

No. 836,083.

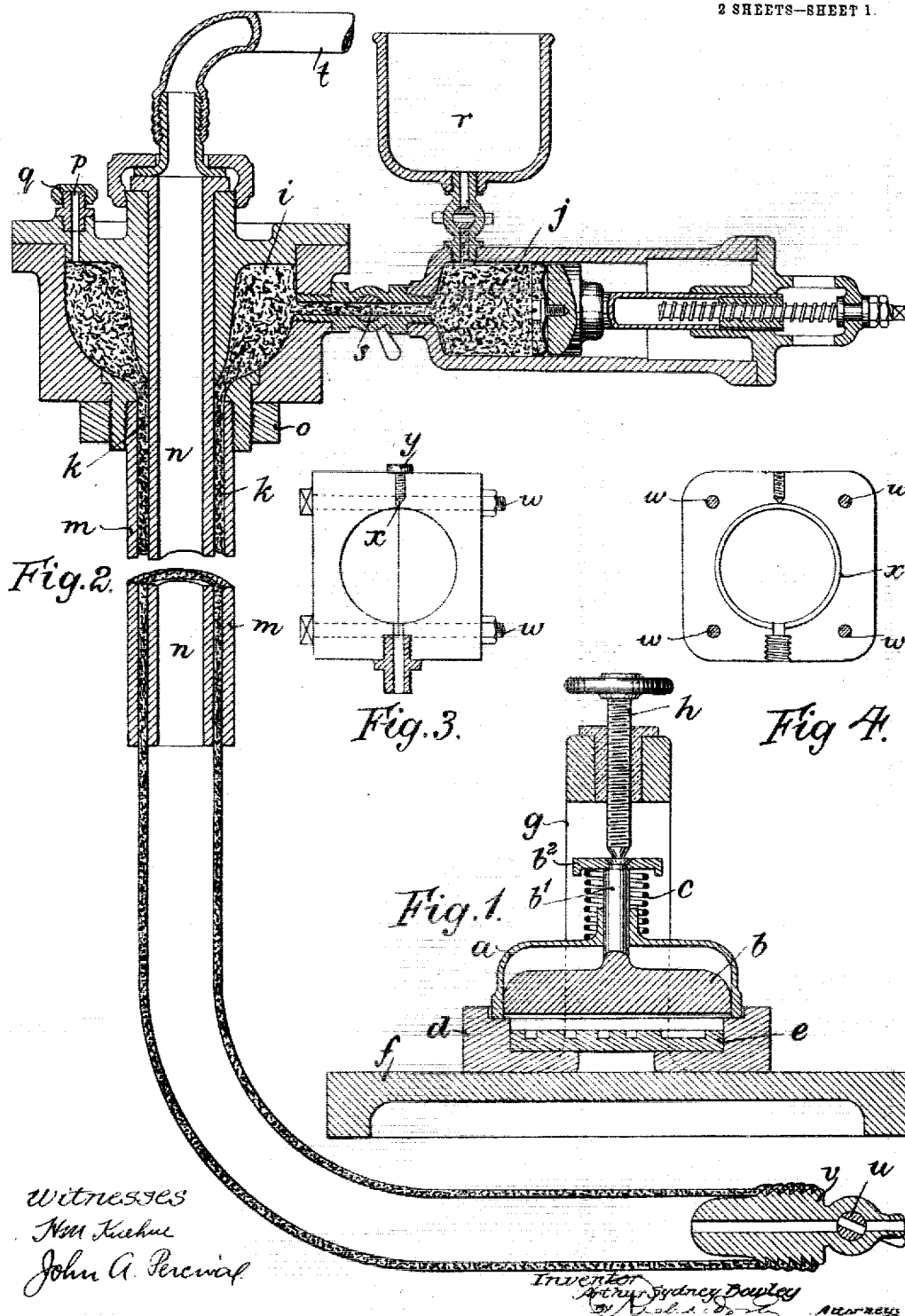
PATENTED NOV. 20, 1906.

A. S. BOWLEY.

PROCESS OF MANUFACTURE OF ARTICLES IN RUBBER AND FOR THEIR REPAIR.

APPLICATION FILED JUNE 30, 1905.

2 SHEETS—SHEET 1.



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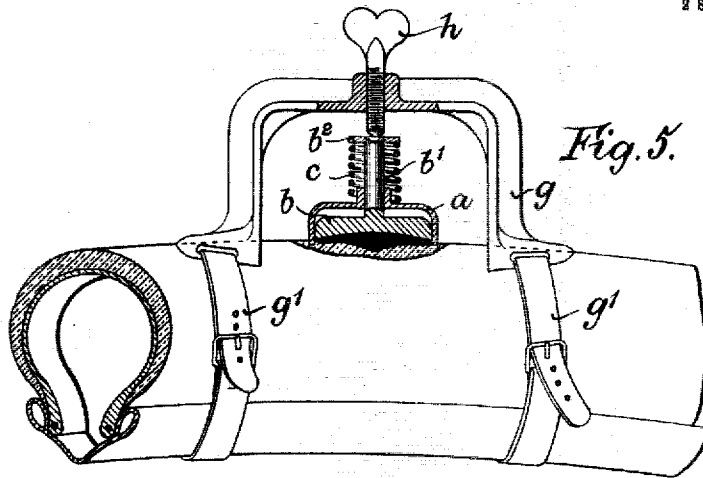


Fig. 5.

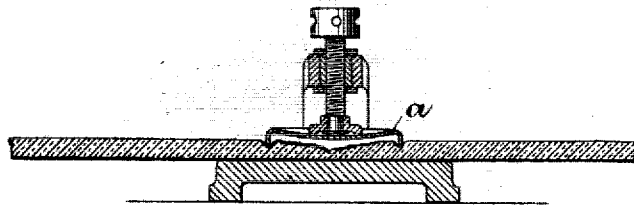


Fig. 6.

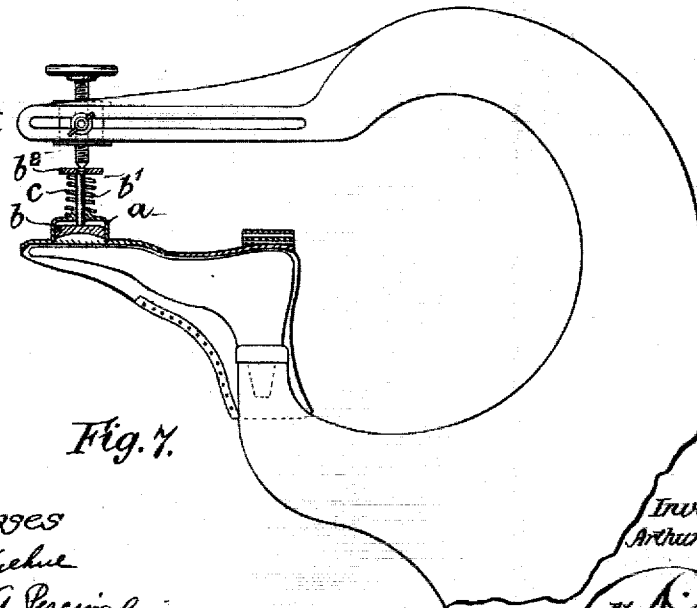


Fig. 7.

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PROCESS OF MANUFACTURE OF ARTICLES IN RUBBER AND FOR THEIR REPAIR.

No. 836,083.

Specification of Letters Patent.

Patented Nov. 20, 1906.

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To all whom it may concern:

Be it known that I, ARTHUR SYDNEY BOWLEY, a subject of the King of Great Britain, residing at 40 Werter road, Putney, in the county of Middlesex, England, have invented a new Process of Manufacture of Articles in Rubber and for Their Repair, of which the following is a specification.

This invention relates to a new process of manufacture of articles in india-rubber (caoutchouc) or in india-rubber compounds whereby they can be at once produced as a concrete uniformly-vulcanized mass molded to any desired shape, and the same process is applicable for repairing articles made of india-rubber or other pliable substances to which india-rubber will adhere.

The process consists in reducing natural rubber, which is unvulcanized or only slightly so, or rubber compounds to a state of division into comparatively small fragments, wetting the surfaces of the fragments with the well-known vulcanizing liquid, consisting, for example, of sulfur monochlorid largely diluted with bisulfid of carbon or other solvent of rubber, and treating the mass, which will for a short time have a very fluid character, in the same manner as molten metal is treated in the operation of casting it under pressure or in the process of what is called the "extrusion" of metals.

The molecular action by which the desired result is achieved is one which may be described as being midway between or a combination of what takes place with metals in the two processes of casting and welding, but without requiring the application of heat. The relative mobility of the particles, by which the mass is able to take any shape, is obtained by the division into fragments instead of rendering the mass liquid, and the subsequent coherence is due to the carbon bisulfid or other solvent employed acting as a flux in preparing and maintaining the surfaces of the fragments in a condition to coalesce when brought into intimate contact under pressure.

The success of the process depends on the possession by the carbon bisulfid of the following other properties besides that which enables it to do duty as a flux—namely: The solvent on account of its very volatile character serves to displace from among the mass any air which otherwise would occupy some portion of the cavity which it is desired should be filled by solid material.

Also the solvent serves as a medium for the uniform distribution throughout the mass of the required quantity of sulfur to effect the vulcanization, the sulfur being presented in a form possessing great affinity for the rubber. By this process the homogeneity of the vulcanization throughout the mass is more perfect and the degree to which the vulcanization is carried can be rendered more certain than in vulcanizing processes as at present practiced. The vulcanization action of the monochlorid of sulfur follows the solvent effect of the carbon bisulfid very rapidly, and it is therefore necessary that the means and arrangements for carrying out the process should be such as to minimize the delay in conveying under pressure the wetted fragments into the cavity or mold.

There are two kinds of uses to which this invention may be applied. In one the molded mass is required to detach itself or be detached from the mold by which it has been shaped, and in the other the mass is required to permanently occupy the cavity into which it has been forced and molded. As an example of this latter use of the invention may be mentioned the repairing of articles composed of material to which the rubber mass is adapted to become firmly attached. Accordingly it will be apparent that in the first-mentioned kind of use of the invention the mold and its surfaces are required to be so prepared as to facilitate the separation therefrom of the molded article. For this purpose in many cases the mold will be required to be made in detachable portions and previous to molding in many cases be covered with a thin parting-film. Glycerin, for example, will serve this purpose well. In the second use of the invention the surface of the cavity into which the rubber is to be molded should be prepared in such a way as to render it as adhesive as possible, and to promote the adherence the cavity may in many cases advantageously be undercut.

The accompanying drawings show means for practically operating the invention. These have been selected as representative examples.

Figure 1 is a vertical section of a mold and press for producing a disk bearing on one face a desired design in relief. Fig. 2 shows an apparatus wherewith a continuous seamless rubber pipe can be produced by the process of extrusion. Figs. 3 and 4 are two views of a mold adapted to produce a solid-rubber

ball. Fig. 5 shows apparatus adapted to effect the repair of the cover of a pneumatic tire without requiring its removal from the wheel. Fig. 6 shows an alternative form of mold as in operation on a tire-cover after removal from the wheel, and Fig. 7 shows an application of the process to the repair of the sole of a boot.

In Fig. 1 there is a cup *a*, fitted with a sliding piston *b*, to which is secured the rod *b'* and piston-head *b''*, there being interposed between *a* and *b'* a helical spring *c*, which tends to force the piston *b* to the inner end of the cup. The rim of the cup *a* is adapted to fit into a recess formed in a second cup *d*, which contains a die-plate *e*, whose surface carries the negative of the pattern required to be produced. The required pressure is effected by means of a press consisting of a base-plate *f*, an arch *g*, and screw *h*.

A sufficient quantity of the rubber fragments to produce the required article are inserted either in the cup *d* or cup *a*, or in both, and immediately after wetting the mass with the vulcanizing liquid pressure is applied by means of the screw *h*, a pressure being maintained by means of the interposed spring *c*.

A convenient form and method of production of the rubber fragments is that of threads produced by cutting up thin rubber sheeting. A mass of such thread-shaped fragments can be sustained within the cup *a* by means of two or more rubber bands made of the threads, which bands are stretched over the upper surface of the cup and beneath the hollow. The cup containing such a mass can be dipped into a vessel of the vulcanizing liquid and applied to the die without delay.

Referring next to Fig. 2, *i* is a chamber into which the semiliquid mass of fragments of rubber or rubber compound and vulcanizing and fluxing liquid is adapted to be forced from the chamber *j* of a screw-press. From the chamber *i* an annular escape-passage *k* is provided, formed between an external die-tube *m* and an internal die-tube *n*. The tube *m* is secured to the bottom of the chamber *i* by means of a nut *o*, and the internal die-tube *n* is secured to the cover of the chamber *i* in such a manner as to be truly concentric with the tube *m*. To insure this result, a short length of metal tubing of the same diameter and thickness as that of the rubber tubing required to be produced is temporarily interposed between the lower ends of the die-tubes *m* and *n* previously to tightening the connection of each to the chamber *i* and its cover, respectively. This tubular distance-piece is left in place to be thrust out by the squirted tube of rubber, after which the preceding portion of the tube under manufacture will serve to maintain the die-tubes truly concentric with one another. When starting the operation, the air in the chamber *i* is evacuated through the orifice *p*,

which is afterward closed by the cap *q*. Continuity in carrying out the process may be maintained by providing a feeding vessel *r*, into which additional material is placed and drawn into the chamber *j* of the screw-press by reversing the movement of its piston. Previously to taking in a fresh charge of divided rubber and vulcanizing liquid the stop-cock *s* is closed. To more effectually keep up the continuity of flow, the screw-press shown can be duplicated. The effect of mixing the fragments of rubber with the fluxing and vulcanizing liquor and forcing the mixture through the annular passage between the die-tubes *m* and *n* will be to cause it to consolidate and form a continuous seamless tube. The tube of rubber will emerge from the space between the die-tubes in a somewhat sticky condition in company with bisulfid of carbon or other solvent. For the purpose of removing the solvent from the interior of the tube a current of warm air is introduced by the pipe *t* and permitted to escape through a constricted opening in the plug *u* of a stopper *v* at such a rate as to keep the rubber tube under manufacture from collapsing, and the stream of air may convey chalk or other suitable dust to destroy the sticky condition of the interior surface of the tube. By means of a suitably modified form of this apparatus in which the interior die-tube *n* is omitted solid rods or threads of rubber may be manufactured of any transverse section by the process of extrusion.

Reference is next made to Figs. 3 and 4, wherein is shown a simple form of mold for consolidating a mass of divided rubber under pressure into a globular shape; but the process herein exemplified may be applied to the production in rubber or rubber compounds of an object of any desired configuration. To permit of the removal of the molded article, the mold is made in two separable halves which are united by screw-bolts *w w*. The halves are caused to register together by means of a centering-ring *x*, formed on one and a corresponding recess formed in the other. The material is introduced by means of a screw-press like that shown in Fig. 2, and preferably, but not necessarily, from below upward, the air being allowed to escape through an orifice which is subsequently closed by a screw-plug *y*.

The remaining figures refer to means for permanently filling cavities.

In Figs. 5 and 7, as in Fig. 1, there is a cup *a*, fitted with a sliding piston *b*, to which is secured the rod *b'* and piston-rod head *b''*, there being interposed between *a* and *b'* a helical spring *c*, which tends to force the piston *b* to the inner end of the cup. There is also provided some convenient form of press whereby with a screw or otherwise a pressure may be applied to force the cup and the

piston contained therein against the surface which is required to be repaired by filling the cavities or cuts which it may contain.

In Fig. 5 the press comprises an arch *g*, the two abutments of which are adapted to be fastened to the rim of the wheel by the straps *g' g'*, a thumb-screw *h* being fitted at the center of the arch. The surface to be mended having been cleansed and prepared, as before described, and the arch strapped to the wheel in the suitable position, the cup *a*, detached from the press, is filled with rubber fragments, and immediately after wetting the mouth of the cup is applied to the wound and the pressure applied by means of the thumb-screw. The excess bisulfid will ooze at the joints or be temporarily absorbed by the surrounding material and in a short time evaporate. The foregoing remarks apply also to the repair of a boot, as shown in Fig. 7, which shows a press the lower arm of which carries a boot-tree adapted to support the boot while under pressure.

Fig. 6 shows a more simple form of mold in which there is no piston, but only a shallow cup of metal thin enough to be flexible, and the required compression of the semiliquid mass is obtained by the combined effects of the deflection of the bottom of the cup toward the material to be repaired and the elastic deformation of the material which becomes temporarily squeezed into the cup.

To permit of the stopping and filling of cavities of various sizes and shapes, a series of cups of corresponding sizes and shapes are provided.

I claim—

1. A process for obtaining a concrete mass of consolidated vulcanized-rubber compound, in which rubber is reduced to fragments of which a sufficient quantity for the purpose is wetted with a vulcanizing liquid and forced into pressure-contact.

2. A process for obtaining a concrete mass of vulcanized-rubber compound consolidated

to a required configuration, in which rubber is reduced to fragments, of which a sufficient quantity for the purpose is wetted with a vulcanizing liquid and forced into pressure-contact.

3. A process for obtaining a concrete mass of consolidated vulcanized-rubber compound, in which rubber is reduced to fragments of which a sufficient quantity for the purpose is wetted with a vulcanizing liquid and forced into pressure-contact by constraint within a cavity.

4. A process for obtaining a concrete mass of vulcanized-rubber compound consolidated to a required configuration, in which rubber is reduced to fragments of which a sufficient quantity for the purpose is wetted with a vulcanizing liquid and forced into pressure-contact by constraint within a cavity.

5. A process for obtaining a concrete mass of vulcanized-rubber compound consolidated to a required configuration, in which rubber is reduced to fragments of which a sufficient quantity for the purpose is wetted with a vulcanizing liquid and forced into constraint within a cavity whose boundary, with which the rubber fragments make terminal contact, determines the configuration effected and maintained under an elastically-applied pressure.

6. A process for obtaining a concrete mass of consolidated vulcanized-rubber compound to permanently occupy a cavity, in which rubber is reduced to fragments, of which a sufficient quantity for the purpose is wetted with a vulcanizing liquid and forced into the cavity and maintained therein under a temporarily-applied elastic pressure.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ARTHUR SYDNEY BOWLEY.

Witnesses:

THOMAS ALFRED HEARSON,
WALTER J. SKERTEN.