July 8, 1941. D. F. COLLINS 2,248,743

APPARATUS FOR MANUFACTURING FLOOR MATS

Original Filed Oct. 16, 1939 2 Sheets-Sheet 1

FIG. 1.

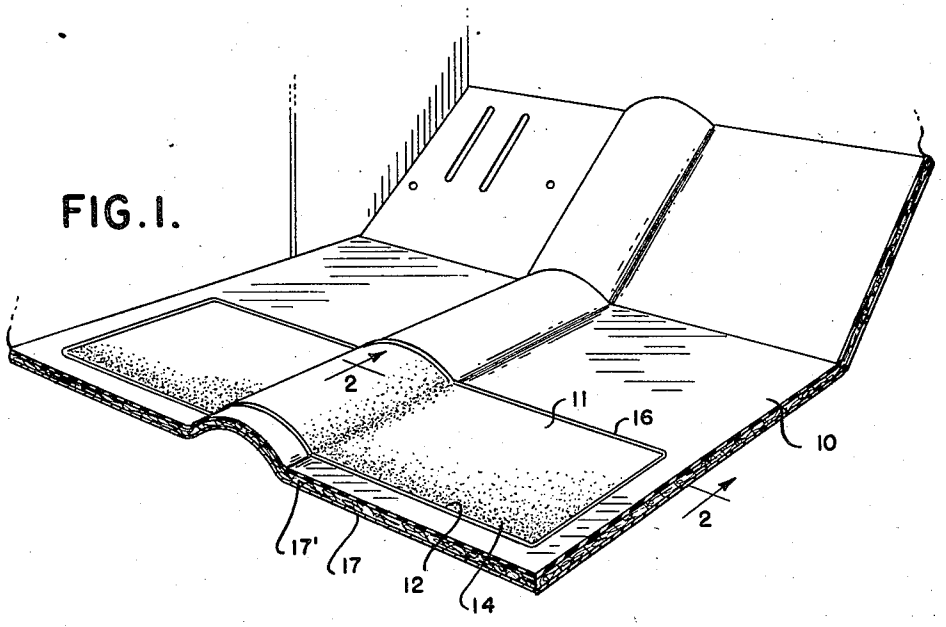


FIG. 2.

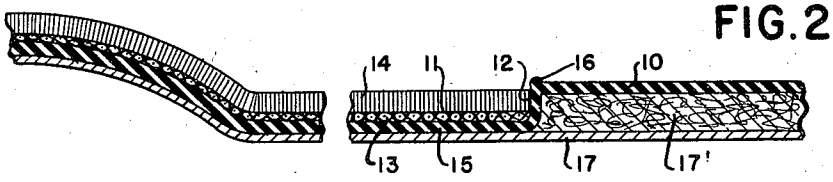
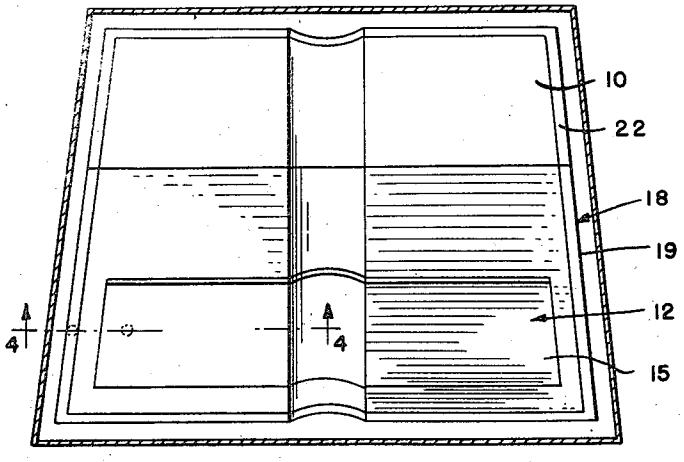


FIG. 3.



INVENTOR.

DON FREMONT COLLINS

BY Watterson Hullert & Belknap

ATTORNEYS

July 8, 1941. D. F. COLLINS 2,248,743

APPARATUS FOR MANUFACTURING FLOOR MATS

Original Filed Oct. 16, 1939 2 Sheets-Sheet 2

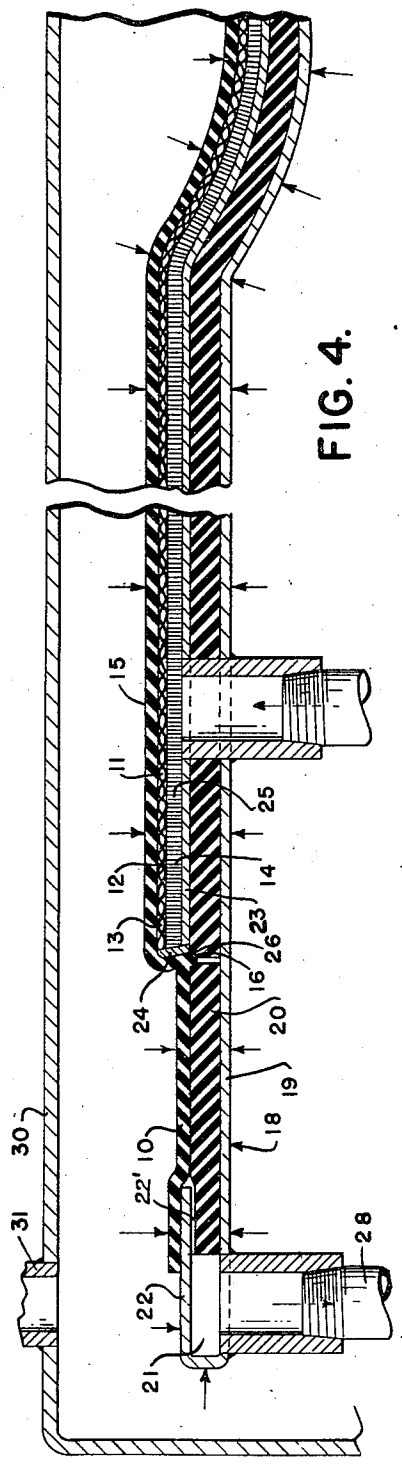


FIG. 4.

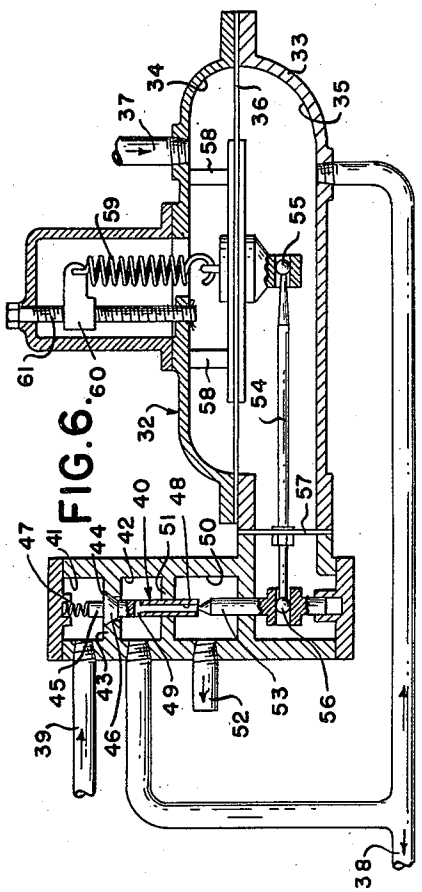


FIG. 6.

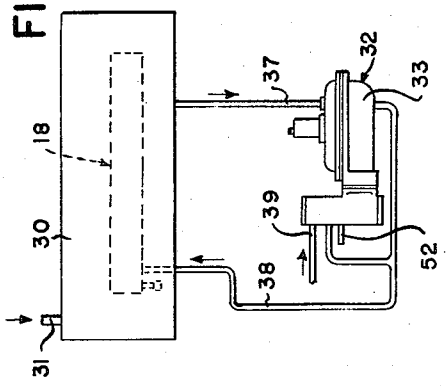


FIG. 5.

INVENTOR.
DON FREMONT COLLINS
BY Guilmore Hullert & Bilkus
ATTORNEYS

Patented July 8, 1941 2,248,743

UNITED STATES PATENT OFFICE

2,248,743

APPARATUS FOR MANUFACTURING FLOOR MATS

Don Fremont Collins, Pontiac, Mich., assignor to Baldwin Rubber Company, Pontiac, Mich., a corporation of Michigan

Original application October 16, 1939, Serial No. 299,729. Divided and this application April 29, 1940, Serial No. 332,341

12 Claims. (Cl. 154—1)

This invention relates generally to apparatus for manufacturing floor coverings and is a division of my copending application Serial No. 299,729, filed October 16, 1939.

More particularly, this invention refers to apparatus for making composite floor mats of the type having a covering sheet of vulcanizable material and having a tread sheet of pile fabric permanently secured to the top surface of the covering material with the pile extending upwardly. To this end, one of the principal features of this invention is to provide apparatus for preforming both sheets to the contour of the floor surface to be covered thereby and for securing the sheets together without disturbing or injuring the pile on the tread sheet.

Another object of this invention resides in the provision of apparatus having a form corresponding in contour to the floor surface to be covered by the mat and adapted to support the sheet of vulcanizable covering material in relation to the tread sheet of pile fabric. In accordance with this invention, the sheet of pile fabric is supported in an inverted position with the pile extending toward the contoured surface of the form and the covering sheet extends over the tread sheet in engagement with the undersurface of the base on the latter sheet.

Still another object of this invention resides in the provision of apparatus wherein fluid under pressure is applied to the exposed surface of the covering sheet to conform both sheets to the contour of this form and wherein this fluid is heated sufficiently to not only cure the covering sheet to the contour of the form but to also vulcanize this sheet to the base of the tread sheet.

In addition to the foregoing, the present invention contemplates apparatus embodying means for introducing fluid under pressure on the pile side of the fabric sheet and controlling this pressure to such an extent that it is sufficient to prevent matting of the pile under the action of the heated fluid under pressure but at the same time does not interfere with the pile assuming the contour of the form.

The foregoing, as well as other objects, will be made more apparent as this description proceeds, especially when considered in connection with the accompanying drawings, wherein—

Figure 1 is a perspective view of a section of a vehicle body flooring covered by a composite mat constructed with the apparatus forming the subject matter of this invention;

Figure 2 is a sectional view taken substantially on the plane indicated by the line 2—2 of Figure 1;

Figure 3 is a plan view of a contoured form and illustrating a mat supported on the top surface thereof;

Figure 4 is a sectional view taken substantially on the plane indicated by the line 4—4 of Figure 3;

Figure 5 is a diagrammatic view illustrating the differential pressure controlled valve;

Figure 6 is a sectional view through the valve.

In Figures 1 and 2 of the drawings, I have illustrated a mat fashioned in accordance with this invention and applied to a floor section of a vehicle body having a "hump" intermediate the opposite side edges to provide clearance for certain parts of the vehicle driving mechanism. The mat is preformed to the contour of the surface of the floor to be covered thereby and is provided with a "hump" of a dimension to snugly fit over the "hump" in the flooring regardless of the particular shape of this "hump." As a result, a neat and pleasing appearance is imparted to the mat.

Upon reference to Figure 2, it will be noted that the mat comprises a covering sheet 10 and a tread sheet 11 of pile fabric permanently secured to the covering sheet with the pile 14 extending upwardly. In the present instance, the covering sheet 10 is formed of a vulcanizable material and is cured to the contour of the particular floor surface to be covered thereby. Although the tread sheet 11 is flexible, nevertheless, it is also subjected to the curing operation and in this manner is likewise preformed to the surface contour of the flooring and this is accomplished without injuring or matting the pile.

In the illustrated embodiment of the invention, the tread sheet of pile fabric 11 is in the form of an insert and is positioned in a recess 12 formed in the covering sheet 10 during the curing process. It will, of course, be understood that the sheet of pile fabric is located in the recess 12 with the undersurface of the base 13 engaging the bottom surface 15 of the recess and a bead 16 is formed on the covering material in a manner to surround the tread sheet of pile fabric. As will be presently set forth, the portion of the covering sheet 10 extending over the base 13 of the tread sheet of pile fabric is vulcanized to the base 13 during the time the covering sheet is cured to the contour of the floor surface. If desired, however, the undersurface of the nap of the tread sheet may be coated with a curing cement or with an adhesive material which will become

tacky under the temperatures employed during the vulcanizing operation.

Referring again to Figure 2, it will be observed that the portions of the covering material 10 are properly supported from the flooring 17 of the body by means of a backing material 17'. The backing material 17' is preferably formed of asbestos, flock or jute and surrounds the recessed portion 12 of the mat, although, if desired, the backing may also be extended beneath the bottom surface of the recessed portion 12.

Having briefly described the mat, reference will now be made to the apparatus employed for making the mat. This apparatus not only renders it possible to cheaply form the mat to the contour of the surface of the flooring to be covered by the mat but also permits permanently securing the tread sheet of pile fabric to the covering sheet during the curing operation without matting or otherwise injuring the pile on the tread sheet. The apparatus is shown more particularly in Figures 3 to 6, inclusive, and comprises a form 18 prefashioned to correspond in contour to the floor surface to be covered by the mat. Upon reference to Figure 4, it will be noted that the form has a base plate 19 covered by a sheet of hard rubber material 20 which, in turn, is suitably secured to the top surface of the plate. The marginal portions of the plate 19 extend laterally beyond the marginal edges of the covering material 20 and are return bent to form a chamber 21 around the border of the covering material 20. The top wall 22 of the chamber 21 overlaps the top surface of the hard rubber covering sheet 20 and, in turn, is adapted to be overlapped by the marginal edge portions of the sheet 10 of the mat when the latter is positioned on the contoured surface of the form. It may further be pointed out at this time that a clearance 22' exists between the flange 22 and the top surface of the form 20. The purpose of this construction will be made more apparent as this description proceeds.

It will also be noted from Figure 4 that the portion of the top surface of the form 18 corresponding to the area of the mat occupied by the tread sheet of pile fabric 11 is covered by a sheet metal plate 23 having an upwardly extending marginal flange 24 forming a pocket 25. The pocket 25 has a depth approximating the thickness of the pile fabric sheet 11 and is adapted to receive the pile 14 on the tread sheet when the latter is supported in the inverted position shown in Figure 4. It may be pointed out at this time that in the present embodiment of the invention, a recess 26 is formed in the top surface of the rubber covering sheet 20 and extends continuously around the marginal flange 24 of the pocket. As will be more fully hereinafter set forth, the recess 26 receives the adjacent portions of the covering sheet and forms the bead 16 around the tread sheet of pile fabric.

The above construction is such as to permit the tread sheet of pile fabric to be positioned in the pocket 25 with the pile extending downwardly and with the bottom surface of the base 13 lying substantially flush with the top edges or side walls 24 of the pocket. After the tread sheet of pile fabric is properly positioned in the pocket 25, a sheet of uncured rubber stock or similar vulcanizable material is placed over the form 18 with the marginal edges thereof overlapping the flanges 22 and with the central portion extending over the pocket 25 in contact with the undersurface of the base 13 on the tread sheet 11.

The air is then exhausted from the chamber 21 through the medium of a suitable vacuum pump (not shown) communicating with the interior of the chamber 21 by means of a conduit 28. As a result, any air trapped between the sheet of uncured stock and the adjacent surface of the form is exhausted through the clearance 22' and a vacuum seal is effected around the marginal edges of the stock. In other words, the stock is drawn tightly against the adjacent surface of the form and this is desirable in that it insures curing the covering sheet 10 to the exact surface contour of the form.

The contoured form is then placed into a pressure chamber, designated generally in Figure 4 by the reference character 30, and fluid pressure is admitted to the chamber through the medium of a supply conduit 31. The fluid under pressure acts upon the exposed surface of the covering sheet 10 in the manner indicated by the arrows in Figure 4 and is preheated to the temperature required to cure the stock to the contour of the form.

It has previously been pointed out that the tread sheet of pile fabric is permanently secured to the covering sheet 10 during the interval the latter sheet is cured to the contour of the form. This may be accomplished in several different ways. One method which has been found satisfactory is to apply a rubber or curing cement to the undersurface of the base 13 on the pile fabric sheet so that during the curing operation, the pile fabric sheet is vulcanized to the covering sheet. Another method of accomplishing this result is to coat the undersurface of the base 13 on the fabric tread sheet with an adhesive or a bituminous binder which will become tacky during the curing operation and cause the base on the pile fabric to adhere to the covering sheet 10.

In order to prevent the force of the pressure acting upon the portion of the stock extending over the pocket 25 from matting or otherwise injuring the pile 14 on the fabric tread sheet 11, provision is made herein for introducing a positive counteracting pressure in the pocket 25. The pressure built up in the pocket 25 is accurately controlled and is preferably slightly less than the curing medium pressure applied to the exposed surface of the covering sheet 10 so that both sheets may follow the contour of the surface of the form. However, the pressure built up in the pocket 25 is sufficient to prevent collapsing of the portion of the mat extending over the pocket and thereby also prevents matting of the pile against the adjacent surface of the form. In other words, the positive differential pressure is such that the pile is retained in its natural state throughout the curing operation and a mat is attained which not only neatly conforms to the irregularities in the surface of the flooring but which also possesses a very neat, pleasing appearance.

The fluid under pressure is admitted to the pocket 25 practically at the same time that the pressure of the curing medium is applied to the stock and is accurately controlled by a valve assembly 32. Upon reference to Figure 6, it will be noted that the valve assembly 32 comprises a valve casing 33 divided into two chambers 34 and 35 by means of a diaphragm 36. The upper chamber 34 communicates with the interior of the pressure chamber 30 through the medium

of a conduit 37 so that the pressure in the chamber 34 is the same as the pressure acting upon the rubber stock during the vulcanizing process. The lower chamber 35 communicates with the interior of the pocket 25 through the medium of a conduit 38 and also communicates with a fluid pressure supply conduit 39 through the medium of a valve 40.

Referring again to Figure 6, it will be noted that the supply line 39 communicates with a chamber 41 and the distributing line 38 communicates with a second chamber 42 separated from the chamber 41 by means of a web 43 having an opening 44 therethrough establishing communication between the two chambers. The opening 44 is controlled by the valve 40 having a valve stem 45 extending through the opening 44 and having an enlarged portion 46 on the stem normally urged into seating engagement with the opening 44 by means of a spring 47. The lower portion of the stem is axially bored to provide a passage 48 terminating at a point below the enlargement 46 and communicating with the interior of the chamber 42 by means of a transverse passage 49. The lower end of the passage 48 communicates with still another chamber 50 separated from the chamber 42 by means of a web 51 having a central opening therethrough forming a guide for the valve stem 45. The chamber 50 communicates with the atmosphere through the medium of an exhaust conduit 52 and communication between the chamber 42 and the chamber 50 is controlled by means of a valve 53. The valve 53 is supported for sliding movement in the direction of the valve stem 45 and the upper end thereof is adapted to control the lower end of the passage 48 through the valve stem 45.

The valve 53 is operated by the diaphragm 36 through the medium of an actuating arm 54 having one end pivotally connected to the central portion of the diaphragm, as at 55, and having the opposite end pivotally connected to the slide valve 53, as at 56. The arm 54 is fulcrumed intermediate the ends by a flexible diaphragm 57 having the marginal portions fixedly secured and forming a seal for the chamber 35. The central portion of the diaphragm 36 is normally urged in an upward direction against the stops 58 to a position wherein the exhaust valve 53 is open by means of a spring 59 having the lower end connected to the central portion of the diaphragm and having the upper end secured to a nut 60 which, in turn, is threaded on an adjusting screw 61.

Operation of the differential pressure controlled valve

The differential pressure controlled valve 32 is shown in Figure 6 in its inoperative position wherein the valve 40 is closed to prevent the supply of fluid pressure to the pocket 25 and wherein the exhaust valve 53 is open to provide for exhausting the pocket 25 through the passage 48 in the valve stem 45. However, as soon as the curing medium pressure is admitted into the pressure chamber 30 through the medium of the supply pipe 31, this fluid medium flows through the conduit 37 into the upper chamber 34 of the valve and acts upon the diaphragm 36 tending to move the latter downwardly against the action of the spring 59 to close the exhaust valve 53. In other words, as the central portion of the diaphragm 36 is moved downwardly by the pressure of the curing medium, the valve 53 is moved upwardly by the arm 54 to close the lower end of the passage 48 in the valve stem 45. As a result, communication between the supply line 39 and exhaust conduit 52 is closed. Upon continued downward movement of the central portion of the diaphragm 36, the valve 53 lifts the valve 40 against the action of the spring 47 and opens communication between the supply line 39 and the delivery conduit 38. Accordingly, fluid under pressure from the source of supply flows through the delivery conduit 38 into the pocket 25 and into the chamber 35 below the diaphragm 36. The fluid pressure admitted to the chamber 35 counteracts the pressure of the curing medium in the chamber 34 and tends to move the central portion of the diaphragm in an upward direction to again open the exhaust valve 53. This force of the fluid pressure in the chamber 35 is assisted by the spring 59, with the result that the pressure in the chamber 35 and in the pocket 25 is maintained below the pressure in the chambers 30 and 34. It follows, therefore, that the pressure in the vulcanizing chamber 30 is at all times balanced against the sum of the spring tension and the differential pressure in the pocket 25. In other words, the difference between the pressure of the curing medium in the vulcanizing chamber 30 and the pressure in the pocket 25 is a constant equal to the tension of the spring 59 which is adjustable to provide for varying the pressure differential.

When the curing operation is completed and the pressure supply line 31 is closed by a suitable valve (not shown), the pressure in the chamber 35 will, of course, predominate. As a result, the central portion of the diaphragm 36 is moved upwardly and the valve 53 is moved downwardly by the arm 54 to not only open the exhaust passage 48, but to also permit the spring 47 to close the differential pressure supply line 39.

Thus from the foregoing, it will be observed that I have provided a relatively simple apparatus for manufacturing composite mats of the type illustrated herein at a nominal cost and at a rate suitable for high production methods. It will also be observed that the apparatus previously described renders it possible to preform the mats so that the latter will accurately conform to contoured floor surfaces and impart a pleasing appearance to the latter.

What I claim as my invention is:

1. In apparatus for making floor coverings, a form adapted to support a covering sheet of vulcanizable stock and a sheet of pile fabric with the undersurface of the base portion of the fabric contacting the adjacent surface of the stock and with the pile extending toward the form, means for applying a fluid under pressure on the exposed face of the stock to urge both the latter and pile fabric toward the form, and means for applying an opposing fluid under pressure on the pile side of the fabric sheet to prevent matting of the pile against the form under the pressure of said first mentioned means.

2. In apparatus for making floor coverings, a form adapted to support a covering sheet of vulcanizable stock and a sheet of pile fabric with the undersurface of the base portion of the fabric contacting the adjacent surface of the stock and with the pile extending toward the form, means for applying a fluid under pressure on the exposed face of the stock to urge both the latter and pile fabric toward the form, means for applying an opposing fluid under pressure on the pile side of the fabric sheet to prevent matting of the pile against the form under the pressure

of said first mentioned means, and means controlling the fluid under pressure exerted on the pile side of the fabric sheet and effective to maintain a predetermined differential between said pressures with a preponderance of pressure acting on the exposed face of the stock.

3. In apparatus for making contoured floor coverings, a form having a contoured surface adapted to support a covering sheet of vulcanizable stock and a sheet of pile fabric with the base of the latter contacting the stock and with the pile extending toward the contoured surface of the form, means for applying a preheated fluid medium under pressure to the exposed face of the stock to urge the latter toward the contoured surface of the form and to cure the stock to the contour of the form, means applying an opposing fluid under pressure against the pile side of the fabric sheet, and control means for the opposing fluid under pressure operable to maintain this pressure at a value predetermined to prevent matting of the pile against the form and at the same time to permit the sheets to follow the contour of the form under the influence of the fluid under pressure exerted by the preheated fluid medium.

4. In apparatus for making floor coverings, a form adapted to support a covering sheet of vulcanizable material and a sheet of pile fabric with the base portion of the pile fabric contacting the covering sheet and with the pile extending toward the form, said form having a chamber into which the pile extends, means for applying fluid under pressure on the exposed face of the covering sheet to urge the latter and pile fabric sheet in a direction toward the form, and means for introducing an opposing fluid under pressure in said chamber to prevent the pile on the fabric sheet from matting against the adjacent surface of the form.

5. In apparatus for making floor coverings for floor surfaces having a hump therein, a form having a surface provided with a recess corresponding in dimension and shape to the hump, said form adapted to support a sheet of vulcanizable stock and a sheet of pile fabric with the base portion of the pile fabric contacting the stock and with the pile extending toward the form, both sheets extending over the recess in the surface aforesaid of the form, means for applying fluid under pressure to the exposed face of the stock to urge the latter and sheet of pile fabric toward the form, means for introducing an opposing fluid under pressure against the pile side of the fabric sheet, control means for the opposing fluid under pressure operable to maintain this pressure at a value predetermined to prevent matting of the pile against the form and at the same time to permit the sheets to conform to the contour of said surface of the form, and means for curing the stock to the contour of the form.

6. In apparatus for making contoured floor coverings, a form having a contoured surface adapted to support a covering sheet of vulcanizable stock and a sheet of pile fabric with the base portion of the latter contacting the stock and with the pile extending toward the contoured surface of the form, means for applying a preheated fluid medium under pressure to the exposed face of the stock to urge the latter toward the contoured surface of the form into intimate contacting relation with the base portion of the pile fabric sheet and to conform both sheets to the contour of the form, the heat of the fluid being sufficient to cure the stock to the contour of the form and to secure the stock to the sheet of pile fabric, means applying an opposing fluid under pressure against the pile side of the fabric sheet, and control means for the opposing fluid under pressure operable to maintain this pressure at a value predetermined to prevent matting of the pile against the form and at the same time to permit the sheets to follow the contour of the form.

7. In apparatus for making contoured floor coverings, a form having a contoured surface adapted to support a covering sheet of vulcanizable stock and a sheet of pile fabric with the base portion of the latter contacting the stock and with the pile extending toward the contoured surface of the form, means for applying a fluid under pressure against the exposed face of the stock to urge the latter into intimate contact with the base portion of the pile fabric and to conform both sheets to the contoured surface of the form, means applying an opposing fluid under pressure against the pile side of the fabric sheet to prevent matting of the pile against the adjacent surface of the form, and means for curing the stock to the contour of the form and for securing the stock to the base of the pile fabric sheet.

8. In apparatus for making composite mats, a form having a surface adapted to support a sheet of stock and having a pocket interrupting said surface, said pocket adapted to be covered by the sheet of stock and being of sufficient size to receive a sheet of material to be secured to said stock, means for applying a fluid under pressure on the exposed surface of the stock to urge the latter toward the surface aforesaid of the form, and means for introducing fluid under pressure into said pocket to oppose the pressure applied by the first named means against the portion of the stock extending over the pocket.

9. In apparatus for making composite mats, a form having a surface adapted to support a sheet of stock and having means extending above the surface forming a pocket of predetermined area, said pocket adapted to be covered by the sheet of stock and being of sufficient size to receive a pile fabric with the base of the fabric facing the surface of the stock extending over the pocket, means for applying fluid under pressure to the exposed surface of the stock to urge the latter toward the surface aforesaid of the form, means for introducing fluid under pressure into said pocket to oppose the pressure applied by the first named means against the portion of the stock extending over the pocket, and means for controlling the counteracting pressures and effective to maintain the pressure in the pocket sufficiently high to prevent matting of the pile against the adjacent surface of the form by the opposing pressure.

10. In apparatus for making composite mats, a form having a contoured surface adapted to support a sheet of vulcanizable stock and having a pocket in said surface, said pocket adapted to be covered by the sheet of stock and also adapted to receive a sheet of pile fabric with the base of the fabric facing the surface of the stock extending over the pocket, means for exhausting air from the joint between the adjacent surfaces of the form and stock, means for applying a preheated fluid under pressure on the exposed surface of the stock to vulcanize the latter to the contour of the form, and means for introducing fluid under pressure into the pocket to oppose the pressure applied on the exposed surface of

the stock extending over the pocket and thereby resist matting of the pile by the latter pressure.

11. In apparatus for making composite mats, a form having a surface adapted to support a sheet of stock and having a pocket in said surface, said pocket adapted to be covered by the sheet of stock and adapted to receive a sheet of material to be secured to the stock with one face of the material in contact with the surface of the stock extending over the pocket, means for subjecting the exposed surface of the sheet of stock to the action of fluid under pressure to urge the stock in a direction toward the form, means for introducing a counteracting fluid pressure in the pocket, and a valve controlling the flow of fluid under pressure to the pocket and effective to maintain a predetermined differential between the counteracting pressures with a preponderance of pressure acting upon the exposed surface of the stock.

12. In apparatus for making composite mats, a pressure chamber, a form supported in the pressure chamber and having a surface adapted to support a sheet of stock, a pocket interrupting the surface of the form and adapted to receive a sheet of material with one surface of the material contacting the surface of the stock extending over the pocket, means for introducing fluid under pressure into the pressure chamber to urge the stock against the contoured surface of the form, means for introducing fluid under pressure into the pocket at the side of the sheet of material opposite the side engaged with the stock, a differential pressure controlled valve having a casing divided into two chambers by a diaphragm and having one chamber communicating with the pressure chamber aforesaid, means establishing communication between the other valve and the pocket, and means responsive to the action of the diaphragm under the influence of the differential pressures on opposite sides of the diaphragm to control the pressure of the fluid in said pocket.

DON FREMONT COLLINS.