Feb. 14, 1939. G. LIEBMANN 2,147,450

APPARATUS FOR PRODUCING RESISTANCES

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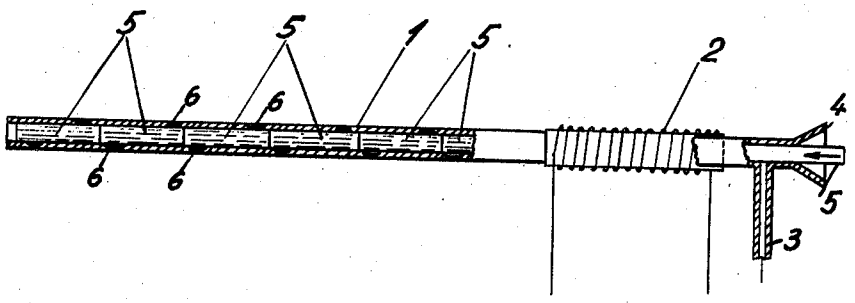


Fig. 1

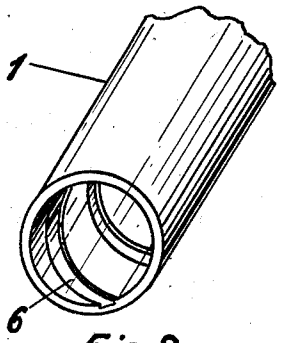


Fig. 2

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APPARATUS FOR PRODUCING RESISTANCES

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3 Claims. (Cl. 91—18)

Different methods are known for the production of highly ohmic resistances by the deposit of a layer of carbon in the gas phase on insulating members. More particularly, it has been proposed to produce resistances according to methods known per se by the fact that a reaction space, which is raised to a constant given temperature, is made up of two crossed pipes. Through the one pipe there is conducted the compound of carbon and hydrogen from which the deposit is to be made, diluted if necessary with an indifferent gas, and through the other pipe there are passed the resistance rods. It is important in accordance with the above specification that the rods are of such length that they pass through the reaction space in freely supported fashion, so that they are provided with the carbon coating on all sides in a very short space of time.

In order to provide satisfactory carbonizing conditions, and more particularly to prevent the resistance rods from becoming sooted, in the apparatus for performing the method above described the feed pipe for the resistances is washed by an indifferent gas. In view of the high reaction temperature which is required for performing that method, a comparatively complicated apparatus is necessary and e. g. quartz pipes are employed.

Now the applicant has found that carbonization may be perfomed under considerably more simple conditions. The present invention is relative to a method of and an apparatus for producing highly ohmic resistances by carbonizing insulating rods continuously or in sets of the decomposition of hydrocarbon gas at high temperature in which the hydrocarbon gas to be decomposed and porcelain rods to be carbonized are conducted from the one end through a pipe furnace whereat a part of said pipe is raised to the temperature necessary for decomposition of the hydrocarbon gas, the pipe itself being of such length that the insulating rods passed continuously or intermittently out of the hot zone of the furnace are able to cool whilst still in the current of hydrocarbon gas. For this purpose there is employed an apparatus, which consists of merely one very long pipe (for example, of 2 metres), the inner diameter of which is only to a very small extent larger than the outer diameter of the rods to be carbonized.

Although it is possible to employ a porcelain pipe at this point, advantage is obtained in using a metallic pipe, for example a seamless steel pipe, as the hydrocarbon is decomposed to a smaller extent thereon. The invention will be further described with the aid of the two figures 1 and 2, Figure 1 of which shows a schematic layout of the apparatus, while Figure 2 is a perspective view of the discharge end of the reaction tube showing the internal spiral gas passage. The resistance rods to be carbonized are passed successively or in sets through the pipe 1 in Fig. 1, whereby the hydrocarbon to be deposited traverses the pipe simultaneously. The point of introduction of the current of gas 3 is situated between the heating coil 2 and the mouthpiece 4 for the introduction of the porcelain rods 5. There is conducted through the pipe 3 in the manner known per se a current of indifferent gas, which is laden with the compound of carbon and hydrogen to be decomposed. It is desirable to constrict the mouthpiece, for example by a felt or rubber washer or by similar means, to such extent that the resistance to flow on the part of the mouthpiece is greater than the resistance to flow on the part of the furnace pipe filled with the rods. The furnace pipe may also be closed by a similar sealing means at the outlet point for the resistance rods, but this is unnecessary if a sufficiently powerful current of gas is conducted through the pipe, as the resistance of the pipe filled with the rods is so great that no air is able to penetrate into the part of the pipe which is raised to a high temperature. The carbonization takes place only in the first half of the pipe, in which a high temperature prevails.

Since the temperature is not evenly distributed and the hydrocarbon to be decomposed is also present at the cold parts of the pipe, the thickness of the carbon layer is governed by a medium temperature and the heating length of the furnace. The thickness of the carbon layer, and accordingly the ohmic value of the resistances produced, depends only on the "average" temperature employed and the sojourn in the hot zone of the furnace, and is not dependent on the amount of hydrocarbon introduced, as this is always present in a very great excess.

Owing to the fact that a comparatively lengthy part of the furnace, for example 1 metre, serves as the reaction chamber by being heated to the requisite temperature, the porcelain rods are at the necessary decomposing temperature for a comparatively long period. In this way it is possible to employ fairly low temperatures, so that there is small wear on the parts of the furnace. On the other hand, by reason of the long sojourn, there is ensured a very even nature of the carbon coating. In particular, small fluctuations

in temperature do not make themselves unpleasantly apparent. By selecting a chemically pure and uniform hydrocarbon having one single definite boiling temperature, for example benzol, and by making use of comparatively long paths as regards contact of the gas with the rods as described, air is prevented from entering the apparatus and a detrimental sooting of the rods is avoided. Precautionary measures of a particular kind are thus unnecessary. Solid condensation or polymerization products which are occasionally separated in the pipe do not contaminate the resistances and may be readily removed by scavenging the pipe with a suitable solvent. Owing to the fact that the pipe acts simultaneously as gas-conducting passage and reaction chamber for the porcelain rods, it is possible to carbonize rods of desired length in the same apparatus. It is also possible, instead of introducing the current of protecting gas and hydrocarbon into the pipe at the one end and to allow the same to pass into the atmosphere at the opposite open or sealed end, to expel the air from the interior of the pipe by pumping it out at the free end, whereby the hydrocarbon is always able to follow up in sufficient excess from a reservoir. For the purpose of equalizing the resistance to flow on the part of the furnace pipe and at the same time improving the quality of the carbonizing process, the pipe may be furnished in the interior with one or more, e. g. spiral shaped grooves, through which the current of gaseous hydrocarbon is conducted, as shown in Fig. 2. It is also possible by the provision of suitable grooves in the pipe to obtain any desired guiding of the current of gas. Cooling bushes or similar devices of any kind are unnecessary, as the rods remain in the long pipe devoid of air and traversed by the hydrocarbon until they have sufficiently cooled.

I claim:

1. Apparatus for producing highly ohmic resistances by carbonizing insulating rods continuously or in sets by the decomposition of hydrocarbon gas at high temperature, comprising a pipe furnace, means for simultaneously conducting the current of hydrocarbon gas to be decomposed, on the one hand, and the porcelain rods to be carbonized, on the other hand, from the one end through said pipe, and means for raising a part of said pipe to the temperature necessary for decomposition of the hydrocarbon gas, said pipe being of such length that the insulating rods passed continuously or intermittently out of the hot zone of the furnace are able to cool whilst still in the current of hydrocarbon gas.

2. Apparatus for producing highly ohmic resistances by carbonizing insulating rods continuously or in sets by the decomposition of hydrocarbon gas at high temperature, comprising a pipe furnace, means for simultaneously conducting the current of hydrocarbon gas to be decomposed, on the one hand, and the porcelain rods to be carbonized on the other hand, from the one end through said pipe, and means for raising a part of said pipe to the temperature necessary for decomposition of the hydrocarbon gas, said pipe being of such length that the insulating rods passed continuously or intermittently out of the hot zone of the furnace are able to cool whilst still in the current of hydrocarbon gas, said pipe being furnished with one or more spiral grooves.

3. Apparatus for producing highly ohmic resistances by carbonizing insulating rods continuously or in sets by the decomposition of hydrocarbon gas at high temperature, comprising a pipe furnace, means for simultaneously conducting the current of hydrocarbon gas to be decomposed, on the one hand, and the porcelain rods to be carbonized, on the other hand, from the one end through said pipe, and means for raising a part of said pipe to the temperature necessary for decomposition of the hydrocarbon gas, said pipe being of such length that the insulating rods passed continuously or intermittently out of the hot zone of the furnace are able to cool whilst still in the current of hydrocarbon gas, said pipe being fluted in the interior.

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