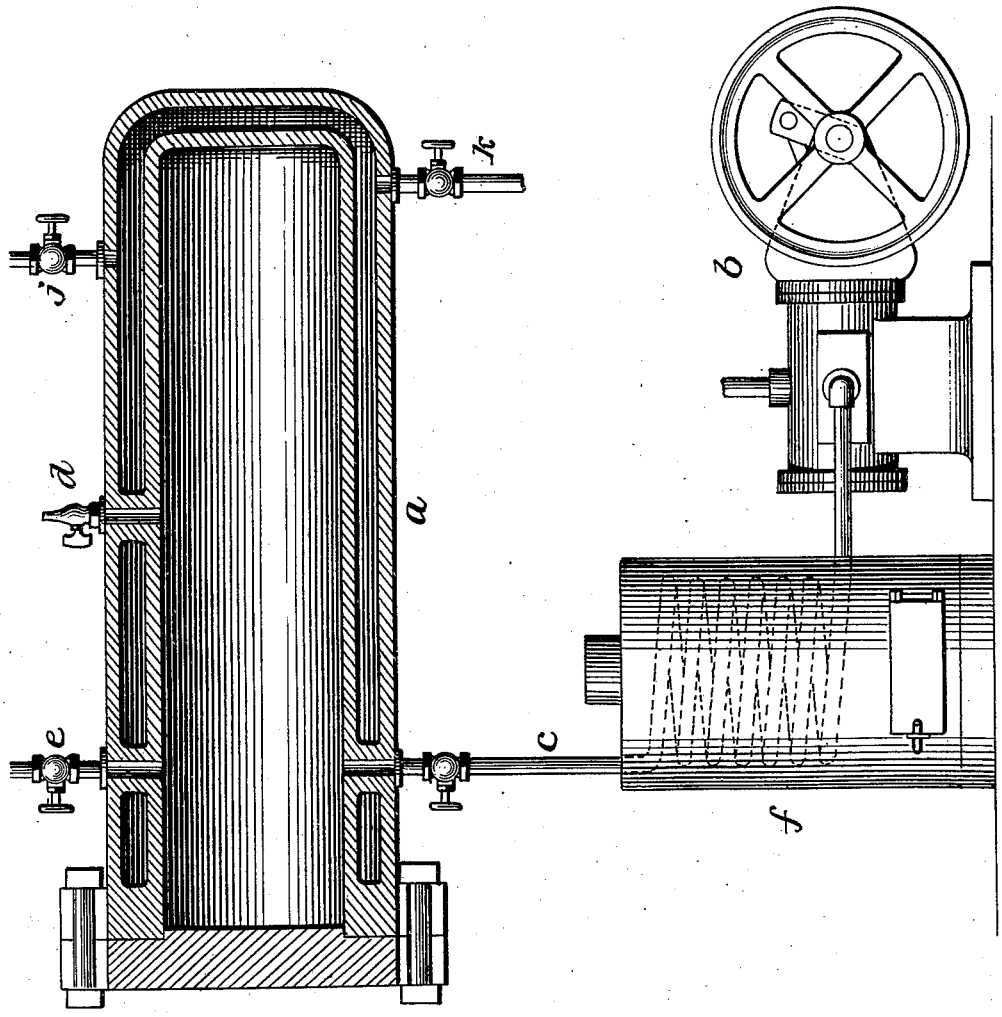
No. 676,350. Patented June 11, 1901.

A. O. BOURN.

PROCESS OF VULCANIZING.

(Application filed Mar. 15, 1901.)

(No Model.)



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AUGUSTUS O. BOURN, OF BRISTOL, RHODE ISLAND.

PROCESS OF VULCANIZING.

SPECIFICATION forming part of Letters Patent No. 676,350, dated June 11, 1901.

Application filed March 15, 1901. Serial No. 51,302. (No specimens.)

To all whom it may concern:

Be it known that I, AUGUSTUS O. BOURN, a citizen of the United States, residing at Bristol, in the county of Bristol and State of Rhode Island, have invented certain new and useful Improvements in the Process of Vulcanizing, of which the following is a specification.

My invention relates to the vulcanizing of articles of rubber; and it consists of a process whereby preliminary to the act of vulcanizing I subject the articles to be vulcanized first to a pressure, which may be a high pressure—as, for instance, ten to one hundred pounds to the square inch—but at a temperature below that necessary for vulcanization, and thereafter subject the articles to a vulcanizing temperature.

The first treatment under a high pressure, but at a comparatively low temperature, is by air or other inert gas—that is, a gas that will not in any way combine with the constituents of the rubber or rubber compounds—for instance, air, nitrogen, or carbonic-oxid gas—and the vulcanizing may be effected by either of the well-known air or steam processes. When the steam process is used, these two operations may be performed in the same cylinder or vessel. When the air process is used, the preliminary pressure may be performed in a vessel which is capable of supporting a high internal pressure, and after the articles have thus been properly treated they may be removed to an ordinary vulcanizing-oven, where they can be vulcanized, as usual.

In the accompanying drawing I have shown a vessel and means whereby both steps of the process may be performed, the said vessel *a* being of sufficient strength to support the desired pressure and a pump *b* serving to force the air through the pipe *c* into the vessel *a*. The air in the vessel *a* is heated to or maintained at the proper temperature (less than the vulcanizing temperature) by a steam-jacket which surrounds the vessel and communicates with a steam-inlet pipe *j* and outlet *k*, or proper means are employed for heating the air to the proper temperature before introducing it into the vessel *a*—as, for instance, a heater *f*, through which the pipe *c* extends in coils—or both means may be employed. The pressure of the inert fluid or gas may be any pressure above the atmospheric pressure up to one hundred or more pounds. The amount of pressure and the time it is continued vary largely with the character of the articles to be treated. I have found excellent results from subjecting the article—a rubber shoe, for example—to a pressure of from thirty-five to fifty pounds at temperatures varying from the atmospheric temperature to about 220° Fahrenheit during a period of thirty to fifty minutes, the pressure being diminished as the temperature increases until the pressure is reduced to about five pounds. After the articles have thus been subjected to an air-pressure at a comparatively low temperature for a sufficient length of time the communication with the pump *b* is cut off, a cock *d* is opened to permit the escape of the air, and steam is then admitted through a pipe *e*, and the process of vulcanization is completed in the usual manner.

I find that by first submitting the articles before being acted on by the vulcanizing temperature to the compacting pressure of an inert gas at a temperature less than vulcanizing temperature they are much stronger than would result from any of the ordinary vulcanizing treatments. This is especially the case with a large variety of compounds of rubber, which are better adapted to be vulcanized by the steam process than by the air process. Further, it is impossible by the use of steam in many instances to have the pressure sufficient to thoroughly compact the articles without at the same time having a temperature high enough for vulcanizing them, and therefore I can secure the benefit of the use of steam for vulcanizing by first compacting the articles at a low temperature with an inert gas, as set forth.

By my improved process I secure the above-named advantages without discarding the ordinary apparatus, which may be employed for the final vulcanization by the air process, it being only necessary to provide small compression vessels to be used in connection therewith.

Without limiting myself to the use of any special apparatus or to the pressures and temperatures set forth, I claim as my invention—

1. The within-described improvement in the art of vulcanizing, consisting in first compacting the articles by subjecting the same to

the pressure of an inert gas at less than a vulcanizing temperature, and thereafter vulcanizing the same, substantially as set forth.

2. The within-described improvement in the art of vulcanizing, consisting in first subjecting the articles to be vulcanized to the pressure of an inert gas at less than a vulcanizing temperature, and thereafter vulcanizing the same by heated gas or vapor, substantially as set forth.

3. The within-described improvement in the art of vulcanizing, consisting in first subjecting the articles to be vulcanized to the action of an inert gas at a high pressure and less than vulcanizing temperature, and thereafter to the action of air or steam at a vulcanizing temperature, substantially as set forth.

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

AUGUSTUS O. BOURN.

Witnesses:

STEPHEN W. BOURN,

HAROLD H. BEDELL.