June 23, 1953 K. H. CASSON 2,642,994

APPARATUS FOR HANDLING MAGNETIC MATERIAL

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Fig. 1

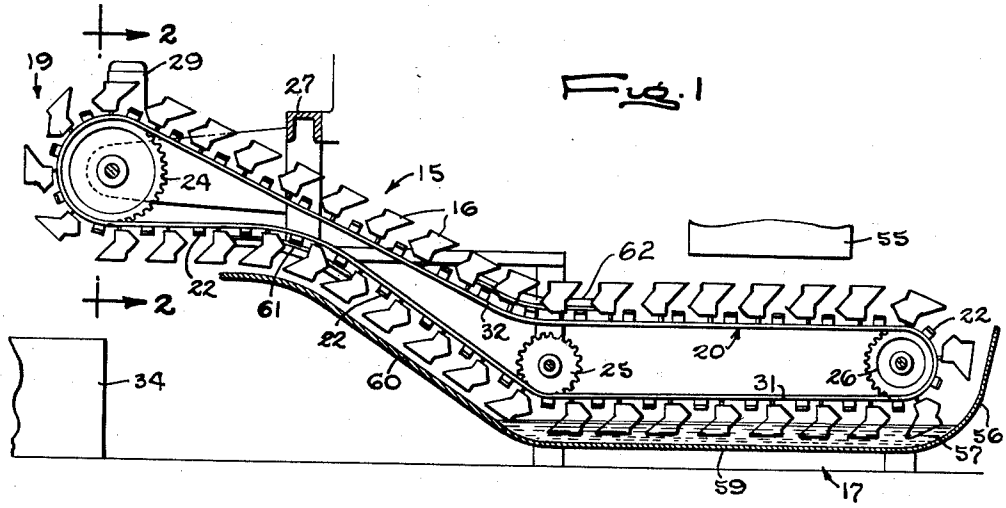


Fig. 2

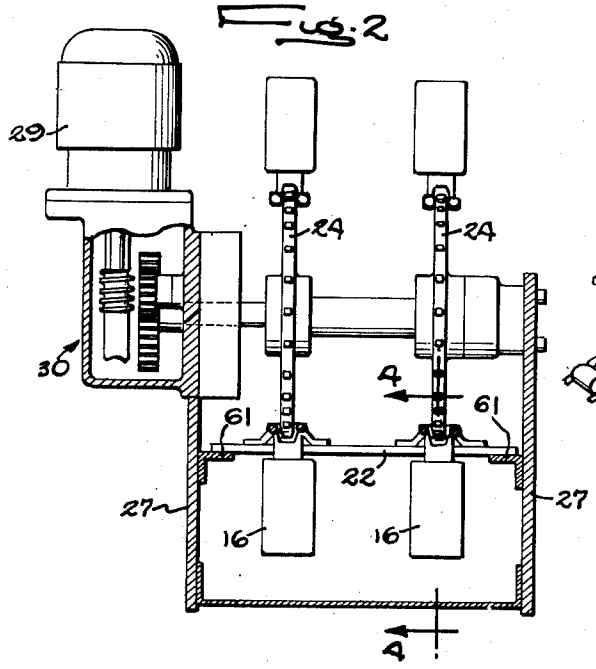
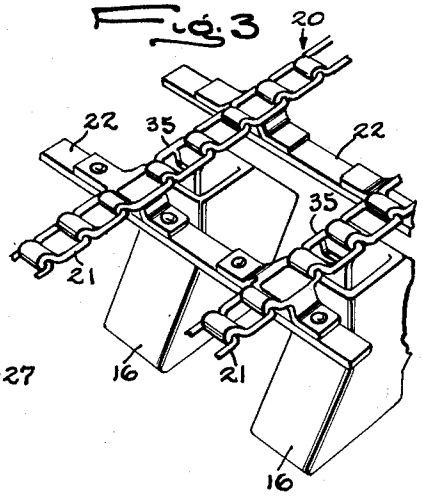


Fig. 3



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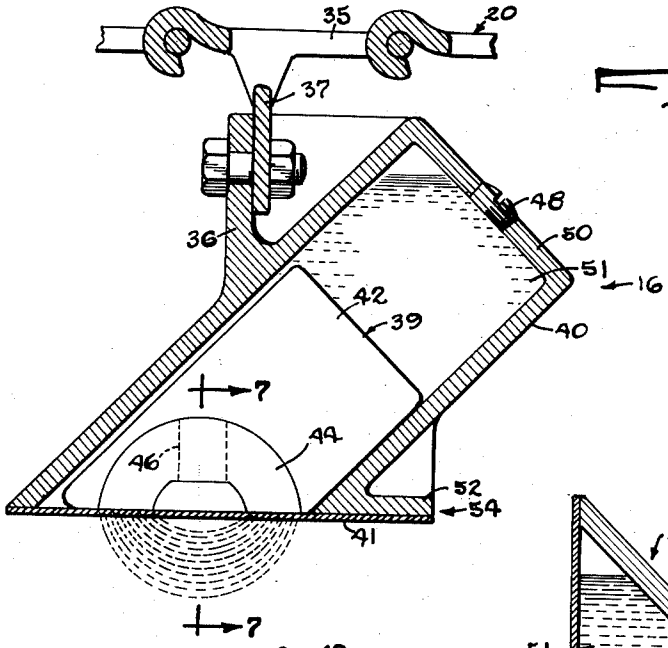


Fig. 4

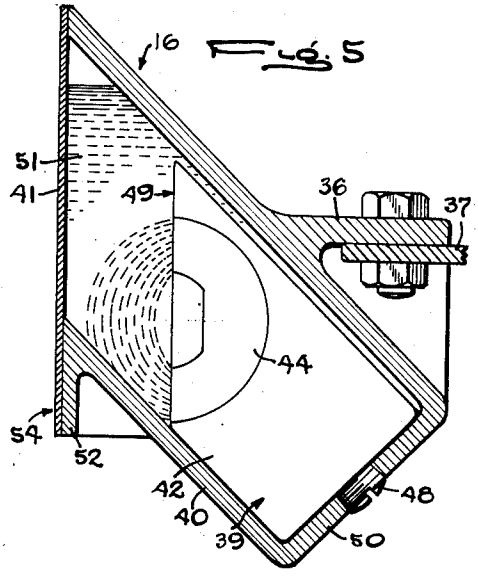


Fig. 5

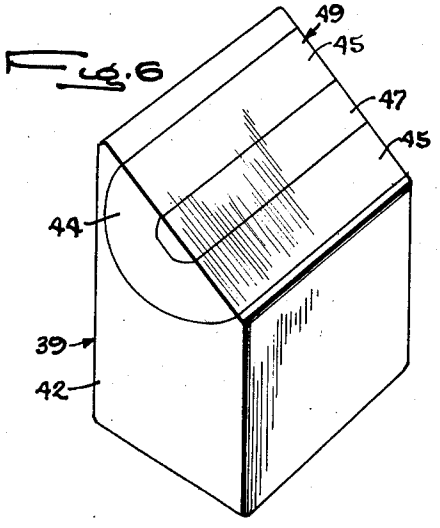


Fig. 6

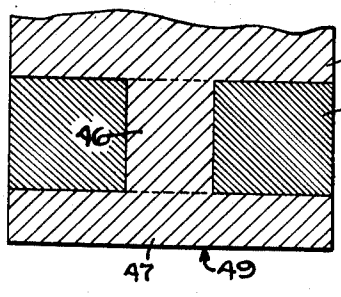


Fig. 7

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Fig. 8

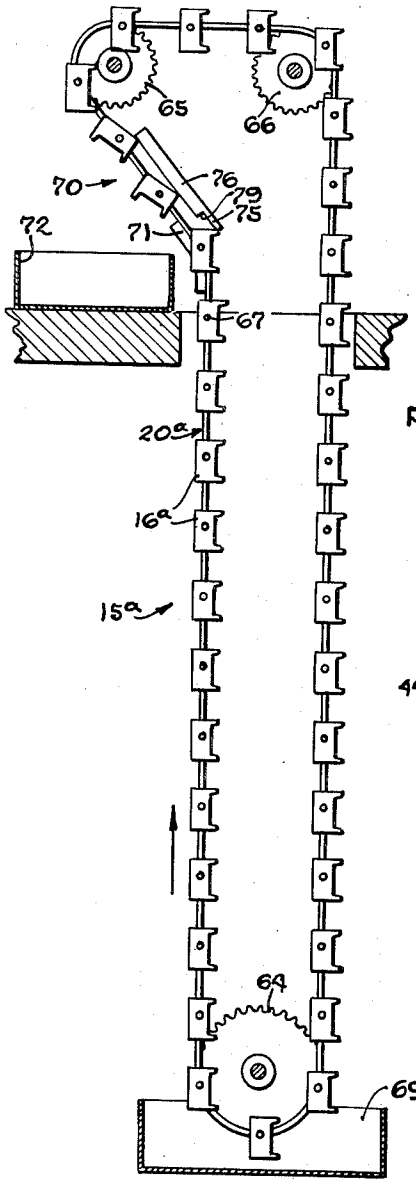


Fig. 10

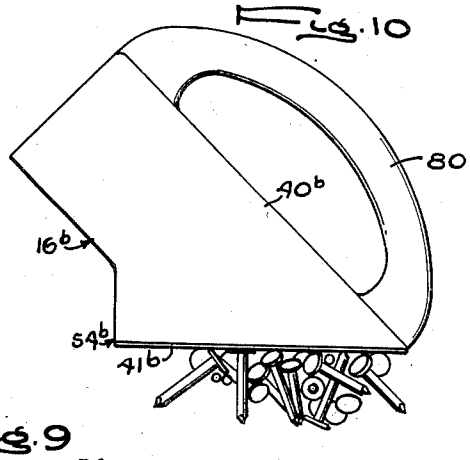


Fig. 9

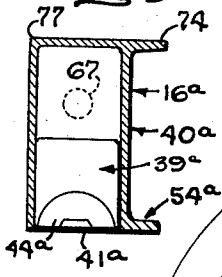
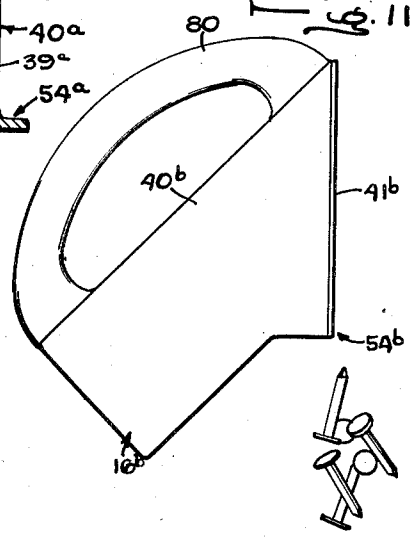


Fig. 11



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APPARATUS FOR HANDLING MAGNETIC MATERIAL

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Application August 21, 1951, Serial No. 242,838

17 Claims. (Cl. 210—1.5)

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The present invention is directed to apparatus for gathering and handling magnetic materials in an expeditious and efficient manner.

One object of the invention is to provide a conveyor for magnetic materials utilizing an endless train of permanent magnetic pick-up units having a novel construction and arrangement adapting the units to be selectively conditioned in an exceedingly simple manner for gathering magnetic materials along one portion of their path of movement and for expeditiously shedding the materials along another portion of their path of movement.

A related object is to provide a conveyor of this type which has an eminently high load carrying capacity comparing favorably with that of electromagnetic conveyors and which at the same time avoids the disadvantageous factors associated with electromagnetic conveyors of a comparable capacity, which factors include the expense involved in creating magnetic fields by the expenditure of electrical energy, heating of the conveyor and the material conveyed by heat generated by the electro-magnets, and the initial cost and maintenance problems associated with the apparatus requisite to properly supplying electrical energy to the electro-magnets.

A more specific object is to provide a conveyor of the above character which is especially adapted for collecting magnetic particles entrained in a body of fluid and withdrawing the particles from the fluid.

Another object is to provide a novel magnetic pick-up unit which is capable of being selectively conditioned for collecting and shedding magnetic materials solely by angular movement of the unit and which is adapted for use either in a conveyor or as a hand implement. An allied object is to provide a unit of this character that is economical to manufacture and durable and efficient in operation.

The objects of the invention thus generally set forth, together with other and ancillary advantages, are attained by the construction and arrangement shown by way of illustration in the accompanying drawings, in which:

Figure 1 is a vertical cutaway view showing the invention embodied in a conveyor adapted to withdraw magnetic particles from a pool of fluid.

Fig. 2 is a vertical sectional view taken along line 2—2 of Fig. 1.

Fig. 3 is a fragmentary perspective view showing the attachment of a pair of pick-up units to the endless carrier of the conveyor of Fig. 1.

Fig. 4 is a fragmentary view, partially in section, taken along line 4—4 of Fig. 2 and illustrating a typical attachment of a pick-up unit to the carrier and showing parts of the unit in load bearing position.

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Fig. 5 is a longitudinal sectional view of a typical pick-up unit showing the component parts in load dumping position.

Fig. 6 is a perspective view of a magnetic plunger used in the pick-up units.

Fig. 7 is a sectional view taken along line 7—7 of Fig. 4 and showing detailed construction of the plunger.

Fig. 8 is a side view of a modified form of conveyor embodying the invention.

Fig. 9 is a detailed view, partially in section, of a typical pick-up unit used in the conveyor of Fig. 8.

Fig. 10 is a side view of a pick-up unit adapted for manual use and showing the device in load bearing position.

Fig. 11 is a view similar to Fig. 10 but showing the unit tipped to shed the load.

While the invention is susceptible of various modifications and alternative constructions, there is shown in the drawings and will herein be described in detail the preferred embodiments, but it is to be understood that it is not thereby intended to limit the invention to the forms disclosed, but it is intended to cover all modifications and equivalent constructions falling within the spirit and scope of the invention as expressed in the appended claims.

Referring more particularly to the drawings, the endless conveyor 15 and parts thereof illustrated in Figs. 1 to 7 constitute the first exemplary embodiment of the invention. In accordance with the invention, the conveyor comprises a plurality of novel, permanent magnet pick-up units 16 of high load carrying capacity which are carried in train through a closed path extending through a loading zone 17 in which the units are conditioned to gather magnetic materials, to a dumping zone 19 in which the units are conditioned to shed the materials. Each pick-up unit 16 provided by the invention is constructed in a fashion whereby the unit, as integrated into the conveyor is selectively conditioned in an exceedingly expeditious manner either to establish a magnetic field about the unit acting to attract magnetic particles and objects to the unit and retain them suspended therefrom, or to effectively withdraw the field permitting the suspended materials to drop free of the unit. As a matter of fact, a simple angular tilting movement of the unit is all that is required either to ready the

unit for loading materials or to unload the unit.

As to the details of the exemplary conveyor 15, it will be perceived from a reference to Figs. 1 to 3 that the units 16 are attached in two parallel trains to an endless carrier 20. The latter comprises a pair of endless sprocket chains 21 interconnected at regularly spaced intervals by crossbars 22, Fig. 3, and running around spaced pairs of sprocket wheels 24, 25, 26 mounted on a suitable frame 27, Figs. 1 and 2. The carrier 20, which traverses a generally horizontal course, is driven in the clockwise direction, Fig. 1, by a motor 29 also mounted on the frame 27 and connected to the sprocket wheels 24 by a speed reducing transmission 30, Fig. 2.

In this particular conveyor 15, the pick-up units 16 are swung angularly into load gathering position in passing over the sprocket wheels 26 at the right end of the conveyor, Fig. 1. They are carried in this position along the lower run 31 of the carrier 20 through the loading zone 17 to the left end of the conveyor over the dumping zone 19. There the sprocket wheels 24 swing the units 16 upwardly into the upper or return run 32 of the conveyor and in so doing change the angular position of the units causing them to shed their loads into a receiver 34.

To bring about the angular swinging action of the units 16 at opposite ends of the conveyor 15, the units are securely attached to adjacent links 35 of the carrier 20 in a manner whereby the units are held outwardly in fixed relation to the respective links. As shown in Figs. 3 to 5, each unit 16 is provided with a rigid ear 36 which is detachably secured to an apertured lug 37 fixed to the contiguous link 35 and extending perpendicularly therefrom. Consequently, the units 16 are constrained to follow the angular movement of the links 35 as the latter pass around the sprocket wheels 24, 26 at opposite ends of the conveyor. Attention at this point is directed particularly to the fact that the angular movement of the units 16 requisite to conditioning the units for loading and shedding magnetic materials arises purely from the belt-like action of the endless carrier 20 and does not require extraneous actuating means of any sort.

As to the construction of the individual pick-up units 16, each unit, as shown in Figs. 4 and 5, comprises a shiftable permanent magnet plunger 39 slidably mounted in an elongated guide on supporting casing 40 for shifting movement into and out of contiguous abutting relationship with a non-magnetic collector plate 41 disposed at the outer end of the guide. The relationship of these component parts of the pick-up unit is such that when the guide 40 is inclined with its outer end extending downwardly, as shown in Fig. 4, the permanent magnetic plunger 39 is shifted through the action of gravity into abutting engagement with the collector plate 41. In this position, it establishes a strong magnetic field extending beyond the plate to attract magnetic materials to the plate and retain them suspended therefrom. Upon angular movement of the unit to incline the guide on supporting casing 40 in the reverse direction with respect to the horizontal, as shown in Fig. 5, the magnetic plunger 39, under the influence of gravity, is shifted along the guide away from the plate 41. In this manner, the magnetic field of the plunger 39 is withdrawn from the plate 41 to the extent that its effective strength beyond the plate is not sufficient to retain magnetic materials on the plate and any such material previously gathered on this plate is quickly shed therefrom.

As shown in Figs. 4 to 7, the shiftable permanent magnetic plunger 39 comprises a generally rectilinear body 42 having an elongated U-shaped permanent magnet 44 mounted in its outer end and presenting a pair of coplanar pole faces 45 adapted to abut against the collector plate 41. The magnet 44, itself, is fabricated from a material, preferably Alnico, having a high retentivity to impart to the magnet a very strong field strength.

Preferably, the plunger body 42 is formed from brass or other suitable non-magnetic material cast about the magnet 44 so the latter becomes virtually an integral part of the plunger. As best shown in Figs. 6 and 7, the magnet 44 is positively held in the plunger by an axial tie 46 extending through a central hole in the magnet to a transverse bar 47 lying across the outer concave side of the magnet between the pole faces 45. The outer face 49 of the plunger together with the magnet pole faces 45 lying flush with the plunger face are finished to a smooth surface adapted to have intimate contact with the collector plate eliminating any magnetically significant gap between the plate and the magnet when the plunger is shifted into abutting engagement with the plate.

The guide 40, which slidably receives the magnetic plunger 39, is in the present instance formed as a non-magnetic elongated hollow casing (also designated by the numeral 49) having a cross-sectional configuration conforming to that of the plunger and being sufficiently large in its internal dimensions to permit free longitudinal movement of the plunger. The forward end of the casing 40 is closed by the collector plate 41 secured to the casing. The rear end of the casing is closed by an abutment plate 50 disposed in position to terminate rearward movement of the plunger 39 after the latter has receded the desired distance from the collector plate.

The supporting casing 40 thus closed at opposite ends by the plates 41 and 50 defines an inner compartment which preferably is fluid-tight. A plug 48 is provided in the plate 50 to permit convenient filling of the space in this compartment, not occupied by the plunger 39 with fluid 51 which dampens the shifting movement of the plunger from end to end of the casing. This dampening action of the fluid not only virtually eliminates noise which would otherwise accompany unrestrained shifting of the plunger 39 within the casing, but it also cushions the repeated engagement of the plunger with the collector plate 41 and the abutment plate 50 to the end that the stresses in these parts, attendant to stopping the plunger, are minimized. Consequently, the parts are protected from fatigue failure in operation and a lightweight, low cost construction of the casing 40 and the adjoined plates 41, 50 becomes feasible. Preferably, the casing 40, abutment plate 50, and attaching ear 36 are formed as a single casting of aluminum or other non-magnetic material.

It is desirable from the standpoint of efficiency in operation of this form of the invention that the collector plate 41 of each pick-up unit 16 be disposed in an approximately horizontal position when the unit is magnetically conditioned for gathering and retaining a load of magnetic material and that the collector plate

occupy a generally vertical position to expedite shedding of the load when the unit is magnetically conditioned for dumping. As best shown in Figs. 4 and 5, this desired positioning of the collector plate 41 in both situations is provided for by disposing the collector plate at an angle, preferably forty-five degrees, relative to the elongated axis of the permanent magnetic plunger guide 40 to which the plate is attached. Thus, when the unit 16 is held in the loading position of Fig. 4, the collector plate 41 is horizontal and the guide 40 is inclined forwardly and downwardly shifting the magnet into engagement with the plate. Upon angular movement of the unit through only ninety degrees to the unloading position of Fig. 5, the collector plate 41 is shifted into vertical position and the guide 40 is inclined rearwardly and downwardly to retract the permanent magnet 44 from the collector plate. It will be noted from Fig. 6 that the abutting face 49 of the plunger 39 is inclined similarly to the collector plate 41 to have flat engagement with the latter.

The released magnetic materials sliding from each collector plate 41, when the associated unit 16 is in the dumping position of Fig. 5, have a tendency to follow the retracting field of the magnet 44 by running around the lower edge of the plate and sticking to the sides of the casing 40. To prevent this from occurring the lower side of the plate 41 is extended downwardly over an underlying support 52 on the side of the casing 40 to form a heel 54 which guides the falling materials away from the unit.

While the conveyor 20 described thus far is suited for general use in conveying magnetic materials, it is particularly well adapted for cleaning cutting and cooling oils by removing finely divided particles of metal entrained in the oil. The previously described conveyor 20, shown in Fig. 1, is adapted for this purpose.

As illustrated, cutting fluid exhausted from machine tools or the like flows through an inlet 55 into a tub-like receptacle 56 where it forms a shallow pool 57 directly under the loading zone 17 of the conveyor 15. The pick-up units 16 in moving across the pool 57 with their lower ends dipping into the oil, collect, through magnetic attraction, particles of metal from the surrounding liquid and from the floor 59 of the receptacle. Thus loaded they are carried up over a drainboard 60 to the receiver 34.

At this point it will be observed that the lower run 31 of the conveyor 15 is guided from the sprocket wheels 25 upwardly over the drainboard 60 by cam or guide rails 61 mounted on the frame 27 to engage the extended ends of the crossbars 22 of the endless carrier 20 (see Figs. 1, 2 and 3). In like manner another pair of guide rails 62 is used to stabilize the upper run 32 of the conveyor and to induce an angular depression therein which reduces the overall space requirements of the conveyor.

It is fitting at this point to observe that the construction and arrangement of the pick-up units 16 and the conveyor 20 whereby the collector plates 41 are swung into vertical position as an incident to unloading the units is especially advantageous in instances in which the conveyor is used to remove magnetic materials from fluids, particularly oils. In the course of passing through the fluid the collector plates become covered with oil, some of which remains as a film on the surfaces of the plates after the latter emerge from the pool 57. This film, by

reason of its surface tension and other factors, causes the magnetic particles to adhere to a certain extent to the collector plate surfaces. This adherence tends to impede shedding of the suspended particles from the plate even when the magnetic field is removed. However, any such tendency the particles may have to cling to the collector plate is wholly overcome by the steep, if not vertical inclination of the collector plate in its dumping position which causes all of the particles to quickly slide free of the plate despite the presence of the fluid film.

Adverting to even more salient features of the invention as presented thus far, it will be comprehended that efficacious use is made of strong permanent magnets to produce a high capacity magnetic conveyor the mechanism of which is quite simple and durable in structure and efficient and trouble free in operation. The invention provides a conveyor in which the load carrying capacity realized from the magnetic attraction of permanent magnets compares favorably with that of conveyors of a similar size employing electro-magnets. Moreover, it will be appreciated that in achieving its high load bearing capacity, the present conveyor dispenses with electro-magnets and the requisite auxiliary devices necessary to properly supply electric current to such magnets. The present conveyor does not require costly expenditure of electrical energy to create the magnetic attraction employed in the conveyor. Of even greater importance in certain applications of the invention is the elimination in the present conveyor of the heating effect of electro-magnets. This feature is quite significant in installations in which the conveyor is used to separate magnetic particles from fluids as any substantial heating, such as might arise from the use of electro-magnets, is in most instances intolerable.

A modified form of the invention is embodied in the conveyor of Figs. 8 and 9, which further illustrates the versatility of the invention. To simplify the description of this form of the invention, structural elements which are counterparts of elements of the conveyor just described are designated with the same reference numerals with the addition of the subscript "*a*." The conveyor 15*a* traverses a generally vertical course and comprises a train of pick-up units 16*a* supported on a carrier 20*a* extending over a pair of lower guide wheels 64 and two pairs of horizontally spaced, upper guide wheels 65, 66.

Each unit 16*a* is supported above its center of gravity on the carrier 20*a* by a pivot 67, Fig. 9, so that the unit inherently seeks a vertical load carrying position. As the units 16*a* are carried around in a clockwise path, in this position, the lowermost units pick up magnetic materials (not shown) from a bin 69 at the lower end of the conveyor. The loaded pick-up units are carried upwardly to an inclined portion 70 of the carrier 20*a* extending between a pair of guide rails 71 and the guide wheels 65 and disposed over a receiver 72.

As each pick-up unit 16*a* in turn moves into the inclined portion of its path defined by the carrier portion 70, a transversely projecting lug 74 formed on the upper end of the unit casing 40*a* engages the free end of an inclined finger 75 projecting downwardly from the lower end of a trip bar 76. The finger 75 acts on the lug 74 of the moving unit to pivot the unit about its support sufficiently to engage the upper corner 77 of the unit casing 40*a*, opposite from the lug,

with a heel 79 on the trip bar 76 at the base of the finger 75. The heel 79 then acts on the casing 40a to continue rotation of the unit to its unloading position in which the elongated axis of the casing is inclined rearwardly and downwardly causing the plunger 39a to shift away from the collector plate 41a. To assure complete unloading of each unit 16a, the unit is held in its unloading position over a short span of its continued movement by the elongated body of the trip bar 76 which extends upwardly in parallel spaced relation to the contiguous portion of the carrier 20a to slidably engage the casing corner 77 after it passes by the trip bar heel 79.

It will be noted that since the pick-up units 16a are normally carried in vertical position, the collector plate 41a of each unit is disposed perpendicularly to the elongated axis of the casing 40a. Moreover, it will be appreciated that the location of the means used to trip the loaded units 16a may be varied as desired to dump the units at any convenient point along the loaded run of the conveyor.

Pick-up units of the type shown in Figs. 4 to 7 and described in connection with the conveyor of Fig. 1 may be readily adapted for use as hand implements for handling magnetic materials. As shown in Figs. 10 and 11, in which the reference numerals of Figs. 4 to 7 are used with the addition of the subscript "b," the modification of the pick-up unit for this purpose is effected merely by substituting a handle 80 on the unit casing 40b to replace the support ear 36 of the unit shown in Figs. 4 and 5.

Handling of the implement thus formed is made most convenient by fashioning the handle 80 in a rainbow shape and attaching the handle at opposite ends to the casing 40b on the side opposite the heel 54b. The handle thus formed may be grasped by the user at a point directly over the center of gravity of the pick-up unit 40b when it is in either the load bearing position of Fig. 10 or the dumping position of Fig. 11. For this reason the implement has a balanced "feel" when it is carried in either its load bearing position or its dumping position. By virtue of its handling ease and its high carrying capacity, the implement is quite useful for handling tacks and other magnetic objects which are rather troublesome to handle by other means.

I claim as my invention:

1. A high capacity endless conveyor for magnetic materials comprising, in combination, an endless carrier, driving means operatively connected to said carrier, guide means supporting said carrier for movement around a closed course, a plurality of permanent magnetic pick-up units attached in train to said carrier to be carried thereby through a closed path extending through a loading zone to a dumping zone; each of said pick-up units comprising an elongated guide, a non-magnetic collector plate mounted on the forward end of said guide, and a permanent magnet of high magnetic retentivity mounted on said guide for free sliding movement thereon toward and from said plate; said units each being carried through said loading zone in a forwardly and downwardly inclined position in which the permanent magnet of each unit is by its own weight shifted into abutting relation with its associated collector plate to establish a strong magnetic field extending beyond the plate for gathering magnetic materials thereon, and said units upon reaching said dumping zone being tilted to a rearwardly and downwardly inclined position in which the respective magnets are retracted by their own weight away from the associated collector plates to effectively withdraw the magnetic fields of the magnets from the plates to release the magnetic materials therefrom.

2. And endless conveyor of the character described comprising, in combination, an endless carrier, means supporting and guiding said carrier for movement around a closed course, a plurality of high capacity permanent magnetic pick-up units attached in train to said carrier to be carried thereby through a closed path extending through a loading zone to an unloading zone; each of said units comprising a non-magnetic casing, a non-magnetic collector plate fixed to one end of said casing, and a permanent magnet plunger slidably mounted in said casing for free movement under its own weight into and out of proximity to said plate to selectively condition said unit for gathering and shedding magnetic materials in response to angular movement of said unit into positions inclined forwardly and downwardly and rearwardly and downwardly, respectively.

3. An endless conveyor of the character described comprising, in combination, an endless carrier, means supporting and guiding said carrier for belt-like movement around a closed course extending through a loading zone to an unloading zone, a plurality of high capacity permanent magnetic pick-up units each comprising a non-magnetic casing, a non-magnetic collector plate fixed to one end of said casing, and a permanent magnet plunger slidably mounted in said casing for free movement under its own weight into and out of proximity to said plate to selectively establish and withdraw a magnetic field from the vicinity of said plate; attaching means securely mounting said units in train on said carrier to stand out in fixed relation to contiguous portions thereof, and said units being swung into and out of a downwardly inclined position by the contiguous portions of said carrier as the latter pass along the closed course of the carrier.

4. An endless conveyor of the character described comprising, in combination, an endless carrier, means supporting and guiding said carrier for movement around a closed course extending through a loading zone to an unloading zone, a plurality of high capacity permanent magnetic pick-up units each comprising a non-magnetic casing, a non-magnetic collector plate fixed to the lower end of said casing, and a permanent magnet plunger slidably mounted in said casing for free movement under its own weight into and out of proximity to said casing to selectively establish and effectively withdraw a magnetic field from the vicinity of said plate; said units being pivotally supported in train to said carrier, the pivoted connections being disposed above the centers of gravity of said units to cause the units to seek a vertical or load bearing position, and trip means disposed alongside said carrier at said unloading zone for upsetting passing ones of said units to cause unloading of the units.

5. An endless conveyor of the character described comprising, in combination, an endless carrier, means supporting and guiding said carrier for movement around a closed course extending through a loading zone to an unloading zone, a plurality of high capacity permanent magnetic pick-up units each comprising an elongated guide, a non-magnetic collector plate fixed to the lower end of said guide, and a permanent

magnet plunger slidably mounted in said casing for free movement under its own weight into and out of proximity to said casing to selectively establish and effectively withdraw a magnetic field from the vicinity of said plate; said units being pivotally supported in train to said carrier, the pivoted connections being disposed above the centers of gravity of said units to cause the units to seek a vertical or load bearing position, a trip lug on each of said units, and trip means disposed alongside said carrier at said unloading zone for engaging the trip lugs of passing ones of said units to pivot said units about their respective carrier supports into rearwardly and downwardly inclined positions in which the units release their loads.

6. A high capacity endless conveyor for magnetic materials comprising, in combination, an endless carrier, driving means operatively connected to said carrier, guide means supporting said carrier for movement around a closed course, a plurality of permanent magnetic pick-up units attached in train to said carrier to be carried thereby through a closed path extending through a loading zone to a dumping zone; each of said pick-up units comprising an elongated non-magnetic casing, a non-magnetic collector plate closing the forward end of said casing, an abutment plate closing the rear end of said casing, and a permanent magnet of high magnetic retentivity mounted in said casing for free, sliding movement between opposite ends thereof as determined by said collector plate and said abutment plate; said units each being carried through said loading zone in a forwardly and downwardly inclined position in which the permanent magnet of each unit is by its own weight shifted into abutting relation with its associated collector plate to establish a strong magnetic field extending beyond the plate for gathering magnetic materials thereon, said units upon reaching said dumping zone being tilted to a rearwardly and downwardly inclined position in which the respective magnets are retracted by their own weight away from the associated collector plates to effectively withdraw the magnetic fields of the magnets from the plates to release the magnetic materials, and the casing of each of said units being filled with fluid which dampens the shifting movement of the enclosed magnet between opposite ends of the casing.

7. An endless conveyor of the character described comprising, in combination, an endless carrier, means supporting and guiding said carrier for belt-like movement around a closed course extending through a loading zone to an unloading zone, a plurality of high capacity permanent magnetic pick-up units each comprising an elongated non-magnetic casing, a non-magnetic collector plate fixed to one end of said casing and disposed in inclined relation to the elongated axis thereof, and a permanent magnet plunger slidably mounted in said casing for free movement under its own weight into and out of proximity to said plate to selectively establish and withdraw a magnetic field from the vicinity of said plate; attaching means monting said units in train to spaced segments of said carrier, said units being carried through said loading zone in a load bearing position with the casings thereof disposed in a forwardly and downwardly inclined position and the associated collector plates disposed in substantially horizontal positions, and means serving to swing said units into an unloading position over said unloading zone with the casings of the respective units disposed in a rearwardly and downwardly inclined position and the associated collector plates disposed in a generally vertical position.

8. Apparatus for cleaning cutting oils and the like by removing magnetic particles entrained in the oil and comprising, in combination, a receptacle for holding a pool of the oil, an endless carrier, means supporting and guiding said carrier for movement around a closed course extending over said receptacle to a position remote therefrom; a plurality of high capacity permanent magnetic pick-up units each comprising a non-magnetic casing, a non-magnetic collector plate fixed to the outer end of said casing, and a permanent magnet plunger slidably mounted in said casing for free movement under its own weight into and out of proximity to said plate to selectively establish and withdraw a magnetic field from the vicinity of said plate; attaching means mounting said units in train on spaced segments of said carrier to be carried thereby across said receptacle in forwardly and downwardly inclined positions, and means shifting said units into reversely inclined positions upon progression of the units to said position remote from said receptacle.

9. A magnetic material handling device comprising, in combination, an elongated hollow casing of non-magnetic construction, a transverse abutment plate closing the rear end of said cylinder, a non-magnetic collector plate closing the forward end of said cylinder and disposed in inclined relation to the elongated axis thereof; said cylinder, abutment plate and collector plate defining an elongated fluid-tight chamber; a plunger shorter in length than said chamber and slidably mounted therein, said plunger comprising a strong permanent magnet presenting a magnetic pole face in the forward end of said plunger adapted to have intimate abutting engagement with said collector plate, said plunger being freely slidable of its own weight between opposite ends of said chamber to move said magnet into and out of contiguous relation to said collector plate upon reverse angular inclination of said casing from a horizontal position, and said chamber being adapted to be filled with fluid around said plunger for dampening shifting movements of the latter between opposite ends of the chamber.

10. A magnetic material handling device of the class described comprising, in combination, an elongated hollow casing, a collector plate fixed to the forward end of said casing, an abutment member on the rear end of said casing in spaced relation to said collector plate, an elongated plunger disposed within said casing for free sliding movement between said collector plate and said abutment, said plunger including a strong permanent magnet presenting at least one pole face on the forward end of the plunger, said pole face being adapted to have abutting engagement with said collector plate upon forward and downward inclination of said casing shifting said plunger under its own weight to the forward end of the casing, said permanent magnet serving to establish a strong magnetic field extending beyond said collector plate upon movement of said pole face into contiguous relation thereto, and said plunger being shiftable of its own weight to the rear end of said casing to effectively withdraw the field of said magnet from said collector plate upon rearward and downward inclination of said casing.

11. A permanent magnetic pick-up unit of the

character described, comprising, in combination, an elongated guide, a non-magnetic collector plate disposed at the forward end of said guide, a permanent magnet slidably mounted on said guide for movement into abutting engagement with said plate upon forward and downward inclination of said guide, said permanent magnet when disposed in abutting engagement to said plate establishing a strong magnetic field extending beyond said plate, said magnet being shiftable of its own weight along said guide to a position remote from said plate to effectively withdraw the field of the magnet from said plate upon tilting movement of said guide to a rearwardly and downwardly inclined position, and means on said guide to limit the rearward movement of said magnet.

12. A magnetic material handling device comprising a non-magnetic hollow casing having a handle disposed on one side thereof, an abutment plate closing the rear end of said casing, a collector plate closing the forward end of said casing and disposed in inclined position relative to the axis thereof to intersect the wall of said casing adjacent said handle at an acute angle, a plunger shorter than said casing and disposed therein for free sliding movement between opposite ends thereof upon inclination of the casing in opposite directions with respect to a horizontal plane, a strong permanent magnet in the forward end of said plunger adapted to abuttingly engage said collector plate and establish a strong magnetic field extending beyond the plate upon movement of said plunger into the forward end of said casing, and a transversely extending heel at the forward end of said casing on the side thereof opposite from said handle.

13. A magnetic material handling device comprising a non-magnetic hollow casing having a handle connected thereto, an abutment at the rear end of said casing, a collector plate fixed to the forward end of said casing in transverse relation thereto, and a strong permanent magnet of high magnetic retentivity disposed within said casing for free sliding movement between opposite ends thereof upon inclination of the casing in opposite directions with respect to a horizontal plane, said magnet serving to abuttingly engage said collector plate and establish a strong magnetic field extending beyond the plate upon movement of said plunger into the forward end of said casing.

14. Means for handling magnetic material, comprising, in combination, a movable carrier, a permanent magnetic pick-up unit attached to said carrier to be moved thereby along a predetermined path extending through a loading zone to an unloading zone, said pick-up unit including an elongated guide, a collector plate fixed to one end of said guide, and a permanent magnet slidably mounted on said guide for free movement under its own weight into and out of proximity to said plate to selectively condition said unit for gathering and shedding magnetic materials in response to angular movements of said guide to respectively raise and lower said one end thereof.

15. Apparatus for handling magnetic material, comprising, in combination, a movable carrier, a plurality of reversely tiltable, permanent magnetic pick-up units interconnected with said carrier to be moved thereby through a path extending from a loading zone to an unloading zone, each of said units including an elongated guide, a non-magnetic collector plate mounted at one end of said guide, and a permanent magnet slidably mounted on said guide for free movement under its own weight into and out of proximity to said collector plate for selectively establishing a magnetic field about said plate and withdrawing the field from the plate in response to reverse tilting of said guide.

16. A permanent magnet pick-up unit of the character described, comprising, in combination, a supporting casing, a non-magnetic collector plate mounted on said supporting casing, and a permanent magnet disposed behind said plate and mounted within said supporting casing for movement into abutting engagement with said plate upon downward inclination of said casing, said permanent magnet when disposed in abutting engagement to said plate establishing a strong magnetic field extending beyond said plate, said magnet being shiftable of its own weight relative to said casing and away from said plate to effectively withdraw the field of the magnet from said plate upon turning said casing up through a predetermined angle.

17. Means for handling magnetic material, comprising, in combination, a movable carrier, a permanent magnetic pick-up unit attached to said carrier to be moved thereby along a predetermined path extending through a loading zone to an unloading zone, said pick-up unit including a supporting casing, a non-magnetic collector plate fixed to one side of said casing, and a permanent magnet disposed behind said plate and mounted within said casing for free movement under its own weight into and out of proximity to said plate to selectively condition said unit for gathering and shedding magnetic materials in response to angular movements of said casing when said casing is tilted down and up respectively.

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