

# UNITED STATES PATENT OFFICE.

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## MANUFACTURE OF HARDENED ASBESTUS.

SPECIFICATION forming part of Letters Patent No. 359,156, dated March 8, 1887.

Application filed October 4, 1886. Serial No. 215,302. (No specimens.) Patented in England October 8, 1885, No. 11,976, and in France July 21, 1886, No. 177,531.

*To all whom it may concern:*

Be it known that I, CHARLES JACKSON, a subject of the Queen of Great Britain, engineer, residing at 134 Robin Hood Chase, county of Nottingham, England, have invented certain new and useful Improvements in the Manufacture of Hardened Asbestos, of which the following is a specification.

This invention has for its object improvements in the manufacture of hardened asbestos, (for which I have received Letters Patent in Great Britain, No. 11,976, dated October 8, 1885, and in France No. 177,531, dated July 21, 1886.)

I mix asbestos in a fibrous condition with a liquid binding material—such as shellac dissolved in spirit. I make up the material into the form required, and thoroughly consolidate it by heavy pressure. At the same time that the material is under pressure I expose it to heat to perish the binding material and render it insoluble. Usually, after the material has been exposed to pressure to mold it into form and has been heated to partly perish the adhesive material, I expose it to a heavy pressure in heated dies, and afterward I again heat the molded article in an oven, preferably at a higher temperature than previously, to complete the perishing; also, according to my invention, I combine metal with asbestos and a binding material and harden the preparation by pressure and heat. Thereby I impart to the hardened asbestos greater strength and durability and obtain other advantages.

In order that my invention may be fully understood and readily carried into effect, I will proceed to describe more fully the manner in which I prefer to operate.

I sometimes commence by forming the asbestos fiber into a coarse thread. At other times I use the asbestos fiber without this previous preparation.

Where it is necessary to resist wear by friction the fiber should be spun, and as far as possible the fiber should be exposed endwise in the finished article. In other cases this precaution is unnecessary.

I saturate the fiber or the yarn with the liquid binding material. A thick solution of

shellac in spirit is suitable, except that for articles which, when in use, are exposed to a high temperature, as the bushings for steam-cocks, I prefer to employ a stoving varnish. I then dry the fiber or yarn for a period of several days in a drying-shed, through which a current of air is constantly passing; or, if necessary, the drying may be hastened by a low heat. Where the fiber is made into yarn, it is often convenient, at this stage, to weave the yarn into a fabric. If this course be resorted to, pieces are afterward cut from the fabric and superposed, the one on the other, to build up the form required, and they are consolidated by pressure in a mold. When the form required is intricate it is often more convenient to wind the loose fiber about a mandrel, to obtain a suitable mass, and then to further shape it by pressure in dies. In the process of building up the form, I repeatedly saturate the asbestos with the binding material, and after each treatment I submit the mass to long drying in the ventilated drying-room. The harder and closer the product required the more of the binding material should be incorporated with the asbestos in these earlier stages. When thus built up and dried the article is reduced approximately to the form required by pressure in metal molds. At this stage a moderate pressure only is required. The molded article then goes back to the ventilated drying-room, where it should remain for some weeks. It is then again pressed, and this time it should be exposed to a very heavy pressure, amounting to many tons on the square inch, and the heavier the better. The molded article is then passed into an oven heated to about 250° Fahrenheit, where it remains for eight or ten hours, until it appears hard and dry. After the article comes from the oven it is again exposed to pressure, and in this case heat is also necessary, as the material would not be condensed sufficiently by a cold pressure. The molds employed (of which the shape, of course, depends on that of the article to be produced) are heated to 350° or 400°, and in these molds the article is exposed to the same heavy pressure as before—the higher the better. If the molded article requires to be fitted into a piece of metal—for



example, if it be a valve-facing and is to be set into a groove in the metal valve—it is at this stage that the molded asbestos is set into its place. The mold is made to receive the  
 5 metal valve (which is also heated) and the pressure drives the asbestos home into its recess. After the hot-pressure the article is again passed into an oven, where a temperature of 300° to 400° is maintained, say, for ten  
 10 hours. After leaving the oven the article is, if necessary, smoothed and polished; ready for use. When the article is to be exposed to high temperatures in use the temperatures employed in the manufacture should be such as  
 15 to exceed by at least 50° the temperature to which the article will be afterwards exposed. In high temperatures stoving varnish is more suitable than shellac solution.

Hardened asbestos produced in this way is  
 20 applicable to a great number of uses. Thus it makes an excellent tobacco-pipe; also, bearings and friction-blocks used in machinery can advantageously be made from it; so, also, parts of boots and shoes, valve-faces and pack-  
 25 ings, and many other articles.

I sometimes combine metal with the asbestos and binding material. Thus I form a stout and durable board or panel with a surface of hardened asbestos by taking a sheet of  
 30 iron and perforating it, by preference, with small holes, leaving the edges of the holes preferably rough and jagged. I then lay on the metal sheet sheets of thin asbestos felt saturated with binding material and dried. I consolidate the whole by a moderate pressure,  
 35 then dry the compound sheet further and expose it to a heavy pressure. Next I stove it. Then I expose it to pressure between heated surfaces, and finally again stove it, all in a  
 40 similar manner to that previously described; also, I combine metal in some cases in the form of wire with the prepared asbestos. I use soft-steel wire, usually in the form of spirals. The spirals are embedded in the prepared  
 45 asbestos, when this is put together into the shape required. The wire, together with the prepared asbestos, goes through all the processes, as already described, and becomes  
 50 strength and toughness. I also combine metal with asbestos by drawing down small tubes of

steel or other metal onto cords of prepared asbestos. I cover such tubes externally with prepared asbestos and then accumulate them  
 55 side by side into a block. I expose the block to heat in an oven, and thus form the whole into a mass. This method is applicable where a very durable material under friction is required. The asbestos is exposed only at the  
 60 ends of the tubes.

Another way in which I combine asbestos with metal is to take threads of the prepared asbestos and coat them with metal by electro-  
 65 deposition—a process well understood. Thus I coat asbestos threads with gold, and I use such threads to make gold lace. Such gold lace, when it becomes tarnished or discolored, can be cleaned with acid.

Having now particularly described and ascertained the nature of my said invention and  
 70 in what manner the same is to be performed, I declare that what I claim is—

1. The improvement in the manufacture of articles of hardened asbestos, consisting in combining fibrous asbestos with a binding material rendered liquid in a solvent, drying the  
 75 material or evaporating off the solvent, pressing the material in molds, exposing the material to heat to perish the binding material, or change it so that it is no longer soluble in the  
 80 solvent, and pressing the materials in heated molds, substantially as and for the purpose set forth.

2. The manufacture of articles of hardened asbestos by molding or forming a mixture of  
 85 fibrous asbestos with a liquid binding material to the shape desired, then partially perishing the binding material by heat, then exposing the article simultaneously to heat and heavy pressure, and afterward again exposing  
 90 the article to heat, substantially as described.

3. The combination of asbestos and a binding material, consolidated by pressure and changed or perished by heat, with metal, whereby strength and durability are obtained,  
 95 substantially as described.

London, September 6, 1886.

CHARLES JACKSON.

Witnesses:

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