UNITED STATES PATENT OFFICE.

HENRY ROBERT POWER, OF NIAGARA FALLS, NEW YORK, ASSIGNOR TO THE CARBORUNDUM COMPANY, OF NIAGARA FALLS, NEW YORK, A CORPORATION OF PENNSYLVANIA.

ABRASIVE WHEEL.

1,310,291. Specification of Letters Patent. Patented July 15, 1919.

No Drawing. Application filed August 27, 1918. Serial No. 251,644.

To all whom it may concern:

Be it known that I, HENRY ROBERT POWER, a citizen of the United States, residing at Niagara Falls, in the county of Niagara and State of New York, have invented a new and useful Improvement in Abrasive Wheels, of which the following is a specification.

My invention relates to abrasive wheels, and especially to an improvement in open or porous abrasive wheels in which the bond employed to hold together the particles of abrasive material is a silicate.

My invention is designed to greatly increase the efficiency of such wheels by an improvement in their construction.

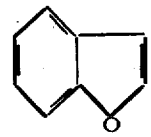
Abrasive wheels to which my invention relates are made up of an abrasive material such as carborundum or carbid of silicon; an aluminous abrasive commonly known as emery, aloxite or corundum, held together by a ceramic bond. In such wheels the bond may be silicate of soda which is mixed with the abrasive grains together with certain other chemical compounds and heated to a temperature sufficient to cause a reaction between the silicate and these other chemicals. This gives a hard porous mass in which the abrasive grains are held securely in place. Such wheels are known as silicate of soda wheels. Or the bond may be clay, together with other mineral silicates, such as feldspar, etc. In such wheels the bond and grain are mixed and heated in a kiln until the bond melts or fuses. This gives upon cooling a hard, porous mass and such a wheel is known commercially as a vitrified wheel.

Both of the types of wheel above described are porous, and in the grinding process these pores become filled with particles of the material being ground, thus covering over the sharp cutting edges of the abrasive grains and preventing proper clearance for the cutting points. Also in the grinding process the abrasive particles become worn, lose their sharp edges and thus become too smooth for effective work. The face of such a wheel must be frequently reduced by a dressing tool to expose new cutting surfaces, which is a laborious and expensive operation.

To increase the efficiency of a porous wheel as above described it has been customary heretofore, to fill the pores of the wheel with a material that becomes soft and fluid at the grinding temperature. It is well known in the trade that a wheel so filled is more efficient, for its pores do not clog or become loaded with the material being ground during the grinding process.

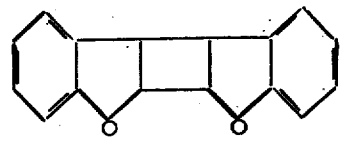
The new substance which I have found useful for filling porous wheels herein described is a coal-tar distillate, known chemically as polymerized benzofuran or paracoumarone. Commercially it is sold under the names "coumarone" and "paracoumarone", though these commercial products are practically identical in physical and chemical properties. This substance is spelled with the following names: coumaron, cumaron, cumarone, paracoumaron, paracoumarone, paracumarone.

The substance known chemically as benzofuran or coumarone is definite and has the formula C_8H_6O shown structurally thus:—



This substance is obtained in the process of distilling coal-tar. When coal-tar is distilled, one distillate is known as "light oil" and this yields on distillation among other things "heavy naphtha". This in turn yields on distillation either coumarone or paracoumarone depending on the temperature control of the process. If uncontrolled, the process yields paracoumarone. If controlled coumarone is obtained and it is later put through a chemical process known as polymerization, which process yields as the ultimate product paracoumarone, and this is the substance, whether sold under the name "paracoumarone" or not, which I preferably use in my process, although I may use paracoumarone of proper grade however it is obtained.

The structural formula of paracoumarone is shown as follows, being made up of two molecules of coumarone:



It is possible that more than two molecules unite to form even higher molecular aggregates.

There are several commercial grades of paracoumarone, some being highly refined and odorless, tasteless and almost colorless. Others have a characteristic light yellow to dark brown color. The grades that are hard at ordinary temperatures are brittle. Others are tough and cold flowing at ordinary temperatures. The melting points of the different grades run from 60° centigrade to 110° centigrade. The specific gravity is about 1.1 in all grades. On heating, paracoumarone melts, gives a pleasant sweetish odor and on cooling again it is found to have lost none of its former chemical and physical properties.

The coal-tar distillate, paracoumarone, is practically inert; it has no saponification number, no acid number, it is insoluble in alcohol, and dissolves readily in solvent naphtha. With an alkali it yields no lather. Furthermore, it oxidizes very slowly, even in the presence of strong oxidizing agents like nitric acid.

In the carrying out of my invention, I have found that the ordinary impregnating machines may be used. Briefly, the process consists in heating the porous wheel in a closed apparatus with the filler. The heat in coils at the bottom is turned on and at the same time the pressure inside the machine is reduced to a partial vacuum to facilitate the proper impregnation of the wheel with the fluid filler. It is essential that the filler become uniformly distributed. The process of impregnation usually occupies 25 minutes which is a sufficient length of time for practically all the voids of the wheel to become filled with paracoumarone. On removing the wheel is balanced while hot and on cooling the paracoumarone solidifies within the voids. The voids may be wholly or partially filled with the paracoumarone, and the term "filled" as used herein and in the claims is to be so understood.

Having thus described and identified this coal-tar distillate which I use and having explained the process of adding it to the wheels I shall now explain the peculiar advantages resulting from its use in porous wheels.

Porous wheels containing a filler are used mainly in the coarser grinding operations such as snagging, rather than in precision work, and in some cases a very high temperature is reached during the grinding process. For such grinding operations, since it is desirable for the reasons above mentioned, to use a porous wheel filled with a substance that becomes soft at the temperature of grinding, due care must be given to the melting point of the filler used in the pores of the wheel. If the grinding temperature is very high it is possible that the filler may become quite liquid long before the grinding temperature is reached. In such a case, the filler will run out of the wheel, the wheel will lose its balance, and acts as though it was softer. In fact, the filler has not accomplished any good purpose. This may be the case if the filler is paraffin, a low melting grease, or other low melting substances. The coal-tar distillate, paracoumarone which I use is, on the contrary, a high melting substance. When certain grades are used, as high a temperature as 90° centigrade may be obtained before the material begins to flow. Such a substance does not melt too soon or before the grinding temperature is reached. Therefore, it does not leave the wheel and so performs its function in the wheel. Moreover, the wheel does not get out of balance and remains true to its grade or hardness.

If the grinding operation is of such a nature that a comparatively low temperature results, a corresponding low melting grade of paracoumarone may be adopted as a filler. The wide range of melting points of the grades of paracoumarone is an advantage not to be found in the use of the materials melting at only one definite temperature and hitherto used as fillers, (such as rosin, etc.).

Furthermore, my invention results in a wheel of greater efficiency apart from the advantages already described. The filler, as it melts, has a lubricating action on the cutting points of the wheel in their process of removing the material being ground.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An abrasive wheel comprising abrasive particles united by a silicate binder to form a porous structure, and having the voids thereof filled with the coal-tar distillate paracoumarone known chemically as polymerized benzofuran.

2. An abrasive wheel having a ceramic bond, and having its voids filled with a polymerized coal-tar distillate.

3. An abrasive wheel having a ceramic bond and having its voids filled with a polymerized substance of the coumarone group having its melting point sufficiently low to become soft at grinding temperatures.

In testimony whereof, I have hereunto set my hand.

HENRY ROBERT POWER.