March 20, 1956 G. F. THOMAS 2,738,876

MAGNETIC SEPARATING MEANS AND TRANSPORTING DEVICE

Filed June 12, 1951 2 Sheets-Sheet 1

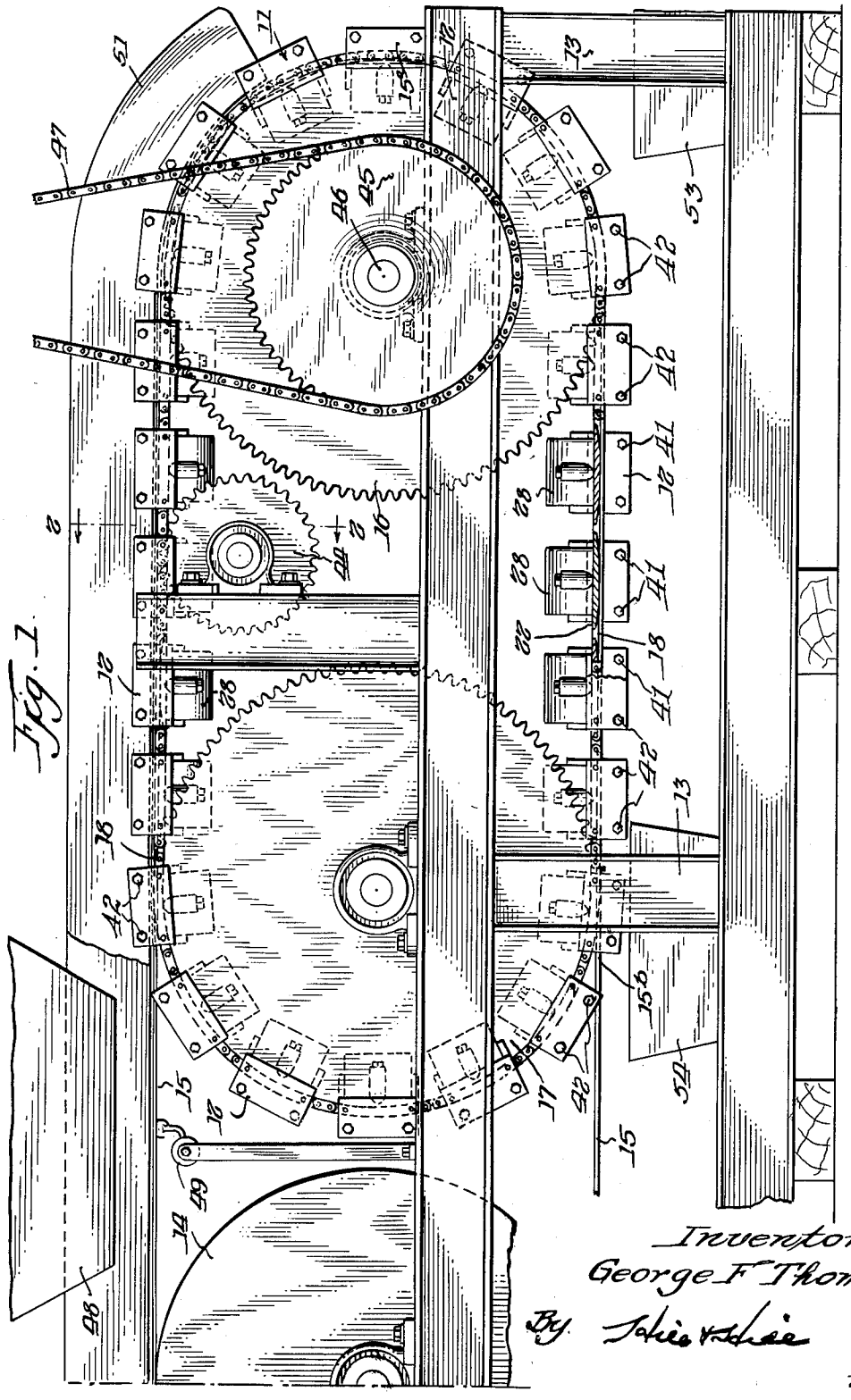


Fig. 1.

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Fig. 2.

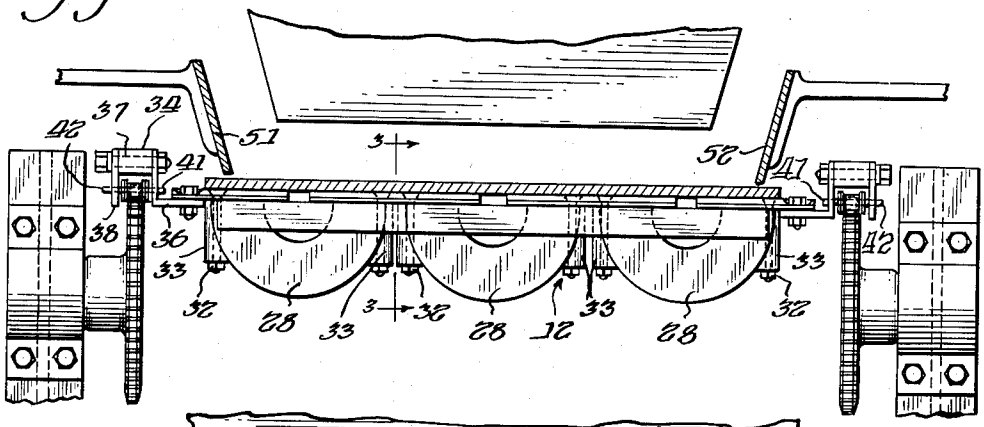


Fig. 3.

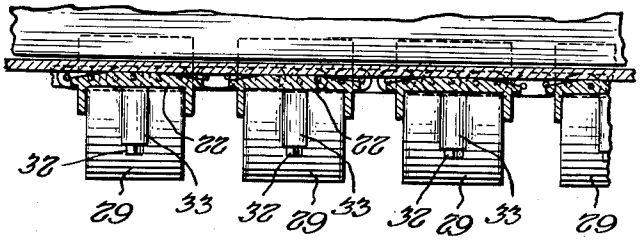
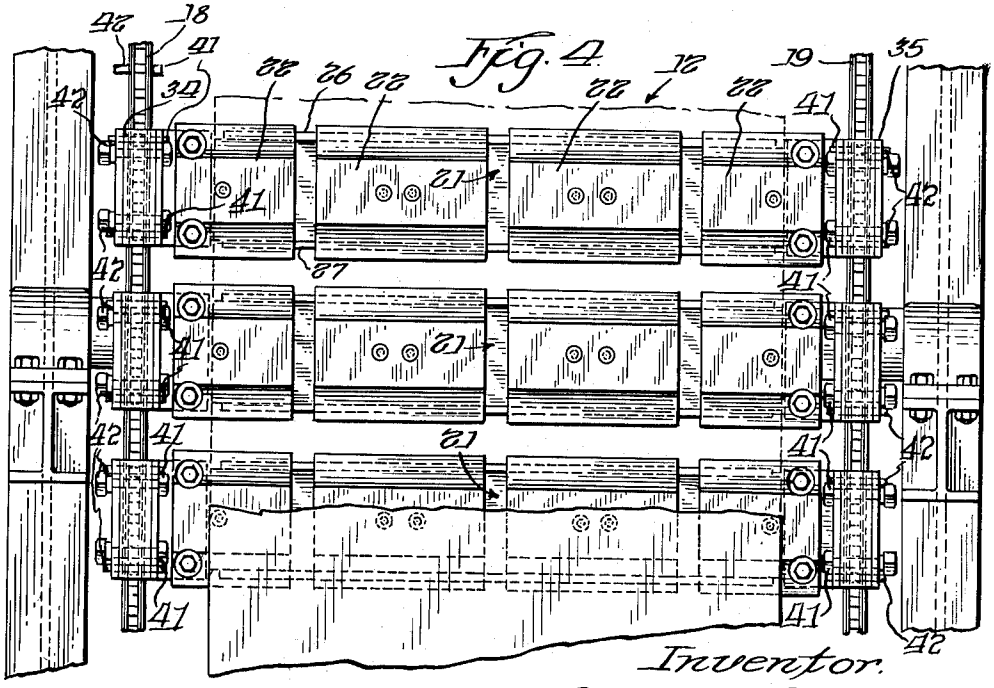


Fig. 4.



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MAGNETIC SEPARATING MEANS AND TRANSPORTING DEVICE

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Application June 12, 1951, Serial No. 231,090

6 Claims. (Cl. 209—218)

The present invention relates to a material transporting device.

More particularly, the invention relates to a combination material transporting and separating device.

Combination material transporting and separating devices are used in many material processing plants, such as grain grinding mills, to transport the material being processed from one location or processing machine to another. Along with the transporting function, the device also serves to separate certain classes of material from others. In particular, the device separates ferrous materials from non-ferrous materials. In known devices of this nature, the separation of materials has not been sufficiently satisfactory due to inherent defects in the design of devices. Further, the known devices are not easily adapted to handle increased quantities of materials efficiently.

It is therefore one object of the present invention to provide an improved combination material transporting and separating device.

Another object of the invention is to provide an improved material transporting and separating device whereby a more positive and efficient separation of ferrous particles entrained in non-ferrous materials may be effected.

A further object of the invention is to provide an improved material transporting and separating device that can be readily adapted to handle any desired quantity of material per unit of time.

A feature of the invention is the provision of a combination material transporting and separating device that comprises an endless belt conveyor. The endless belt conveyor includes a traction roller that comprises a sub-assembly endless belt conveyor having a magnetic endless belt member. The traction roller formed by the sub-assembly endless belt conveyor is spaced from an idler roller, and a second endless belt member is arranged over the idler roller and the sub-assembly endless belt conveyor, the second endless belt member being constructed of a non-magnetizable material having a low reluctance to magnet lines flux.

Other objects, features and many of the attendant advantages of this invention will be appreciated readily as the same becomes understood by reference to the following detailed description when considered in connection with the accompanying drawing, wherein similar parts in each of the several figures are designated by the same reference numeral; and wherein:

Fig. 1 is a side elevational view of a material transporting and separating device constructed in accordance with the invention;

Fig. 2 is a cross sectional view of the device taken through plane 2—2 of Fig. 1;

Fig. 3 is a sectional view of a portion of the device taken through plane 3—3 of Fig. 2; and

Fig. 4 is a fragmentary plan view of the device.

Referring now to Fig. 1 more specifically, the combination material transporting and separating device includes a traction roller, indicated at **11**, which actually comprises a novel sub-assembly endless belt conveyor having a magnetic belt member **12**, and is mounted on a supporting frame **13** that comprises a generally box-shaped structure constructed of steel channel beams. Also mounted on supporting frame **13** is an idler roller **14** which is spaced from and aligned with traction roller **11**. Arranged over traction roller **11** and idler roller **14** is a second delivery belt member **15** constructed of a non-magnetizable material having low permeance to lines of magnetic flux, for example, canvas, leather, or some similar material.

The traction roller or sub-assembly endless belt conveyor **11** includes a first set of parallel sprocket wheels, one of which is shown at **16**, journaled on supporting frame **13**, and a second set of sprocket wheels, one of which is shown at **17**, spaced from the first set of sprocket wheels **16**, and likewise journaled on supporting frame **13**. In the embodiment of the invention shown, each of the sets of sprocket wheels **16** and **17** consist of a pair of parallel sprocket wheels with a sprocket wheel of one of the pairs being aligned (i. e. lying in a common plane) with a corresponding sprocket wheel in the other pair. While the embodiment of the invention shown is preferred, it is to be understood that any desired number of sprocket wheels may be included in each of the sets **16** or **17** in order to increase the overall width of the device.

Referring now to Fig. 2, the magnetic endless belt member **12** includes a pair of endless sprocket chains **18** and **19** that are arranged over the aligned sprocket wheels in each of the sets **16** and **17** in the manner shown in Fig. 1 of the drawings, and that have a plurality of magnetic structures **21** connected therebetween. Each of the magnetic structures **21** comprises a plurality of aligned, rectangularly shaped plates **22**, secured together by a pair of longitudinally extending side bars **26** and **27**, and a plurality of semicylindrically shaped, permanent magnets **28**. The permanent magnets **28** are secured to base plates **22** by a plurality of bolts **32** secured in the base plates, and in a plurality of collars **33** formed on opposite sides of the permanent magnets. The magnetic structure thus formed has one of the ends thereof secured to chain **18** by means of a fastening clamp or yoke **34**, and the remaining end of the structure is secured to chain **19** by a fastening clamp or yoke **35**. The fastening yokes **34** and **35** are identical in construction, and preferably comprise an L-shaped plate **36** which has one of the legs thereof secured to the end of the structure **21** with the remaining leg thereof having a spacer **37** secured thereto. Fixed to the end of the spacer **37** is a plate **38** which extends downwardly and runs parallel to the unattached leg of L-shaped plate **36** to form a yoke therewith. Journaled in the yoke thus formed is a pair of oppositely extending pins **41** and **42**, the pin **41** being secured to one side of the chain **18**, and the pin **42** being secured to the opposite side of chain **18**. By reason of this construction, the magnetic structure **21** is pivotally secured to each of the chains **18** and **19** without impeding the travel thereof over the sprocket wheels **16** and **17**. If desired, the length of the magnetic structure **21** may be extended by merely increasing the number of base plates **22** and permanent magnets **28**, and spacing the chains **18** and **19** further apart. By increasing the length of the magnetic structure **21**, the width of the overall transporting separating device can be increased correspondingly, and thereby adapted to deliver increased quantities of materials without in any manner affecting the overall efficiency of the device.

The magnetic endless conveyor belt member constructed in the above manner is arranged over the sets of sprocket wheels **16** and **17** to form a sub-assembly endless belt conveyor. Because the assembly magnetic endless belt

conveyor thus formed has a relatively large mass, it is desirable that it form the traction roller of the overall transporting and separating device. For this reason, the prime mover means for driving the transporting and separating device is operatively connected to the sub-assembly magnetic endless belt conveyor. The prime mover means includes a coupling sprocket wheel 45 keyed or otherwise secured to a shaft 46 in common with the sprocket wheel 16. The coupling sprocket wheel 45 is rotated by a drive chain 47 which may be arranged over a smaller driving sprocket wheel, not shown, connected to the shaft of a prime mover. The nonmagnetizable belt 15 is arranged over the traction roller thus formed, and over idler roller 14 to form the overall combination transporting and separating device. Because in certain plants it may be desired to deposit ferrous particles of material at a substantial distance from the non-ferrous material being delivered, it may prove desirable to have the sets of sprocket wheels 17 spaced a substantial distance from the set of sprocket wheels 16. In this event, a set of supporting idler wheels, one of which is shown at 44, may be provided on the supporting frame 13 to support the weight of the magnetic belt member 12.

The combination transporting and separating device constructed in the above manner is located with the upper stretch of nonmagnetizable belt 15 positioned under a discharge hopper 48 through which the material to be transported and separated is discharged upon the belt 15. In order to distribute the material discharged upon the belt 15 evenly over its surface, a vibrator 49 engaging the upper stretch of belt 15 is mounted on supporting frame 13. And in order to maintain material on the belt 15, and prevent the same from spilling over the sides of the belt, a pair of guide members 51 and 52, best seen in Fig. 2 of the drawings, is provided on opposite sides of the upper stretch of the belt.

In operation the material to be transported and separated is discharged upon the upper stretch of the belt 15 where it is evenly distributed over the surface of the belt by reason of the action of vibrator 49. As the particular portion of the belt moves the material in a clockwise direction from its position under the hopper 48, as shown in Fig. 1, the under surface of the belt eventually becomes engaged by one of the magnetic structures 21. Ferrous particles contained in the material then adheres strongly to the belt due to the presence of the permanent magnets 18 of magnetic structures 21. Upon the portion of the belt reaching the position shown at 15*a*, the non-ferrous particles of material spill off, due to gravity, into a collecting hopper 53, where they are collected for further processing or packaging. The ferrous particles are retained against the surface of the belt 15 due to the continued presence of the permanent magnets 28, and remain so until the belt reaches the position shown at 15*b*, where the permanent magnets are separated from the belt. Upon the permanent magnets and the belt 15 being separated, the magnetic flux causing the ferrous particles to adhere to belt 15 is no longer present, and the particles fall off into a collecting hopper 54.

From the foregoing description it can be readily appreciated that the invention provides a novel combination material transporting and separating device wherein ferrous particles of material being processed and transported can be separated from non-ferrous particles of the material in an efficient and positive manner. By controlling the spacing or the length of the magnetic sub-assembly conveyor 11, the distance that the ferrous particles are carried from the non-ferrous particles can be readily controlled. Because of its relatively simple construction, the device can be easily adapted to handle larger or smaller quantities of materials, and for this reason, can be easily adapted for inclusion in existing processing plant machinery arrangements.

Having thus described my invention, it is obvious that various immaterial modifications may be made in the same without departing from the spirit of my invention; hence, I do not wish to be understood as limiting myself to the exact form, construction, arrangement and combination of parts herein shown and described, or uses mentioned.

What I claim as new and desire to secure by Letters Patent is:

1. A material transporting and separating device comprising an endless belt conveyor, said endless belt conveyor including a traction roller comprising a sub-assembly endless belt conveyor, the belt member of said sub-assembly endless belt conveyor having a plurality of magnetic structures secured thereon, each of said magnetic structures including a plurality of laterally spaced base plates, said base plates being transverse to the direction of movement of the magnetic endless belt member, side bars affixed to the base plates for spacing and supporting the base plates, and spaced permanent U-shaped magnets affixed to the base plates, the legs of each said U-shaped magnets affixed to the contiguously spaced base plates, an idler roller spaced from and aligned with said traction roller, means for driving said traction roller, an endless belt arranged over said traction roller and said idler roller, said last mentioned endless belt being constucted of a non-magnetizable material having a low permeance to magnetic lines of flux, means for vibrating the upper stretch of said last mentioned endless belt, and guide means adjacent the sides of said last mentioned endless belt for preventing spillage of material over the sides thereof.

2. A combination material transporting and separating device comprising an endless belt conveyor including an endless belt, said endless belt conveyor including a traction roller comprising a first set of parallel sprocket wheels, a second set of parallel sprocket wheels spaced from said first sprocket wheels, each one of said second set of sprocket wheels being aligned with a corresponding sprocket wheel in said first set, a magnetic endless belt member arranged over said sets of sprocket wheels, said magnetic endless belt member including endless chains arranged over corresponding ones of said first and second pairs of sprocket wheels and a plurality of magnetic structures supported between said chains, each of said magnetic structures comprising a plurality of semi-cylindrically shaped permanent magnets fixed to an elongated base, said elongated base having yoke elements fixed to each of the ends thereof with a portion of one of said endless chains being pivotally mounted in one of said yoke elements, means for rotating one of said sets of sprocket wheels, an idler roller spaced from and aligned with said sprocket wheels, said endless belt of said endless belt conveyor formed of thin non-magnetic material and arranged over said idler roller and said traction roller, guide means formed on each side of the upper stretch of said non-magnetic endless belt, and means engaging the upper stretch of said non-magnetic endless belt for vibrating the same.

3. The combination with a material transporting and separating device for transporting and separating magnetic material from other non-magnetic material, comprising an endless belt conveyor, of a drive means for the endless belt conveyor, said drive means comprising a magnetic endless belt member over which one end of the endless belt conveyor extends in operative relationship, said magnetic endless belt member comprising spaced endless sprocket chains, a plurality of longitudinally spaced magnetic structures operatively connected between the spaced endless sprocket chains and arranged as an endless belt in operative relationship for imparting movement to said endless belt conveyor, and each of said magnetic structures including a plurality of laterally spaced base plates, said base plates being transversely arranged with respect to the direction of movement of the magnetic endless belt member, side bars affixed to the base plates for spacing and supporting the base plates, transversely spaced

permanent U-shaped magnets affixed to the base plates, the legs of each of said U-shaped magnets affixed to contiguously spaced base plates, and yoke members operatively connecting each end of the magnetic structures to the spaced endless sprocket chains, whereby said magnetic endless belt member is adapted for driving said endless belt conveyor and separating magnetic material from non-magnetic material transported by said endless belt conveyor.

4. As an article of manufacture, a magnetic structure for a magnetic endless belt member adapted to drive an endless belt member of an endless belt conveyor, said magnetic structure adapted to be assembled into a magnetic endless belt member including laterally spaced chains, sprockets therefor and having a plurality of longitudinally spaced magnetic structures and comprising a plurality of laterally spaced base plates, said base plates transversely arranged with respect to the direction of motion of the assembled magnetic endless belt member, side bars affixed to the base plates for spacing and supporting the base plates, and transversely spaced permanent U-shaped magnets affixed to the base plates, the legs of each said U-shaped magnets affixed to contiguously spaced base plates, whereby said laterally spaced base plates when assembled into a magnetic endless belt member are adapted to engage the endless belt member of the endless belt conveyor as the magnetic endless belt member is assembled in operative relationship between bights of the endless belt member for driving the endless belt member.

5. As an article of manufacture, a magnetic endless belt member comprising laterally spaced endless chains adapted to be arranged over sprocket wheels for supporting and actuating the magnetic endless belt member, a plurality of longitudinally spaced elongated magnetic structures adapted to be operatively connected at their opposite ends to the endless chains, each of said magnetic structures including a plurality of laterally spaced base plates, said base plates transversely arranged with respect to the direction of motion of the magnetic endless belt member, side bars affixed to the base plates for spacing and supporting

the base plates, and transversely spaced permanent U-shaped magnets affixed to the base plates, the legs of each of said U-shaped magnets affixed to contiguously spaced base plates, and yoke elements affixed to each end of the elongated magnetic structures with a portion of one of said endless chains being pivotally mounted in one of said yoke elements.

6. A material transporting and separating device comprising an endless belt conveyor, said endless belt conveyor including an endless belt and a traction roller and comprising a sub-assembly endless belt conveyor having a magnetic endless belt member, said magnetic endless belt member comprising spaced endless sprocket chains, a plurality of longitudinally spaced magnetic structures, each of said magnetic structures including a plurality of laterally spaced base plates, transversely spaced permanent U-shaped magnets affixed to the base plates, said base plates being transversely arranged with respect to the direction of movement of the magnetic endless belt member, side bars affixed to the base plates for spacing and supporting the base plates, and yoke members operatively connecting each end of the magnetic structures to the spaced endless sprocket chains, an idler roller spaced from and aligned with said traction roller, said endless belt arranged over said traction and idler rollers, and said last-mentioned endless belt being constructed of a non-magnetizable material having a low permeance to magnetic lines of flux.

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