442 communicate with one end of each of the cavities 440, said inlets being connected by flexible tubes, such as 260, 261 (Fig. 2), with cam-actuated control valves such as are shown in Figs. 4 to 6, whereby the cavities 440 are subjected to suction and atmospheric pressure at the proper stages in the cycle. Cavities 440 are connected by passages 443 to cup-shaped recesses 444 in seats 439, whereby suction may be applied at said seat to hold a separator strip B therein, the strip being released when the suction is broken and the corresponding cavities 440 are connected to atmosphere.

The bore of each shaft 420 has an inlet 445 at one end connected by a flexible tube, such as tubes 283, 284 (Fig. 2), to the cam-actuated valve mechanism shown in Figs. 4 to 6, so that the bores of shafts 420 may be connected to suction and atmosphere at the proper stages in the cycle. Passages 446 connect the bore of each shaft 420 with a recess 450 formed in a boss 462, integral with the sleeve 460, and closed by a plate 447. The recess 450 is connected by passages 448 in arms 421 with cup-shaped recesses 449 formed in the surface of the bar 461 which engages the separator strip B. Thus, suction may be applied at said surface to hold the strip thereto as it is being transferred from the strip-feeder to the mouth of the confining passage, said suction being released when the strip is to be deposited in said passage.

The operation of the plaiting mechanism above described is as follows: The warp A passes through the warp guide to the mouth of the confining passage between the opposite pairs of rods 410. In the use of a warp of yarns, the

individual yarns are separated and held from lateral displacement by the partitions 411. Each magazine contains a supply of severable separator strips B, resting on edge on the bottom plate 180, and fed toward head 438 by the pressure exerted by weight 192. Tracing the movement of the parts from the positions shown in Fig. 16 through a complete revolution of shaft 51, during the first half of the revolution the warp guide moves across the mouth of the confining passage formed by plates 145 and 146 to the dotted line position. At the same time, the left-hand shaft 420 is rotated so that bar 461 moves upwardly into engagement with stop pins 256. At the beginning of the cycle, the left-hand slide 437 is at the top of its stroke, and the feeding pressure on the supply of strips B has lodged the foremost strip in seat 439, while suction is applied at the cup-shaped recess 444 to hold the strip in said seat. After the left-hand transfer arms have risen to their vertical position, the left-hand slide 437 moves down carrying with it strip B in seat 439 until, at the bottom of the stroke, strip B is positioned between seat 439 and the strip-engaging surface of the adjacent bar 461. At about this point in the cycle, suction will be released from recesses 444, and applied to recesses 449 in the face of bar 461, so that the strip is released from head 438 and held to the bar. At this time, the parts at the left of Fig. 16 would occupy positions corresponding to the illustrated positions of the right-hand strip-feeding and strip-transferring devices.

At the beginning of the cycle, the right-hand slide 438 moves up, the suction having been broken at recesses 444 and applied to recesses 449, so that strip B is released from seat 439 and retained by the bar 461. After head 438 has moved above the bar 461, the right-hand shaft 420, together with the sleeve 469, is rotated so as to move the arms 421 from the vertical to the horizontal, the bar 461 thus transferring strip B from the strip-feeder to the mouth of the confining passage formed by plates 145 and 146, and depositing it therein. Suction is cut off from recesses 449 at the instant the strip enters the mouth of the confining passage.

During the last half of the cycle, the warp guide moves from the dotted line to the full line position of Fig. 16, and the other parts return to the positions there shown in accordance with the description previously given. Thus it appears that, during the first half-cycle, the warp is laid from right to left over the upper face of the strip last deposited, and a severable separator strip B from the right-hand magazine is deposited in the mouth of the passage on the warp so laid. During the last half-cycle, the warp is laid from left to right over the upper face of the strip deposited during the first half-cycle, and a strip B from the left-hand magazine is deposited in the mouth of the passage on the warp so laid. Thus, the warp is plaited about the severable separator strips as they are deposited one by one in the confining passage.

In the specification, and the appended claims, the term "warp" is used as meaning either a warp of spun yarns or a bat of unspun fibers.

I am aware that the apparatus here shown is susceptible of considerable variation without departing from the spirit of my invention and, therefore, I claim my invention broadly as indicated by the appended claims.

What I claim is:

1. In a machine for making cemented pile fabric by plaiting a warp about separator strips, a strip-feeding mechanism comprising the combination of a magazine having a strip-discharge passage, a feeding bar substantially coextensive with said separator strips and reciprocable in one end of said magazine and having a seat therein to receive the foremost strip of the supply in said magazine, means urging a supply of strips in said magazine toward said bar, and means for reciprocating said bar in a direction perpendicular to its length to force said foremost strip through said passage.

2. In a machine for making cemented pile fabric by plaiting a warp about separator strips, a strip-feeding mechanism comprising the combination of a magazine having a strip-discharge passage therein, a feeding bar substantially coextensive with said separator strips and reciprocable in one end of said magazine and having a seat therein to receive the foremost strip in said supply, suction passages in said bar communicating with said seat for applying suction to hold a strip in said seat for a portion of the machine cycle, means for controlling the application of suction to said passages, means urging a supply of strips in said magazine toward said bar, and means for reciprocating said bar in a direction perpendicular to its length to force said foremost strip through said passage.

PAUL S. SMITH.