Feb. 27, 1934. A. O. ABBOTT, JR 1,948,607

HINGED MANDREL

Original Filed July 11, 1930 3 Sheets-Sheet 1

Fig. 1.

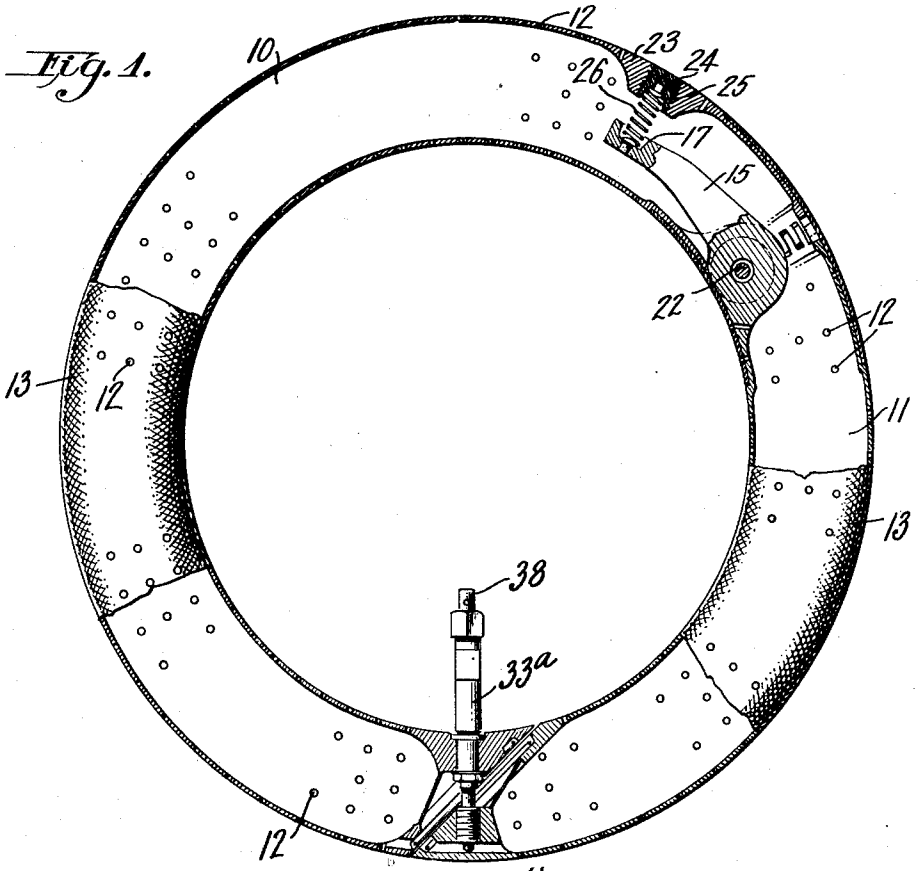
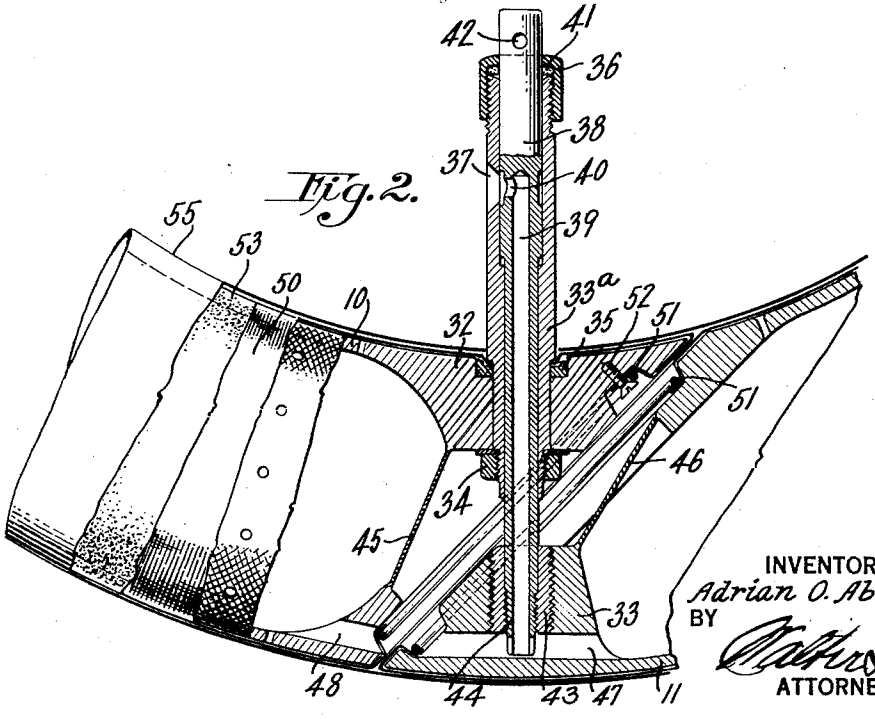


Fig. 2.



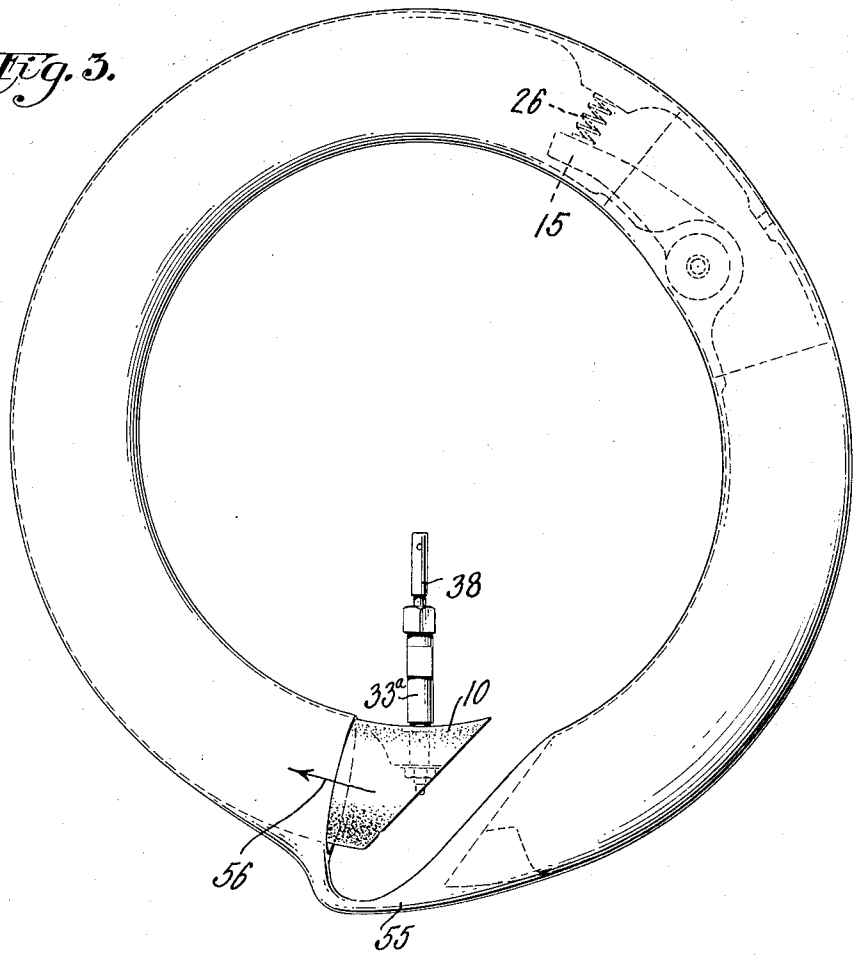
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HINGED MANDREL

Original Filed July 11, 1930 3 Sheets-Sheet 2

Fig. 3.



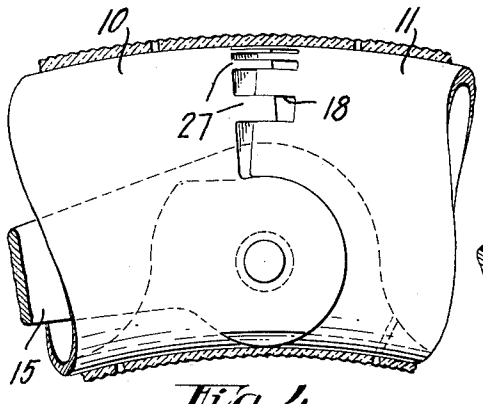


Fig. 4.

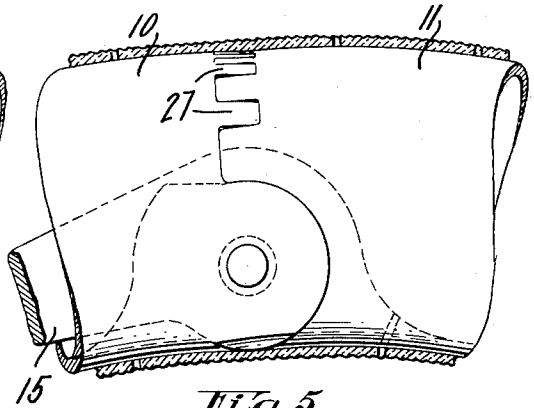


Fig. 5.

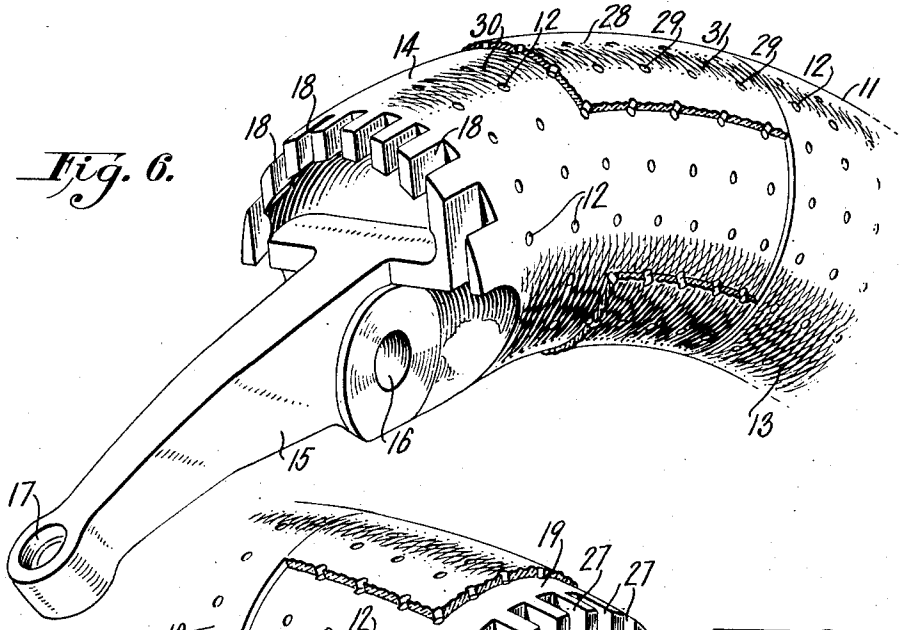
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HINGED MANDREL

Original Filed July 11, 1930 3 Sheets-Sheet 3

Fig. 6.



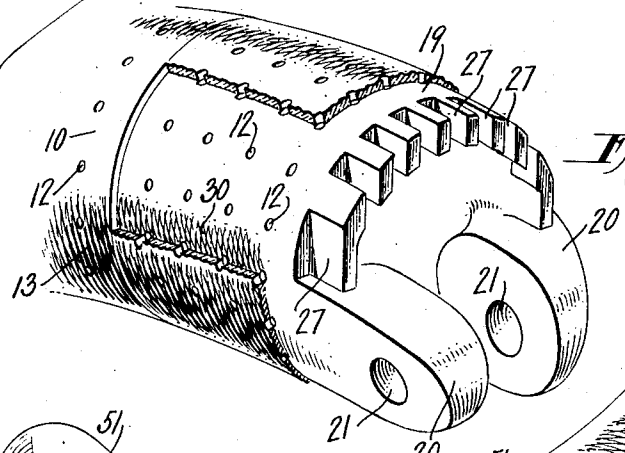


Fig. 7.

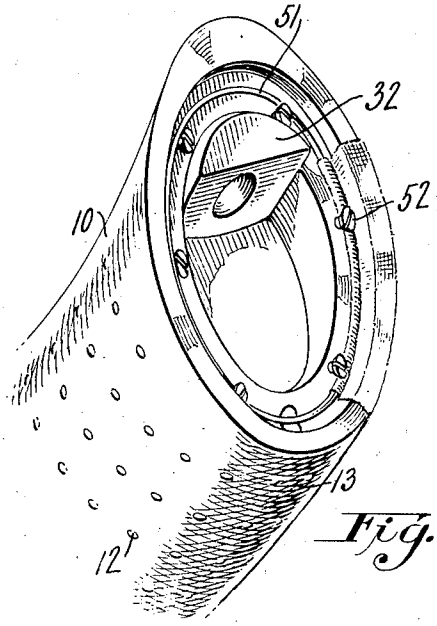


Fig. 8.

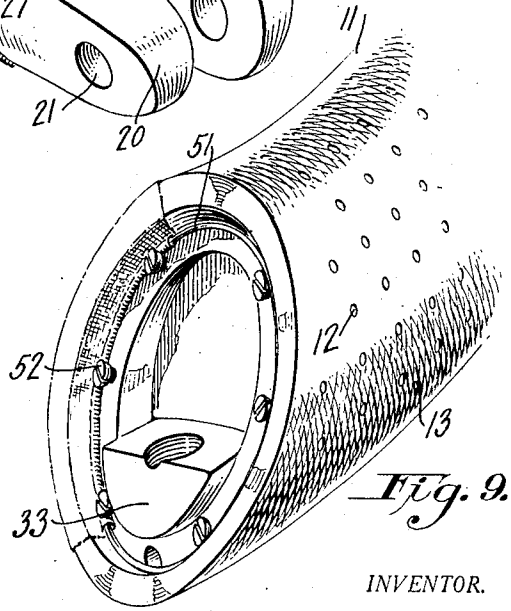


Fig. 9.

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Patented Feb. 27, 1934 1,948,607

UNITED STATES PATENT OFFICE

1,948,607

HINGED MANDREL

Adrian O. Abbott, Jr., Detroit, Mich., assignor to Morgan & Wright, Detroit, Mich., a corporation of Michigan

Application July 11, 1930, Serial No. 467,251
Renewed November 25, 1933

6 Claims. (Cl. 18—41)

My present invention relates to the manufacture of tubes for pneumatic tires by the latex deposition process and more particularly to an improved mandrel or form on which such tube may be built.

Considerable difficulty has heretofore been experienced in the manufacture of endless tubes for pneumatic tires, due to the character of the form or mandrel employed, it having been difficult to devise a mandrel which could be collapsed or disassembled to enable the endless tube to be removed therefrom, and the mandrel then extended or re-assembled into its original form.

In my present invention, I have devised an improved form of mandrel in which an annulus is composed of a plurality of parts hingedly mounted with respect to each other and with joining faces at the opening thereof extending on a bias i. e. non-radially with respect to the body of the annulus or, in the case where an annulus is circular in form, such joining faces are on a chord of the circle. Preferably, such annulus is covered with a fabric material on which a thin coating of clay or whiting is deposited, and in order to prevent undue distortion and stretching of such fabric at the hinged joint between the sections of the annulus, I preferably reduce the thickness of the annulus over a desired portion adjacent the joint and build up such reduced section with a layer of resilient material.

The principal object of my invention, therefore, is an improved mandrel for facilitating the manufacture of endless or seamless latex tubes.

Another object of my invention is an improved hinged type of annulus mandrels.

In the accompanying drawings, Fig. 1 is a side elevation partly in section of my improved mandrel in closed position.

Fig. 2 is an enlarged sectional view illustrating the mandrel joint.

Fig. 3 is a side elevation of the mandrel in open position and illustrating the method of removing an endless and seamless tube therefrom.

Figs. 4 and 5 are enlarged views of the hinge employed in connecting sections of the mandrel together showing the position of parts when the sections of the mandrel are in closed and open positions respectively.

Fig. 6 is a perspective view of one end of a mandrel section showing a portion of the hinged joint.

Fig. 7 is a perspective view of one end of another of the mandrel sections, that is associated with the structure of Fig. 6.

Figure 8 is a perspective view of one of the ends of the mandrel sections at the joining portion thereof and Fig. 9 is a perspective view of one of the ends of a mandrel section at the joint portion thereof, which cooperates with the structure shown in Fig. 8.

Referring to the drawings, 10 and 11 designate arcuate members which, when placed in the relation shown in Fig. 1, for example, constitute an annulus on which an endless tube may be formed. Each of the members 10 and 11 are preferably built of a light metal such as aluminum, and are hollow, as shown, and each member is provided with a plurality of perforations 12, distributed generally over the entire surface thereof. Also the entire outer surface of the members 10 and 11 is preferably knurled as indicated at 13. Such knurled surface constitutes a network of channels that communicate with the perforations 12 for a purpose to be hereinafter described.

One end of the member 11, indicated at 14 is reduced in cross section and this end 13 is concentric with the main body 11. This reduced portion 14 is also provided with perforations 12 distributed over the entire area thereof. At the extreme end of the reduced portion 14 is formed integral therewith an arm 15, in which is formed a transverse bearing 16. The arm 15 extends generally in the length of the member 11, and at its extreme end is provided a recess or depression 17. The upper portion of the outer end of the reduced portion 14, as viewed in Fig. 6, is provided with a plurality of vertically arranged spaced grooves 18; these grooves being of any desired size and number.

Referring now to Fig. 7, it will be noted that one end of the member 10 has such end reduced in cross section, as indicated at 19, this reduced end 19 being preferably equal in cross section to the reduced end 14 of the member 11, and this reduced end also is provided with a plurality of perforations 12 extending therethrough. Formed integral with the reduced end 19 of the member 10 are spaced lugs or ears 20, provided with aligned holes 21, the space between the lugs or ears 20 being equal to the thickness of the member 15 at the bearing 16. The arm 15 is adapted to be inserted into the end of the reduced end 10, so as to bring the bearing 16 in the arm 15 into alignment with the holes 21 in the lugs or ears 20 and when so positioned a pin 22 is adapted to be inserted therein, so as to hingedly hold the members 10 and 11 together. Formed integral with and on the inner wall of the member 10 is a

boss 23 threaded to receive a plug 24 and the inner end of the plug 24 is recessed at 25 and, referring to Fig. 1, it will be noted that the recess 25 in the plug 24 is in alignment with the recess 17 on the end of the arm 15. In the recesses 25 and 17 is arranged a compression spring 26 which tends to rotate the arm 15 about the pin or shaft 22 in a counter-clockwise direction as viewed in Fig. 1, and, therefore, to rotate in like manner the member 11.

On the upper side of the reduced end 19 of the member 10 is provided a plurality of spaced teeth 27, which teeth are adapted to engage in the vertical grooves 18 on the reduced end 14 of the member 11. The intermeshing projections 27 and grooves 18 distribute the opening that would ordinarily occur between the members 10 and 11, due to the working of such members on the hinge pin or shaft 22. The reduced portions 14 and 19 are covered with a sleeve 28 preferably of resilient material, such as rubber, to a thickness substantially that of the difference in dimensions between the reduced portions of the members 10 and 11, and the outer measurements thereof. This sleeve 28 is provided with perforations 29 preferably in alignment with the perforations 12 in the reduced portions 14 and 19. The reduced portions 14 and 19 are knurled, as indicated at 30, to facilitate passage of fluid under the action of a differential of pressure to the interior of the members 10 and 11, and, also, the sleeve 28 is knurled as indicated at 31 for a like purpose.

The joining faces of the members 10 and 11 extend biasly, i. e. non-radially, from the inner to the outer diameter of the annulus, and the material of the members 10 and 11 at such joining faces is thickened as shown in Fig. 2 to provide a boss 32 on the member 10, and a boss 33 on the member 11. The boss 32 is apertured more or less radially to receive the lower reduced end of a sleeve 33*a*, the extreme lower end of this sleeve being threaded to receive a nut 34 and by means of which the same may be securely fixed to the member 10. A washer 35 of relatively hard material is employed between the sleeve 33*a* and the boss 32 for mechanical reasons only, due to the fact that the member 10 is preferably made of relatively light or soft material, such as aluminum. The other end of the sleeve 33*a* is threaded to receive a packing nut 36 and is also provided with a lateral hole 37 extending to the inner portion thereof and to which may be attached a conduit leading to a source of pressure or vacuum. Rotatably and slidably mounted in the sleeve 33*a* is a pin 38. This pin is provided with a hole 39 extending through the major portion thereof and with a transverse hole 40 connecting the hole 39 with the hole 37 in the sleeve 33*a* when the parts are in proper position. Surrounding the pin 38 and within the packing nut 36 is a packing 41 for obtaining a tight joint between the sleeve 33*a* and the pin 38. Also the pin 38 is provided with a transverse hole 42 through which means may be passed for the purpose of manipulating it. The boss 33 in the member 11 is drilled and tapped to receive a plug 43, this plug being in turn drilled and its lower end tapped to receive the lower threaded end 44 of the pin 38. The untapped portion of the plug 43 acts as a mechanical steadying means for the pin 38.

The upper ends of the joining faces of the members 10 and 11 are permanently closed by diaphragms 45 and 46 respectively. These diaphragms are secured in position in any suitable manner as by soldering or welding. The boss 33 of the member 11 is provided with a perforation 47 with which communicates the lower open end of the passage 39 in the pin 38 and this passage 47 is preferably in alignment with a corresponding passage 48 in the end of the member 10. A free passage is, therefore, assured between the inner portions of the members 10 and 11 with the passage 39 in the pin 38, and, thence through the holes 40 and 37 to a source of vacuum.

A fabric material 50 covers the entire surface of the members 10 and 11 composing the mandrel. This fabric 50 is shaped to form a seamless annular sleeve, and is fitted onto the mandrel by shrinking. The ends of the fabric sleeve 50 are attached to the joining ends or faces of the members 10 and 11 by retaining rings 51, held in position by screws 52.

In operation any suitable means is employed to support the mandrel during the immersing and other operations, but as this holding means form no part of the present invention, it has not been shown. As a preliminary operation, the mandrel, as shown in the drawings, (supported through sleeve 33*a* preferably) is dipped into a solution of clay or chalk, vacuum is applied inside the mandrel and a thin coat of clay or chalk 53 is deposited onto the fabric surface 50. This coating is then permitted to dry and the mandrel is ready for the deposition of the latex in the formation of the latex tube. With the vacuum (preferably but not necessarily) still applied to the interior of the mandrel, the mandrel is lowered into a tank containing an aqueous dispersion of rubber such as natural or artificial latex and either compounded or uncompounded. The combination of the clay or chalk deposit 53 and the fabric covering 50 acts as a proper filtering medium, so that the material held to the clay or chalk coating consists almost entirely of rubber globules together with a small amount of absorbed non-rubbers and the filtrate is a serum free from rubber. This filtrate or serum passes through the coating 53 and fabric 50 along the network of interstices or channels formed by the knurling or equivalent formation on the mandrel surface, thence through the perforations 29 and 12 into the interior of the mandrel and out through the passage 39 by reason of the vacuum applied through the hole 37. After a proper thickness of rubber is deposited to form a tube 55, the mandrel is removed from the tank and the tube 55 permitted to dry with the vacuum still applied to the mandrel. When the deposited tube is dried sufficiently to maintain its own form, the vacuum is removed and the tube, with the mandrel, is subjected to temperature in order to vulcanize the tube, suitable to the vulcanizing ingredients employed.

After vulcanization, the latex tube 55 is manually stripped from the mandrel and, in order to accomplish this operation, the pin 38 is removed from the sleeve 33*a*, thus disengaging the ends of the members 10 and 11. Upon this disengagement, the compression spring 26 tends to rotate the members 10 and 11 with respect to each other and separate the joining faces thereof. The sleeve 33*a* is now removed from the boss 32 by means of the nut 34. It will be noted that a hole is necessarily formed in the latex tube, because of the presence of the sleeve 33*a* and this hole in the tube is stretched over the end of the member 10 as indicated in Fig. 3. To facilitate

the removal of the tube 55, an air hose (not shown) may be inserted between the tube 55 and the member 10 at the point 56, as indicated by the arrow, and pressure applied through such hose. This application of pressure inflates the tube 55 to a greater volume than that occupied by the mandrel, with the result that the tube 55 is loosened from the mandrel and is in a condition to be more easily removed therefrom. In the removing operation, the air hose is held in place, as indicated by arrow 56, and is followed around with the tube 55, as such tube is progressively forced along the mandrel until the entire mandrel is emerged through the connector opening of the tube.

The object and utility of the plates 45 and 46 is now apparent, for upon application of air pressure to swell or inflate the tube 55 and loosen it from the mandrel, the presence of the plate 45 prevents the air from entering the interior of the member 11 of the annular mandrel. As can be seen from an inspection of Fig. 3, the air will pass between the tube 55 and the outer surface of the member 10 of the mandrel, and will follow around the mandrel, and in the absence of the plate 46 would enter such opening, reverse direction, follow within the interior of the member 11 and in the absence of the plate 45 would emerge in that opening.

The passage 47 will not permit escape of air to a great extent from the inflated tube, and, furthermore, the air introduced is usually of considerable volume, and is constant in application until the tube 55 is removed. After the tube 55 is removed, the stretched tube opening made by the sleeve 33*a* returns to its normal size, the tube is washed to remove any of the clay or chalk that may have adhered to the interior of the tube, and it is ready for the application of the valve base and valve stem. It should be noted that the hole in the tube made by the sleeve 33*a* is in such location that upon completion of the tube such hole may be covered by the base for the valve stem, which may be incorporated or applied in any suitable and convenient manner as for instance by cementing with an adhesive vulcanizable at room or elevated temperature. Upon removal of the tube 55, the sleeve 33*a*, and the pin 38 are adjusted to proper position, and the mandrel is ready to be used again in a similar cycle of operations, after being washed to remove the clay or chalk coating 53.

I have described my invention as being preferably adapted to facilitate the manufacture of endless tubes from latex or an aqueous dispersion of rubber, either natural or artificial. It is obvious, however, that my invention is not to be so limited, and, therefore, it is within the scope of my invention to utilize my improved articulated mandrel to facilitate the manufacture of endless tubes by alternately dipping the same into a body of latex or an aqueous dispersion of rubber, either natural or artificial, or I may dip the mandrel into a suitable coagulant and then dip it into a body of latex or an aqueous dispersion of rubber, either natural or artificial until the requisite thickness of material is deposited therein.

Further I am not limited to the use of latex, or an aqueous dispersion of rubber, either natural or artificial, but may utilize any coating material desired, in liquid or semi-liquid form. Further, the knurling on the surface of the mandrel and also the fabric cover, may be dispensed with where the desired endless tube is to be made by dipping.

Having thus described my invention, what I claim and desire to protect by Letters Patent is:

1. An improved mandrel for facilitating the manufacture of endless tubes by deposition from latex comprising, a plurality of arcuate members articularly united and having abutting ends, locking means therefor and means opposing said locking means for yieldingly holding the abutting ends out of engagement with each other.

2. An improved mandrel for facilitating the manufacture of endless tubes by deposition from latex comprising, a plurality of hollow arcuate members, articularly united to form an annular structure, and provided with perforations extending therethrough, abutting ends on said arcuate members, and locking means for the abutting ends providing a passageway for the application of a differential pressure to the interior of the arcuate members.

3. An improved mandrel for facilitating the manufacture of endless tubes by deposition from latex comprising, a plurality of hollow arcuate members, articularly united to form an annular structure, and provided with perforations extending therethrough, abutting ends on said arcuate members, locking means for the abutting ends providing a passageway for the application of a differential pressure to the interior of the arcuate members, and conduits in the abutting ends communicating with the interior of the arcuate members.

4. An annular mandrel comprising arcuate sections hinged together, means for locking a pair of free ends of said sections together, and means adjacent the hinged joint for exerting pressure on said sections to move the said locked ends away from each other when said locking means is in inoperative position.

5. An annular mandrel comprising arcuate sections, a connection between a pair of said section, means for holding a pair of adjacent ends of said sections adjacent to each other, and resilient means adjacent said connection for maintaining said adjacent ends in spaced relation when said holding means is made inoperative.

6. An annular mandrel comprising arcuate sections, a pivotal connection between a pair of said sections, an arm adjacent said connection being connected to one section and projecting into the other section of said pair of sections, locking means for joining the sections into an annular mandrel and resilient means acting on said arm for forcing the ends of said sections remote from said connection in directions away from each other and in opposition to the locking means when operative.

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