

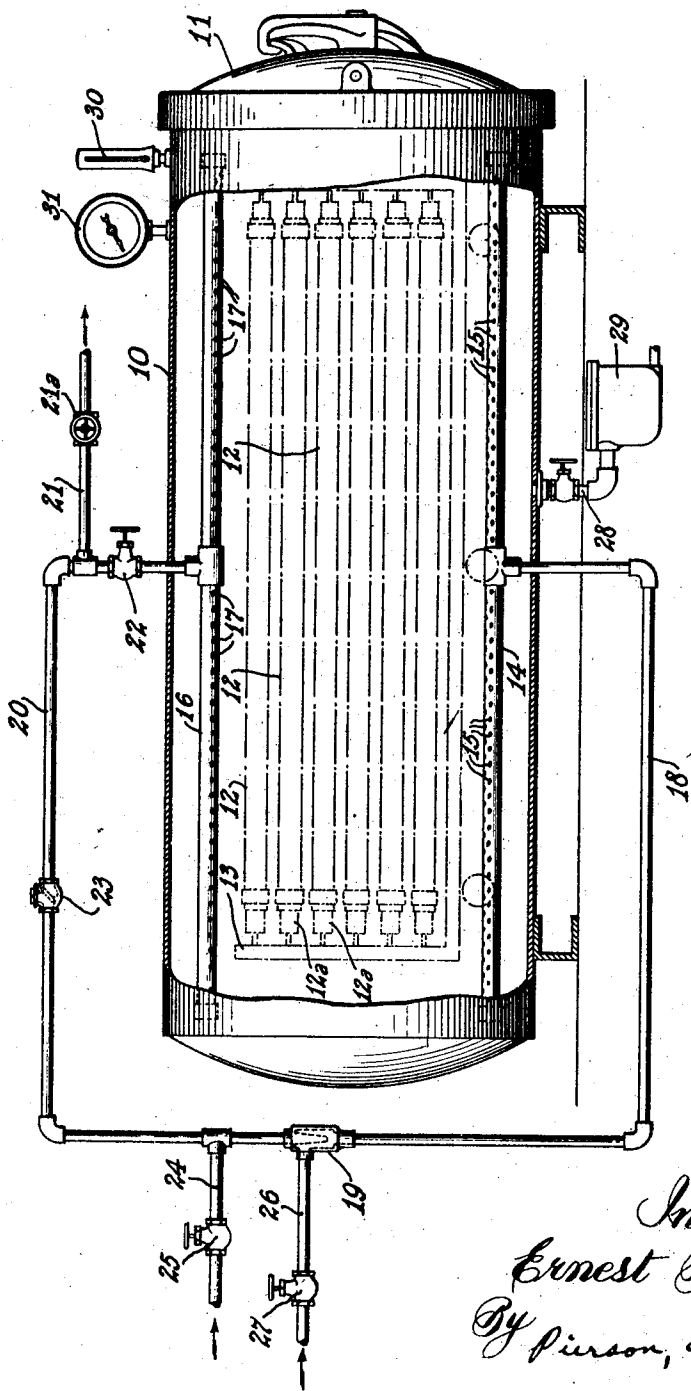
June 30, 1931.

E. BLAKER

1,812,282

VULCANIZER AND METHOD OF VULCANIZING

Filed July 19, 1928



Inventor,
Ernest Blaker
By Pearson, Eakin & Avery
Attys.

UNITED STATES PATENT OFFICE

ERNEST BLAKER, OF AKRON, OHIO, ASSIGNOR TO THE B. F. GOODRICH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

VULCANIZER AND METHOD OF VULCANIZING

Application filed July 19, 1928. Serial No. 293,910.

This invention relates to the vulcanization of rubber articles in a mixture of gases such as air and steam, as in the case of employing steam at a suitable partial-pressure to give the desired vulcanizing temperature and air at a suitable partial-pressure to provide a total pressure of air and steam adequate to compact the article.

In vulcanizing inner tubes upon mandrels, for example, it is desirable to provide thorough and uniform admixture of the air and steam throughout the interior of the vulcanizer from the beginning of the operation, while the pressure is being built up, in order to avoid unequal heat-softening and unequal vulcanization of the articles, and my chief objects are to provide improved procedure and apparatus for that purpose and to provide a suitable ratio of the fluids and an improved schedule of temperature and pressure.

The single figure of the accompanying drawing is a side elevation of apparatus embodying and adapted to carry out my invention in its preferred form, part being broken away and in section.

Referring to the drawing, 10 is a horizontal vulcanizer of the usual single-wall construction and 11 is a hinged door at one end thereof. The work, here shown as consisting of inner tubes 12, 12 built upon cylindrical mandrels 12^a, 12^a, is mounted upon a wheeled truck 13. The tubes 12 have their respective ends tightly bound to the mandrels with moist tape, the intermediate portion of the tube being unconfined and exposed.

Positioned inside the vulcanizer 10 along the bottom thereof is an inlet manifold 14 comprising a horizontal pipe having its upper side formed with apertures 15, 15, and a similar pipe 16 formed with apertures 17, 17 on its under side is positioned along the top of the vulcanizing chamber and comprises an outlet manifold therefor.

The inlet manifold 14 is connected at its middle with a supply pipe 18 which leads through the vulcanizer wall from the outlet port of an injector 19. The outlet manifold 16 is connected at its middle with a pipe 20 which extends through the vulcanizer wall to the suction-inlet port of the injector 19.

A vent pipe 21 provided with a shut-off valve 21^a branches from the pipe 20, and the latter, between the vent pipe 21 and the vulcanizer, is provided with a shut-off valve 22. Beyond the vent-pipe 21 the pipe 20 is provided with a check-valve 23 to prevent movement of fluid through the pipe 20 toward the vulcanizer, and between said check-valve and the injector 19 the pipe 20 is connected to a high-pressure air line 24, the latter being provided with a shut-off valve 25. The pressure-inlet port of the injector 19 is connected to a high-pressure steam line 26 which is provided with a shut-off valve 27. The vulcanizer 10 is provided with a drain-pipe 28 leading to a steam-trap 29, and also with temperature and pressure gauges 30 and 31 respectively.

In the operation of the apparatus, after the work 12 has been wheeled into the vulcanizer, the door 11 is closed and sealed; the valve 21^a in the vent-pipe 21 is closed, and the valve 22 is opened or allowed to remain open. The valves 25, and 27 are then opened to admit compressed air and steam to the injector 19, wherein they are intimately mixed and so that they pass as a composite fluid to the inlet manifold 14, from which they are distributed throughout the length of the vulcanizer 10 at substantially its lowest point. The check-valve 23 prevents air from the pipe 24 from passing through the pipe 20 to the vulcanizer, yet permits air from the latter to be drawn through the pipe 20, by reason of the increasing pressure within the vulcanizer and the suction set up by the injector 19, and to mix with the composite fluid flowing from said injector. The arrangement is such that the air and steam are intimately mixed before they enter the vulcanizer, and by effecting withdrawal of air from the top of the vulcanizer as the composite fluid enters the bottom thereof, I obtain a uniform distribution of the composite fluid within the vulcanizer, and any of said fluid which may be drawn off through the pipe 20 is returned to the vulcanizer by reason of the closed circuit comprising the pipes 18, 20 and injector 19.

The valves 25, 27 preferably are opened

to such extent with relation to each other that the air-steam mixture within the vulcanizer attains a temperature of 220° and a pressure of 75 pounds in about 7 minutes. The air-
 5 valve 25 is then closed and steam alone is permitted to continue to flow into the vulcanizer until a temperature of 290° is obtained therein, at which time the pressure will be 120—125 pounds, and this condition is maintained for
 10 about 5 minutes. In the operation as thus far described the unvulcanized rubber of the tubes 12 softens under the effect of the heat and concurrently is compressed by the composite fluid, with the result that all air
 15 entrapped within the tube is greatly reduced in volume and the tubes are compacted against the mandrels.

The valve 21^a in the vent-pipe 21 is then opened for a time to permit the escape of composite fluid to reduce the pressure thereof in
 20 the vulcanizer, the valve 27 remaining open to maintain the vulcanizing temperature therein. When, after 5 or 6 minutes, the pressure has dropped to about 55 pounds, the
 25 vent-pipe is closed, and the drain pipe 28 is opened to permit the escape of any water of condensation from the vulcanizer, through the steam trap 29, and approximately the
 30 then existing condition of temperature and pressure is maintained in the vulcanizer until the work is completely vulcanized, by control of the steam inlet, although some of the air remaining in the vulcanizer escapes the steam trap.

35 At the end of the vulcanization the valve 27 is completely closed and the valves 21^a and 22 are opened to vent the vulcanizer, after which the vulcanizer is opened and the work removed, and the operation as described is repeated.
 40

The concurrent injection of the air and steam from the beginning assures that the work will be adequately compressed as it softens, before a surface skin has been vulcanized thereon, as is likely to occur when the
 45 steam in substantial quantity is admitted to the vulcanizer before the air. Removal of the air from the vulcanizer after vulcanization starts avoids the possibility of oxidation of the rubber, and expedites vulcanization, since better heat transfer is obtained from steam alone than from an air-steam mixture.

The initial mixing of the steam and air by means of the injector, and also the withdrawal
 55 of air from the vulcanizer and the circulation of the mixture through the vulcanizer by means of the injector, assures a uniform mixture, which is to say a uniform distribution of each of the fluids throughout the interior of the vulcanizer so that local cool
 60 spots or air pockets are avoided.

Modifications of my invention are possible within the scope of the appended claims.

I claim:

65 1. The method of vulcanizing rubber arti-

cles which comprises enclosing the articles in a vulcanizer, mixing a heating fluid and a pressure fluid, conducting the mixture into the vulcanizer the rubber articles therein being exposed to the mixture, and concurrently
 70 withdrawing fluid from the vulcanizer and adding it to the mixture of fluids passing into the vulcanizer.

2. A method as defined in claim 1 in which fluid is withdrawn from the vulcanizer and
 75 added to the mixture of fluids passing into the vulcanizer, in part, at least, by the kinetic energy of the said mixture.

3. The method of vulcanizing externally unconfined rubber articles which comprises
 80 applying to the articles a mixture of air and steam and thereafter lowering the pressure while maintaining a vulcanizing temperature by replacing a part of the mixture with steam.
 85

4. In a vulcanizer the combination of a vulcanizing receptacle having an inlet and outlet, a piping circuit connecting said inlet and outlet, and means for admitting fluid pressure to said circuit, said means being so
 90 arranged that the admission of said fluid induces a circulation of fluid through the vulcanizing receptacle and piping circuit.

5. In a vulcanizer the combination of a vulcanizing receptacle, an inlet and an outlet manifold therefor, a piping circuit connecting said inlet and outlet manifolds, an injector in said circuit, and a fluid pressure line so connected with said injector as to induce a circulation of fluid within the vulcanizing receptacle and piping circuit when pressure fluid is admitted to the injector.
 100

6. In combination, a vulcanizing receptacle having an inlet and an outlet, a circuit of piping connecting said inlet and outlet, an injector in said piping circuit, and two pressure-fluid lines connected with said piping circuit in such relation to the injector as to cause fluids flowing therefrom to the injector to be intimately admixed in passing there-
 105 through.
 110

In witness whereof I have hereunto set my hand this 5th day of July, 1928.

ERNEST BLAKER.

115

120

125

130