

March 27, 1945.

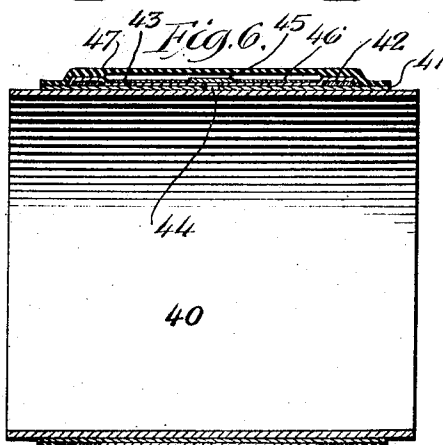
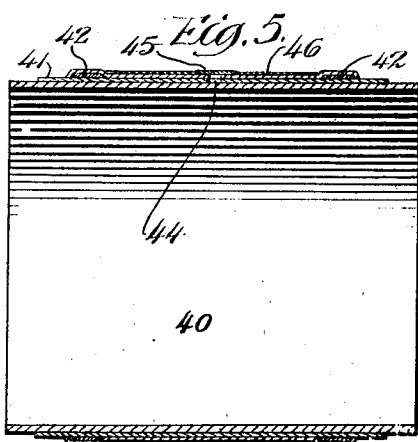
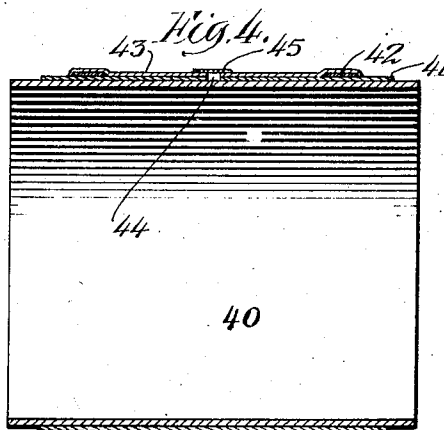
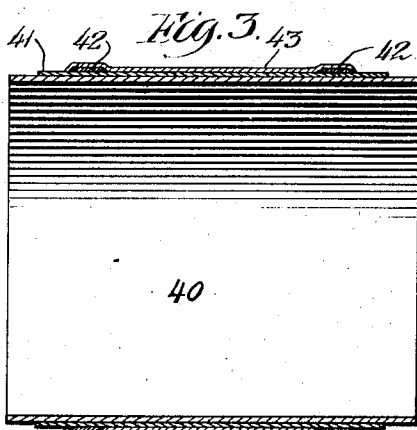
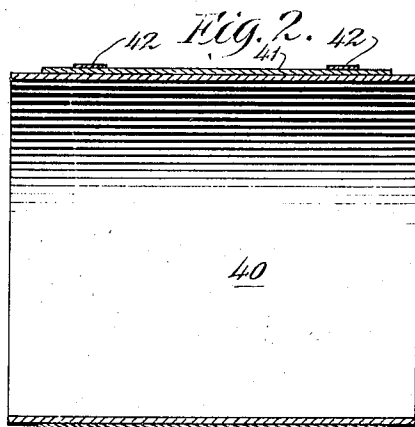
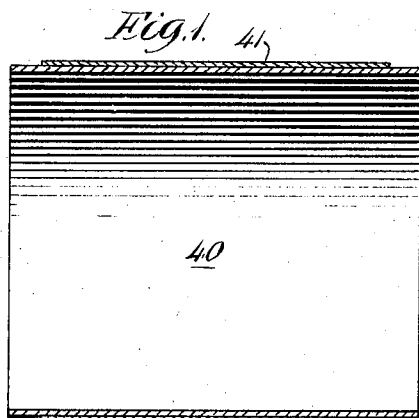
F. A. KRUSEMARK

2,372,382

METHOD OF CONSTRUCTING SAFETY INNER TUBES

Filed Aug. 8, 1940

6 Sheets-Sheet 1



INVENTOR.  
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*C. L. Stallings* Attorney

March 27, 1945.

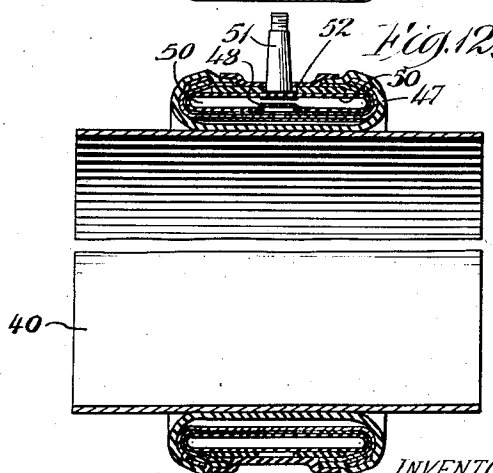
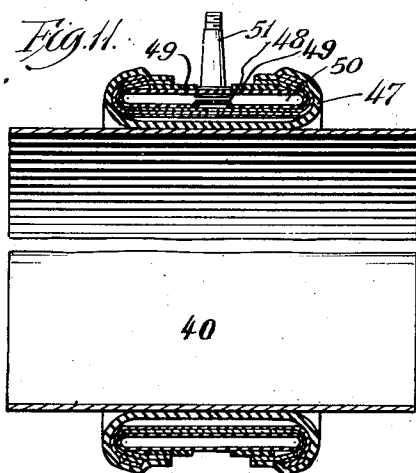
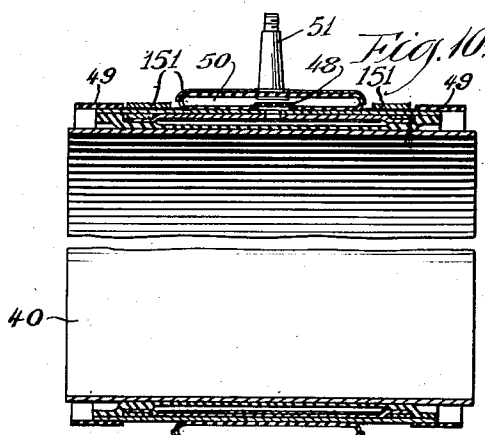
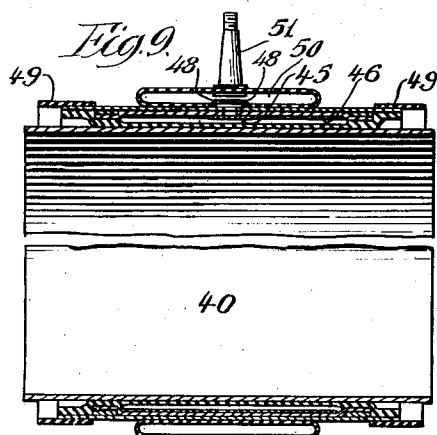
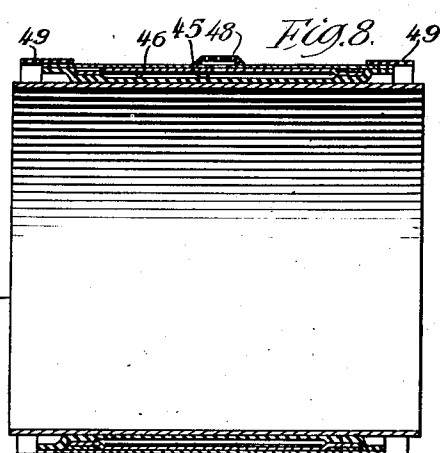
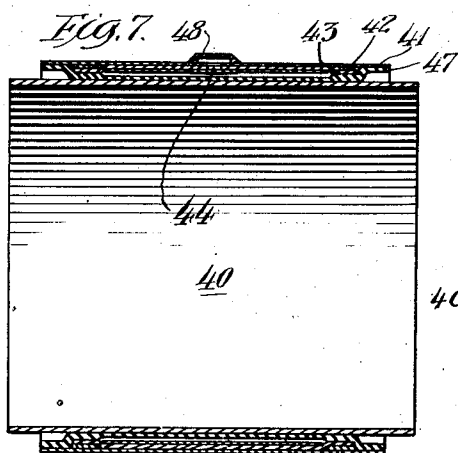
F. A. KRUSEMARK

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METHOD OF CONSTRUCTING SAFETY INNER TUBES

Filed Aug. 8, 1940

6 Sheets-Sheet 2



INVENTOR:  
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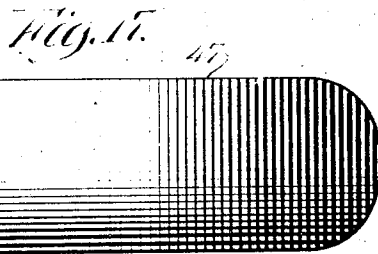
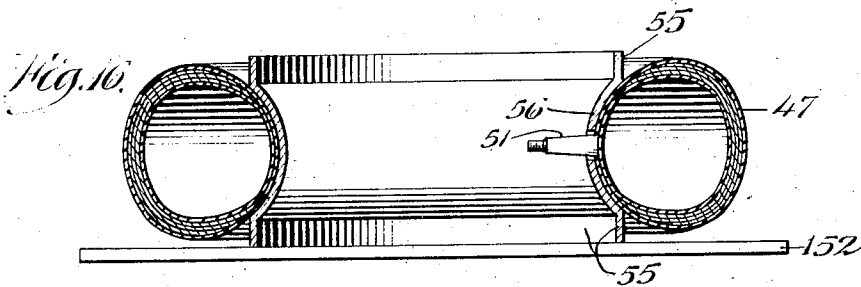
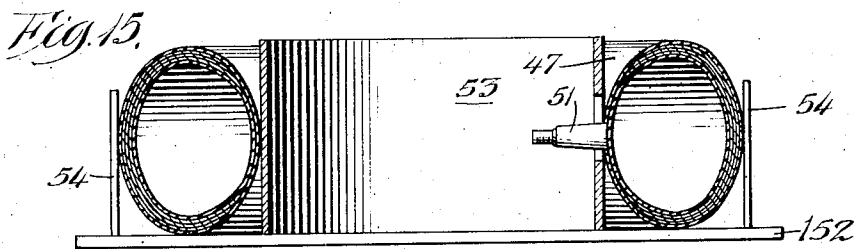
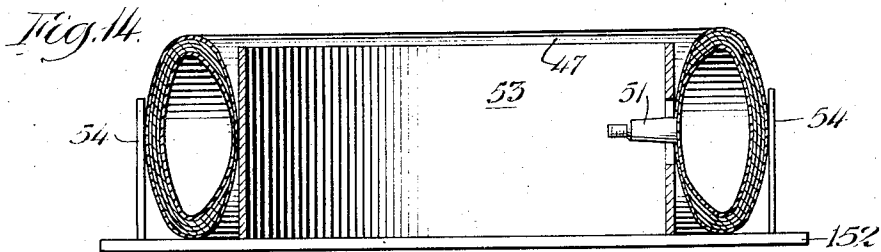
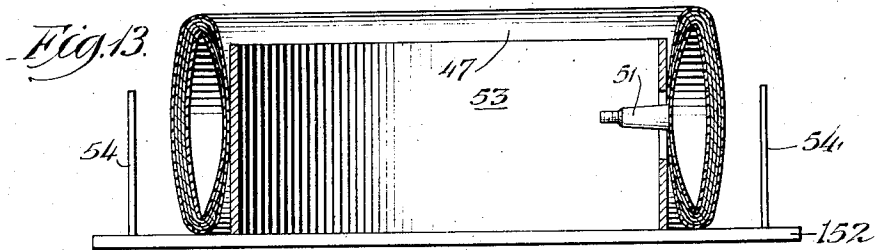
F. A. KRUSEMARK

2,372,382

METHOD OF CONSTRUCTING SAFETY INNER TUBES

Filed Aug. 8, 1940

6 Sheets-Sheet 3



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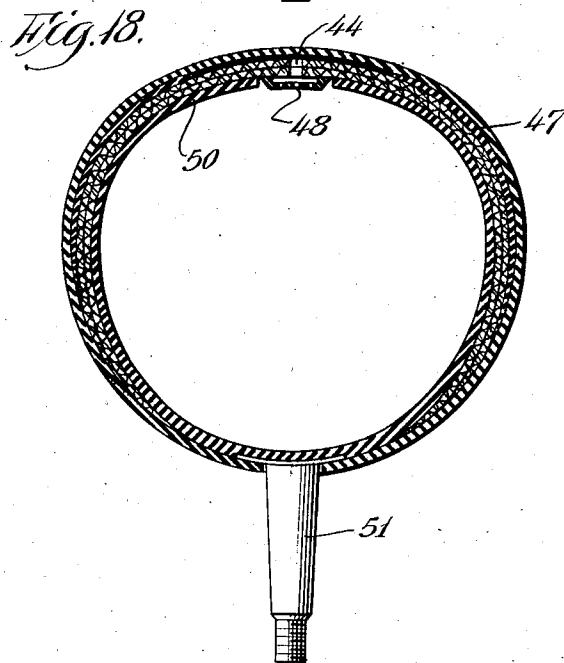
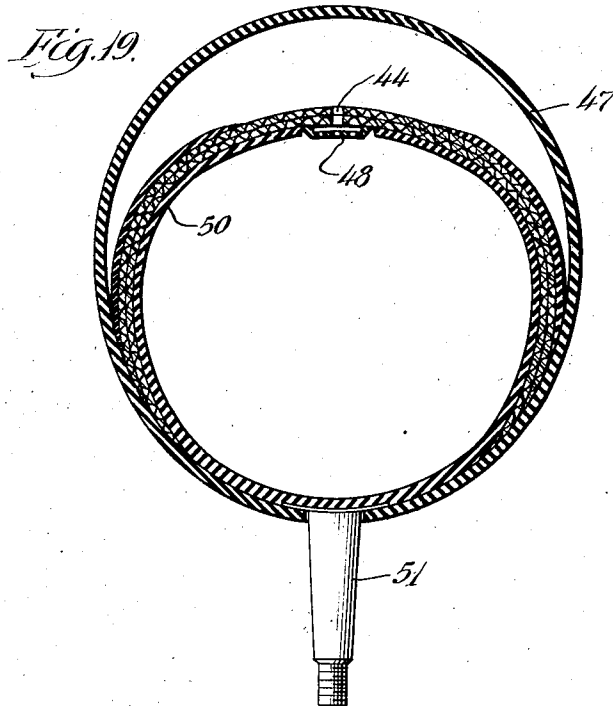
F. A. KRUSEMARK

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METHOD OF CONSTRUCTING SAFETY INNER TUBES

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6 Sheets-Sheet 4



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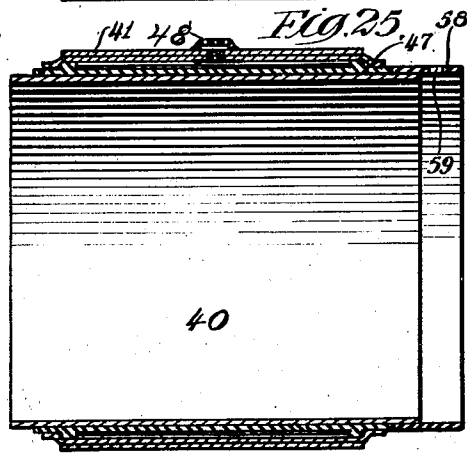
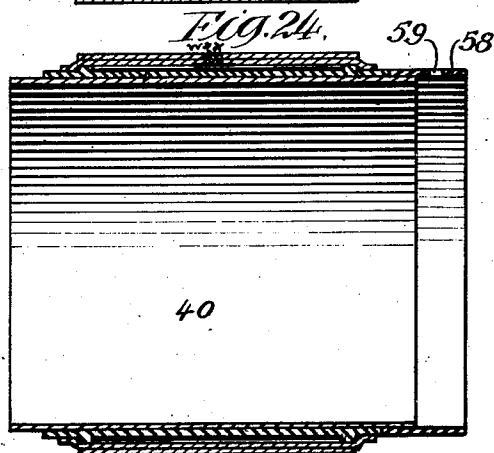
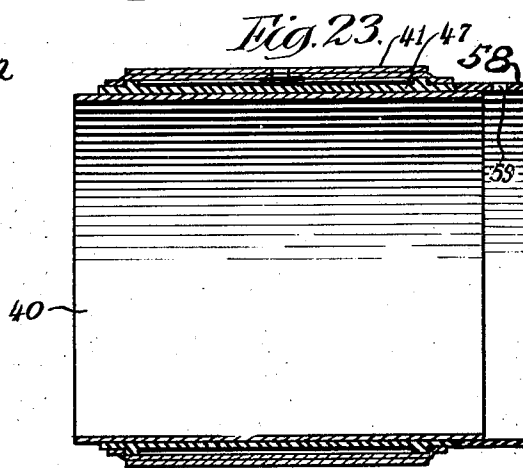
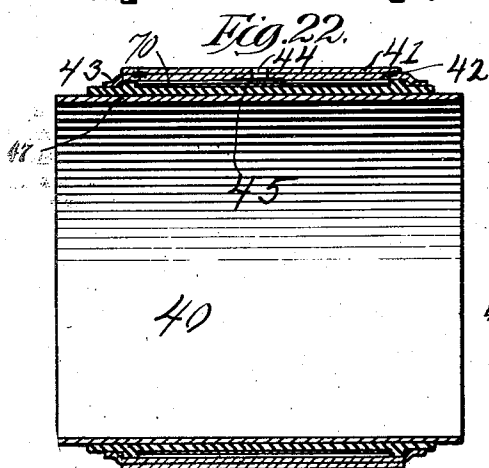
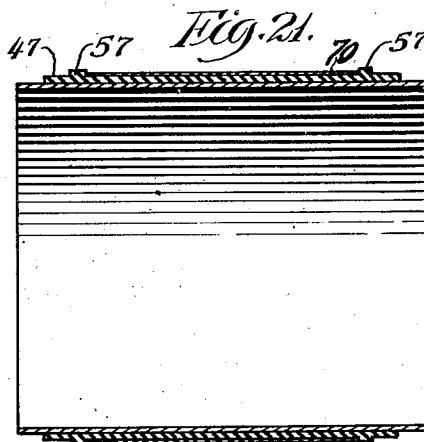
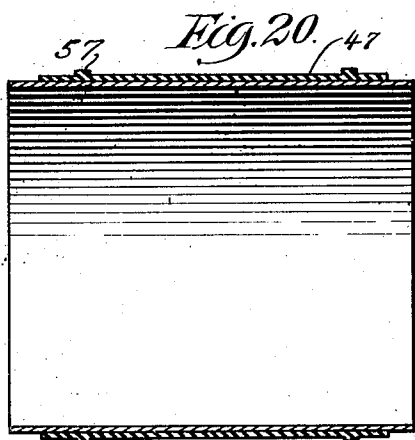
F. A. KRUSEMARK.

2,372,382

METHOD OF CONSTRUCTING SAFETY INNER TUBES

Filed Aug. 8, 1940

6 Sheets-Sheet 5



INVENTOR.  
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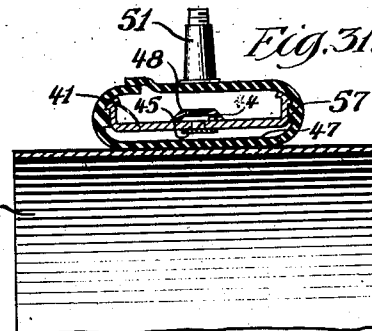
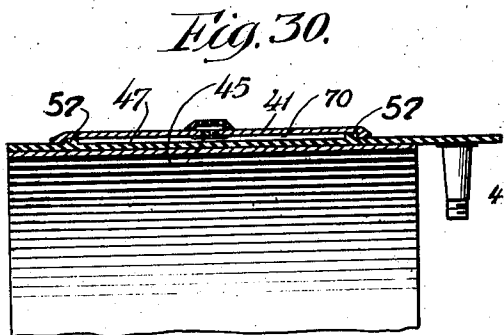
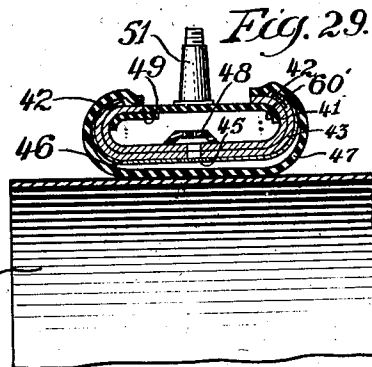
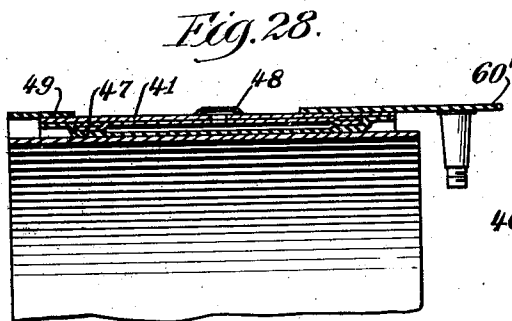
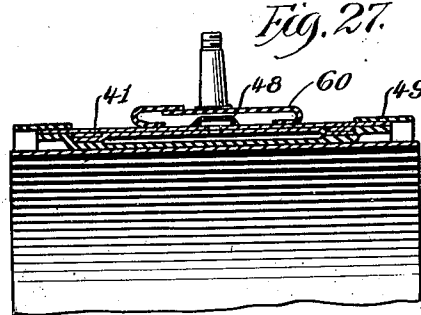
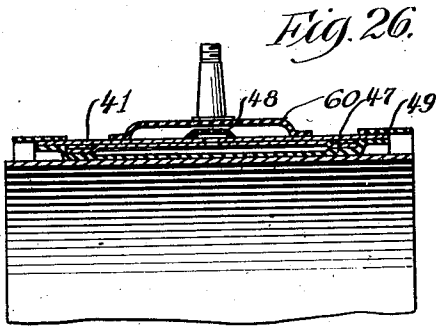
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2,372,382

METHOD OF CONSTRUCTING SAFETY INNER TUBES

Filed Aug. 8, 1940

6 Sheets-Sheet 6



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## UNITED STATES PATENT OFFICE

2,372,382

## METHOD OF CONSTRUCTING SAFETY INNER TUBES

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Mansfield, Ohio, a corporation of Ohio

Application August 8, 1940, Serial No. 351,826

9 Claims. (Cl. 154—14)

This invention has to do with the manufacture of inner tubes of the so-called multiple chamber type, such, for example, as is set forth in my Letters Patent Number 2,307,002 granted December 29, 1942. More specifically, this invention provides a method of constructing safety inner tubes, hereafter called "safety tubes."

In the past, the usual methods of manufacturing safety tubes provided for the construction and curing of the inner unit comprising generally the inner air chamber, then removing said unit from the mold and completing the construction by adding the outer air chamber unit and then replacing the whole arrangement in another mold and curing it again to complete the unit. This is an involved and expensive procedure using considerable time with its attendant costs and delays, and requires extra equipment.

It is an object of the present invention to provide means of effecting a manufacture of a complete properly cured safety tube by the use of a single cure operation, thus eliminating, where desired, the double cure.

In this connection, as indicated above, the building of the tubes now on the market usually involves partial building before the first cure and further building after the first cure. It is an object of the present invention to disclose a method of building a safety tube which completes the building of the tube before any curing operation takes place. Carrying this a step further, it is another object of this invention to provide a method of manufacture in which a double cure may be used if desired, but which will involve no additional building operations after the first cure, other than placing in a second mold, inflating an additional amount, and completing the cure.

It is a further object of the present invention to provide a method and means whereby the inner air chamber is temporarily blocked off from the outer air chamber during the curing operation so that inflation of the inner air chamber for curing purposes does not pass any substantial amount of air or inflating fluid to the outer air chamber, thus causing the outer air chamber to cure in contact with the wall structure of the inner air chamber unit and the curing heat to penetrate the materials forming both units and cure said materials at the same time.

It is another object of the present invention to disclose a method of manufacture involving the use of a bead structure which retains various parts of the safety tube structure from moving out of position during cure, and also in normal

operation performs the desired functions of a bead structure.

It is a further object of the present invention to provide a method of manufacture in which the forming operation before placing in the mold is much improved over that of other methods of manufacture and which forming operation enables the tube to be built flat and then properly shaped and proportioned before placing in the mold for curing. In this connection, it is another object of this invention to provide a forming operation which enables the manufacturer to expand the tube to its outer desired circumference without distorting the base or throwing the tube out of balance, and then forming the base structure to its inner desired circumference.

It is another object of the present invention to provide an arrangement whereby the entire safety tube can be "built flat;" that is, flat on the customary building drum.

It is another object of the present invention to disclose a method and procedure of building an inner tube which is much less expensive than methods in use today, and which involve a considerable saving of time as compared with the methods in use today for building multiple chamber safety inner tubes.

Other objects and advantages of the invention will appear as the nature of the improvements is better understood, the invention consisting substantially in the novel construction, combination and arrangement of parts hereinafter fully described, illustrated in the accompanying drawings, and finally pointed out in the appended claims.

In the drawings—

Figures 1 to 8 inclusive are longitudinal sectional views through a building drum, such as commonly used in the manufacture of tubes and tires, showing successive steps in the building operation and the materials as added;

Figures 9 to 12 inclusive are likewise longitudinal sectional views through a drum, showing further successive steps in the building operation, the drum, however, in these figures being shown in a fragmentary view;

Figures 13, 14, 15 and 16 show the use of the forming drum in the manufacture of safety inner tubes and the like, the view being a cross-sectional view through the forming drum;

Figure 17 is a vertical elevational view of the safety tube after removal from the forming drum and before placing in the mold for the curing operation;

Figures 18 and 19 show a cross-sectional view

through a safety inner tube such as may be built by the method disclosed herein, Figure 18 showing the tube as it is cured by a single operation and before inflation, and Figure 19 showing the tube of Figure 18 after inflation. Figure 19 equally well shows a completed tube performed by the one cure method, as it would look when inflated or shows a tube one step further advanced than the tube of Figure 18, when a double cure operation is performed;

Figures 20, 21, 22, 23, 24 and 25 are views similar to Figures 1 to 8, but illustrate modifications of my process and method of manufacture; and the remaining figures from Figure 26 to 31, both inclusive are likewise cross-sectional views illustrating modifications, the showing of the building drum, however, being fragmentary only.

Referring more in detail to the various constructions shown in the drawings, I provide the building drum 40, which may be the conventional drum used today, and it is preferably made so that it may be expanded or shrunk within limits, as desired.

As shown in Figure 1, I place on said drum a sheet 41 of material preferably comprising rubberized fabric or rubber coated fabric. The ends of said sheet are joined, around said drum, and may if desired be over-lapped to assure a perfect union.

As disclosed in Figure 2, my next operation is the provision of the bead strips 42, hereinafter referred to as the beads 42, which are placed over said sheet 41 circumferentially. These beads 42 are preferably of material containing cords or they may be formed with wire beads. These beads perform several very desirable functions among which are that they hold the various parts subjected to strain in the forming and curing operation enabling said parts to retain their proper position and result in a balanced tube after the curing operation. It is to be noted that the beads 42 should be very carefully positioned on the sheet 41, the position being determined by the diameter of the building drum upon which the tube is built in relation to the position the bead is to assume in the cured product. They must be properly placed however since they do not stretch materially in the curing operation, and since the other portions of the tube may stretch such as the base when it constricts inwardly, stretching in some portions and shrinking in others, and the outer air chamber structure and some of the inner air chamber structure is expanded outwardly in the forming operation and in the curing process. These beads however since they do not stretch materially must be positioned so that they will be where they are of the proper circumference for the completed safety tube.

The bead performs, in both the building operation and actual operation in the tire on a vehicle, an action that might be termed a snubbing action. The fabric may be, and usually is, put together so that the strands of fabric in the fabric material are at somewhat of an angle to the longitudinal circumference of the safety tube and preferably "fish-tailed." The greater the angle the more they will stretch in the forming and building operations, and in use. The bead 42 on each side runs longitudinally and at little or no angle to the longitudinal circumference, and hence will have little or no stretch.

The position of each of the beads 42 is determined on each size of tube by the diameter of the building drum and the diameter of the posi-

tions of the beads in the finished tube. Each should be positioned with respect to the sides of the fabric in the building operation at the approximate position where the material inside or between the bead strips moves outwardly in the forming operation, and the material outside of (or later becoming the base portion of the tube as shown in subsequent steps) start moving inwardly, there being little or no movement at the position where the beads are located. Failure to properly position these beads tends to throw a tube off balance in the finishing operation and in the finished product.

Usually, experiment in building any size of tube will indicate the exact position for the beads 42. The beads also may be used to mark automatically the position of various steps used in the performing operation, such for instance is a step subsequently described where a dusting or painting operation known to the trade as lubricating, is performed to prevent the walls of the inner and outer air chambers adhering in the limits of said air chamber, and thus forming said air chamber. In this connection, it may be that the operator will paint up to or just over the bead, as desired, or each side, although the bead does not necessarily mark the limit of the lubricating operation.

One tube built experimentally by this operation had the bead placed so that its outer edge was approximately two inches from the edge of the sheet 41. In connection with the above operation, it is to be noted that in the forming and curing operation, various portions of the tube in expanding may tend to distort by curl or turn or otherwise move, and this bead structure maintains the proper relationship of said portions with the remainder of the safety tube structure.

In the finished product, the cords perform the normal functions of a cord and assist in maintaining the safety tube properly positioned in the tire, and also they tend to prevent the inner air chamber from moving to a position of contact with the crown of the outer air chamber, restraining movement under centrifugal force. This is very desirable for obvious reasons.

The beads may be any size desired, but a preferable size is about one-half inch in width.

The operation shown in Figure 3 comprises the placing of a second sheet 43 over said first sheet 41 and beads 42. Preferably this second sheet is of a fabric material similar to sheet 41, and preferably also the sheet is brought just over the outer edges of the bead 42 and stitched or otherwise fastened to the sheet 41. The fabric materials described herein are preferably of raw stock or coated with raw rubber so that they cohere and upon contact, and, after curing as later pointed out, become what may be considered a single unit or sheet. I will refer frequently to the assembled materials constituting sheets 41 and 43, and beads 42 as the "fabric."

As shown in Figure 4, there are two operations provided. The first operation consists of punching the hole 44 in the fabric, somewhere between the limits forming the inner chamber as pointed out in later steps. This hole may be punched by hand or by machinery, using a leather punch or any other suitable punch desired. The other step shown is the step of placing, over said hole, a patch of gum coated cellulose tape, commonly called "Scotch tape" or the like 45. This "Scotch tape" will generally adhere somewhat to the area around the hole and will provide a seal over said hole during the forming operation

and for at least a portion of the curing operation.

Referring to Figure 5, I show the step of placing a lubricant, designated as a solution herein, over the fabric between the beads and to a position as desired marking the limits of the outer air chamber. This solution may in fact be any solution used as a lubricant to prevent rubber sticking in a curing operation, and may be talc or such a material expedient as paper, "Scotch tape" or the like which is here considered the equivalent of the solution. Many solutions are commonly known to the trade for this purpose, such for example as soapstone and water; or glycerine, alcohol and mica; or any of the well-known soap solutions combined with soapstone and mica if desired.

The solution is preferably placed over the fabric and beads to a position, say, for example, a couple of inches from the edge of the material on each side. This distance is determined by preference as it may vary over a considerable range.

It is an expedient useful in manufacturing to provide what may be designated as marker strips (not shown) for use in lubricating as above described. These marker strips are merely circumferential strips or sheets of material, inserted over the edge of the drum and over the fabric to the position of the outer limits where the solution is desired. These cover the portions not to be lubricated and enable a person to blow the solution on with a sprayer gun or paint with a paint brush, rapidly and without danger of carrying the solution too far or splashing where not desired. These marker strips are removed after the lubricating operation, and may be used time after time for the same purpose.

The solution abovementioned is shown in Figure 5 as a layer, the showing preferably being exaggerated for that purpose as in Figure 5. The solution is designated here as solution 46, and is shown as extending from the inside of one bead to the inside of the other bead, although it may extend across the bead if desired. Preferably the solution covers the "Scotch tape," too, on the upper side as shown in Figure 5.

Referring to Figure 6, I show a further step consisting of placing a sheet of material such as rubber over the arrangement of Figure 5, and preferably bringing this sheet of material to approximately the outer limits of the sheet 41. This material is of such construction as raw rubber stock and is here designated as the "outside wall 47" which forms the outer wall of the outer air chamber in the finished safety tube. The outside wall 47 will adhere with the fabric, particularly with the sheet 41, except where the solution 46 covers said fabric. It is merely necessary to place said outside wall on the fabric and press it down or stitch it, or, if desired, cement it or otherwise attach, assuring adhesion where desired.

It may well be pointed out that fabric material has a tendency to conduct air much like a capillary attraction action; that is, it will operate as a wick and conduct air from air chambers to which the fabric may be exposed, if the fabric is not carefully coated with rubber or the like. In such case, it may be desired to extend the outside wall 47 to a position somewhat past the outer edges of the sheet of material 41, thus preventing a gradual deflation of the finished product because of the wick action.

Referring to Figure 7, I have shown three sub-

sequent steps in the process of building which comprise removing the assembly built up in Figures 1 to 6 from the drum, and turning it inside out to the arrangement shown in Figure 7, herein called reversing, then filling the hole 44 with wax such as the wax known to the trade as "Flexo" wax, and then attaching the valve 48 over the opening or hole 44. This valve 48 may be of any desired form, and in fact may be eliminated and merely a restricted opening 44 provided in place thereof such as that obtained by using a grommet or otherwise. It is understood, however, that while the hole 44 may be sealed by means of the "Scotch tape," or by means of the wax alone or any other means, it is usually desirable to use both in the ordinary operation. This wax and "Scotch tape" preferably maintain the seal until at least a portion of the curing operation is completed, and until after all of the expanding operation hereinafter discussed as forming operation, has been completed. When the safety tube is inflated after the curing operation or at some time during the curing operation perhaps without additional inflation, the "Scotch tape" and the wax to seal the hole 44, the "Scotch tape" usually pulling loose and falling harmlessly into the outer air chamber, and the wax either disintegrating or melting out from the heat. It is not believed necessary to denote specific composition of waxes used, although preferably a greaseless wax is used and one which will not melt until the temperatures are considerably increased. The heat causes the cellulose or other material composing the "Scotch tape" to curl and pull away from the hole, or if it fails to do that because of the adhesion of the gum, inflation after curing will blow the tape loose. If necessary, the tube may be taken in the fingers and the tape pulled loose by wrinkling the tube.

Referring to Figure 8, I have provided the gum strips 49 which are placed over the sheet of material 41 in the manner shown in Figure 8. These gum strips may extend inwardly only a short ways or preferably extend over the fabric to a position under the inner tube as shown in Figure 9, and when so extended have a tendency to prevent the wick action discussed above in connection with some of the other figures. This is particularly true since the hole 44 usually has fabric material exposed to the air in the tube.

Referring next to Figure 9, the inner air chamber may be formed in several ways by a completed inner tube preferably of raw stock, such as is made up on the market today as an inner tube for automobiles, with an opening or a hole therein corresponding to the hole 44, which tube is placed on the sheet 41 so that the opening in the inner tube corresponds with the hole 44 and valve, the inner tube being brought around circumferentially and joined as is the case with other materials above used generally speaking. This inner tube is tacky or sticky and adheres, as the case may be to the sheet 41, for a distance determined by the desires of the person manufacturing the tube but which is preferably about that shown in Figure 9 as contacting sheet 41. This inner tube is designated as inner air chamber unit 50, the air containing portion thereof usually being referred to as inner air chamber 50. The addition of the word "unit" describes the complete structure forming the inner air chamber, and this unit 50 is that structure in the arrangement here shown. Preferably the inner air chamber unit 50 contains the inlet valve

51 which usually opens into the inner air chamber and is used in inflating the safety tube.

After the inner air chamber unit 50 has been placed in position, the assembly is painted with solution 151 as shown in Figure 10, the solution covering the top face of the sheet of material 41, except where the inner air chamber unit 50 attaches thereto. The solution maintains the parts from sticking. One of the gum strips 49 may be omitted and the other strip extended out so that in subsequent operations, to be described particularly in connection with Figure 11, one of the gum strips comes all of the way over the inlet valve 51 and attaches to the other edge of the face of the sheet 41, eliminating using two strips. This is merely a variation, however, and will be pointed out more in detail in connection with other figures.

As shown in Figure 11, the edges (and so much of the material as follows naturally the movement of the gum strip and fabric) are turned inwardly and brought over the inner air chamber unit. For this purpose the gum strips may each have a half circle hole cut out to match the hole in the other and accommodate the valve 51, or one gum strip may, as above mentioned, have a hole therein and be slipped entirely over the valve 51. The solution 151 prevents the turned up portions from sticking to the inner air chamber unit except where desired, and when the edges have been turned over as shown in Figure 11, the upper portion of the gum strip is as shown in that figure and the edge portions along the top, after the turning process, are still tacky.

The base strip 52, having an opening therein to accommodate the valve 51, is placed in position and sealed down on the tacky surface of the gum strips, and if desired the outside wall 47, thus forming a protective flap or portion over the inner air chamber, and retaining the tube units in shape for curing.

The complete safety tube is thus "built flat" and is now ready for the forming operation. The building drum 40 is collapsed if of the collapsible type, otherwise the safety tube is just "pulled off" of the building drum, and again turned inside out, or reversed for the forming drum. The forming operation is one of the important steps as at present indicated in building this safety tube, for the reason that improper forming will tend to pull the units apart, will distort the tube, and will be objectionable. I have provided a forming procedure which is very desirable and enables the tube to be formed quickly for the mold, without injury or undesired distortion.

Preferably a forming drum is provided which is collapsible; that is, which may have its circumference constricted. The forming drum should have a hole for insertion of the inlet valve after the safety tube has been reversed. This forming drum may be either built on a platform as shown in Figure 13, the platform being numbered 152, and having the drum walls 53, or the platform may be eliminated, and any means of holding the safety tube in place on the walls 53 may be used (including friction).

Preferably one or more guides 54 are provided, and are positioned to indicate the outer limits of expansion desired in the forming operation.

The tube is inserted on the forming drum so that the forming drum preferably provides a support for the bead portion of the safety tube at least, the support generally being at the base. Air or other inflating fluid is forced into the inlet valve until the crown portion of the tube struc-

ture touches the guides 54, which is the position shown in Figure 14.

The inlet valve is then plugged by means of a cap, or a wax plug or rubber plug, or any other type of plug desired (not shown) whereby the inflating fluid is retained in the safety tube. Since the hole 44 from the inner air chamber to the outer air chamber is plugged by means of the "Scotch tape" 45 or the wax (above described) or both, the inflating fluid will not flow into the outer air chamber, and the outer wall 47 will lie adjacent, or against, the fabric structure forming the wall between the inner and outer air chambers, and the heat used in the curing operation will be easily transmitted between the various layers of fabric and rubber comprising the whole tube that a rapid cure of the units of both air chambers at the same time is accomplished.

In this connection, the material forming the fabric and other units of the inner air chamber may be of composition that cures more rapidly than that of the outer air chamber, particularly the outside wall 47 of the outer air chamber. By this means the inner wall between the two air chambers may be entirely cured at the same time as the outside wall 47, or prior to completion of the cure of the outside wall 47 as hereafter indicated, and thus be assured of proper curing.

After the step shown in Figure 14, it is desirable to contract the inner wall 53 of the forming drum so that the base of the safety tube moves inwardly and is formed, the inner circumference being generally determined by the distance such forming drum constricts inwardly. By forming the safety tube thus and expanding the outer portion outwardly and constricting the base inwardly, the various layers of material do not pull apart. The inner tube is preferably supported at all times in the forming operation at the beads and the base, and the beads 42 maintain the parts in proper position if such support at the beads is present. Upon contraction or constriction of the inner walls of the drum, the beads will probably be some distance from the inner wall in the position shown in Figure 15. The beads however still maintain the parts against rolling sideways and the inner wall of the drum provides additional support.

As shown in Figure 16, I have provided a modified type of forming drum which has a recessed or concave portion on its surface. When the safety tube is placed on the drum, it is supported by the vertical face portions 55, herein referred to as face 55, on either side of the recessed portion. Preferably these faces 55, should be in the position to support the beads 42, as the safety tube upon inflation constricts radially inward from the inner edges of the faces 55, and the concaved surface 56 is or becomes little by little, the support for the structure at the base and from the base to the beads, as clearly apparent from Figure 16. The forming drum does not thus have to be contracted in order to form the tube, but it is necessary that the safety tube be at least partially supported at the bead structure or thereabouts and at the base, during at least some of the forming operations.

Figure 17 shows the safety tube as it appears when ready for insertion into the mold, for the curing operation, it having much the appearance of an ordinary tube.

It is desirable to describe the curing operation although no mold equipment is shown, or believed necessary in the illustrations. Preferably

a mold is used which has been vented to eliminate trapped air. This is not absolutely necessary, however, and more or less standard equipment may be used in the curing mold.

The formed tube is inserted in the mold and the valve connected with the air which is forced into the inner air chamber. The plug in the inlet valve, above described, will be blown into the inner air chamber by the air, or be removed otherwise, as the case may be. If the valve is wax it will probably disintegrate under the action of the air and be blown into the inner air chamber, and if the valve is a rubber plug it likewise may be pushed into the inner air chamber where it is harmless. The curing operation may cause the "Scotch tape" 45 to pull away from the hole 44, and the wax in said hole 44 to melt. If the "Scotch tape" does not pull away, it may be easily broken away after removal from the mold by distorting the safety tube around the position of the "Scotch tape," or even by merely additionally inflating the inner air chamber, thus blowing it away.

It is considered satisfactory to have the completed tube after curing with the inner air chamber and outer air chamber, lying close together as shown in Figure 18. To eliminate possible criticism that it requires too much stretch of the outer air chamber upon inflation to the position shown in Figure 19, of the cured tube, it may be desirable to have the wall structure between the two inner tubes made of material which cures rapidly and faster than the material in the outside wall 47. The safety tube may then be placed in the mold and partially cured and then pulled out of the mold and placed in a larger mold, inflated an additional amount necessary to assure opening of the hole 44 and blowing away of the "Scotch tape" 45, and extension of the wall 47 to an arrangement as shown in Figure 19. This position would be determined by the capacity of the larger heater or mold, in normal procedure. The safety tube may then be given a further cure, which will assure its permanently retaining the approximate positions indicated in Figure 19.

The tube is then removed from the mold and placed in use.

If the additional cure just above described is not used, and the tube as shown in Figure 18 is placed in the tire, inflated and run, the outer wall 47 will gradually become more or less permanently positioned away from the inner air chamber unit at the crown, and from the standpoint of utility there is no serious objection to curing the tube as in Figure 18. If desired, the outer wall 47 may be of a somewhat heavier stock to allow for "thinning" by stretch upon inflation. This is a matter of the manufacturer's preference, however.

Referring to the modifications, it is considered feasible, and in fact it may be preferable, to build up the units disclosed in Figures 1, 2, 3 and 4, on a table before placing on a drum. In such event the ends of the units of said figures as represented by the sheets 41 and 43 and the beads 42 may be slightly overlapped when placing on a drum and "sealed" together, assuring a good union. In such a building operation it would probably be customary to "fish-tail" the sheets 41 and 43 so that the fabric in each of said sheets runs angularly, to the other sheet.

Referring to Figures 20 to 25 inclusive, I show a modified process of building the safety tube wherein it is unnecessary to reverse the assembly in the step shown in Figure 7. In other words,

the arrangement is built up without taking off the drum until ready for forming. As shown in Figure 20, the outer wall 47 is placed around the drum. This outer wall has, preferably, the permanent markers 51, which mark the outer limits of the outer air chamber. Markers 51 may be just a rubber strip or the like or may be a ledge on the outer wall 47, made when forming the outer wall.

The outer wall 47 is lubricated as shown at 70 in Figure 21 by one of the solutions above described, up to the limits determining the outer air chamber, preferably within the limits shown by the markers 51. The fabric sheet 41, with the beads 42 and fabric sheet 43 are preferably assembled flat on a table, having the hole 44 punched therein and a piece of "Scotch tape" 45 placed under the hole so that in the position shown in Figure 22 the "Scotch tape" will be between the fabric and the outer wall 47 and covering the hole 44. This assembly is then placed over the outer wall as shown in Figure 22, and joined circumferentially in the outer edges to the outer wall 47, by stitching or the like "outside" the limits of the solution shown in Figure 1.

As shown in Figure 23, I have provided the side strip 58 which performs the same function as the gum strips 49 shown in Figure 8, etc. This strip 58 may be integral with the outside wall 47, and is preferably made by merely extending the outside wall 47 out sufficiently to form the necessary extra portion. It is here shown as a separate strip. It is provided with a hole or opening 59 which accommodates the valve stem. Obviously, two narrower strips may be provided, one on each side, so long as there is sufficient material of this nature to go across and form a flap over the base of the tube.

Referring to Figure 24, I have shown an arrangement similar to that in Figure 23 but with the wax added in the hole 44. Figure 25 shows a further step, that of placing the valve over the hole 44, the valve being numbered 48. The structure may then be finished as provided in Figures 9, et seq.

Another modification consists of building up the structure as shown in Figures 1 to 8, both inclusive, and in providing an inner air chamber structure as shown in Figure 26. This comprises a tube sheet 60 which is placed over the valve and fabric structure taking the place of the inner tube shown in Figure 9. This tube sheet 60 is more economical because a portion of the rubber forming the inner air chamber is eliminated. This portion which is eliminated is not absolutely necessary, as the fabric is usually rubber coated and makes a satisfactory wall regardless of whether rubber coated or not when used between the two air chambers.

The arrangement shown in Figure 27 is similar to that of Figure 26 except the edges of the tube sheet 60 are turned under making a smoother union. In these two arrangements, the procedure subsequently followed is the same as is shown in Figures 10, et seq.

In Figure 28, I have shown the arrangement of Figure 7 having added thereto on one side an extended gum strip 49, having inlet valve, and preferably on the other side a gum strip 49. As clearly apparent from Figure 29 the tube sheet 60 is folded over and the gum strip 49 is attached thereto thus completing an inner air chamber. In this connection Figure 7 shows the outer air chamber already built up. It is desirable in the structure of Figures 28 and 29 that the upper sur-

face of the fabric (except under the gum strip 49, and under the tube sheet 60', as well as the portion shown as the top of the tube sheet 60', which forms the inner wall of the inner air chamber unit) be painted with solution to prevent sticking. The gum strip 49 however sticks to the tube sheet 60'.

If desired the gum strip 49 may be eliminated and the tube strip 60 increased in size so that when it is brought over the fabric, etc., as shown in Figure 7 and is curled over and attached to the edge of the tube sheet 60 it completes the inner air chamber.

It is understood that a simple although probably not so desirable arrangement, may be made by merely using an outside wall 47 which is extended on one side and has a valve going through, said valve being an inlet valve. See Figures 30 and 31. Preferably it is positioned in the building operation, on to the side of joinder with the fabric sheet, such as sheet 41. This fabric sheet is placed over the outside wall 47 after a solution has been painted on one or the other (the outside wall or fabric sheet) at a position between the two, except where they are joined along the edges of the fabric 41. Preferably in such an arrangement the markers 57 are provided, and "Scotch tape" 45 is provided over the hole or grommet or valve opening of some type in the fabric 41. This hole is numbered 44 to be consistent with the other showing in the other figures. The outside wall 47 containing the valve is then curled over and joined at the edges, a solution being inserted between the top of the fabric 41 as shown in Figure 30 and the sheet 47 where it passes over said fabric 41. This forms the double air chamber arrangement. Of course other means of blocking the hole 44 may be employed but a feasible means is that shown by use of "Scotch tape" and/or wax.

The safety tubes of Figures 29 and 31 are ready for the forming operations.

It is to be understood that other processes of forming may be employed than that shown, such as very slowly inflating the safety tube the desired amount. The method disclosed however is very desirable, but I do not intend to limit myself thereto except that I may do so in the claims.

The form of the invention herein shown and described presents a preferred embodiment thereof, and delineates its adaptation to practical use, but it is to be understood that the present disclosure is to be considered from the illustrative standpoint and not as imposing restriction or limitation on the invention.

While I have herein shown and described certain features of my invention, still I do not wish to limit myself thereto, except as I may do so in the claims.

I claim:

1. A method of forming, in the process of building a safety inner tube and the like having multiple air chambers with at least one base portion, comprising building up the units of said safety tube, placing said units on a means supporting said base of said safety tube, and expanding said safety tube to a predetermined outer circumference, then constricting the base supporting means to a predetermined inner circumference, and thereby causing said base portion of said safety tube to constrict to a desired inner circumference.

2. A method of forming in the building operation, a safety inner tube having inner and outer air chambers, comprising building up the units of the safety tube and placing them substantially uninflated on a forming drum which supports at

least a portion of said safety tube whereby the units of said safety tube are prevented from pulling apart in the forming operation, and expanding the safety tube to predetermined outer and inner dimensions, the operation being such that the base of said safety tube constricts inwardly for a portion of said forming operation and another portion of said safety tube expands outwardly.

3. A method of forming in the building operation, a safety inner tube having inner and outer air chambers, comprising building up the units of the safety tube and placing them substantially uninflated on a forming drum which supports at least a portion of said safety tube whereby the units of said safety tube are prevented from pulling apart in the forming operation, and expanding the safety tube to predetermined outer and constricted inner circumference dimensions.

4. The process of manufacturing a safety inner tube consisting of placing a sheet of rubber comprising an outside wall, on a building drum, lubricating the outside wall with the exception of the marginal edges, placing a fabric assembly having a hole therein over said outside wall, sealing said hole with "Scotch tape," attaching a side strip to at least one edge of said outside wall, placing an inner air chamber unit over said fabric and attaching said inner air chamber unit to said fabric, lubricating said inner air chamber unit a predetermined amount, bringing said side strip over said inner air chamber unit, and sealing said side strip to the material comprising the opposite edge of said fabric and outside wall assembly, removing said safety tube assembly from said building drum, and forming and curing said safety tube.

5. A method of building a safety inner tube upon a building drum, comprising placing a layer of rubberized fabric on said building drum and joining the ends of said rubberized fabric together, attaching a plurality of bead strips on said rubberized fabric a predetermined distance from each of the side edges thereof, attaching a second layer of rubberized fabric having a hole therein over said first layer of rubberized fabric and over said bead strips, with the cords of the respective layers angularly disposed with respect to one another, sealing said hole with a waxy sealing material, lubricating the upper surface of the upper sheet of fabric in the area within and a predetermined distance from the respective edges, placing a strip of rubber material comprising the outside wall over the lubricant and on the portion not lubricated and attaching said outside wall to said fabric where not lubricated, reversing the structure on said drum whereby the outside wall is next to said drum, placing a valve over said hole and attaching said valve to said fabric, attaching a gum strip on the edges of said fabric circumferentially of said drum, attaching an inner air chamber unit having an inlet valve and an aperture over the upper face of said fabric on said building drum, with the opening aligned with said valve attached to the fabric, preventing said inner air chamber attaching to said fabric and gum strips except in a predetermined amount by lubricating, turning the edges of said fabric and gum strips up over the inner air chamber unit, attaching a base strip circumferentially around said structure to said gum strips thereby completing a flap over the base of said structure, removing said structure from said building drum and reversing whereby the inlet valve is on the inner circumference

thereof, placing said structure on a forming drum and inflating to a predetermined outer circumference, constricting said forming drum and thus forming the base to a predetermined inner circumference, plugging said inlet valve, removing said structure from said forming drum, placing said structure in a mold of predetermined size, removing said plug from said inlet valve and curing, said curing operation involving the forcing of a curing medium such as steam through said inlet valve into the inner air chamber, said outer air chamber unit curing substantially against said inner air chamber unit, and removing said cured structure from the mold.

6. A method of building a safety tube and the like comprising attaching bead means to a layer of material such as rubberized fabric, placing a second layer of material such as rubberized fabric over said first layer abovementioned and said bead means, providing a hole through said layers of material, providing a seal means for said hole, placing an outside wall of material such as rubber over said structure hereinbefore described, and attaching said outside wall to said fabric material abovementioned at predetermined places, placing an inner air chamber unit on the other side of said first-mentioned fabric, attaching the side edges of said outside wall to each other over the base of the inner air chamber unit, and forming and at least partially curing said units with the inner air chamber unit sealed off from the outer air chamber unit whereby inflating fluid in said inner air chamber unit is restrained from passing to the outer air chamber unit between said outside wall and said fabric material.

7. A method of building a safety inner tube by use of a building drum, comprising placing material such as rubberized fabric on said building drum and fastening the ends of said material together, providing a hole through said fabric, temporarily sealing said hole, lubricating the outer surface of the fabric material within a predetermined distance from its respective edges, attaching a sheet of rubber material comprising the outside wall on the fabric material and attaching to the portion not lubricated, reversing the structure on said drum whereby the outside wall is next to said drum, attaching material forming at least a base portion of an inner air chamber unit over the upper face of said fabric material on said building drum, turning the edges

of said fabric material over the inner air chamber unit, and attaching across the base of the inner air chamber unit, circumferentially placing said structure on a forming drum and expanding to a predetermined outer circumference and constricting to a predetermined inner circumference, removing said structure from said forming drum, and curing, and removing said cured structure from the mold.

8. A process of manufacturing an inner safety tube and the like comprising placing a sheet of rubberized material having an inlet valve in the margin of one side thereof on a building drum, placing a sheet of fabric material having an opening therethrough on said rubberized material, sealing said opening by a removable adhesive sheet of material folding said rubberized material over said fabric material and joining the edges of said rubberized material, removing said units so built up from the building drum and placing on a forming drum, forming said unit so built up by expanding the outer circumference to a predetermined position and constricting the inner circumference to a predetermined position, placing said formed unit in a curing means such as a mold, and curing with the fabric material against the rubberized material substantially throughout the area of the fabric material.

9. The process of manufacturing a safety inner tube comprising placing a sheet of rubber suitable to form an outside wall on a building drum, lubricating the center area only of the sheet, leaving the marginal edges unlubricated, placing a fabric assembly having a hole therein over said outside wall sheet, temporarily sealing said hole by placing a waxy substance therein, attaching a side strip to at least one edge of said outside wall, attaching a valve over said hole in said fabric, placing over and attaching to said fabric an inner air chamber unit, lubricating said inner air chamber unit where unattached to said fabric, bringing said side strip over said inner air chamber unit, and sealing said side strip to the material comprising the opposite edge of said fabric and outside wall assembly, said material over said inner air chamber unit being prevented from adhering thereto by said lubricant abovementioned, removing said safety tube assembly from said building drum, and forming and curing said safety tube.

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