Jan. 13, 1970 A. G. ST. PIERRE 3,489,281

MAGNETIC SEPARATOR

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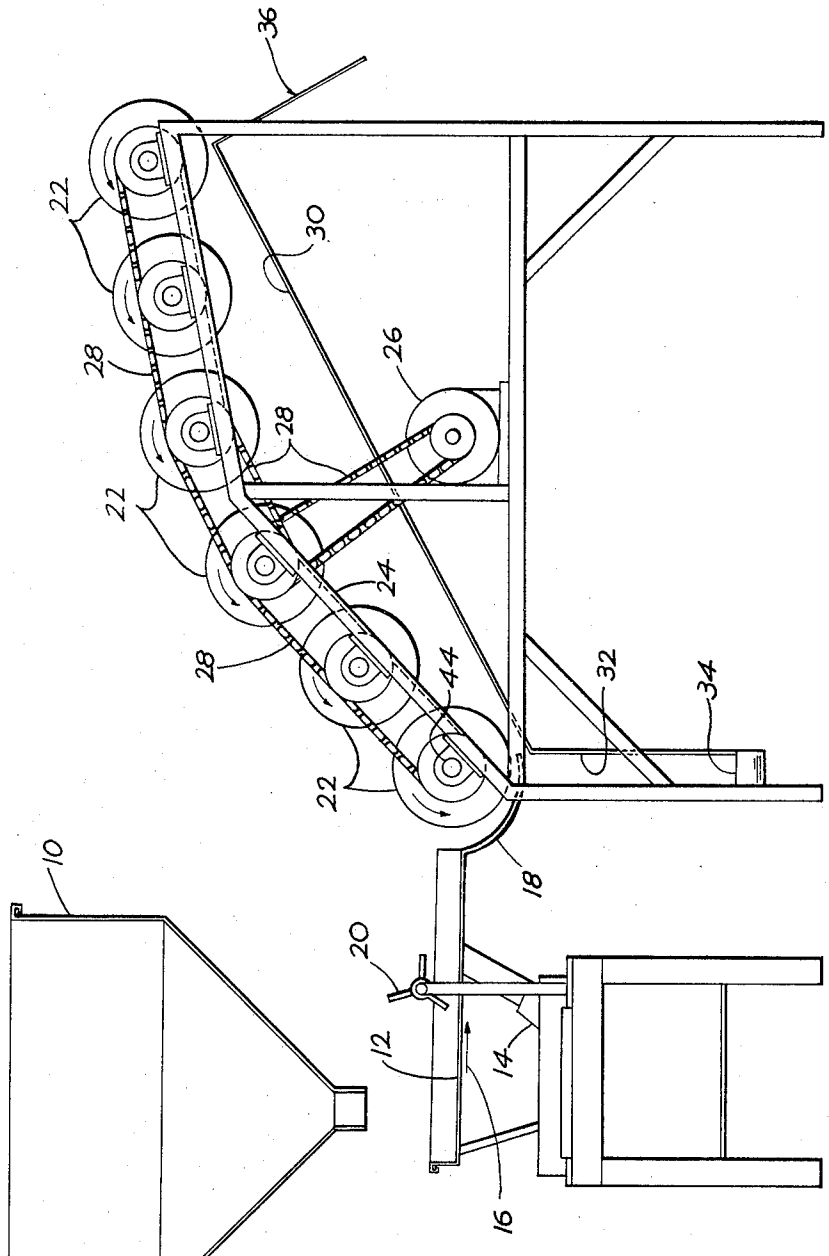


FIG. 1

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FIG. 2

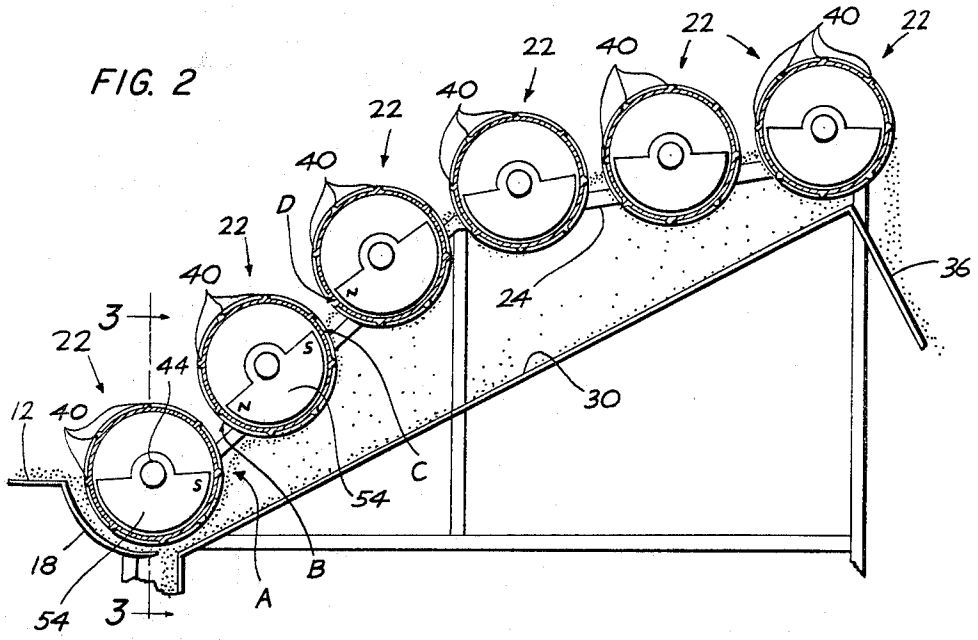
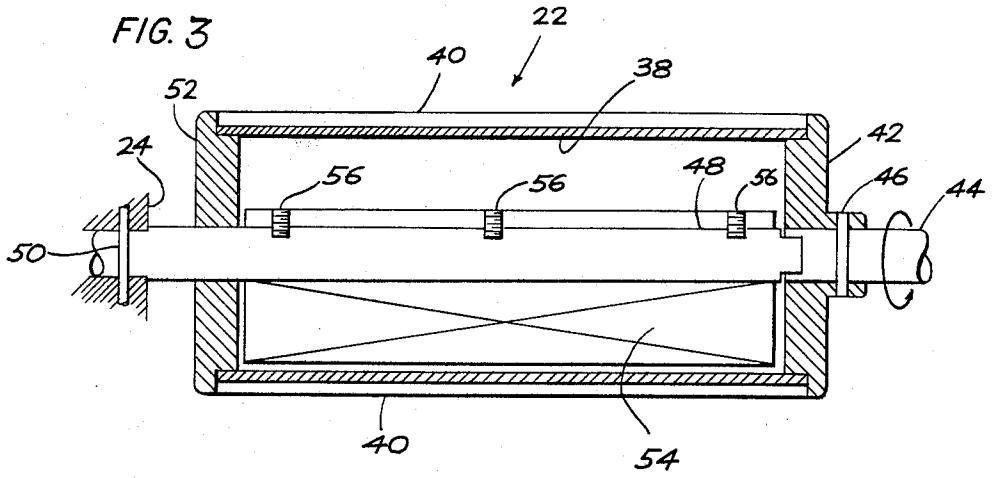


FIG. 3



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MAGNETIC SEPARATOR

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ABSTRACT OF THE DISCLOSURE

A vibrating tray feeds a mixture of magnetic and non-magnetic material onto a non-rotating magnetized segment of a rotating drum. The drum is not magnetic so that non-magnetic material drops from the drum and magnetic material is carried through the magnetized segment. Another drum, mounted slightly higher than the first on an inclined frame, also has a non-rotating magnetized segment, and the polarity of the segments are such that the magnetic material is transferred onto the magnetic segment of the second drum with additional non-magnetic material being dropped off in the process. An inclined surface below these, and other similar drums on the inclined frame, carries the non-magnetic material in one direction beneath the drums while the magnetic material travels along the magnetic drum segments generally in the opposite direction.

SUMMARY OF INVENTION

This invention relates to magnetic separators, and deals more particularly with an apparatus which is capable of segregating a very high percentage of purely magnetic material from a heterogeneous mixture of magnetic and non-magnetic material.

A primary object of the present invention is to provide a magnetic separator in which only magnetic material is allowed to reach one end of the apparatus.

Another object of the present invention is to provide a magnetic separator which utilizes drums having magnetized fields located in fixed segments thereof for separating magnetic material from non-magnetic material, which drums do not require the use of scrapers or other devices for removing the magnetic material from their peripheries.

The drawings show a preferred embodiment of the invention and such embodiment will be described, but it will be understood that various changes may be made from the construction disclosed, and that the drawings and description are not to be construed as defining or limiting the scope of the invention, the claims forming a part of this specification being relied upon for that purpose.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is an elevational view of a magnetic separator which has a plurality of drums constructed in accordance with the present invention.

FIG. 2 is a vertical sectional view through the plurality of drums showing the mixture of magnetic and non-magnetic material in the process of being separated.

FIG. 3 is a sectional view of one of the rotating drums shown in FIG. 2, being taken along the line 3—3 of that figure.

DETAILED DESCRIPTION

Turning now to the drawings in greater detail, FIG. 1 shows a hopper **10** having a supply of a heterogeneous mixture of magnetic and non-magnetic material, such as scrap metal chips recovered from various manufacturing operations. The mixture drops through an opening in the hopper **10** onto a tray **12**, which tray is adapted to be vibrated in a conventional manner through the mechanism

14, so as to feed the scrap metal chips horizontally toward the right in the direction of the arrow **16**. The tray **12** includes an arcuately shaped shovel portion **18** at its downstream end into which the chips will fall when they have reached the right-hand end of the horizontal portion of the tray **12**. Means may be provided for spreading the chips on the tray **12** in order to provide a uniform distribution thereof across the width of the shovel **18**, and preferably said means comprises a spreader wheel **20** rotatably mounted above the surface of the tray **12** and driven by suitable means (not shown).

A plurality of rotating drums **22**, **22** are supported in inclined relationship on an inclined frame **24**, and means is provided in the form of a motor **26** for rotating each of the drums **22**, **22** in the same rotative directions through a chain and sprocket drive mechanism indicated generally at **28**. The rotating drums **22**, **22** are constructed of non-magnetic material and each includes a magnetized segment which does not rotate with the drum for feeding magnetic chips successively from the periphery of one drum to the periphery of the next drum. The non-magnetic chips fall downwardly onto an inclined pan **30** where they slide toward the left generally beneath the first drum **22**. The said drum is located with at least a portion of its magnetized segment arranged in spaced radial relationship to the arcuate shovel **18** of the tray **12**. Some non-magnetic material thus will drop immediately from the downstream edge, on lip, of the shovel portion **18** into a chute **42** where said material combines with the non-magnetic chip material fed to this point along the surface of the pan **30** and ultimately is deposited onto a take-away conveyor **34**. The magnetic material carried from drum to drum in the apparatus shown drops from the last drum **22** in the series onto an inclined ramp surface **36** where it can be carried away on another take-away conveyor (not shown).

Turning now to a more detailed description of the construction of each of the drums **22**, **22**, FIG. 3 shows a typical drum as comprising a cylindrically shaped stainless steel shell portion **38** having a plurality of longitudinally extending ribs **40**, **40** for engaging and agitating the chip material. The shell portion **38** is secured at one end to an end plate **42** of aluminum, which end plate is attached to a rotating shaft **44** through a pin **46**. The shaft **44** is journalled as shown in FIG. 1 and continuously driven in the direction indicated through the chain and sprocket mechanism **28** mentioned previously. Still with reference to FIG. 3, the inner end of the continuously driven shaft **44** is rotatably supported on a fixed shaft **48**, which fixed shaft extends axially through the drum **22** and is nonrotatably attached at its opposite end to the fixed frame **24** of the apparatus by means of the pin **50**. A second aluminum end plate **52** is provided at the opposite end of the shell portion **38** and is rotatably supported on the fixed shaft **48**. A permanent magnet **54** is secured to the fixed shaft **48** by a plurality of screws **56**, **56** to provide the fixed magnetized field segment in the rotating drum. As best shown in FIG. 2, the fixed magnetized field segment in each of the drums **22**, **22** comprises approximately one-half the periphery of the rotating drums **22**, **22**. The first drum **22**, which is located in spaced relation to the shovel portion **18** of the tray **12**, has its magnetized field located in the lower half portion of the drum with the result that magnetic material is carried off the shovel portion **18** and in a counterclockwise direction around the drum **22** to the point A. The second drum **22** has its axis of rotation located slightly above and to one side of the axis of rotation of the shaft **44** and the magnetized segment thereof is located below a line connecting said first and second drum axes. Preferably, the polarity of the permanent magnets **54**, **54** provided in these drums is so

arranged that lines of magnetic force are created between the point A and a point B on the second drum. This configuration of the magnets **54**, **54** in the first and second drums assures that the material transferred therebetween is substantially all of a magnetic nature. The non-magnetic material will not be attracted to the pole of the magnet **54** in the second drum but instead will drop downwardly onto the inclined surface **30** for delivery to the take-away conveyor **34**. The second and all of the subsequent drums **22**, **22** on the inclined frame **24** are similarly situated with respect to one another so that magnetic material is caused to move from a point C to a point D on each succeeding drum during operation of the apparatus:

I claim:

1. A magnetic separator for reclaiming magnetic chip material and for culling out very high percentages of non-magnetic chip materials, and comprising in combination a plurality of non-magnetic drums rotatably supported on parallel axes so that their respective peripheries are adjacent one another, means for driving all of said drums in the same relative direction, means for generating a fixed magnetic field in a non-rotating segment of each of said drums, said drum axes being inclined with respect to one another so that a second drum is arranged slightly above the first and a third drum is located above the second, said magnetic field segments comprising substantially half portions of said second and third drum peripheries and being oriented below a line connecting said second and third drum axes so that the magnetic chip material is attracted to the next adjacent drum material and successively refined, all of said drums having radially outwardly extending ribs for engaging said chip material and to break up intermingled formations of magnetic and non-magnetic chips as they are carried around one drum and transferred to the next drum.

2. A magnetic chip separator as set forth in claim **1** and further characterized by means for feeding a mixture of magnetic and non-magnetic material to be separated into the peripheral path of rotation of said first drum, said means comprising a vibrating tray having an arcuately shaped shovel portion at its downstream end into which

the mixture is fed, said shovel portion located in radially spaced relation to said fixed magnetized field segment of said first drum whereby the magnetic material is attracted to said first drum and carried thereon for subsequent transfer to said second drum as aforesaid and a rotary spreader located above said tray for providing a uniform depth of chip material to said shovel portion.

3. A magnetic chip separator as set forth in claim **2** wherein said means for generating a fixed magnetic field in said non-rotating segments of each of said rotating non-magnetic drums comprises a permanent magnet mounted in an associated portion of each drum.

4. A magnetic separator as set forth in claim **3** wherein said permanent magnets in said second and third drums are so arranged that their polarity creates lines of magnetic force across and between the adjacent peripheries of said second and third drums for assuring that only magnetic material is transferred therebetween.

5. A magnetic separator as set forth in claim **4** and further characterized by an inclined pan beneath said rotating drums for receiving the non-magnetic material not attracted to the magnetized segments of said drums and conveying said non-magnetic material downwardly to a position generally beneath said first drum.

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