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METAL CLEANING APPARATUS

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Fig. 1.

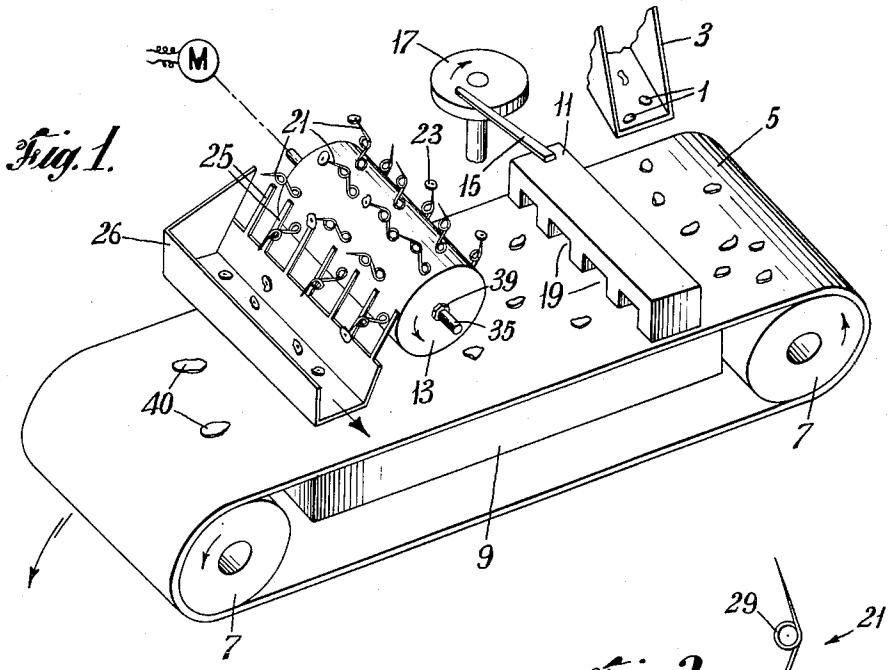


Fig. 2.

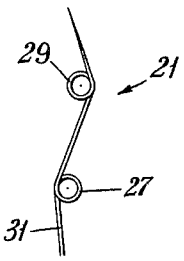


Fig. 3.

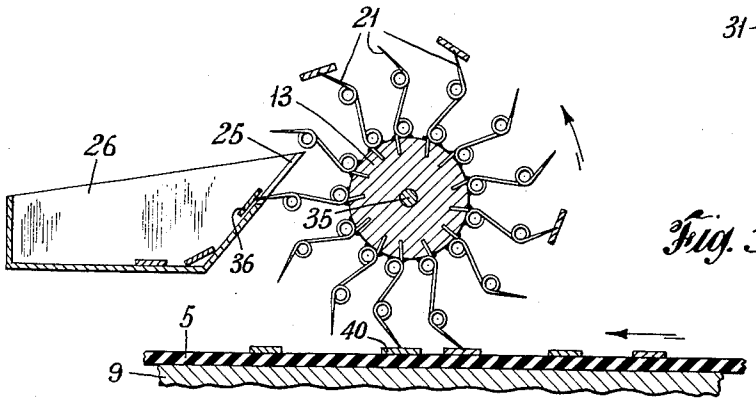
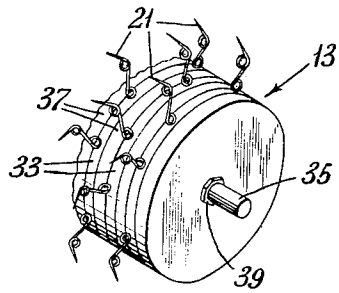


Fig. 4.



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METAL CLEANING APPARATUS

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The invention relates in general to apparatus for cleaning metals and more particularly to apparatus for removing foreign matter from metal products.

Although this invention is applicable to many metal cleaning operations it is described here in connection with a titanium sponge cleaning operation. It is to be understood that this description is presented by way of illustration and is not intended to limit the scope of the invention.

In the production of titanium sponge on a large scale, a considerable amount of foreign matter is found among the crushed product. This contaminating matter includes pieces of rubber, wood, asbestos packing, gasket material and the like which usually result from the normal erosion of process equipment.

Some of these contaminating particles are of a size which permit them to be visually identified and readily removed, but most are generally of relatively small size, approximating the size of a thumb nail, or slightly smaller, and are not readily seen and removed from the metal product.

However, the great proportion of these small particles are capable of being pierced by metal objects such as spikes, and it is with the removal of these particles that the present invention is concerned and which are hereinafter referred to as contaminants.

Accordingly, it is an object of this invention to provide an apparatus to remove contaminants from metal products.

Other objects and advantages of the invention will be apparent from the following description, and appended claims, taken in conjunction with the accompanying drawing in which:

FIGURE 1 shows an assembly of the invention which includes a conveyor, a distributing gate, a spiked rotatable member and a collecting member;

FIGURE 2 shows a spike especially suitable for the removal of foreign matter from a metal product;

FIGURE 3 shows in section, a spiked rotatable member and collector of this invention, and illustrates the manner of operation of the invention; and

FIGURE 4 shows the arrangement of a preferred form of a spiked rotatable member.

With reference to the drawing, FIGURE 1 shows contaminated crushed titanium sponge 1 being discharged from a feeder 3 onto an endless conveyor belt 5. Conveyor belt 5 is driven by rollers 7 at a predetermined speed suitable to the particular operation. A supporting member 9 prevents conveyor belt 5 from sagging under the load of titanium sponge and the surface of the conveyor belt is held firm and substantially horizontal throughout the range in which the cleaning process is performed. The width and length of the conveyor are not critical and are determined by the particular operation with which the invention is employed.

A distributing member 11 is located above conveyor belt 5 between feeder 3 and spiked rotating member 13. Distributing member 11 spreads the material from feeder 3 to form a layer of the material over the surface of conveyor belt 5. This is accomplished by employing suitable means, such as rod 15 and actuated cam 17 to cause the distributing member 11 to move reciprocatively across conveyor belt 5. The gates 19 of distributing member 11 are dimensioned to permit the crushed metal

product and contaminant particles of a predetermined maximum size to pass to the vicinity of spiked rotatable member 13. The large contaminants will be restrained by the distributing member and may be removed manually.

One spiked rotatable member 13 is shown in FIGURE 1, although several may be used and located successively along conveyor belt 5; rotatable member 13 may be driven by an suitable means. Spikes 21 are provided to remove the contaminants and are arranged over the surface of rotating member 13 in a pattern which ensures that the entire width of conveyor belt 5 is continuously searched for removable contaminants. The rotation of rotatable member 13 is such that the spikes affixed thereto move through and search the moving layer of material on conveyor 5 in a direction opposite to the flow of material so that piercing and removal of contaminants is facilitated. As the titanium sponge and contaminants pass into the vicinity of rotating member 13 the particles are contacted by spikes 21. A contaminant 23, which is softer than titanium sponge, is shown being pierced by a spike and removed from the conveyor. Rake 25 having prongs spaced at intervals less than the width of the gates of distributing member 11, causes the contaminant to be removed from the spike to collecting member 26. When a particle of titanium sponge is contacted by a spike the particle will not be pierced but will pass along on the conveyor to a suitable container.

Rake 25 and collecting member 26 are located above the surface of conveyor 5 at a distance sufficient to provide the necessary clearance and collecting member 26 may be inclined to assist in the removal of the foreign matter therefrom.

Spikes 21 are of a special design. Each spike consists of a suitably resilient metallic rod pointed and bent as illustrated in FIGURE 2. The spike is shown having two loops therein, 27 and 29. It is seen in FIGURE 3 that loops 27 and 29 are opposite in direction. When assembled in the metal cleaning apparatus of this invention, spikes 21 are fixed to the rotating member 13 so that the bend of loop 29, the loop closest to the point of the spike, is in the same direction as the rotation of rotating member 13.

The bends in spike, 27 and 29, provide added resiliency and a knee action which enables a spike to strike particles of titanium sponge without damage to the spike or apparatus while being fully capable of piercing contaminant particles. In the case that a spike 21 contacts a particle which is not pierceable, such as titanium sponge, by virtue of bend 27, it will deflect or bend resiliently, or if necessary fold in the knee action provided by bend 29, thus protecting the needle-like point of the spike. Further, the added resiliency provided by bend 27 readily permits the removal of pierced contaminants from the spikes without resulting in deformation of the spikes or damage to the points of the spikes. The portion of the spike denoted by numeral 31 is adapted to be inserted in the rotating member and may be welded therein.

FIGURE 3 illustrates the manner of operation of the invention and shows a pierced contaminant particle 36 being removed from a spike and deposited in collecting member 26. A spike is also shown contacting a particle of crushed titanium sponge 40 and bending in a knee action to permit passage of the titanium particle.

A preferred form of the rotatable member is known in FIGURE 4 as being comprised of a plurality of disks 33, axially mounted on a shaft 35, and equally separated from one another by suitable spacers 37. Disks 33 are fixed in position by a locking nut 39. Spikes 21 are shown to be arranged at substantially equal intervals

along the periphery of each disk. The spikes of alternate disks are shown to be substantially in register along the longitudinal axis of the rotatable member, while the spikes of adjacent disks are arranged in anti-register. That is, any given spike is substantialy equidistant from the adjacent spikes located on adjacent disks. This arrangement avoids crowding of spikes and at the same time permits the full area of the conveyor to be adequately searched.

The minimum distance between the points of any two spikes on the rotatable member is arranged so that the largest particle allowed through gates 19 of distributing member 11 cannot be jammed between the two spikes without being pierced, and thus erroneously removed from the conveyor. For example, the spikes are preferably arranged so that the distance between any two adjacent spikes on the rotatable member is at least equal to, or slightly greater than the wides of gates 19.

From the description hereinabove it may be seen that this invention provides a simple and easily fabricated apparatus for the removal of contaminants from crushed metal products.

What is claimed is:

1. An apparatus for removing contaminant particles from a metal product which comprises a conveying means to receive and transport a metal product; distributing means spaced closely above said conveying means and having gates to permit metal product and contaminant particles of a predetermined maximum width to pass therethrough and form substantially in a layer upon said conveying means; at least one rotatable member axially mounted above said conveying means being spaced from said distributing means in the direction of motion of said conveying means and having its axis substantially perpendicular to the direction of movement of said conveying means; means operable to rotate said rotatable member in a direction such that the opposing surfaces of said rotatable member and said conveying means move in opposite directions; a plurality of resilient pointed spikes affixed to said rotatable member having the points thereof extending outward from said rotatable member and in the direction of rotation thereof and each having a length sufficient to search the layer of metal product and contaminant particles so that any contaminant particles in the layer are contacted and pierced by said spikes; said spikes being arranged upon said rotatable member in a plurality of parallel planes perpendicular to the axis of said rotatable member with substantially equal number of spikes being arranged in each of said planes at equal intervals; the spikes of alternate planes being arranged in register and the distance between any two adjacent spikes on said rotatable member being arranged to be at least equal to the width of said gates of said distributing member; and at least one scavenging means located adjacent to said rotating member to remove pierced contaminant particles from said spikes.

2. An apparatus according to claim 1 wherein said scavenging means comprises a rake-shaped member positioned closely adjacent to said rotating member and having prongs spaced at intervals less than the width of said gates of said distributing member and being arranged so that said spikes pass between said prongs whereby contaminant particles pierced by said spikes are removed therefrom.

3. An apparatus according to claim 1 wherein each of said plurality of spikes is a pointed resilient rod having loops at two locations in its length, the said loops being in opposite directions, the loop located closest to the point of said rod being formed by causing said rod to be bent in the same direction as the rotation of said rotatable member, whereby said rod is provided with a knee-action and added resiliency.

4. An apparatus for removing contaminant particles from a metal product which comprises a conveying means to receive and transport a metal product; distributing means spaced closely above said conveying means and having gates to permit metal product and contaminant particles of a perdetermined maximum width to pass therethrough and form substantially in a layer upon said conveying means; at least one rotatable member axially mounted above said conveying means being spaced from said distributing means in the direction of motion of said conveying means and having its axis substantially perpendicular to the direction of movement of said conveying means; means operable to rotate said rotatable member in a direction such that the opposing surfaces of said rotatable member and said conveying means move in opposite directions; a plurality of resilient pointed spikes affixed to said rotatable member having the points thereof extending outward from said rotatable member and in the direction of rotation thereof and each having a length sufficient to search the layer of metal product and contaminant particles so that any contaminant particles in the layer are contacted and pierced by said spikes; said spikes being arranged upon said rotatable member in a plurality of parallel planes perpendicular to the axis of said rotatable member with substantially equal number of spikes being arranged in each of said planes at equal intervals; the spikes of alternate planes being arranged in register and the distance between any two adjacent spikes on said rotatable member being arranged to be slightly greater than the width of said gates of said distributing member; and at least one scavenging means located adjacent to said rotating member to remove pierced contaminant particles from said spikes.

5. An apparatus according to claim 4 wherein said scavenging means comprises a rake-shaped member positioned closely adjacent to said rotating member and having prongs spaced at intervals less than the width of said gates of said distributing member and being arranged so that said spikes pass between said prongs whereby contaminant particles pierced by said spikes are removed therefrom.

6. An apparatus according to claim 4 wherein each of said plurality of spikes is a pointed resilient rod having loops at two locations in its length, the said loops being in opposite directions, the loop located closest to the point of said rod being formed by causing said rod to be bent in the same direction as the rotation of said rotatable member, whereby said rod is provided with a knee-action and added resiliency.

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