

# UNITED STATES PATENT OFFICE.

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PROCESS OF RECLAIMING RUBBER FROM WASTE-RUBBER GOODS.

SPECIFICATION forming part of Letters Patent No. 419,697, dated January 21, 1890.

Application filed December 3, 1889. Serial No. 332,454. (No specimens.)

*To all whom it may concern:*

Be it known that I, NATHANIEL C. MITCHELL, of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and useful Improvement in the Process of Reclaiming Rubber from Waste-Rubber Goods, which improvement is fully set forth in the following specification.

This invention has reference to the art or process of recovering rubber from waste-rubber goods. The bulk of the waste stock collected and sold by junk-dealers consists of old boots and shoes, which may be taken as a fair sample of the articles treated according to this invention. When received at the factory, this stock contains much dirt and sand, not only on the surface but ground into the fabric. The rubber has a backing of fibrous material—sometimes cotton and sometimes wool—upon which it has been vulcanized, and to which it therefore adheres tenaciously, the fiber being to some extent impregnated with the rubber which is to be recovered. It also contains much metal in the shape of buckles, nails, stiffeners, &c. All these and other foreign substances which are unavoidably mixed with the stock have to be separated and removed from the rubber, and the latter must be treated in a special way to bring it again to a condition resembling crude gum susceptible of vulcanization.

By long-continued effort and experiment I have succeeded in developing a process whereby this waste stock can be treated with certainty and in an economical manner, removing all foreign matters of every description from the rubber, and without appreciable loss thereof, and resulting in a uniform and satisfactory product. Such process, including the various steps or operations in their proper sequence, constitutes the present invention, the restored or reclaimed rubber which is the product thereof being now a recognized marketable commodity known to the trade as "Mitchell rubber."

In a series of applications filed September 20, 1889, I have described apparatus for acting upon the stock at different stages of the operation, and these applications may be referred to for descriptions of apparatus which I have devised and find advantageous in car-

rying on the process which constitutes the present invention; but inasmuch as other means may be employed for performing the different operations the invention is not limited to such or to any particular mechanical contrivances.

After the stock is picked over and sorted and what is unfit for treatment thrown to one side the available stock is reduced to fragments of a size convenient for further treatment. This is the first step of the process, and it is preferably effected by means of the cracker-mill described in my application, Serial No. 324,578, filed September 20, 1889. Without limiting myself to any particular degree of fineness, I would say, for sake of clearness, that fragments which will pass through a screen of one-quarter-inch mesh are sufficiently reduced for the purpose. The stock thus ground contains metal fragments, as already pointed out, and the next step is to remove all particles of iron or steel. This is effected by passing the stock through magnetic separators, which may be such as described in application Serial No. 324,579.

The stock is next treated to destroy or separate the fiber. This part of the operation may be effected in any suitable way, several modes of treatment being well known and requiring no detailed description. According to one method the stock is ground fine and the fiber or a portion of it is blown off by an air-blast. A more perfect separation of the fiber may be effected by the acid process or by the caustic alkaline process, the latter being particularly applicable to the destruction of woolen fibers.

The next step in the treatment is the washing of the stock to remove mud and all impurities which are soluble in or may be carried away by water. This operation may be effected in a large circular vessel or tank, such as described in application Serial No. 324,584. In this vessel the stock is rolled and mud squeezed out by a large heavy roller, in advance of which a series of plows stir up the stock. After repeated washings in clean water the above-mentioned impurities are practically all removed; but much sand and other fine particles not soluble in water remain. To remove these the stock is agitated

or shaken in a sifter, preferably a rotatory cylinder composed of finely-perforated plates. Water is constantly thrown upon the stock while in this sifter to assist in carrying away the sand, &c. An apparatus suitable for effecting this part of the purification is described in application Serial No. 324,582. The sand separated from the stock carries away a certain quantity of rubber in very fine particles; hence this sand is treated to recover such particles of rubber, these matters being carried into a vessel filled with water. A stream entering the bottom of the vessel is directed in such manner as to float the rubber particles over the edge thereof, leaving the heavier matters to be collected at the bottom of the vessel. By a similar operation the main body of the stock is treated to remove all large particles which the water could not wash away in the washing-tub and which could not pass through the screen of the sifter. The impurities removed at this stage of the treatment are often of a very miscellaneous character, including screws, brass buckles, and nails, rivets, eyes, small stones and gravel, and many other articles. After this operation the stock is ready for devulcanization, to effect which I preferably mingle with it heavy petroleum and calcium sulphide and subject it to live steam under pressure, as fully described in application Serial No. 324,583. When drawn from the devulcanizer, the stock is a compact soggy mass in large lumps. To prevent its becoming set, which would soon occur and render sheeting impossible, it must be immediately broken up, which is effected by passing between cracker-rolls, though any means suitable for disintegration may be used instead.

For producing the ordinary restored rubber, the devulcanized stock is spread out upon perforated screens and air is drawn through it to dry it thoroughly, which requires several hours. When thoroughly dry, the reclaimed rubber is preferably sheeted by pressing it a sufficient number of times through a rubber-sheeting mill, (such, for example, as described in my patent, No. 408,734, dated August 13, 1889,) when the process is complete and the rubber ready to be packed for the market. The treatment of the stock for restoring and reclaiming the rubber is of course practically complete without sheeting, that step being resorted to simply to put the rubber in a form convenient for packing and handling. It may be pressed into other forms or packed in a loose state without departing from the spirit of the invention.

Having thus fully described my said invention, what I claim, and desire to secure by Letters Patent, is—

1. The herein-described process of recovering and restoring old rubber, said process

consisting in first reducing the stock to small pieces or fragments; second, removing particles of iron or steel from said fragments; third, disintegrating or decomposing the fibrous matters in the stock; fourth, further purifying the stock to remove all foreign substances therefrom, and, fifth, devulcanizing and desulphurizing the rubber, substantially as described.

2. The herein-described process of recovering and restoring old rubber, said process consisting in first reducing the stock to small pieces; second, eliminating particles of iron and steel by magnetic attraction; third, separating the fiber from the rubber; fourth, washing with water to carry away the soluble matter; fifth, sifting to separate sand and other fine particles; sixth, acting on the mass with a stream of water to float off the rubber from the heavier foreign substances associated with it, and, finally, devulcanizing and sheeting, substantially as set forth.

3. In the art of restoring rubber, the improvement consisting in reducing the stock to small pieces, separating from it all foreign substances with which it is associated, substantially as described, then devulcanizing in a close vessel by live steam under pressure, removing the mass from the devulcanizer and disintegrating it while moist and drying the disintegrated mass, as set forth.

4. The herein-described process of restoring or reclaiming old rubber, which process consists in grinding the stock into small fragments, attacking and disintegrating the fiber, removing the mud and similar impurities by washing in water, separating the heavier foreign substances by flooding the mass with water and floating the rubber away from such heavy substances by the action of a current of water, devulcanizing by the action of live steam under pressure and disintegrating the devulcanized mass, substantially as set forth.

5. The described process of restoring rubber, which process consists in the following steps: first, grinding the stock; second, eliminating iron and steel particles by magnetic attraction; third, destroying the fiber; fourth, washing; fifth, sifting out sand and other impurities; sixth, separating the rubber from substances of greater specific gravity by flooding the mass with water; seventh, devulcanizing; eighth, disintegrating the devulcanized mass, and, lastly, drying and sheeting, all substantially as set forth.

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

NATHANIEL C. MITCHELL.

Witnesses:

J. M. STOTESBURY,  
JOEL H. LEEDS.