Dec. 30, 1941. L. J. COSTA 2,267,817

PIPE FITTING OF FELTED ASBESTOS AND CEMENT

Filed Aug. 30, 1937 3 Sheets-Sheet 1

Fig. 1.

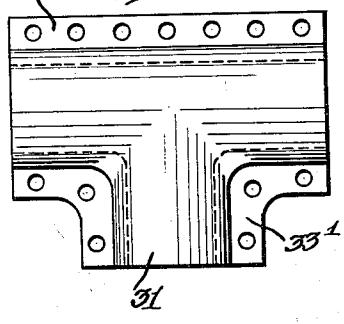


Fig. 2.

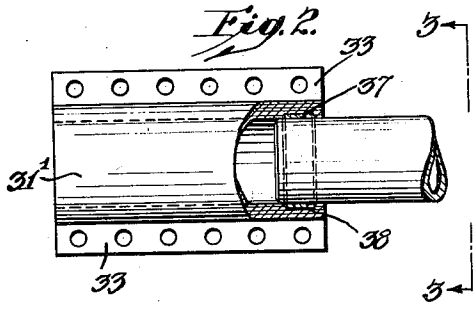


Fig. 3.

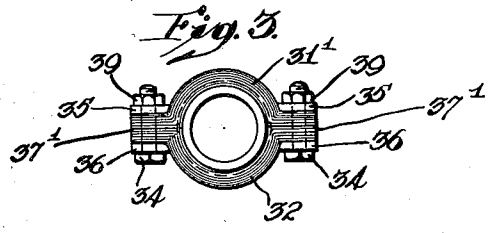


Fig. 4.

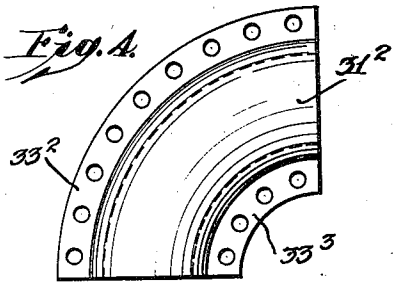


Fig. 6.

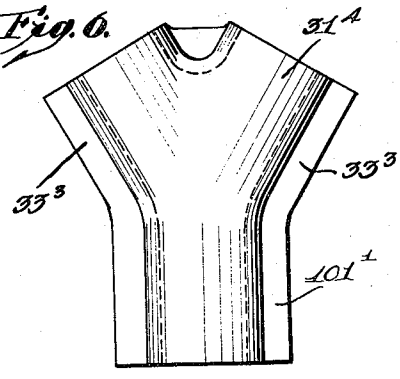


Fig. 5.

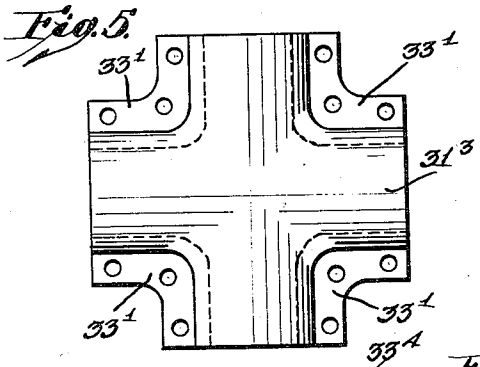


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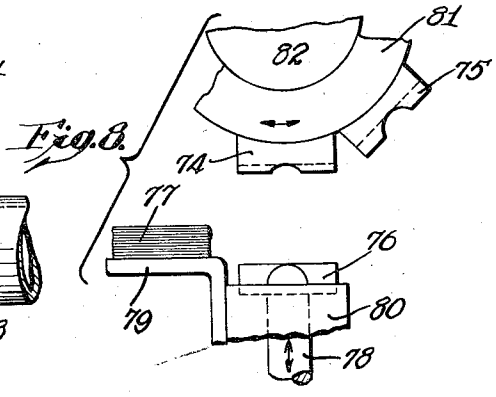
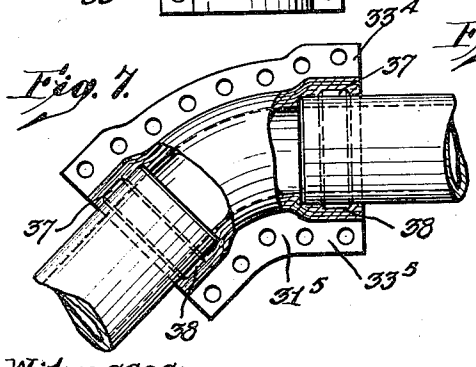


Fig. 7.



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Dec. 30, 1941. L. J. COSTA 2,267,817

PIPE FITTING OF FELTED ASBESTOS AND CEMENT

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Fig. 9.

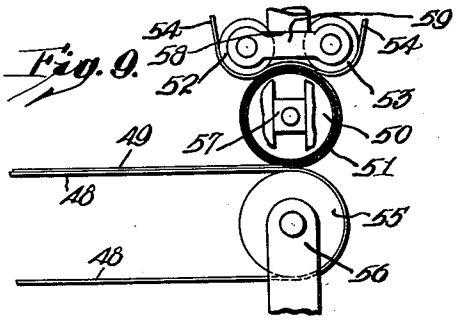


Fig. 11.

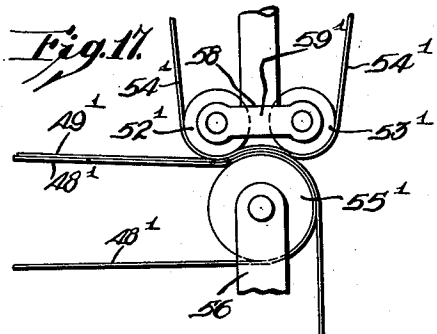


Fig. 10.

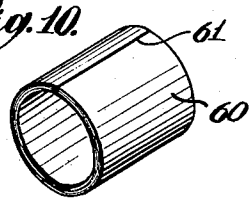


Fig. 13.



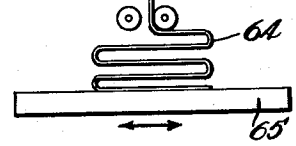


Fig. 14.

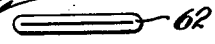


Fig. 18.

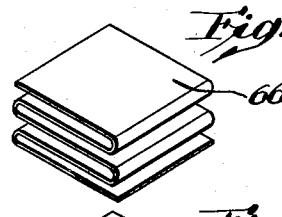


Fig. 11.

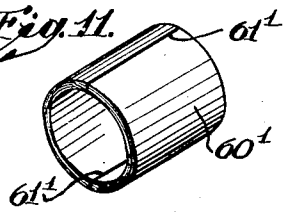


Fig. 15.



Fig. 16.

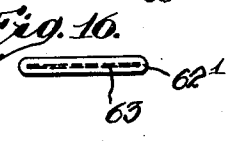


Fig. 19.

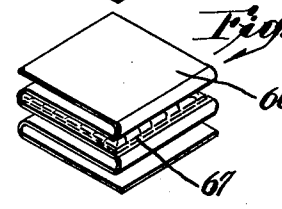


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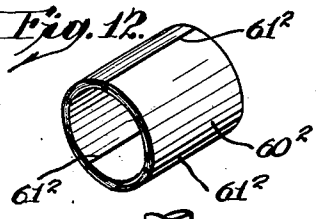


Fig. 20.

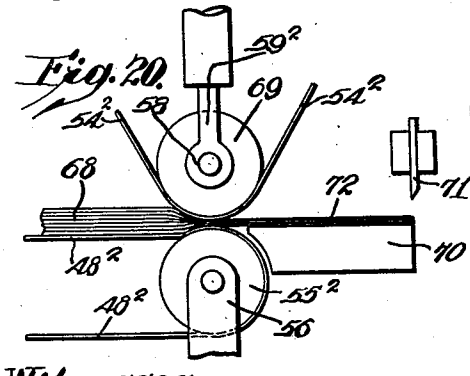


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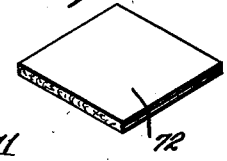
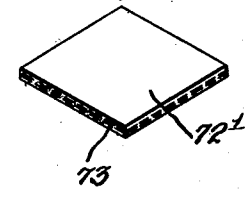


Fig. 22.



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Dec. 30, 1941. L. J. COSTA 2,267,817

PIPE FITTING OF FELTED ASBESTOS AND CEMENT

Filed Aug. 30, 1937 3 Sheets-Sheet 3

Fig. 23.

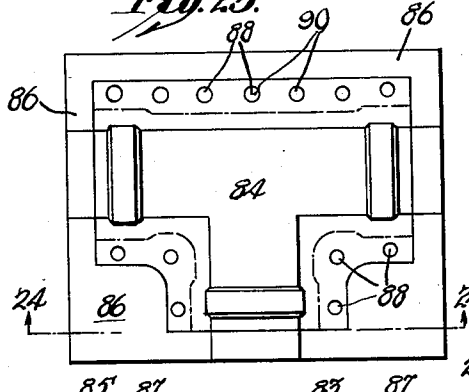
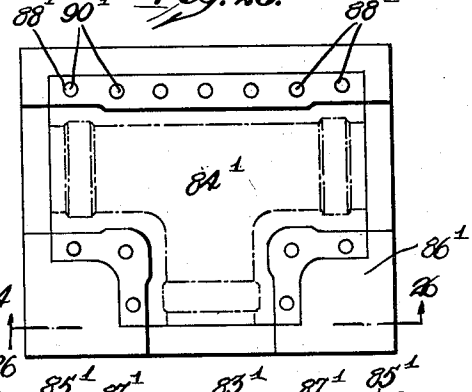
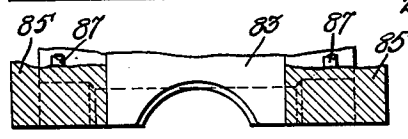


Fig. 25.





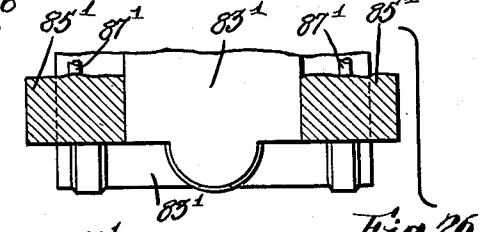


Fig. 24.

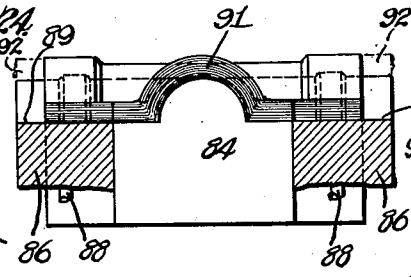


Fig. 26.

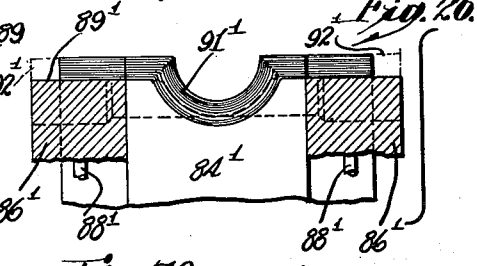


Fig. 27.

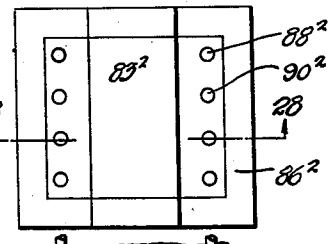


Fig. 30.

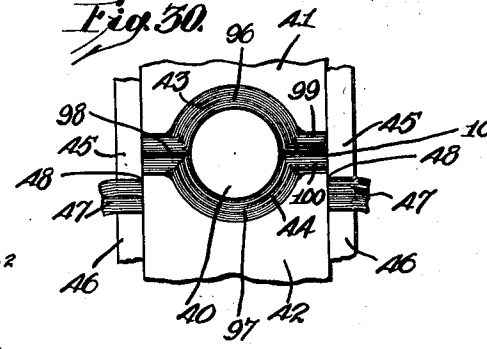


Fig. 28.

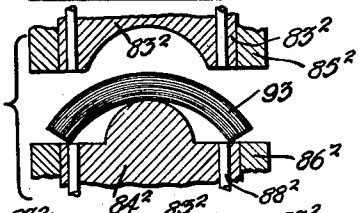
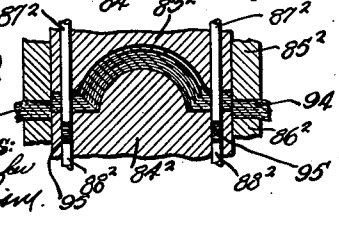


Fig. 29.



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Patented Dec. 30, 1941 2,267,817

UNITED STATES PATENT OFFICE

2,267,817

PIPE FITTING OF FELTED ASBESTOS AND CEMENT

Louis J. Costa, Philadelphia, Pa.

Application August 30, 1937, Serial No. 161,595

16 Claims. (Cl. 154—2)

The invention relates to pipe fittings of different kinds such as Y's, crosses, bends, etc., for uniting sections of pipe made from asbestos fiber and cement or other like pipe or for making connections by which the low of fluids in such piping is divided or its direction rather abruptly changed.

A main purpose of my invention is to provide fittings of asbestos fiber and cement material which have maximum strength because of the most advantageous direction of the fibers involved.

A further purpose is to provide a plurality of longitudinal sections built up of wet sheets pressed to lie parallel to the adjacent internal surfaces of the pipe section respectively intermediate adjacent adjoining sections.

A further purpose is to provide pipe fittings to be inserted between sections of so-called "transite" pipe formed of asbestos and cement whereby the fitting is composed of the same material and made in similar manner as that of the pipe.

A further purpose is to provide fittings for combined asbestos and cement piping which comprise a like material formed of successive layers of sheets from a Fourdrinier or other type of paper making or felting machine for felting fibers by which successive parts of the thickness of the section of the fittings are made from successive sheets from the Fourdrinier machine and for this reason the fibers have the same sheet direction and interfit to the best advantage.

A further purpose is to use a plurality of initially distinct sheets of asbestos and cement in moist felted condition for a blank to be pressed into contact with a form corresponding with half or other portion of a fitting to be manufactured, the felted sheets preferably being united progressively and part of their water being removed by compression prior to application of the blank to the form.

A further purpose is to take successive sheets from a Fourdrinier or other paper making machine, and comprising mixed asbestos and cement and place them over a form outlining a pipe fitting upon which form they are to be united by pressure, which at the same time is intended to remove any remaining excess moisture, each sheet in turn covering substantially the entire area of the form so that all the parts about the form are fastened together by the sheets.

A further purpose is to unite in a pipe fitting divergent parts of half pipe sections using sheet material for the covering and forming all at one operation whereby the individual sheets connect at the joints and form a union at the joints of the same character as that which is formed progressively to produce the length of any pipe part of the fitting.

A further purpose is to wind upon a mandrel a felted sheet of asbestos and cement in plastic form, such as is produced upon a Fourdrinier felt, until a desired thickness has been attained for compression upon a form, to compress the felted sheet, as it is wound, to withdraw the compressed fitted stock from the mandrel while still plastic, to place it as a blank upon the form and to compress it upon the form while still plastic, subsequently curing the product optionally as in the prior art and preferably on the form.

A further purpose is to withdraw compressed and still plastic felted material from a cylindrical mandrel of circumference such that when collapsed the withdrawn stock will be of suitable size for pressing upon the form, to transfer it to the form and to press it upon the form to complete the ultimate product, withdrawing moisture by pressure as far as permissible while the felted material is being placed upon the mandrel but not too much for the material not to be plastic at the time it is collapsed and pressed.

A further purpose is to form felted material by layers wound progressively upon a preferably cylindrical mandrel, and to cut the material wound from the mandrel, transferring the still wet cut sections to a form and pressing them upon the form, whereby the plastic on the form maintains substantially the same direction of fiber in sheet layers generally parallel to the surface of the form and which sheet layers correspond to the original sheets wound and pressed.

A further purpose is to provide a part of a special fitting of asbestos and cement in which portions at substantially the same distance from the inside of the fitting have come from the same sheets of Fourdrinier matted material, and in which the entire section is formed at one operation.

A further purpose of the present invention is to apply sheets or successions of sheets over a form representing a laterally flanged part of a fitting, to correspond to an interior portion between longitudinal flanges, and to press the sheets or layers of sheets into conformity with the form. The still somewhat wet sheets are thus pressed into the form so that the walls of the ultimate fitting may comprise layers of sheets

Pipe Fitting of Felted Asbestos and Cement (US Patent 2,267,817, 1941)
ACL Doc 23332 · Page 4 of 11
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everywhere transverse to the wall thickness, whereby the fibers of the "transite" material at any point of the fitting wall extend in all directions transverse to the fitting thickness. It will be seen that the same sheet layers unite different branch portions of the fitting by one common sheet bond, avoiding the need for splicing the branch portions.

A further purpose is to secure the benefit of two pressing operations upon felted material received from a Fourdrinier machine, pressing successive layers of the felted sheet material into contact to form a blank or work piece and then pressing this blank or work piece against the form to outline the final pressed product or to form one of several layers of a final pressed product, providing for a second pressing operation, using either or preferably both pressing operations to unite and compress the stock and to remove a portion of the moisture from the stock, leaving some moisture in the stock for setting and curing functions.

A further purpose is to die-stamp split fittings of uncured asbestos fiber and cement from blanks and to have the blanks for the die-stamping laminated, in order to secure a fiber direction substantially everywhere in the directions of wall extension as distinguished from directions transverse to the wall.

A further purpose is to use laminated sheets of uncured asbestos fiber and cement as a blank for die-pressing a split fitting of such material.

A further purpose is to optionally intersperse reinforcement material, such as expanded metal, metal screen, or the like between laminations of uncured asbestos fiber and cement and to use the composite sheet of reinforcement and of uncured sheets of asbestos fiber and cement as a blank for die-pressing a split fitting.

Further purposes will appear in the specification and in the claims.

My invention relates both to the methods involved and to mechanism by which the methods can be carried out.

Throughout the specification and claims "transite" is intended to mean broadly any composition of asbestos fiber and cement adapted to use in the manufacture of pipe, herein called "transite" pipe, but which in practice may vary with respect to the character of the asbestos fibers, of the cement and also with respect to the relative proportions of fiber and cement.

I have preferred to illustrate my invention by several different forms, selecting forms particularly because of their advantage in illustrating the invention.

Figure 1 is a top plan view of the upper half of a split T fitting intended to represent broadly any fitting of the character indicated and suitable to manufacture by die-pressing laminated sheets of uncured asbestos fiber and cement.

Figure 2 is a top plan view showing a split coupling with holding bolts removed, the fitting being intended to be of "transite" and a fragment of pipe connecting to the coupling being shown, and the coupling partly sectioned to show one of many different forms of gasket connection between the coupling and the pipe.

Figure 3 is an end elevation of Figure 2 taken upon line 3—3 thereof, and showing some fastening parts omitted in Figure 2.

Figures 4, 5 and 6 are top plan views of an elbow, T and Y fittings, respectively intended to be typical illustrations merely of a few of the fittings that may be made to embody the present invention.

Figure 7 is a top plan showing a 45 degree bend split fitting, the upper half partially sectioned showing fragments of "transite" pipe connected to the outlet ends of the bend.

Figure 8 is an elevation intended to be largely diagrammatic and to indicate different methods of building the blank prior to die-pressing, the views showing relatively movable upper and lower dies spaced apart and ready to receive one or more sheets of uncured "transite" stock preparatory to die-pressing.

Figure 9 is intended to be a conventional fragmentary illustration, in elevation of suitable mechanism for manufacturing short lengths of laminated asbestos fiber and cement pipe and for the manufacture of blanks for die-pressing into laminated fittings in accord with the present invention.

Figures 10 to 12 are perspective views showing different blanks from the mechanism of Figure 9.

Figures 13 and 14 are end views illustrating a somewhat different blank for use in die-pressing fittings in accord with the present invention.

Figures 15 and 16 are views corresponding generally to Figures 13 and 14 and illustrating the use of reinforcement material with the laminated blank of Figures 13 and 14.

Figure 17 is a view generally similar to Figure 9, but illustrating the mechanism for formation of uncured sheets delivered, to a shuttle structure for piling the successive folds of the sheet to form a blank for die-pressing into a laminated split fitting.

Figures 18 and 19 are perspective views illustrating blanks made from the sheet material delivered by the mechanism of Figure 17, Figure 18 showing the "transite" in a pile of back and forth folds, and Figure 19 showing a similar blank provided with a reinforcement insert.

Figure 20 is a diagrammatic elevation generally similar to Figures 9 and 17 showing a pile of asbestos fiber and cement sheets rolled into a single or dense laminated sheet and cut to lengths to form blanks for die-pressing into split fittings.

Figures 21 and 22 are blanks made from the laminated sheet material delivered from the structure of Figure 20, Figure 22 having a reinforcing insert placed therein.

Figure 23 is a top plan of a lower and male die for use cooperatively with an upper and female die in die-pressing a split fitting of laminated uncured asbestos fiber and cement material, the view being intended to represent any suitable die mechanism adapted to accomplish the intended die-pressing operation. The ultimate thickness of the die-pressed fitting is indicated in dot-and-dash lines.

Figure 24 is a fragmentary elevation intended to be diagrammatic, corresponding generally to vertical section on the line 24—24 of Figure 23, but showing the lower and inside or female die after the die-pressing operation the upper and outside or male die being shown raised and the pressed fitting being seen in section above the lower die.

Figures 25 and 26 are views corresponding generally to Figures 23 and 24 but with the dies relatively reversed in that in Figures 23 and 24 the inside or male die is stationary while in Figures 25 and 26 it is the outside or female die that is stationary, the terms "inside" and "outside" relating to the pipe surface.

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Figure 27 is a top plan view of an inner die for die-pressing a split coupling of laminated asbestos fiber and cement and is intended to show conventionally any suitable die adapted to perform the intended service.

Figures 28 and 29 are elevations of the mechanism of Figure 27 at different positions. They correspond to a section upon the line 28—28 of Figure 27 and show the movable die structure as well as the lower die. In Figure 28 the dies are separated and a blank has been inserted between them and the die movement is about to begin for pressing the fitting. In Figure 29 the pressing stroke has been completed and the fitting, here a coupling, is shown between the dies with the dies ready to separate to release the fitting.

Figure 30 is a diagrammatic elevation showing opposing female dies cooperatively pressing two laminated blanks upon a core and to provide a complete laminated asbestos fiber and cement fitting for two blanks.

Like numerals refer to like parts in all figures.

Describing in illustration and not in limitation and referring to the drawings.

During recent years there has come upon the market a pipe used for controlling the flow of fluids under pressure which pipe is much lighter than cast iron, and less expensive and has many advantages over cast iron in ease of laying, etc. It is composed of a fiber such as asbestos and a good quality of cement, which fiber and cement material (herein usually referred to as "transite") is laid wet in felted form like paper pulp in progressively forming sheets upon a travelling screen, felt or belt. The screen or felt withdraws the felted material from a pool or reservoir, supporting it for a short or long distance according to the operations to be performed upon it or to the length of time needed for these operations. To partially eliminate the water it is usually subjected to suction from so-called suction boxes beneath the felt or screen and ultimately may be handled in various different ways. In one method of manufacturing this somewhat wet sheet of asbestos and cement (uncured "transite"), as deposited upon the felt and subsequently freed by suction from some of its water is transferred to the surface of a revolving mandrel of diameter substantially that of the pipe which is being constructed. In some forms the travelling sheet is as wide as the length of the pipe and is laid on straight, layer upon layer with each layer the full length of the pipe. In others, the sheet is narrower than the length of pipe and is so laid on spirally or otherwise that the mandrel is covered by successive windings until the desired thickness is reached.

While the felted asbestos and cement sheet is being wound upon the mandrel, it is concurrently compressed upon the mandrel by pressure rolls whereby the cement is more intimately bonded with the asbestos, and more of the surplus moisture is squeezed out and the density of structure is considerably increased.

It has been found desirable in this operation to use a very thin winding sheet of asbestos and cement, one manufacturer preferring a thickness of sheet such that when finally compressed on the mandrel it shall occupy but 0.005 of an inch radial depth in the cylinder which is being formed. The winding on the mandrel continues until the desired thickness is reached—such for example as a half inch for a four-inch water pipe that is to be subjected to 300 pounds working pressure. It is then usually taken from the mandrel and put upon a suitable form so that it may hold its shape during curing.

The Fourdrinier or paper machine is intended to be shown conventionally in cross section in Figure 9 with a diagrammatic showing of the winding and compressing mechanism just described.

Pipe of the character above indicated is on the market under several different trade names.

The manner of manufacture thus far described has been limited to substantially straight pipe sections and is not suited to the manufacture of non-straight sections, as to the manufacture of most commercial crosses, T's, Y's and elbows.

Such fittings of the types indicated have for this reason hitherto been of cast iron, steel and in some cases brass and these special fittings have not been available in asbestos fiber and cement.

Various efforts have been made to manufacture these fittings of "transite" but so far as I am aware, prior to the present invention, without success.

In molding sections of split fittings with a laminated blank of sheet asbestos fiber and cement by die-pressing the blank between suitable dies, there will always be distortions of the laminations and these distortions will be more in some fittings than in others and more at certain portions of a fitting than in other portions thereof. Nevertheless a fitting made by die-pressing a laminated blank of "transite" has in general everywhere a laminated wall structure, in that substantially everywhere the fitting wall is made up of sheet laminations with the sheet extensions generally parallel to the wall extension, that is everywhere transverse to the thickness dimension of the wall. As a result the fibers in each lamination, which initially have extended in all directions of the sheet extension, after die-pressing of the blank into a fitting, will in fact everywhere extend in all directions transverse to the thickness of the wall, with, however, such small extensions in directions parallel to the wall thickness that are advantageous rather than otherwise.

The result is a wall of great strength without undue wall thickness.

The fittings illustrated in Figures 1 to 7 are intended to be conventionally illustrations of any split fittings die-pressed of laminated asbestos fiber and cement.

More usually the terms split fitting have been used to indicate one section merely of the split fitting that in reality comprises two sections, optionally integrally united at the time of manufacture, each fitting comprising upper and lower sections 31—31⁵ and 32 united along mating flanges 33—33⁵ with or without the aid of flange bolts 34 and, where flange bolts are used, with or without strengthening fish plates 35 and 36 between the flanges and the heads and nuts of the bolts.

The assembly of the sections 31—31⁵ and their corresponding lower sections such as 32 more usually is done at the time of laying the piping with which the fittings are to be used. On Figure 3, for example, the lower section 32 having upwardly presented perforated side flanges 33, fish plate 35 and bolts 34 at each flange, receives at its outlets the pipe ends to which it is to be connected.

The upper section 31 is put in place over any suitable gasket 37 illustrated in Figure 2 as in a

formed inner groove 38 on the fitting and bolted down, using upper fish plates 35 and nuts 39.

At 37' is shown conventionally gasketing between the divided halves of the fitting. This has been illustrated in Figure 3 only, but of course such gasketing between the longitudinal flanges would be present also in all of the other figures unless the flanges were molded together so that the molding effected the sealing between the united flanges.

This form of connection overcomes certain disadvantages found to exist with connections of unsplit fittings and pipes. In some instances, however, as where it is desired to use the same type of connection between pipe and fitting as are now used with unsplit fittings the half sections of the split fitting may be united in manufacture with or (in Figures 6 and 30) without the use of bolts and fish plates and before curing the molded laminated asbestos fiber and cement sections.

Figure 6, showing a Y fitting as a conventional illustration of any fitting of the type indicated, has for this reason been shown with the flanges 33^3 of its upper and lower sections molded together and for this reason without perforations or fish plates for uniting the sections that together make up the complete fitting.

If the fitting half sections are molded simultaneously, sections may optionally be molded simultaneously upon opposite sides of a core 40 between upper and lower main dies 41 and 42, Figure 30.

In this Figure 30 the upper and lower dies 41 and 42 have just compressed laminated blanks 43 and 44 upon the core 40. The upper and lower deckle structures 45 and 46 have moved downwardly longitudinally of the dies prior to the complete closure of the main dies 41 and 42 to shear off waste material indicated at 47. The lower edge of each upper deckle 45 as at 48 comprises a shear to cut away the compressed waste material, preferably prior to the complete compression, in order to compress the laminated sheets all the way to their edges. The lower deckle 46, initially flush with the adjoining top surface of the lower main die 42, has been depressed during the edge trimming. When the dies separate, the fitting united about its core 40 is preferably passed within a curing-mold for the period of curing.

It will be understood that the fitting normally does not attain proper strength, to protect it from greater or lesser change of form during curing, unless it is constrained to hold its shape within a suitable curing box. This box has not been shown.

The core in Figure 30 is intended to be of course removable after curing. It might be sand or any suitable structure adapted to hold its shape during molding and subsequent curing of the fitting and to easy removal after curing.

Figures 9, 17 and 20 are intended to indicate conventionally and in fragment the delivery portions of different suitable mechanisms for manufacturing somewhat different forms of uncured wet asbestos fiber and cement blanks, suitable to be used in die-pressing split fittings.

In Figure 9 the structure is intended to be generally similar to that used in the manufacture of asbestos fiber and cement pipe and the blanks are intended to be made of wet tubes of asbestos fiber and cement flattened or cut up after delivery from the mechanism of Figure 9 to provide blanks of the desired size.

In Figure 9 a travelling porous endless felt 48 carries a thin layer or sheet 49 of wet asbestos fiber and cement stock. The felt 48 has received this stock material 49 in any suitable or usual way, not shown, from a suitable dispersion of asbestos, fiber and cement.

The felt 48 delivers its layer or sheet 49 to wind upon a mandrel 50, layer upon layer, to any desired thickness and with continuous compression upon the mandrel and control of the final moisture left within the winding 51 by pressure rolls 52 and 53 and a second travelling porous felt 54 presented downwardly under heavy pressure against the mass 51 on the mandrel.

The second felt 54 together with the compression members 52 and 53 control both the degree of compression of the laminated windings and the degree of moisture left within the wound mass. Normally this amount of moisture remaining in the winding should be that for ultimate combination with the cement during the curing processes.

It will be understood that the degree of moisture desirable in the blank for die-pressing the blank to form a split fitting will be best determined by practice and somewhat different according to the degree of compression of the blanks during molding and different also according to the degree of distortion of the blank by the molding pressure.

The cylinder which is to be wound upon the mandrel and part of which is ultimately to form the blank should be removed from the mandrel before it has hardened sufficiently to prevent conformation with the mold or form upon which it is to be pressed. There are three factors to be varied in this, the time during which the earliest deposit upon the mandrel has opportunity to set, the thickness of the layer with its consequential effect upon the composite for conformation of the blank to the mold and the amount of moisture remaining, since part of the moisture can be removed during this operation and part of it during the ultimate pressure on the mold.

The pressure upon the sheet being wound should not be greater than enough so that with the time and thickness of winding the material upon the mandrel will still be plastic. If this means that not all of the moisture is taken out which should be removed then the surplus moisture should be removed during the present operation upon the forms.

Where the fitting is a straight coupling, for example, as indicated in Figures 2 and 3, a distortion of the blanks during molding is relatively small and the moisture content desirably should be that needing to be present in the ultimate cured asbestos fiber and cement. For this reason the blanks made with the sections of asbestos fiber and cement pipe tube as by the mechanism of Figure 9 is particularly suited to die-pressing couplings (Figures 2 and 3) and also to other fittings where the degree of moisture is to be unchanged in the molding process.

In Figure 9 the endless felt 48 travels continuously over the roll 55. The roll 55 is supported in suitable bearings 56. The mandrel 50 is shown supported in vertically movable bearings 57 and the pressure rolls 52 and 53 are intended to be hydraulically pressed down at 58 to press the porous felt 54 upon the winding 51 on the mandrel. Suitable supporting structure of the pressure rolls is intended to be indicated at 59 and the second porous endless felt 54 between the

pressure rolls 52 and 53 and the winding 51 at once keeps the pressure rolls from direct engagement with the winding and cooperates with the rolls in controlling the water left within the wound mass, the felt usually carrying away pressed out water but optionally adding water instead of carrying it away by being itself initially moist to any desired extent.

In Figures 10, 11 and 12 the tubular sections 60, 60' and 60² of uncured asbestos fiber and cement are intended to be used while still plastic and therefore within a time limit or a moisture content and thickness such that they shall be still plastic. These have been slit in one, two and three positions at 61, 61' and 61² respectively. This is intended to indicate that the diameter may be of any size and the cutting into any suitable number of sections so that initially we can wind as large a diameter as desired and can unfold the whole section as in the case of Figure 10 or can unfold partial sections or use partial sections in their curved form as desired. As will appear in Figures 27 and 28, when couplings are being made it is desirable to have as a blank a half section without illustrating its curvature except as it is pressed upon the form.

In Figures 13, 14, 15 and 16 the cylinder of wound plastic material such as that shown in Figure 10 is not cut but is removed from the mandrel and is collapsed. This is shown at 60³ in Figure 13 in partially collapsed form and at 62 in Figure 14 where it is in condition for use as a blank. Being in plastic condition the opposite folds at the center shown in a line in this figure will unite under the forming pressure.

In Figures 15 and 16 the blank 60⁴ is collapsed part way after which a reinforcing insert 63 is placed within the circumference. In Figure 16 a cylinder is collapsed fully about the insert.

The insert may be metallic such as expanded or otherwise reticulated metal through whose interstices the plastic asbestos fiber and cement will seal or bond under pressure or may be fabric of which burlap is one good illustration.

Obviously the intended use of the blanks will dictate whether the blanks be made of wound sheeting or of separate sheets. If of separate sheets they can be laid as thick felted sheets initially and used individually or they can be laid as sheets either thick or not so thick and piled individually as in Figure 8 or they can be piled in serpentine form as they come from the Fourdrinier or other paper laying machines.

In the mechanism of Figure 17 the ultimate product is a sheet of uncured asbestos fiber and cement paper conventionally indicated as having been folded back and forth at 64 upon a suitable reciprocating receiver plate 65.

The endless felt 48', roll 55', asbestos fiber and cement paper 49' carried upon the felt, second felt 54', pressure rolls 52' and 53' and hydraulic pressure mechanism 59' are intended to be optionally generally like the corresponding structure of Figure 9.

In Figure 17 the pressed paper 49' of controlled moisture content is received as a folding pile 64 upon the reciprocating plate 65. The ultimate blanks in the mechanism of Figure 17 may suitably comprise a succession of folds as indicated at 66 and 66' in Figures 18 and 19 with or without the insertion of one or more reinforcement members as indicated at 67 in Figure 19. The reinforcement member 67 may be of expanded metal, metal mesh, or fabric mesh or such other suitable materials as in the case of the insert of Figures 15 and 16.

The pile of sheets shown in Figures 17, 18 and 19 is shown widely separated in the individual sheets for clearance of illustration but in fact each upper sheet will rest upon the sheet below. It is desirable to compact such a pile of sheets into a blank or into a length long enough to be cut into several blanks before use, the individual blank or individual blanks being then rested upon the top of the form for plunger pressing. During the consolidation of the sheets they may be further compressed if desired than is the compression in Figure 17; and this may be for the purpose largely of uniting them layer to layer or of withdrawing further moisture, if it has not seemed desirable to withdraw all in the Figure 17 operation before plunger pressing or for both purposes.

Where a pile of sheets is desirably used as a blank—as distinguished from piling the sheets separately for use in plunger pressing as hereinafter described in connection with Figure 8—it is desirable to compress the sheets between the pile into a compact blank form. Mechanism and a method of accomplishing this is shown conventionally in Figure 20 that either piled individual flat sheets of uncured asbestos fiber and cement or reversely folded sheets such as shown in Figures 18 and 19 are to be used for the blank, they may be compacted and consolidated with or without substantially further elimination of moisture by passing them between pressure rolls with or without the use of felting or other such material to assist in withdrawal of moisture. The mechanism of Figure 20 includes felted or other absorbent belting for the purpose of reducing the moisture content or merely avoiding pre-moisture at the surfaces.

As shown the sheets 68 (or folds 66) are passed between pressure rolls 55² and 69 where they are compressed to any desired extent. The pile is carried to the pressure rolls upon an endless felt 48². The lower pressure roll is optionally similar to the rolls 55 and 55' of Figures 9 and 17 respectively. The upper pressure may, as is true also in Figures 9 and 17, be effected by a single roll, if desired, instead of the two rolls and felt used in those figures. The roll shown is illustrated as separated from direct engagement with the sheets 68 by a porous felt 54² as indicated in the mechanism of Figures 9 and 17. The compressed sheets deliver on to a suitable table 70 to be cut into sections of desired dimensions by any suitable knife mechanism 71. These sections may be of size and thickness to each comprise a complete blank or each comprise a portion only of the blank thickness.

In Figure 21 the blank 72 comprises one or more of these laminated sections of piled sheets of uncured asbestos fiber and cement pressed together and cut to the required size by the knife mechanism 71 of Figure 20. In Figure 22 a blank 72' is shown in which a reinforcing sheet 73 has been inserted between upper and lower thicknesses of uncured asbestos fiber and cement as cut from the stock being delivered from the rolls of Figure 20.

Figure 8 is intended to illustrate a conventional die-pressing mechanism in which a plurality of upper dies 74 and 75 are presented selectively downward to cooperate successively with a vertically movable lower die 76. The lower die is shown as a male die and the upper dies 74 and 75 are therefore female of any de-

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sired number and of progressively greater size. In practice there seldom will be more than two of the female dies 74, 75 for use successively upon successive blanks placed upon the lower die.

Where the fitting walls are to be of considerable thickness, the blanks without great initial compression and the contour of fitting is such as to require very considerable distortion of the blank, it may be sometimes preferable to perform the die-pressing operations in steps with successively larger female dies as the fitting wall progressively thickens by the use of successive blanks. One or more relatively thin blanks 77 are placed successively upon the lower die, and each optionally may be pressed by hand or tool to very close conformation with the surface of the lower die and then pressed against the proper upper die, 74 or 75, by upward movement of the lower die. When a suitable depth of sheet or blanks have been piled upon the lower die with or without reinforcement sheets, the proper upper die 74 or 75 is moved to alignment with the lower die, that is positioned directly above the lower die and then the lower die as illustrated is intended to be moved up hydraulically to press the sheets to the first of the upper dies. The lower die is then moved down and any desired additional sheets or blanks added and the die-pressing operation repeated upon the final or larger upper die.

As shown in Figure 8, the lower die 76 is intended to be mounted upon the upper end of a hydraulic ram 78. The blanks 77 are carried upon a table 79 fastened to stationary structure 80 of the ram. The upper dies 74 and 75 are mounted to be presented radially from shoe or bed structure 81 intended to be supported on and arcurately movable about a stationary heavy shaft 82, supported in any suitable way not shown.

More usually the die-pressing will be accomplished during a single movement of the cooperating dies, preferably the dies mounted upon a suitable hydraulic press of the compound type intended to be illustrated conventionally in Figures 23 to 30.

Figures 23 and 24 are intended to show press structure that includes a main upper die 83 vertically movable hydraulically, a main lower die 84 (Figure 24) with cooperating upper and lower structures for trimming and punching operations. The main lower die 84 is intended to be stationary and the cooperating upper and lower structures for trimming and punching operations as shown are intended to include mating upper and lower vertically movable deckles 85 and 86 respectively and mating upper and lower vertically movable punch rods 87 and 88 respectively.

After the insertion of a suitable blank upon the lower die 84, usually a blank adapted to be die-pressed into a complete half-section of a split fitting, the main upper die 83 descends, and suitably comes to rest for the trimming and punching operations of the deckle and punch members. At the first coming to rest of the main upper die 83 the lower deckle 86 and the lower punch rods 88 may be presenting their upper surfaces 89 and 90 respectively everywhere flush with the contiguous upper surface of the lower die 84. It will be understood that either upper or lower die may be movable and usually it is more convenient to have the upper die moved down upon the lower die.

In Figure 24 the blank has been placed upon the lower die. The upper die has moved down compressing the blank 91 upon the lower die 84. Before compression is complete, or optionally after it is complete, the edges of the compressed stock are trimmed and the flange wall is punched, by cooperating upper and lower deckle members 85 and 86 and cooperating upper and lower punching members 87 and 88, respectively. Usually it is more desirable to have the punching and trimming operations take place prior to the completion of the downward stroke of the main die, in that the final compression incident to the completion of the downward stroke of the upper die 83 may then take place with the trimmed edges of the fitting side supported by the deckles and the outer surfaces of the freshly punched bolt holes side-supported by the punch members then extending through the holes.

Figure 24 at 92 shows waste material trimmed off by the descent of the upper deckle 85 after having been first compressed against the downwardly movable lower deckle 86, all preferably prior to the complete downward stroke of the upper main die 83. This waste material in Figure 24 is shown in alignment with the die-pressed fitting 91 from which it has been cut. More usually, however, both the waste trimmings and the punchings will be kept out of the way by maintaining the lower deckle 86 and the punch receiving rods 88 depressed until the upper die members, including the main die 83, the deckle 85 and the punch rods 87, have moved up out of the way and the die-pressed fitting 91 has been released from the lower die, in any usual or suitable way. The deckle and punch preferably are depressed also until the die-pressed fitting 91 has been removed from the lower die, after which the lower deckle 86 and the lower punch receiving members 88 move up to their initial position at which time they present their upper faces flush with the adjacent upper face of the top of the lower die.

These punchings and trimmings more usually can be returned to the "transite" supply, for dispersion with new "transite" stock and for use in the manufacture of pipes and fittings in the manner already explained.

The description of operation in the structure of 23 and 24 will apply to the structure of the Figures 25 and 26 for which reason the corresponding parts have been lettered, the same using primes and seconds to distinguish between the figures. The structures are in fact alike except that the male and female dies are respectively lower and upper dies in Figures 23 and 24 and upper and lower dies in Figures 25 and 26.

In the die structure of Figures 27 and 29 the same description applies and the parts have again been related by seconds after the distinguishing numerals. Figure 28 is intended to show the dies separated and a blank 93 in place prior to the downward movement of the upper dies.

In Figure 29 the downward movement of the main upper die 83^2 has not yet reached its final low position. Preferably the upper die comes temporarily to rest during the trimming and punching operations and as seen in Figure 29 the upper deckle 85^2 and the punches 87^2 have operated and are still somewhat above their final low positions. The small additional downward movement of the upper die 83^2 will strongly compress the incompletely formed fitting section against the inwardly presented faces of the upper deckle 85^2 and against the surfaces of the punches

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87². The trimmings and punchings are indicated at 94 and 95 respectively.

There is an advantage in placing two halves of sections—opposite counterparts—together for curing, rigidly fastening them together whether or not the same halves be used together on the job. Placing halves together, preferably rigidly fastening their flanges together during curing protects the flanges from warping. More usually the half sections of the fitting are made separately rather than molded together, advantage can then be taken of the ability to exactly locate the gasket between the outside of the pipe and the inside of the fitting outlet; but in certain circumstances it may be preferred to have the two blanks molded into an integral fitting at the time of pressing as illustrated in Figure 30. In this event in some cases the bolts and fish plate reinforcements such as are shown in Figure 3 may be dispensed with and the half sections 96 and 97 presented face to face 98 during the stamping operation at 98, with compression at the flanges forming an adequately strong union. The flanges 99 and 100 together then form merely a strengthening rib 101 as indicated in the Y fitting at 101' of Figure 6.

In view of my invention and disclosure variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain part or all of the benefits of my invention without copying the structure shown, and I, therefore, claim all such in so far as they fall within the reasonable spirit and scope of my invention.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. The method of manufacturing fittings for pipe connection having irregular conformation which consists in mounting a form sectionally outlining diametrically opposite flanges and, intermediate the flanges, the interior or exterior surface of half of a fitting, so that the form is accessible from the side, placing wet sheets of uncured asbestos fiber and cement upon the form of the half fitting, compressing the wet sheets upon the form to remove much of the water and, before curing the compressed material, in progressively repeating the operation with additional wet sheets placed upon those just pressed until the required thickness as pressed is attained.

2. The method of manufacturing fittings for pipe connection having irregular conformation which consists in mounting a form sectionally outlining, for the length of the fitting, diametrically opposite flanges and, intermediate the flanges, the interior or exterior surface of half of a fitting so that the form is accessible from the side, placing wet sheets of uncured asbestos fiber and cement upon the form of the half fitting, pressing the sheets down initially at the low spots of the form and compressing the still wet sheets upon the form to remove much of the water, and, before curing the compressed material in progressively repeating the operation with additional still wet sheets placed upon those just pressed until the required thickness as pressed is attained.

3. The method of manufacturing a fitting for connecting pipes together and providing outlet, forming half of the fitting at a time, each upon a form which for the length of the fitting sectionally outlines longitudinal flanges and between the flanges the intended interior of the half fitting, which consists in winding a felted sheet of still wet and uncured asbestos and cement in plastic condition upon a mandrel while compressing the sheet upon the mandrel and upon previously wound layers, removing the compressed winding from the mandrel, in transferring the removed winding to juxtaposition with the form for the half fitting, and in compressing the winding upon the form to produce the half fitting, the edges of the felted sheet being turned outwardly to form flanges.

4. The method of manufacturing a partial fitting from still wet and uncured felted sheet asbestos fiber and cement which consists in winding and compressing the sheet progressively upon a mandrel, in removing the tubular winding from the mandrel, in flattening the removed winding to form a flat work piece of twice the thickness of the winding and in compressing the work piece laterally against a form to produce a partial fitting corresponding interiorly to the exterior of the form.

5. The method of manufacturing a partial fitting from still wet and uncured felted sheet asbestos fiber and cement which consists in progressively and concurrently winding and compressing the sheet stock upon a mandrel, in cutting arcuate blanks out of the tubular winding, in transferring the blanks as work pieces, while still in curved form to a mold having an arcuate section and in pressing the work pieces upon the mold, the said arcuate blanks having curvature of the order of that of the said mold.

6. The method of manufacturing a partial fitting from still wet and uncured felted sheet asbestos fiber and cement which consists in winding and compressing the sheet progressively upon a mandrel, in cutting blanks out of the tubular stock, in transferring a blank while still curved to a mold for a partial fitting, in pressing the blank upon the mold, and in pressing an additional curved wet blank upon the first blank before the first blank has set, the said arcuate blanks having curvature of the order of the said mold.

7. The method of manufacturing fittings of irregular conformation from still uncured and wet asbestos and cement felted stock which consists in laying the felted stock in a series of tubular windings, in flattening the windings and in pressing the plastic stock thus produced laterally into the irregular form of half of the fitting with flanges for attachment to a corresponding half fitting and in pressing a second flattened plurality of windings laterally upon the first in the position of the first upon the form and before the first has set.

8. The method of manufacturing fittings of still uncured and wet felted asbestos fiber and cement sheet corresponding to curved forms which consists in winding and concurrently compressing the sheet upon a mandrel under pressure to produce a tubular plastic mass of uncured asbestos fiber and cement, in cutting arcuate blanks from this mass, in removing the blanks to forms upon which they are to be pressed to produce the half fittings and in pressing them transversely of the winding against the forms to produce the irregular fittings, using the curved shape of the wound sheets to give initial partial conformation to the forms, the said arcuate blanks having curvature of the order of that of said mold.

9. The method of manufacturing pressed fittings corresponding to a mold from mixed asbestos fiber and cement which consists in form-

ing felted plastic asbestos and cement, in laying the sheet thus formed in serpentine fashion backward and forward in successive layers, in compressing and removing moisture from the plurality of layers thus formed, producing a compressed blank and in pressing the blank laterally with respect to the form to produce the fitting.

10. The method of manufacturing blanks for die-pressing against forms from asbestos fiber and cement and inserting reinforcement within the blank which consists in felting the asbestos and cement into a sheet, in winding the sheet into a cylinder while compressing it progressively, in collapsing the cylinder and in inserting the reinforcement within the cylinder before its total collapse and pressing it into engagement with the adjacent faces of the cylinder.

11. The method of manufacturing objects from plastic sheets of felted asbestos fiber and cement received from a fourdrinier apron which consists in successively laying the sheeted material one layer upon another while at the same time compressing it and squeezing moisture out of it, producing a hollow body having a periphery approximately twice that of the width needed for the final pressing operation and a length corresponding with that needed for the pressing, flattening the hollow body while the stock is still plastic to form a blank of the size needed and pressing the blank over a form to produce the object intended.

12. The method of manufacturing an object from the plastic stock ultimately pressed against a form which comprises producing the stock, in laying the sheet material successively in layers under pressure to yield a mass of thickness greatly in excess of the thickness of the single sheet, compressing the material and withdrawing moisture formed and at the same time uniting the sheet material to supply a blank having the fibers throughout generally parallel and in applying the blank while still plastic against the form under pressure.

13. The method of manufacturing "transite" fittings which includes providing uncured blanks of laminated asbestos fiber and cement, die-pressing the blanks to yield split fittings having flanges and curing the die-pressed fittings while flanges of split fittings are secured together to prevent warping of the flanges.

14. The method of manufacturing fittings of asbestos fiber and cement stock which includes providing uncured blanks of plastic laminated asbestos fiber and cement, in die-pressing the blanks to yield opposite counterpart split fittings having flanges adapted for ultimate union to complete the fittings, in rigidly fastening together opposite counterpart split fittings through their flanges and in curing the die-pressed fittings while the flanges are so united.

15. A split fitting of felted asbestos fiber and cement stock having laminated walls of the stock united by pressure and having flanges about the fitting.

16. A split fitting having asbestos fiber and cement laminated walls and a reinforcing sheet of metal having openings through it, the stock of adjoining laminations being united through the openings.

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