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MAGNETIC SEPARATOR

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FIG. 1.

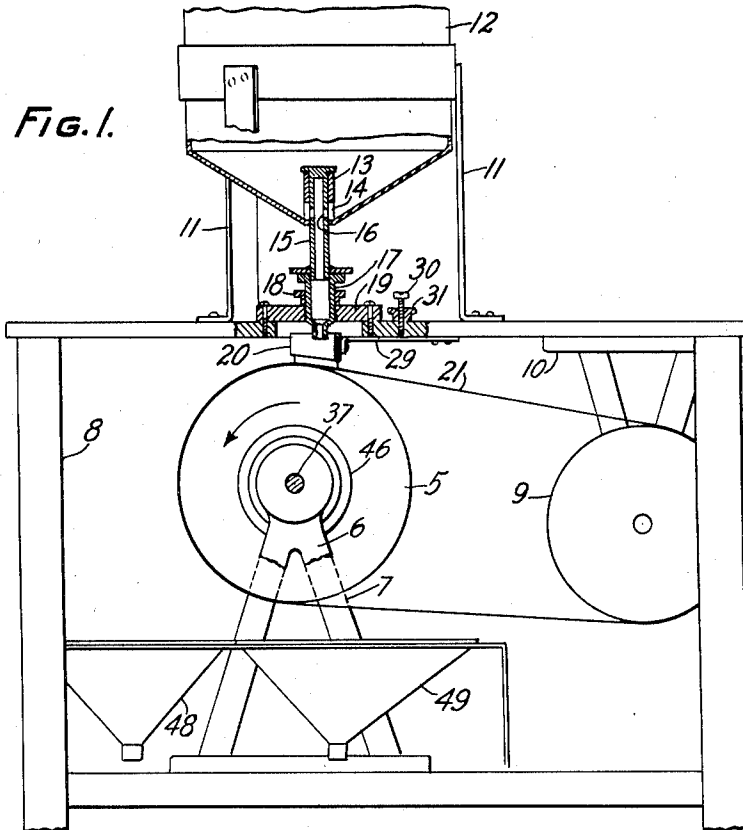


FIG. 3.

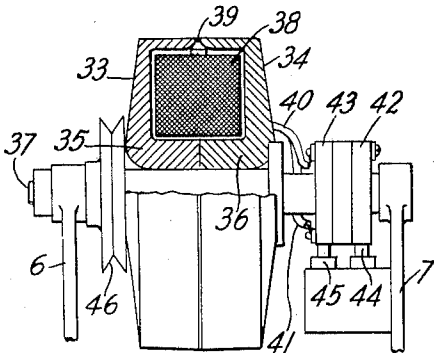
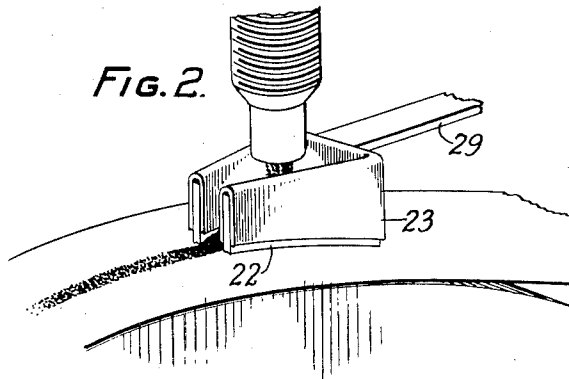


FIG. 2.



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MAGNETIC SEPARATOR

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3 Claims. (Cl. 209-219)

This invention relates to magnetic separators and more particular to a magnetic separator especially adapted for the separation of magnetic particles of granular transmitter carbon from those less magnetic.

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 becomes 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 granular carbon used in telephone transmitters is preferably made from a high grade of anthracite coal having less than 10% 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" and "aging". 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.

It is an object of the present invention to provide a magnetic separator of improved construction and one which is particularly adapted for the magnetic separation of granular carbon.

In accordance with this invention there is provided a magnetic separator in which the carbon granules are directed upon a very thin non-magnetic belt whereby the granules are allowed to come into close proximity to the more intense portion of the magnetic field produced by the magnetic pulley over the face of which the belt travels.

A further feature of the invention is an adjustable guide member which receives the carbon

particles as they pass from the hopper through a suitable valve and nozzle and guides them to the mid-point of the belt where the magnetic field is the most intense.

These and other features of the invention will be more clearly understood by reference to the detailed description and the accompanying drawings in which:

Fig. 1 is a side elevation of the magnetic separator in accordance with this invention, certain of the features being shown in cross-section for the sake of clearness.

Fig. 2 is a view in perspective showing the guiding member for guiding the carbon particles to the mid-point of the belt; and

Fig. 3 is a view partly in cross section of the magnetic pulley of Fig. 1.

Referring more particularly to Figs. 1 and 3, a magnetic pulley 5 is mounted by suitable supports 6, 7 to the supporting framework 8 and an idler pulley 9 is likewise rigidly mounted on this framework by means of supports 10-10. Supported upon the top of framework 8 by means of legs 11-11, is a hopper 12 provided at the bottom with a reentrant tube 13 having perforations 14 through the walls thereof. Slidably mounted within this tube is a tubular valve 15 having perforations 16 therein adapted to align with the perforations 14 when in the position shown in Fig. 1. The lower portion of valve 15 fits into a nozzle 17 which is rigidly secured by means of locknut 18 to a plate 19 which in turn is rigidly fastened to the framework. The lower portion of nozzle 17 is provided with a relatively long bore of small diameter, in order to insure the discharge of carbon from the hopper 12 at a substantially uniform rate irrespective of the head of carbon in the hopper. In practice it has been found satisfactory to provide a bore approximately .060" in diameter and $\frac{7}{8}$ " in length.

Directly under the nozzle 17 is a guiding member 20 which receives the carbon particles and guides them to the mid-point of metallic belt 21 as it travels over the face of pulley 5. This belt is preferably made very thin in order that it may conduct the carbon particles into a strong magnetic field. Furthermore, it must have a high tensile strength and a high fatigue resistance. Satisfactory results have been obtained with a belt .006" thick of phosphor bronze, the width of this belt being approximately 1". The guiding member 20 which as more clearly shown in Fig. 2 consists of a strip of felt 22 supported on either side by a supporting member 23 and formed as shown into a structure substantially

U shaped but with the free ends converging as shown to guide the carbon particles to the mid-point of the belt where the magnetic field is most intense. This guiding member is secured to the framework 8 by means of flexible member 29 and an adjustable means consisting of a screw 30 and locknut 31 is provided for varying the tension of member 29 and thus regulating the force which the guiding member exerts upon the traveling belt 21.

The magnetic pulley as shown more clearly in Fig. 3 comprises a pair of cup-shaped members 33, 34 having hollow center posts 35, 36, respectively, positioned upon the shaft 37 as shown to provide an annular space in which is mounted the energizing coil 38. A spacing ring 39 of brass or other suitable non-magnetic material is clamped between the outer portions of the cup-shaped members 33 and 34 and thereby serves to produce a definite air gap in the magnetic circuit of the pulley. In practice it has been found that an air gap of approximately $\frac{1}{16}$ " gives satisfactory results. The energizing winding 38 is provided with terminal wires 40 and 41 which are connected respectively to slip rings 42 and 43. Brushes 44 and 45, engaging the slip rings, serve to connect the energizing coil to a suitable source of energy. Also mounted upon shaft 37 is driving pulley 46 which is belted to a driving motor (not shown).

In the operation of the device the magnetic carbon is placed in hopper 12 and with the valve in the position shown, passes through the perforations 14 and 16 through tube 15 and the nozzle 18 and is deposited at a uniform rate upon belt 21. At this point the guide member 20 functions to draw the particles to the mid-point of the belt as shown more clearly in Fig. 2. With the pulley 5 rotating in the direction shown by the arrow, the non-magnetic particles fall by gravity into the funnel 48 when they are no longer supported by the belt 21. Those particles, however, which are sufficiently magnetic are held to the belt by the force of the magnetic field and are not discharged until the belt draws away from the pulley 5 when the magnetic particles are discharged into funnel 49.

It has been found that this separator operates satisfactorily with a wide variation in the speed of the belt. By varying the intensity of the magnetizing current, it is possible to regulate the percent of magnetic material eliminated. With the conditions as described above, it has been found that a magnetizing force of approximately 225 ampere-turns provides a field intensity which gives very satisfactory results, removing 5 to 20% of the more magnetic particles present in carbon obtained from a high grade of anthracite coal.

What is claimed is:

1. A magnetic separator comprising a magnetic pulley, and a belt traveling over the face thereof and upon which the material to be separated is directed, said belt being of phosphor bronze and approximately .006" thick.

2. A magnetic separator comprising a magnetic pulley, a non-magnetic metallic belt traveling over the face thereof and upon which the material to be separated is directed, and a guiding member including a substantially U shaped wiper of felt with converging free ends resting upon said belt and arranged to guide the particles to be separated to the mid-point of the belt.

3. A magnetic separator comprising a receptacle in which the material to be separated is placed, said receptacle having at its lower portion a reentrant tube provided with a perforation therethrough, a tubular valve slidable in said reentrant tube and having a perforation therethrough which may be positioned to align with the perforation of the reentrant tube, a nozzle having its upper end adapted to receive the lower end of the tubular valve and having therethrough a relatively long perforation of small diameter whereby the material passes therethrough at a rate substantially independent of the head of the material in the receptacle, a magnetic pulley, a belt traveling over the face of said pulley, and adapted to receive the material passing from the receptacle through said valve and nozzle and a guiding member adapted to guide material received from the nozzle to the midpoint of said belt, where the magnetic field is at a maximum.

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