Sept. 28, 1954 W. E. BOX ET AL 2,690,263

MAGNETIC SEPARATOR

Filed Oct. 23, 1950 2 Sheets-Sheet 1

FIG1.

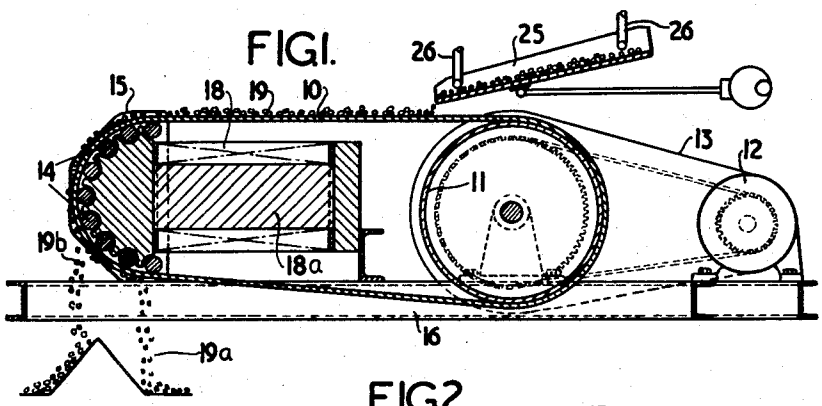


FIG2.

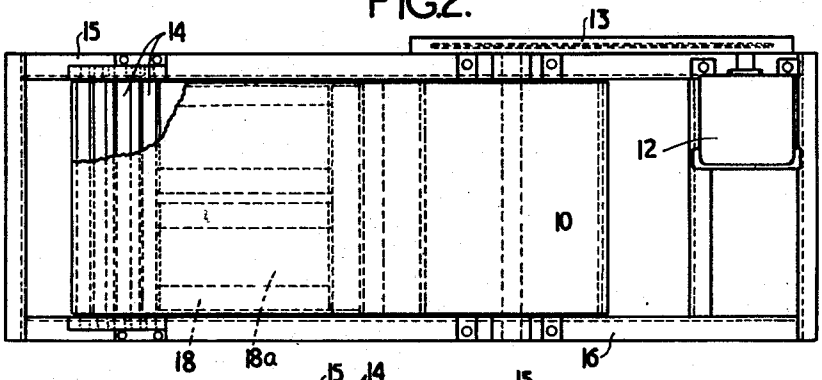


FIG3.

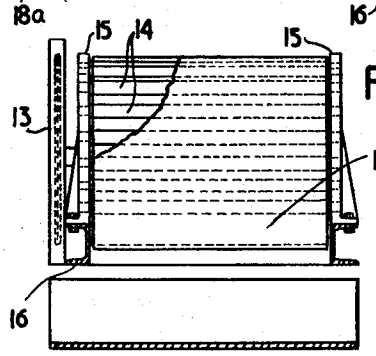
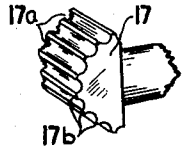


FIG4.



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Sept. 28, 1954 W. E. BOX ET AL 2,690,263

MAGNETIC SEPARATOR

Filed Oct. 23, 1950 2 Sheets-Sheet 2

FIG.5.

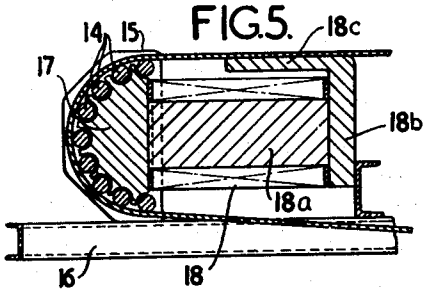


FIG.6.

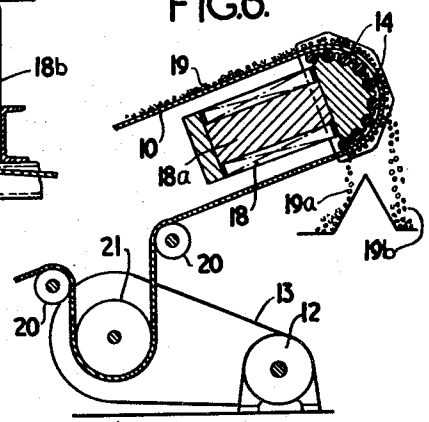
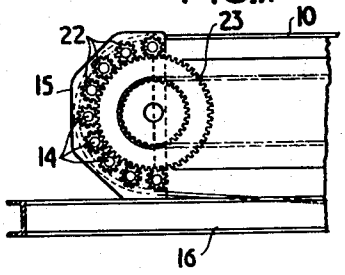


FIG.7.



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2,690,263

MAGNETIC SEPARATOR

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Claims priority, application Great Britain May 12, 1950

3 Claims. (Cl. 209—223)

1

This invention has reference to improvements relating to magnetic separators and is concerned particularly with magnetic separators of the kind in which the separated magnetic material is removed by means of a conveyor usually in the form of an endless belt which passes around a source of magnetic energy located at the place where separation is to be effected.

In magnetic separators of the aforesaid kind as heretofore constructed, the conveyor is passed around either a magnetised pulley or a drum which is adapted to rotate about a stationary magnet.

Magnetic separators as aforesaid using a magnetic pulley are subject to the limitations that the magnetic flux has to emanate from the whole of the curved surface of the pulley and since the pulley is constantly rotating, a considerable portion of the magnetic energy is dissipated uselessly, and further since the cost of a magnetic pulley must necessarily depend upon the diameter of the pulley, the cost becomes disproportionate in the case where the circumstances necessitate the use of a large diameter pulley and consequently an increase in the wasted energy.

Magnetic separators as aforesaid which employ a drum adapted to rotate about a stationary magnet are not subject to the disadvantage of the magnetic pulley that the source of magnetic energy has to provide magnetic flux around the whole curved surface but nevertheless the diameter of the drum determines the size of the source of magnetic energy so that the diameter of the drum again determines the cost and this cost once more may be disproportionately high in the case where circumstances require a drum of large diameter especially in the event of the use of the costly high intensity permanent magnetic materials now available.

The present invention has for its object to provide an improved magnetic separator of the kind referred to which provides the advantages of the magnetic pulley and of the drum type of magnetic separator without being subject to the limitations thereof and which furthermore admits of the concentration at the place of separation of a field of force, the intensity of which may be increased to any desired degree.

A magnetic separator constructed in accordance with this invention incorporates an endless band conveyor having superposed runs, upon the upper run of which the material to be separated is directed, magnetic polar means located transversely between the runs of the conveyor at the discharge end of the conveyor and extending for the full width of the conveyor with the poles arranged transversely to the conveyor, said polar means having a semi-circular convex surface which is concentric with and substantially coincident with the locus of the conveyor in changing direction at the discharge end and which extends from the diametrical plane which includes the place where the uppermost run commences to change direction, magnetic flux providing means which is located to the rear of the aforesaid polar means and between the runs of the conveyor, a plurality of equidistantly spaced transverse concave indentations in the curved surface of the polar means and rollers arranged within said indentations which extend for the full width of the conveyor but which project slightly above the convex surface bounding the said indentations, said rollers serving as a guide means for the conveyor so that as the stream of material passes over the rollers, it is subjected to intense magnetic flux emanating from the polar means in close proximity thereto.

2

The invention will now be described with particular reference to the accompanying drawings which illustrate the invention somewhat diagrammatically as applied to magnetic separators utilising electro-magnets as the source of magnetic energy.

In the drawings:

Figure 1 is a view partly in side elevation and partly in section of one embodiment of the invention.

Figure 2 is a plan partly broken away of the magnetic separator illustrated in Figure 1.

Figure 3 is a view partly in front elevation and partly in section of the magnetic separator illustrated in Figures 1 and 2.

Figure 4 is a fragmentary view in perspective of the pole piece utilised in the magnetic separator illustrated in Figures 1–3.

Figure 5 is a fragmentary view partly in side elevation and partly in section of a magnetic separator which is generally similar to that illustrated in Figures 1–4, but in which provision is made for pre-magnetisation before separation.

Figure 6 is a fragmentary view partly in side elevation and partly in section illustrating an alternative method of driving the endless belt in a magnetic separator such as is illustrated in Figures 1–4.

Figure 7 is a fragmentary view illustrating another variant of a magnetic separator as illustrated in Figures 1–4.

In the drawings like numerals of reference indicate similar parts in the several views.

Referring first to the embodiment of the invention illustrated in Figures 1–3.

According to the said embodiment of the invention the improved magnetic separator incorporates an endless belt conveyor 10 which at the end remote from the place where separation is to take place is passed around a pulley 11 which is adapted to be driven from an electrical motor 12 through the medium of chain and sprocket gearing, said chain and sprocket gearing being contained within a casing 13.

At the place where separation is to take place the belt 10 is passed around a plurality of horizontally and transversely arranged freely rotatable rollers 14 the ends of which are rotatably mounted in end plates 15 located on either side of the belt 10 said end plates 15 being supported from the main girder structure 16.

The rollers 14 aforesaid are located within and project slightly from the gaps 17*a* between the indentations 17*b* of the pole piece 17, each of said indentations being bounded by a concave curved surface.

The pole piece 17 aforesaid is secured to the front end of the core 18*a* of an electro-magnet 18 which is located between the runs of the belt 10.

The freely rotatable rollers 14 constitute a guide means for the belt 10 at the place where separation is to take place.

By reason of there being no restriction within wide limits as to the length of the electro-magnet 18 the said electro-magnet 18 may be constructed so that a magnetic field of any required degree of intensity can be concentrated at the pole piece 17, whereby the material 19 to be separated as it passes through the field of force emanating from the pole piece 17 is subjected to a magnetic force of great intensity which ensures efficient separation of and the removal of, and the discharge of the separated magnetic material 19*a* away from the main stream 19*b* of non-magnetic material from which separation has been effected.

In the variant of the embodiment of the invention just described which is illustrated in Figure 5 the rear end of the core 18*a* of the electro-magnet 18 is provided with a pole piece 18*b* having a forwardly directed extension 18*c* which is located below the underside of the upper run of the belt 10 in advance of the place where the belt 10 commences to pass around the uppermost of the rollers 14, said extension 18*c* of the pole piece 18*b* subjecting the material 19 on the belt 10 to pre-magnetisation before it is submitted to the influence of the magnetic energy emanating from the pole piece 17.

In the further variant of the embodiment of the invention illustrated in Figures 1–4 which is shown in Figure 6, the belt 10 is passed around an idle pulley (not shown) at the position remote from the place where separation is to take place and at an intermediate position the said belt 10 is passed over jockey pulleys 20 and under and around a driving pulley 21 which is adapted to be driven from an electric motor 12 again through the medium of chain and sprocket gearing.

According to the still further variant of the embodiment of the invention illustrated in Figures 1–4, which is shown in Figure 7 the rollers 14 have fixed on the ends thereof pinions 22 which mesh with a common gear wheel 23 which is adapted to be driven from the electric motor 12 through the medium of chain and sprocket gearing so that in this variant the rollers 14 are positively driven.

As is indicated in Figure 1 the material 19 to

be dealt with conveniently may be fed on to the upper run of the belt 10 by means of a shaker feed consisting of a chute 25 which is suspended by means of links 26 and which is capable of being vibrated by means of a rod and eccentric mechanism in a well known manner.

Although in the embodiments of the invention which have been described electro-magnets are employed it is to be understood that the invention is applicable to cases where permanent magnets are required to be used as the source of emanating energy, and once again as there is no restriction with wide limits of the length of the magnet a permanent magnet battery may be built up so that a magnetic field of any required degree of intensity can be concentrated at the pole piece which is located at the place where separation is to be effected.

Having thus disclosed our invention and described in detail illustrative embodiments thereof, we claim as new and desire to secure by Letters Patent:

1. A magnetic separator incorporating an endless band conveyor having superposed runs on to the upper run of which the material to be separated is directed, magnetic polar means located transversely between the runs of the conveyor at the discharge end of the conveyor and extending for the full width of the conveyor with the poles arranged transversely to the conveyor, said polar means having a semi-circular surface which is concentric with and substantially coincident with the locus of the conveyor in changing direction at the discharge end and which extends from the diametrical plane which includes the place where the uppermost run commences to change direction, magnetic flux providing means which is located to the rear of the aforesaid polar means and between the runs of the conveyor, a plurality of equidistantly spaced transverse indentations in the curved surface of the polar means and rollers arranged within said indentations which extend for the full width of the conveyor but which project slightly above the surface bounding the said indentations, said rollers serving as a guide means for the conveyor so that as the stream of material passes over the rollers it is subjected to intense magnetic flux emanating from the polar means in close proximity thereto.

2. A magnetic separator according to claim 1 in which the rollers are freely rotatable.

3. A magnetic separator according to claim 1 in which the rollers are adapted to be driven positively.

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