

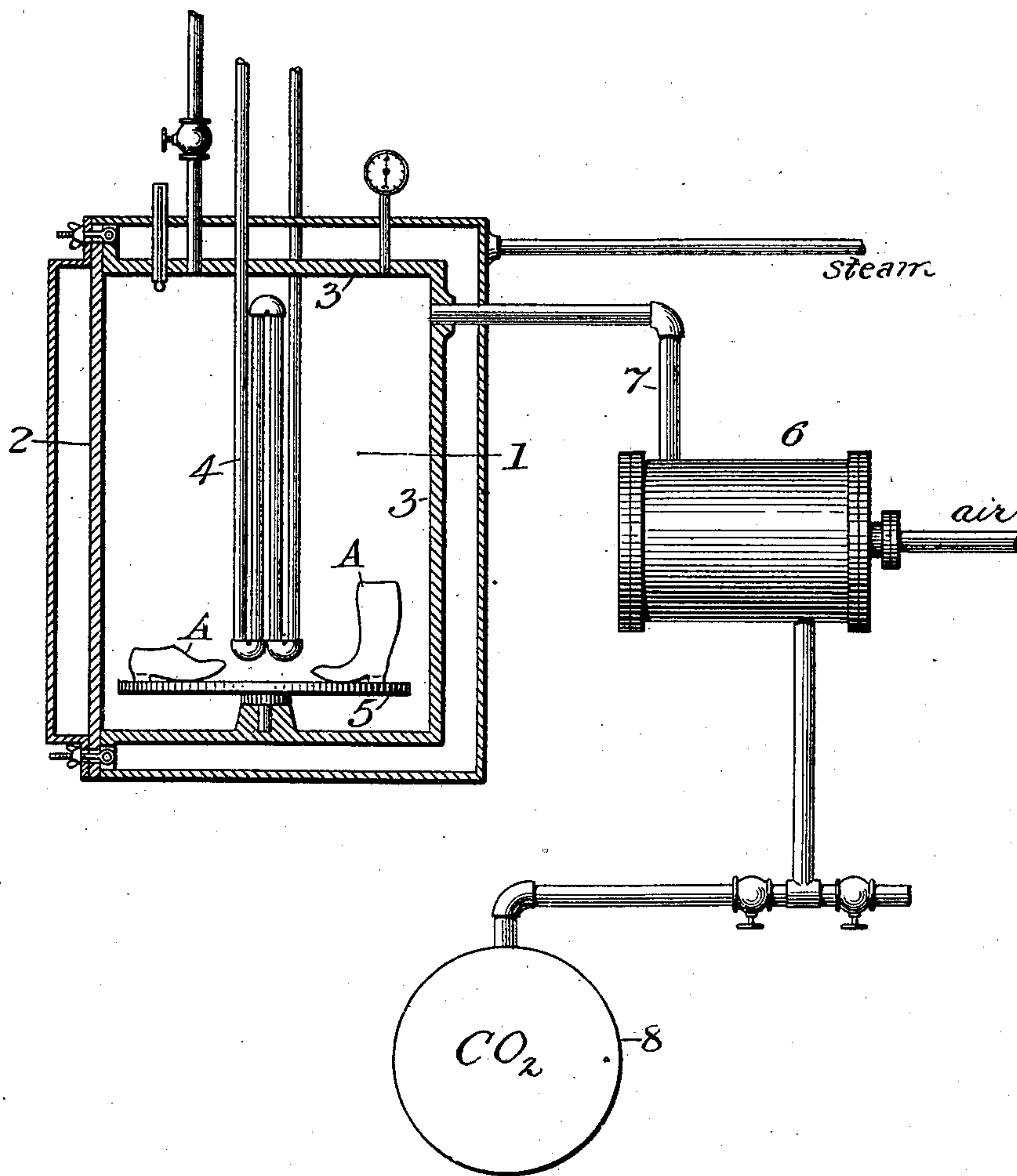
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W. G. HILL, JR.
PROCESS OF VULCANIZATION.

(Application filed Jan. 9, 1900.)

(No Model.)



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UNITED STATES PATENT OFFICE.

WILLIAM G. HILL, JR., OF MALDEN, MASSACHUSETTS.

PROCESS OF VULCANIZATION.

SPECIFICATION forming part of Letters Patent No. 661,177, dated November 6, 1900.

Application filed January 9, 1900. Serial No. 826. (No specimens.)

To all whom it may concern:

Be it known that I, WILLIAM G. HILL, Jr., a citizen of the United States, residing at Malden, in the county of Middlesex and State of Massachusetts, have invented a new and useful Process of Vulcanization, of which the following is a full, clear, and exact description.

The object of this invention is the production of a new process of vulcanizing india-rubber and allied gums, such as gutta-percha, &c.; and my process consists, essentially, in exposing the articles in an atmosphere of air or other dry gas maintained at a pressure and at a high temperature.

Previous to my invention it has been the custom in what is known as the "dry" process to place the articles within a hot room and there keep them exposed to a high temperature for many hours, or, by what is termed the "wet" process, to subject the articles to the action of live steam, or, by what may be called the "mold" process, heating each article in a confining-mold. Each of these three methods is objectionable in certain directions. The dry process requires the rubber compound to be subjected to the vulcanizing-heat for many hours, thereby causing a deterioration in the rubber and in the fabric which may be used therein. The wet process is found to be so injurious to any fabric in such articles as to be wholly out of the question for the treatment of many rubber boots and shoes and rubber-covered textiles. The mold process must be restricted to only such articles as can be contained in molds.

By my process all the above objections and others not yet enumerated are wholly overcome, while, on the other hand, I obtain certain other decided advantages hereinafter set forth.

Referring to the drawing, forming part of this specification and which illustrates a form of apparatus by means of which my process can be carried into effect, the numeral 1 indicates a hot room or retort provided with a door 2, adapted to be made air-tight and heated by means of an outer jacket filled with steam and by a steam-coil introduced within the retort. This steam-coil 4 is preferably located at the center of the hot room or retort, and the articles to be treated, as the rubber-shoes A illustrated, are placed upon a rotating

table 5, by which they are slowly carried about within the hot room, and thereby more evenly subjected to the heat striking them from the said coils and the walls 3. This prevents certain parts of the articles from receiving more heat than others, and thereby being unevenly vulcanized. While this movement of the articles being vulcanized is an important feature, the essential step thereof is the increasing of the pressure within the hot room to several atmospheres, this being done by means of a pump 6 or other means adapted to force dry air therein through a suitable conduit 7.

The manner in which I carry out my process is as follows: Having placed the articles to be vulcanized upon the revolving table or platform in the hot room and tightly closed the door, the pump is set in motion and air or other dry gas forced into the room until the pressure therein reaches from thirty to one hundred pounds per square inch. At the same time the above-described heating means brings the temperature within the hot chamber to from 240° to 300° Fahrenheit. These conditions of heat and pressure being maintained until vulcanization is complete, the time required varying from a few minutes to from one to two hours, according to the character of the article being treated, and the platform or table having been made to uniformly continue its motion, the articles will be found to be perfectly vulcanized, and nothing remains but to open the door and remove them.

As a further improvement in my process I substitute carbon dioxid for the air, said gas being in a dry state and drawn from any suitable source, as the tank 8, and forced by the pump 6 into the hot room. This carbon dioxid (CO₂) serves to exclude all atmospheric oxygen from the articles being treated. This is a point of the greatest importance, there always being more or less moisture in or upon the rubber or the fabric combined therewith, with which moisture and the sulfur in the compound the oxygen unites to produce sulfuric acid, and it is this acid which is the most active agent in the deterioration of the rubber and fabric.

By the substitution of carbon dioxid (an inert gas) for atmospheric air in the hot room I obviate the objectionable features above

noted, even when the gas is not forced into the room under pressure; but when the carbon dioxid is admitted under pressure I obtain other advantages hereinafter mentioned.

5 For instance, among the most important results obtained by the use of carbon dioxid I find that I can produce even from Central American, African, or other inferior grades a rubber of notably-increased tensile strength
10 and elasticity and that the strength and elasticity of the finer grades, such as Para rubber, are also greatly increased.

Among other advantages possessed by my process are the following: First, the pressure
15 of the air or other gas upon the surface of the article being treated becomes, in effect, an air-mold, which serves to wholly prevent porosity of the rubber. The reason is this: Porosity is caused by a chemical production of gas
20 within the rubber, or by the expansion when heated of the air mixed in the dough originally, or by the vaporization of moisture contained in the compound. The surface pressure on the rubber by preventing the expansion
25 of these gases or air prevents such porosity, and thereby renders the vulcanized article firm, strong, durable, and impervious to water. Further, by enveloping the articles being vulcanized in a dense dry atmosphere a
30 higher temperature can be maintained in the hot room without injury to them, consequently reducing to a minimum the time required for their treatment. Hence articles which necessitate from six to eight hours when treated by
35 the old dry process I am able to vulcanize in from one to two hours, thus considerably reducing the cost of rubber goods.

Compared with the mold process my method shows equally pronounced advantages. Said
40 process, while well adapted for preventing porosity, is restricted to a comparatively-limited range of articles. The cost of the molds is large. Much valuable time must be expended in the labor of applying and removing them from the articles. In my process,
45 since the pressure of the enveloping air or gas upon the entire surface of the article being treated acts, in effect, as a mold, I obtain all the advantages of the latter, with absolutely none of its disadvantages.
50

In the manufacture of rubber boots and shoes, for which my process is especially designed, it is necessary to vulcanize every such article with a last therein. My process by
55 so greatly reducing the time of vulcanization, and consequently the time during which the

lasts must remain in each lot of shoes, enables the work to be performed with a greatly-lessened expenditure for lasts.

To recapitulate: My process preserves the
60 quality of the rubber and fabric used therewith, both through the great shortening of the time during which they are subjected to heat and through the entire absence of free oxygen when carbon dioxid is used. Porosity
65 is wholly prevented. A cheap grade of rubber is made to equal the product of a much higher grade. Time is saved, heating-bills reduced, and better results achieved generally.

In a companion application I have claimed
70 the employment of carbon dioxid, (or other inert gas,) either with or without pressure, for the purposes described and under the conditions set forth, for which reason I do not claim the same herein, save as such use is
75 broadly covered by certain of the generic claims.

What I claim as my invention, and for which I desire to secure Letters Patent, is as follows, to wit:

1. The process of vulcanizing rubber and allied gums, which consists in surrounding
80 with gas the substance to be vulcanized, heating the gas to a temperature sufficient to vulcanize the substance, and subjecting the gas
85 to pressure irrespective of that which may be due to the expansion of the gas by heat; substantially as described.

2. The process of vulcanizing rubber and allied gums, which consists in surrounding
90 with air the substance to be vulcanized, heating the air to a temperature sufficient to vulcanize the substance, and subjecting the air to pressure irrespective of that which may be
95 due to the expansion of the air by the heat; substantially as described.

3. The process of vulcanizing rubber and allied gums, which consists in surrounding
100 with gas the substance to be vulcanized, heating the gas to a temperature sufficient to vulcanize the substance, and subjecting the gas to a pressure of from thirty to one hundred pounds per square inch; substantially as described.

In testimony that I claim the foregoing invention I have hereunto set my hand this 4th
105 day of January, 1900.

WILLIAM G. HILL, JR.

Witnesses:

ERNEST O. HILER,
C. E. MERRILL.