May 9, 1933. H. H. LOWRY 1,907,843

METHOD OF MANUFACTURING TRANSMITTER CARBON

Filed March 11, 1930

FIG. 1.

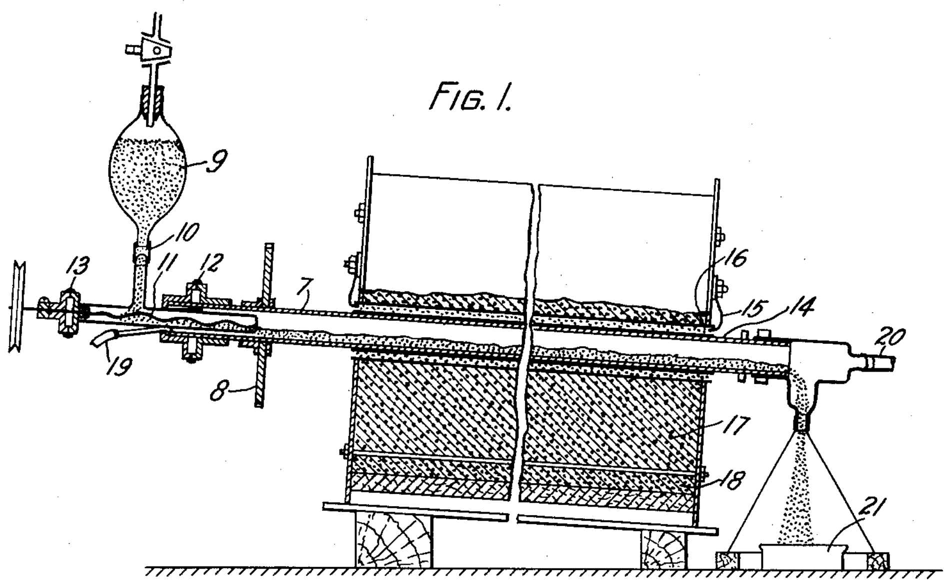


FIG. 2.

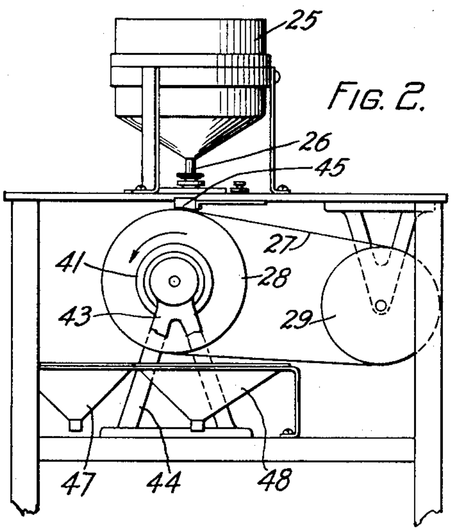
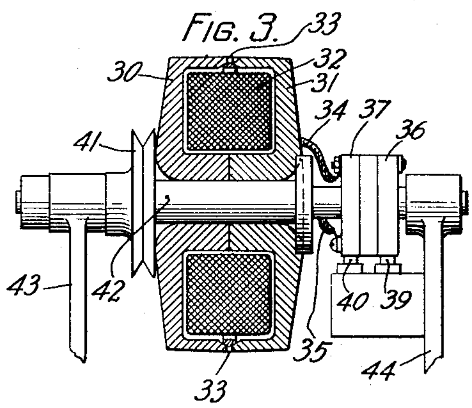


FIG. 3.



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UNITED STATES PATENT OFFICE

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METHOD OF MANUFACTURING TRANSMITTER CARBON

Application filed March 11, 1930. Serial No. 434,990.

This invention relates to the manufacture of carbon and more particularly to the production of a granular carbon suitable for use in telephone transmitters.

Transmitter carbon must be free from certain objectionable characteristics which carbon improperly prepared is liable to exhibit or develop in service. These are "burning" or a disagreeable sputtering noise which sometimes become so troublesome as to interfere with transmission, and "aging" or a tendency for the carbon to change in resistance with use and to change in sensitivity or volume efficiency. The latter is usually made evident by an increase in resistance although it may possibly occur with a decrease in resistance. Furthermore, in order that the carbon may operate efficiently it is essential that its resistance be uniform and that it be relatively free of ash.

Granular carbon for telephone transmitters is generally made from a high grade anthracite coal having less than ten percent volatile matter and having a small percent of ash (less than 5%). This ash is traceable to two different causes. One portion is present in the vegetable matter from which the coal is formed and is therefore rather uniformly distributed throughout the mass. The other portion, and that which is far more objectionable, is in the form of silt at the time the coal is formed and as a result it is not evenly distributed. As a consequence it may occur in a very appreciable amount at the surfaces of the carbon granules and since this ash is non-microphonic the material would then be of high and variable resistance and in service would be objectionable because of "burning" or "aging".

It is an object of this invention to provide carbon granules which have a particularly low ash content and which are also free from other substances which might affect the resistance of the material or its operating efficiency. To obtain this object the anthracite coal after being crushed, screened and washed, is roasted in the presence of a reducing atmosphere whereby volatile matter is expelled. Since silt contains a considerable amount of iron oxide and to a lesser degree iron sulphide, the roasting process in a reducing atmosphere reduces these iron compounds to magnetic iron. The granules of carbon which are the more magnetic and particularly those containing magnetic iron at their surfaces are then separated from those less magnetic thus reducing the objectionable ash content to a considerable degree. By thus magnetically separating the more magnetic particles of the roasted carbon from those magnetic to a lesser degree, there results a product in which the ash content is decreased to a considerable extent as well as a product with a decidedly lower iron content. For example, the results of tests made to determine to what extent the ash and iron contents are lowered in carbon made from a preferred grade of anthracite coal are as follows: In one test one percent of the more magnetic particles was removed and found to have an ash content of 26.63 percent and an iron content of 13.8 percent whereas the remaining 99 percent of the sample had ash and iron contents of 3.39 percent and .14 percent respectively. In another sample 68 percent of the more magnetic particles were removed and found to have ash and iron contents of 4.74 percent and .09 percent respectively whereas the ash and iron contents of the remaining 32 percent of the sample had ash and iron contents of .81 percent and .05 percent respectively. In a third test on this same lot of carbon 39 percent of the more magnetic particles were removed and found to have ash and iron contents of 8.50 percent and .83 percent respectively whereas the remaining 61 percent had ash and iron contents of 1.87 percent and .06 percent respectively. Transmission tests made on transmitters in which these various grades of carbon were used show that the reduction in ash and iron contents results in considerable improvement in the operating efficiency, particularly in the case of transmitters or microphones in which the voice currents are amplified.

This invention may be more clearly understood by reference to the accompanying drawing; in which:

Fig. 1 is a longitudinal vertical cross-section of a furnace for roasting the carbon particles in accordance with this invention.

Fig. 2 is a view in elevation of a magnetic separator for separating the more magnetic particles of carbon from those less magnetic, and

Fig. 3 is an enlarged sectional view of the magnetic pulley shown in Fig. 2.

Referring to the drawing, Fig. 1 discloses a continuous roasting furnace in which the raw coal after being crushed, screened and washed, is roasted in the presence of a reducing atmosphere. This furnace comprises a central tube 7 of alundum or other refractory material which is gas tight and through which the carbon particles are "tumbled" or passed. This tube is rotated by means of a gear 8 cooperating with suitable reducing gears and motor which are not shown. The carbon is fed into the furnace from a hopper 9 provided with a valve 10, by means of a spiral conveyor or feeder 11 which may be driven by the same reducing gear employed to rotate tube 7. In order to make possible the close regulation of the atmosphere entering the tube 7, the joints and connections at the intake end of the apparatus are preferably made substantially gas tight. For this purpose mercury seals 12 and 13 have been found satisfactory.

The heating unit comprises a grooved refractory tube 14 such as alundum wound with resistance wire 15. This heating tube is preferably made removable by enclosing it in a refractory tube 16, over which the insulating material is placed. This insulation may comprise, for example, a powdered sil-o-cel 17 held in place by means of magnesia-asbestos pipe covering 18. A gas inlet 19 is provided for supplying hydrogen or other suitable gas which passes through the tube 7 and is expelled at the outlet 20.

The rate of rotation of tube 7 and its angle of inclination is determined by the length of the furnace and the controlled temperature. For a tube whose controlled temperature length is two feet a rate of rotation of the tube of one revolution per minute when inclined at an angle of $4\frac{1}{3}°$ to the horizontal has been found satisfactory since, under these conditions, the granular carbon is moved at a rate of two feet per hour, the temperature of the furnace being maintained approximately within a range of 1,000° to 1,300° C.

As the carbon particles pass from hopper 9 through valve 10 into the entrance of the tube 7, they come in contact with the rotating conveyor 11 which propels them to the heated portion of the furnace. Due to the rotation of the tube 7, these particles are maintained at the desired temperature for a predetermined time and are then received in a suitable receptacle 21. The reducing gas employed, which is preferably hydrogen, enters through inlet 19 and maintains a reducing atmosphere within the furnace so that the iron compounds present to a greater or less degree in individual particles of carbon are reduced to magnetic iron.

The roasted carbon particles are next placed in the hopper 25 of the magnetic separator shown in Fig. 2. From this hopper they pass at a predetermined rate through a valve 26 and then upon the belt 27 which passes over magnetic pulley 28 and idler 29. The magnetic pulley as shown in detail in Fig. 3 comprises a pair of cup-shaped members 30 and 31 having hollow central posts and placed in opposition to each other in such a way as to provide an annular space for the energizing coil 32. The outer portions of the cup-shaped members are separated from each other by means of a spacer ring 33 of brass or other suitable non-magnetic material so dimensioned as to insure a separation of approximately $\frac{1}{16}$ inch between these members. The coil 32 is provided with terminal wires 34 and 35 which are connected to slip rings 36 and 37 respectively which in turn are engaged by brushes 39 and 40 and by means of which connection may be made to a suitable source of energy. These slip rings and the cup-shaped members 30 and 31 together with driving pulley 41 are rigidly connected to shaft 42 which is journaled in suitable supports 43 and 44.

The belt 27, which is preferably of phosphor bronze approximately .006 inch in thickness receives the falling particles of carbon which are directed to the center line of the pulley 28 by means of guide member 45. As this pulley rotates in the direction shown by the arrow, the non-magnetic particles, or those magnetic only to a slight degree, are dropped into the funnel shaped hopper 47, while those more magnetic are held in contact with the surface of the belt until it passes from the pulley 28 and as the field density becomes less, these particles fall into the funnel 48.

By varying the intensity of the energizing current in the winding 32, greater or less percentages of the magnetic material may be caused to pass into funnel 48. It has been found that with the type of anthracite coal referred to above, namely, one having an ash content of less than five percent and less than ten percent volatile matter, a satisfactory product results with a field strength which removes from five percent to twenty percent of the material. This is accomplished with a magnetizing force of approximately 225 ampere turns.

In the arrangement described above, the roasting of carbon is accomplished without a preheat treatment. In practice, however, more satisfactory results have been accomplished if the carbon is first given a heat treatment as described in Patent 1,722,055, granted to me on July 3, 1929.

What is claimed is:

1. A method of producing transmitter carbon from anthracite coal which consists in crushing, screening and washing said coal to obtain a clean granular material of the desired size, reducing the iron compounds present in the granular material to magnetic iron, and magnetically separating the more magnetic particles from the remainder of the carbon mass.

2. A method of producing transmitter carbon which comprises selecting anthracite coal having an ash content less than 5%, crushing, screening and washing said selected coal to obtain a clean, granular material of the desired size, subjecting such granular material to a high temperature in a reducing atmosphere whereby iron compounds therein are reduced to magnetic iron and then separating those particles which are the more magnetic from the remainder of the carbon mass.

3. As a new article of manufacture, transmitter carbon having an iron content not greater than .14%.

In witness whereof, I hereunto subscribe my name this 10th day of March, 1930.

HOMER H. LOWRY.