T. COOPER.

PROCESS AND APPARATUS FOR MAKING VACUUM OR PRESSURE CHAMBERS.

No. 184,462. Patented Nov. 21, 1876.

FIG 1.

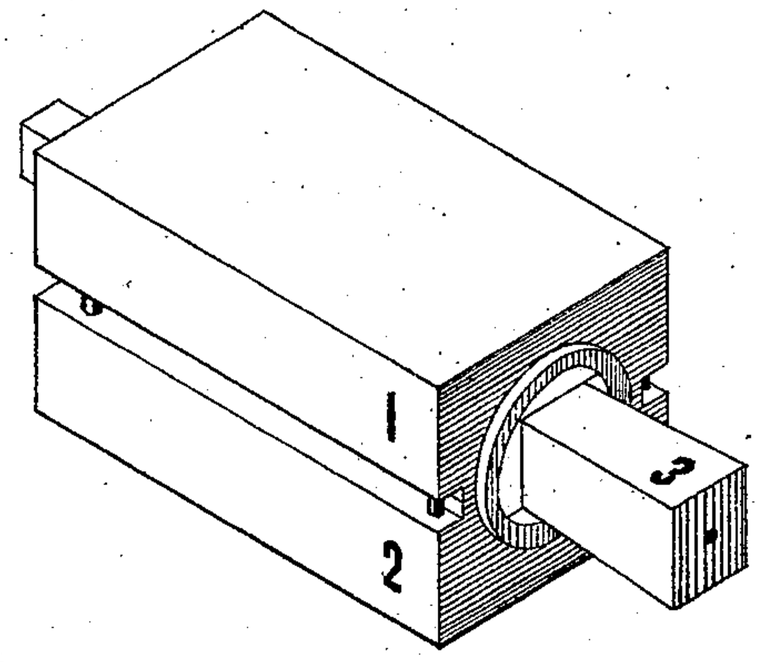


FIG 2.

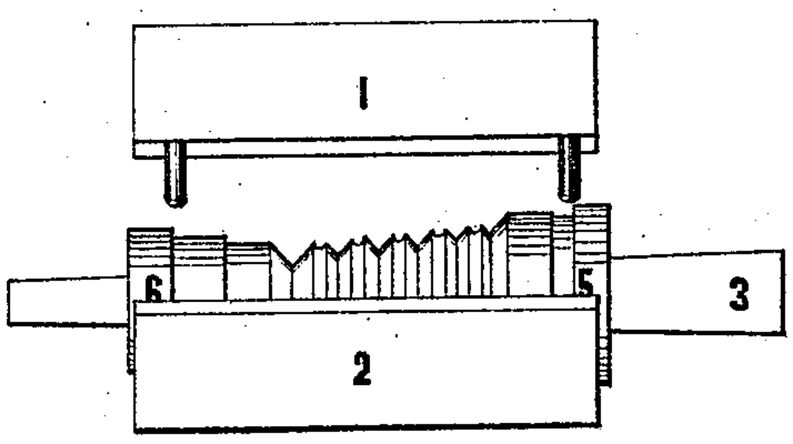


FIG 3.

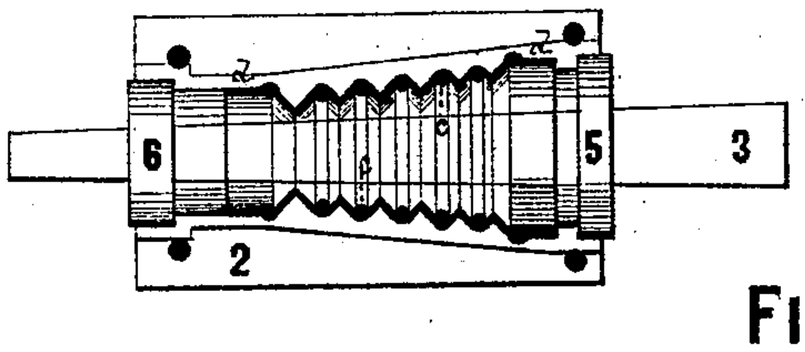


FIG 6.

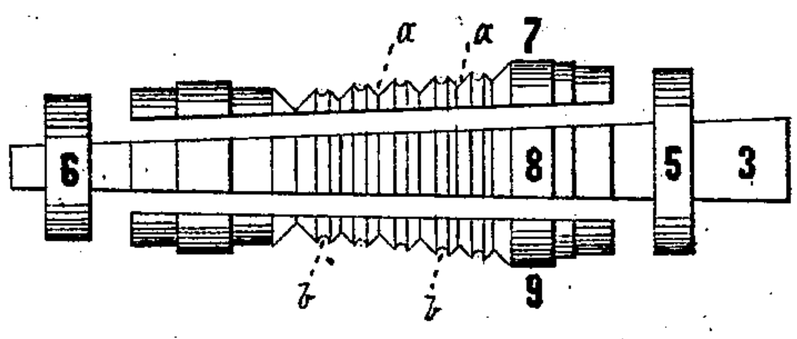


FIG 5.

FIG 4.

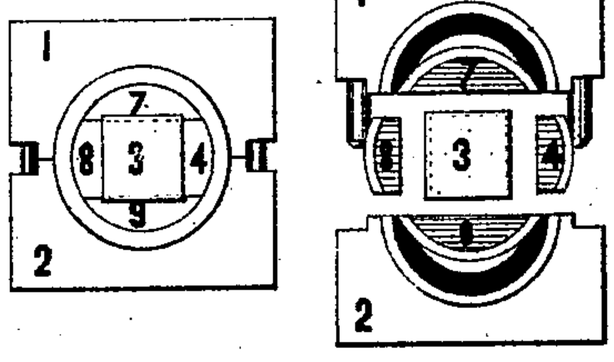
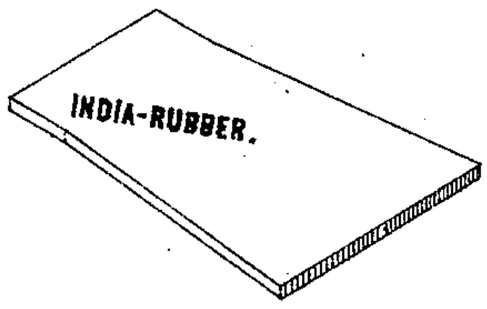


FIG 7.



WITNESSES.

Philip F. Larner

A. B. Cauldwell

INVENTOR.

Theodore Cooper

By Munn & Co

Attorneys

UNITED STATES PATENT OFFICE.

THEODORE COOPER, OF WARWICK, RHODE ISLAND.

IMPROVEMENT IN PROCESSES AND APPARATUS FOR MAKING VACUUM OR PRESSURE CHAMBERS.

Specification forming part of Letters Patent No. **184,462,** dated November 21, 1876; application filed April 6, 1876.

To all whom it may concern:

Be it known that I, THEODORE COOPER, of Warwick, in the county of Kent and State of Rhode Island, have invented certain new and useful Improvements in the Method of Making Longitudinally-Collapsible Vacuum or Pressure Chambers, and in the means employed therein; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part of the same, is a clear, true, and complete description thereof.

Collapsible chambers are widely useful in many connections. In some cases they are normally collapsed, and required to do service when subjected to internal pressure, and in other cases they are normally extended and required to perform service when contracted by external pressure incident to the exhaustion of the air therefrom. Under all circumstances it is desirable that they be constructed with as few joints as possible, so as to reduce leakage to a minimum, and that they possess powers of resistance against such collapsing or extending as is not requisite to enable the chamber to perform the required service.

My invention relates to such chambers as are composed in part of vulcanized rubber, and have the capacity of collapsing or expanding longitudinally, but are diametrically rigid. They are usually cylindrical in form, and have heretofore been variously constructed. Leather has been employed for the sides of these chambers, not only cut and stitched after the manner of cylindrical bellows, but also flatly secured to the heads of the chamber without special cutting and stitching. In this latter form there is, of course, a lateral as well as longitudinal collapsible movement. Elastic material has also been heretofore employed, such as vulcanized rubber, cylindrical sections of which have been clamped to intermediate flat metallic rings, which prevent collapsing.

The object of my present invention is the production in an economical manner of a longitudinally collapsible or extensible chamber composed of vulcanized india-rubber, which is seamless, and is thoroughly braced against internal or external lateral pressure, and is yet capable of freely expanding or contracting longitudinally; and my invention consists in molding the chambers with suitable braces or stiffeners properly located within the mold during the vulcanizing process, and in imparting to said chambers in the mold the configuration or outline which is requisite to secure the desired expansive or contractile capacity.

My invention further consists in the combination, with a sectional mold having annular scores or grooves, of a coring-arbor correspondingly scored or grooved, and also scored to receive annular braces or stiffeners, and which is also constructed in longitudinal sections, and provided with a central section or key, which, on removal, admits of the removal of all the sections from the interior of a chamber, having an interior surface corresponding with the exterior surface of the arbor.

My invention is specially valuable in the manufacture of longitudinally-collapsible chambers for use in connection with vacuum braking mechanism for railway-cars, and a portion of this description has special reference thereto.

To more particularly describe my invention, I will refer to the accompanying drawings, in which—

Figure 1 represents, in perspective, a mold and arbor embodying the mechanical features of my invention. Fig. 2 represents the same in side view, with the upper portion of the mold lifted. Fig. 3 represents, in top view, the lower portion of the mold with arbor in position, and also shows the collapsible chamber and its internal braces in section. Fig. 4 represents, in end view, the mold and coring-arbor. Fig. 5 represents the same with the several parts separated. Fig. 6 represents the arbor in side view, with parts thereof separated. Fig. 7 represents one of two sheets of rubber of the general form requisite for making a chamber.

The mold is formed in two parts, (shown at 1 and 2,) with dowels for securing proper relations of the parts with each other. The mold and arbor shown is for making a collapsible chamber which is smaller at one end than at the other, as is described and claimed in another pending application for Letters Patent filed by me. It will be seen that, when it is

desired to make chambers not thus tapered, the arbor and mold will be correspondingly varied in construction. For longitudinally-collapsible chambers, the annular scores or grooves in the mold and arbor are made of greater width than for longitudinally-extensible chambers.

The coring-arbor is made in four exterior longitudinal sections, respectively numbered in the drawings 4, 8, 7, and 9, with a tapered central key, No. 3, which, when in position, maintains the several exterior sections, so that they present an unbroken periphery at all points. The arbor is provided with two sets or series of scores or grooves. The larger ones, at *a*, inversely correspond with those in the mold which secure, in the collapsible chamber, its longitudinal collapsible capacity. The smaller grooves of the arbor, at *b*, are prepared to receive the metallic annular braces or rings, which, when within the flexible chamber, render it diametrically rigid. For a tapered chamber, these rings, as shown at *c*, Fig. 3, are of different sizes, graduated to correspond with the tapered form of the chamber.

At each end of the main portion of the arbor is a plain annular surface for the reception of two collars, (shown at 5 and 6,) which, by occupying recesses in the ends of the mold, serve to close the mold at the ends and assist in locating the arbor with reference to the interior surface of the mold. For furnishing the requisite necks at each end of the flexible chamber, for connection with suitable heads, the mold and arbor are provided with concentric plain annular surfaces at *d*, Fig. 3, by means of which said necks are formed with or without a beaded rib, as shown.

For making a longitudinally-collapsible chamber, two pieces of sheeted unvulcanized rubber of proper thickness, with an outline like that indicated in Fig. 7, are placed in the lower section of the mold. The several metallic rings or stiffeners are properly mounted on the arbor, which is then pressed into the opened section of the mold upon the sheet of rubber. Another sheet of similar form is then placed on top of the arbor, the top section of the mold placed thereon, and properly united with the lower section, after which the whole is placed in a vulcanizing-oven, and after a proper time removed, cooled, and taken from the mold. The tapered key 3 is then withdrawn longitudinally, followed by the removal of the smaller sections 4 and 8, after which the larger sections 7 and 9 are readily removed, leaving the seamless chamber perfect in its form, and with a generally uniform distribution of rubber at all points.

In some cases I employ an additional set of smaller stiffeners, located in each instance between those shown, and provide the arbor with suitable additional grooves to receive them. Instead of having a single thickness of rubber, it is sometimes desirable to employ two thicknesses, in which case one thickness is applied to the arbor beneath the metallic stiffeners, and the other thickness applied between the arbor and mold, as before described. Chambers of this class are as well adapted to operate with internal as under external pressure.

I am aware that it is not new to employ molds in the manufacture of hollow rubber goods, and that suction-hose and similar articles, for instance, are always provided with interior braces or stiffeners; but I am not aware that corrugated collapsible chambers, with interior annular stiffeners or braces located at intervals, have ever heretofore been molded; and

I therefore claim as new, and desire to secure by these Letters Patent—

1. The method of making flexible portions of chambers which are longitudinally collapsible or extensible and diametrically rigid, which consists in molding and vulcanizing the rubber of which said chambers are composed between correspondingly-corrugated surfaces, and in maintaining within the mold annular braces or stiffeners at proper intervals, substantially as described.

2. The combination, with a sectional mold having an interior conical or cylindrical surface, which is annularly scored or grooved, of a sectional coring-arbor, provided with annular scores inversely corresponding with those of the mold, and annular scores for the reception of annular braces or stiffeners, substantially as described.

THEODORE COOPER.

Witnesses:

J. C. B. WOODS,

THOMAS COSGROVE.