UNITED STATES PATENT OFFICE

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PROCESS OF EXTRACTING RUBBER.

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To all whom it may concern:

Be it known that I, GEORGE B. BRADSHAW, a citizen of the United States of America, residing in the borough of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in the Processes of Extracting Rubber, of which the following is a specification.

My invention relates to a process for extracting rubber from rubber-bearing plants or materials, such as *Guayhule*, *Hevea brasiliensis*, rubber bark, chips, &c.

The process consists in the reduction of the rubber-bearing material in the presence of water to its almost individual fibers by a suitable comminuting device, which in comminuting cuts rather than rubs or grinds, and in the subjection of this finely-comminuted pulpy material to an agitating and compressing action in the presence of water which causes the particles of rubber to ball up, and in the final separation of the balled-up pellets of rubber from the sludge by gravity.

Marked advantages of the process are that it makes possible the use of continuously-operating machines instead of the intermittent types hitherto used, permits the use of emulsifiers for removing the resin, and furnishes a by-product suitable for making certain grades of paper.

In carrying out this process with continuous machines I prefer to use two well-known pieces of machinery. The first is known as the "Marshall engine," commonly used in the making of paper-stock and may be of the style as illustrated and described in any of the numerous patents to F. J. Marshall. I prefer to use the Marshall engine because of its efficiency and rapidity, although the Jordan engine or Hollander may be used or any machine which will comminute woody material in the presence of water without subjecting said material to a rubbing and compressive action, and which will comminute the woody material so finely that the pulp formed will tend to settle in water. In other words, it is essential that the first machine reduce the rubber-bearing material in the presence of water by a cutting action, from which rubbing and compression of the material are practically absent, and reduce it so evenly and finely that it sinks or tends to sink in water. If Hollanders which are intermittent were used, the beating-roll and bed-plate would have to be so constructed and set that the above effect is obtained.

The second is the tube-mill, a well-known continuous-process pulverizing-machine. The intermittent type of this machine is commonly called a "pebble-mill." Any machine which will subject the pulp to an agitating and rubbing action can be used; but I prefer a tube-mill because of its continuous operation and automatic feeding and discharging facilities. Heretofore processes of the same purport as mine have not been able to use tube-mills and have had to forego the advantages of this continuous-operating machine. The reason of this was because the tube-mill was required to do two things—that is, first, reduce the shrub to a pulverized state, and, second, ball and agglomerate the rubber. To do this required from two to four hours grinding, and as the different pellets of rubber became freed they would rise to the surface of the water in the mill and gradually become agglomerated into huge balls, which would not discharge from the discharge-pipe, hence nullifying the continuous feature. If the discharge were hastened, so as to allow the rubber to run out before it became thus agglomerated, the grinding would not be completed and considerable imperfectly-extracted shrub would also be discharged. Again, if the tube-mill were operated with a continuous discharge floating particles of wood riding above the pebbles would tend to flow right through the mill without being subjected to the action of the pebbles. The intermittent type-mills are consequently largely used and the rubber-bearing material is ground and extracted in them.

In my process the material from which rubber is to be extracted can be fed to the tube-mills in an already very finely comminuted condition, so that practically all the work required of the tube-mill is the balling up of the rubber into pellets of size large enough to float. As the material fed to the tube-mill is of uniform size and does not require grinding, a tube-mill can be so proportioned that the stream from the discharge end will just equal the feed and the discharged material will have been just long enough in the tube-mill so that all the rubber contained in it will have been balled up into small pellets, but not long enough for the forming of the huge balls referred to above. Also as the material from my process is so finely comminuted that it tends to sink in water it will work down in among the pebbles as soon as it

is fed into the tube-mill, thus making complete extraction a certainty.

In the present processes using the pebble-mills it has also long been a desideratum to feed fine material to the pebble-mills for the sake of saving time in the pebble-mill operation. However, hitherto all efforts to that end have been failures, because it was attempted to reduce the rubber-bearing material dry. Dry reduction to less than about one-quarter inch size was harmful in at least two ways. In the first place the rubber was oxidized, due to heat generated in the reduction, and, secondly, the rubber was driven full of fine splinters of wood, which later in the extraction process became water-soaked and prevented the floating of the balled-up pellets. As generally run at present the pebble-mills are charged to just above the line of the pebbles with macerated, crushed, or cut-up shrub of three-sixteenths to one-half inch size and water, so that the material is like a thick soup. The mill is rotated from one to two hours or until the material has been ground so fine that practically all of it except the cork has worked in among the pebbles. Then the mill is filled nearly full of water and the rotating continued until the rubber has balled up and floated to the surface of the water. The mill is then discharged into tanks, and the floating rubber and cork is skimmed off and subjected to further cleaning. The cork at this stage is equal to about fifteen to twenty per cent. of the weight of the rubber. The comminuting in water according to my process overcomes all these difficulties. The water prevents the heating up of the material and consequent harm to the rubber, and also prevents the filling of the rubber with fine pieces of wood.

The fineness of the comminution and the consequent water-soaked condition of the pulp reduce the time required in the pebble-mill. Also the fact that the cork in my process is so finely cut up that a good deal of it sinks in water results in a product containing very little cork.

Another feature of my process is that it enables the use of dilute caustic alkali or other emulsifier for the purpose of emulsifying, and thus removing a portion of the resins, which commonly occur in nature along with rubber. This alkali may be added to the liquid in which the shrub is comminuted—for instance, to the liquid fed to the Marshall engine—so that the liquid contains about one-half per cent. alkali. Adding alkali to the liquor in pebble-mills is beneficial; but its effects are slight because the rubber is in such large-sized pellets In my process the resin in the finely-comminuted woody fiber and rubber becomes thoroughly subjected to the emulsifying actions of the caustic. This use of caustic alkali is not essential to the operation of my process, but is only possible when my process is used.

The waste material in my process is the sludge left in the settling-tanks after the rubber has been skimmed off. It consists of woody material reduced to its almost individual fibers and without further treatment is in exactly the right condition for use as pulp in making paper.

In using my process with the machines for which preference has been expressed above I proceed as follows: The rubber-bearing material is fed along with water or water containing caustic alkali to the Marshall engine. The fed material should be of about three-eights inch size and may have been reduced to this size by any convenient process. Some material will need previous soaking for best results. The amount of water required will vary with the material used. For *Guayhule* I use from one to two barrels of water to each barrel of shrub. From the Marshall engine issues a continuous stream of pulp, which is run directly into the feed end of a tube-mill. The tube-mill needed for taking the discharge of a standard Marshall engine is about twenty-two feet long by five feet in diameter. I prefer the Abbe spiral feed and discharge mill equipped for wet grinding for this purpose. The material requires about fifteen to thirty minutes to work through this mill when fed as fast as the Marshall engine will deliver it. The discharge from the tube-mill consists of a sludge containing woody matter which sinks in water and small pellets of rubber which float. This discharge is led into tanks from which the floating pellets of rubber are skimmed.

I claim as my invention—

1. The continuous process of extracting rubber from rubber-bearing plants or portions of plants which consists, first, in reducing the material in the presence of water by a cutting action to its almost individual fibers, and at the same time comminuting the rubber so that the resulting pulp of rubber and fiber will sink or tend to sink in water, second, in separating this pulp into a floating and sinking portion by any suitable means, third, in collecting the floating portion containing the rubber, and in further cleansing this portion to obtain clean rubber.

2. The process of extracting rubber from rubber-bearing plants or materials which consists in reducing such material to practically its individual fibers by cutting action in the presence of an emulsifying liquid, subjecting the pulp thus formed to rubbing and agitation in the presence of an excess amount of liquid until the rubber portion of the pulp has become agglomerated into such sized particles that it will float in water, collecting the mixture in suitable receptacles, where, if necessary, the specific gravity of the liquid is modified by suitable means to permit gravitational separation, allowing gravity to act

and skimming off the resulting floating rubber.

3. The process of extracting rubber from rubber-bearing plants or materials which consists in reducing such material to practically its individual fibers by cutting action in the presence of a liquid, subjecting the pulp thus formed to rubbing and agitation in the presence of an excess amount of liquid until the rubber portion of the pulp has become agglomerated into such sized particles that it will float in water, collecting the mixture in suitable receptacles, where, if necessary, the specific gravity of the liquid is modified by suitable means to permit gravitational separation, allowing gravity to act and skimming off the resulting floating rubber.

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

GEORGE B. BRADSHAW.

Witnesses:

WILLIAM ABBE,

WALTER ABBE.