March 1, 1955 H. BECKING 2,703,175

DEVICE FOR REMOVING FINE PARTICLES OF IRON FROM LOOSE MATERIAL, ESPECIALLY TOBACCO

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FIG. 1

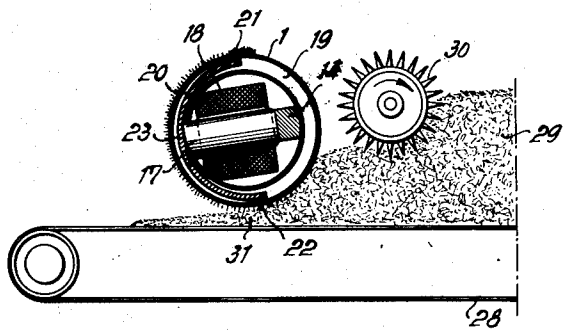
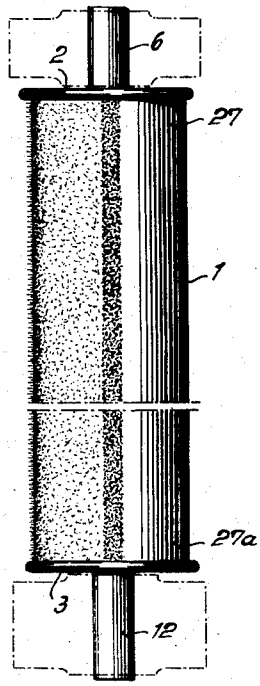



FIG. 2




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FIG. 3

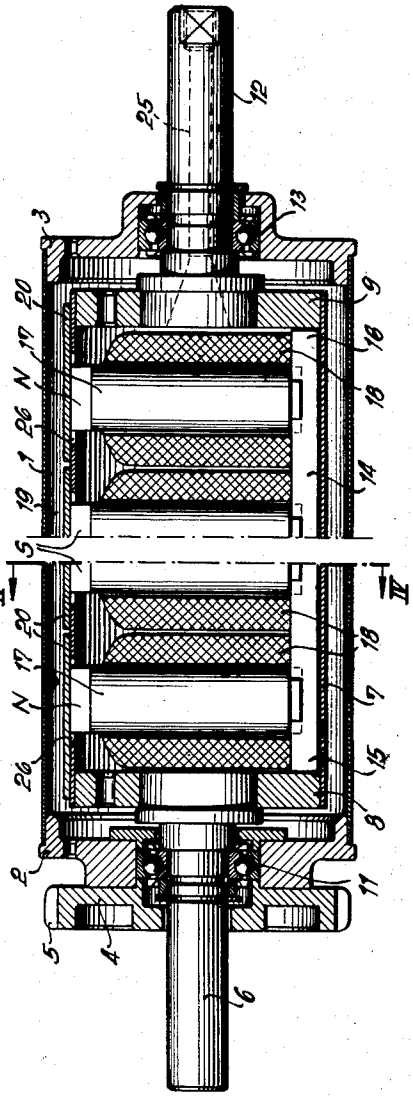
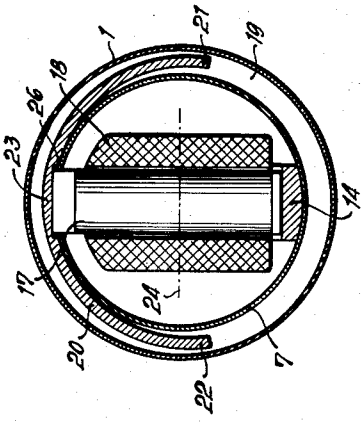



FIG. 4




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# DEVICE FOR REMOVING FINE PARTICLES OF IRON FROM LOOSE MATERIAL, ESPECIALLY TOBACCO

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Application January 8, 1954, Serial No. 402,925

7 Claims. (Cl. 209—223)

The invention relates to a device for removing fine particles of iron from loose material especially from tobacco.

It has already been proposed to pass the material to be cleared in a transverse direction below a rotating hollow cylinder of non-magnetic material, inside which were arranged stationary magnets, in particular electromagnets, placed side by side in the axial direction, the axes of these magnets being radial to the axis of rotation of the cylinder and approximately horizontal; those poles of these magnets which were facing in the direction opposite to the incoming material were provided with an approximately semi-circular pole piece extending at both sides of the pole.

In order to have powerful magnets in such an arrangement a large amount of space had to be provided for the magnets and in particular for the coils of the electromagnets.

On the other hand the supports for the stationary electromagnets had to have sufficient solidity and strength. It was very difficult to reconcile these two requirements. In particular if such magnetic cylinders are to be of long construction—a requirement which is always becoming more frequent—then the requirements for the strength of the supporting members for the fixed magnets become so severe that the construction of the magnets themselves is liable to suffer.

According to the invention these difficulties are avoided by arranging the stationary magnets inside a drum which itself is fixed within the rotating cylinder.

In this manner the construction of the magnets, and in particular of the electromagnets, is no longer liable to suffer by consideration for the strength characteristics of the supporting members. The stationary drum of comparatively large diameter has such a moment of resistance that the cylinders can be constructed in practically unlimited length without having to adopt a small or unsuitable design for the electromagnets.

In such magnetic cylinders it is known to mount the electromagnets on the bend of a shaft which is carried centrally in the trunnions of the rotating cylinder. Such a cranked shaft facilitates the incorporation of a large weight of copper in the electromagnets, but on the other hand reduces the strength characteristics of the shaft in such a way that, in the known types of magnetic cylinders such a construction can only be adopted when short cylinders are to be used. On the other hand, in magnetic cylinders of long construction it was necessary to build out centrally the stationary supporting shaft in order to obtain a sufficient degree of strength, so that again the construction of the electromagnets themselves suffered in the process. By means of the invention it is directly possible to arrange the cores of the electromagnets upon a continuous rod of magnetic material, in particular of iron, which is arranged eccentrically to the axis of the rotating cylinder. This rod then serves essentially only for the distribution of the magnetic flux and does not have to serve any constructional purpose, as a consequence of which the cross-section of the rod may be quite small. By such means very long magnetic cylinders may be constructed having individual electromagnets of considerable strength and extending over a large portion of the cylinder periphery.

Preferably the armature is arranged between the rotating cylinder and the stationary drum by arranging that only that part of the magnet core which serves to secure



the armature penetrates the drum surface. Moreover, it is preferred to make the substantially semi-cylindrical armature eccentric to the cylinder in the manner that the central portion of the armature which is connected with the magnet core is farther removed from the inner surface of the rotating cylinder than are its ends. Such a construction provides the possibility of obtaining, at the ends of the semi-cylindrical armature, a greater concentration of the magnetic field than was before possible, whereby the mode of operation of the magnetic cylinder itself is improved.

Further improvements and preferred embodiments will now be described with reference to the accompanying drawing in which one constructional form of the invention is represented.

In the drawing:

Figure 1 shows a section through a diagram intended to make clear the mode of operation of the invention.

Figure 2 is a plan of the arrangement shown in Figure 1.

Figure 3 is a section on a larger scale of a magnetic cylinder constructed according to the invention.

Figure 4 is a section according to the plane of line IV—IV of Figure 3.

A magnetic cylinder according to Figures 3 and 4 is constructed from a cylinder **1** of non-magnetic material, for example brass, which at its two ends is secured to discs **2** and **3** also of non-magnetic material for example Silumin. This magnetic cylinder is driven through a spur gear wheel **4** which is made fast to the disc **2**. The pinion which engages with the teeth **5** of the spur gear is not shown. Inside this cylinder **1** and concentric with the axis of rotation **6** there is arranged a drum **7** also of non-magnetic material, the respective ends of which are each secured to a disc **8** and **9**, also of non-magnetic material. The disc **8** is secured to a stub shaft **6** of steel, upon which the disc **2** of cylinder **1** is rotatably mounted by means of the journal bearing **11**. In the same manner the disc **9** is secured to a stub shaft **12** of steel, by means of which the disc **3** of the cylinder **1** is rotatably mounted on the journal bearing **13**. A steel rod **14** is arranged inside the drum **7** and eccentrically to the axis of rotation **6**. Upon this rod **14** are secured a series of axially spaced magnet cores **17** which project through openings **26** of the drum **7** into the annular space **19** between the stationary drum and the rotating cylinder **1**. The magnet coils **18** enclosing the cores are wound in such a manner that the poles alternate from one to the other in the axial direction. A south pole follows a north pole this being indicated in Figure 3 by the letters S and N. Upon the ends of the cores **17** which project from the openings **26** in the drum **7** there are secured armatures or pole shoes **20** which lie eccentrically within the annular space **19** so that their ends **21** and **22** lie considerably nearer to the inner surface of cylinder **1** than do their centres **23**. The cross-section of the rod **14** can be designed to be so small that the coils **18** can extend a considerable distance over the central plane **24** (see Figure 4), this construction giving the possibility that the ends **21** and **22** of the pole shoe may also extend a considerable distance over the central plane, in which connection it should be observed that the magnetic flux cannot short circuit between the ends of the pole shoe **21** and **22** and the steel rod **14**. The current leads for the magnet coils **18** are extended through the hollow centre **25** of the stub shaft **12** and the disc **9**.

The pole shoes **20** of those magnets which are arranged at the ends of the cylinder may be constructed in asymmetrical form in that their ends are extended axially. Accordingly the pole shoe **20** of that electromagnet which is shown on the left in Figure 3 is extended towards the disc **8** whilst the armature of that electromagnet which is shown on the right in Figure 3 is extended towards the disc **9**. In this manner the magnetic effect is made available even at the edges of the rotating cylinder. The mode of operation of the invention is shown in more detail in Figures 1 and 2.

The magnetic cylinder, which in Figure 1 rotates in a clockwise direction, is indicated by the numerals **27** and **27*a***. The spur gear **5** and its driving pinion are omitted here for the sake of simplicity. This magnetic

cylinder is arranged above a travelling conveyor **28** which transports the material, for example tobacco **29** to the cylinder. In front of the magnetic cylinder there is arranged a beater cylinder **30** whereby it is arranged that the material is guided evenly into the gap **31** which is formed between the upper limb of the conveyor **28** and the magnetic cylinder. The arrangement according to the invention provides a concentration of the magnetic flux at the ends of **21** and **22** of the pole shoes **20** so that this magnetic effect is practically constant over the entire length of the cylinder. At the centre **23** of the pole shoe **20** the magnetic effect is comparatively small whilst the influence is substantially zero at that side of the cylinder **1** which is opposite to the pole shoe.

With this arrangement the end of the pole shoe **22** extracts any fine iron particles from the passing stream of material, for example tobacco. Since the magnetic force is always sufficiently great, the rotating cylinder carries on the extracted iron particles until they are approximately opposite to the other end **21** of the pole shoe, the electromagnet being constructed in such a manner that these upper ends of the pole shoes lie somewhat behind the crown of the cylinder. At this point the magnetic force is again at a maximum. The fine particles are held at this point and partake no further in the rotation of the drum. A special collector need not be provided. The fine iron particles which collect above the pole shoe ends **21** can be removed by hand from time to time during the running of the machine.

What I claim is:

1. In a device for removing fine iron particles from loose material especially tobacco, a rotatable hollow cylinder of non-magnetic material, means for revolving said rotatable hollow cylinder, a stationary hollow cylinder of non-magnetic material arranged within said rotatable hollow cylinder, two shaft members connected with the one and the other side respectively of said stationary hollow cylinder, means for rotatably supporting said rotatable hollow cylinder on said shaft members, a plurality of magnets arranged within said stationary hollow cylinder side by side in such a way that the north-south direction thereof lying substantially radially with respect to the axis of said cylinders, the said plurality of magnets having pole shoes lying on the same side with respect to the axis of said cylinders and extending substantially semi-circularly with respect thereto.

2. In a device for removing fine iron particles from loose material especially tobacco, a rotatable hollow cylinder of non-magnetic material, means for revolving said rotatable hollow cylinder, a stationary hollow cylinder of non-magnetic material concentrically arranged within said rotatable hollow cylinder, two shaft members connected with the one and the other side respectively of said stationary hollow cylinder, means for rotatably supporting said rotatable hollow cylinder on said shaft members, a rod member extending axially and eccentrically from one side of said stationary hollow cylinder to the other side thereof, a plurality of magnet cores supported by said rod member and extending substantially radially with respect to the axis of said cylinders, a plurality of solenoids wound round said magnet cores, and a plurality of pole shoes each extending substantially semi-circularly with respect to the axis of said cylinders and being fixed on one of said magnet cores on the side thereof opposite said rod member.



3. In a device as claimed in claim 2, said solenoids being wound round said magnet cores in such a way that north pole will follow a south pole in the axial direction.

4. In a device for removing fine iron particles from loose material especially tobacco, a rotatable hollow cylinder of non-magnetic material, means for revolving said rotatable hollow cylinder, a stationary hollow cylinder of non-magnetic material concentrically arranged within said rotatable hollow cylinder, two disc members of non-magnetic material connected with the one and the other side respectively of said stationary hollow cylinder, two shaft members concentrically secured to said disc members and each extending outside said stationary hollow cylinder, means for rotatably supporting said rotatable hollow cylinder on said shaft members, a rod member supported by said disc members and extending axially adjacent the inner surface of said stationary hollow cylinder, a plurality of magnet cores supported axially side by side by said rod member and extending substantially radially with respect to the axis of said cylinders, a plurality of solenoids wound round said magnet cores, and a plurality of pole shoes each extending substantially semi-circularly with respect to the axis of said cylinders and being fixed on one of said magnet cores on the side thereof opposite said rod member.

5. In a device as claimed in claim 4, said pole shoes being arranged within the annular gap between the inner circumference of said rotatable hollow cylinder and the outer circumference of said stationary hollow cylinder.

6. In a device as claimed in claim 4, said pole shoes being arranged within the annular gap between the inner circumference of said rotatable hollow cylinder and the outer circumference of said stationary hollow cylinder in such a way that the ends of said pole shoes will lie nearer to the inner circumference of said rotatable hollow cylinder than the middle part thereof.

7. In a device as claimed in claim 1, means for supporting said shaft members, means for feeding loose material below and past said hollow cylinders in a direction transverse to the axis thereof with a small gap between said feeding means and said rotatable hollow cylinder, said stationary cylinder being arranged in such a way that the pole shoes thereof will substantially lie opposite that side where the loose material is entering.

No references cited.