Jan. 14, 1958 F. F. L. MORGAN 2,819,571

DUST EXTRACTION SYSTEMS FOR GRINDING WHEELS

Filed Aug. 28, 1956 2 Sheets-Sheet 1

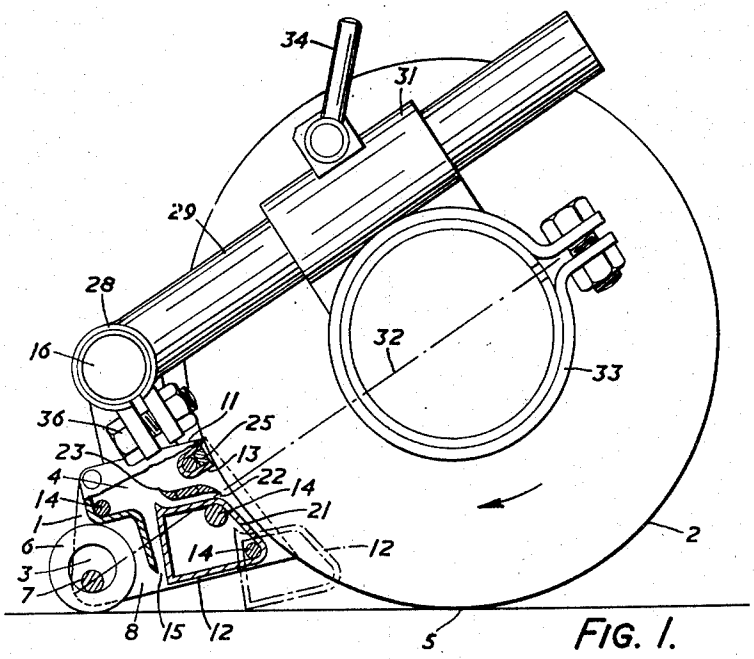


FIG. 1.

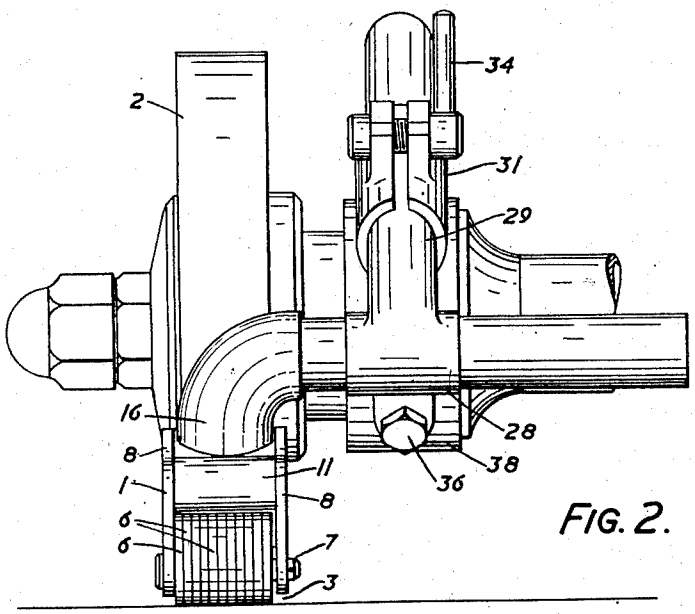


FIG. 2.

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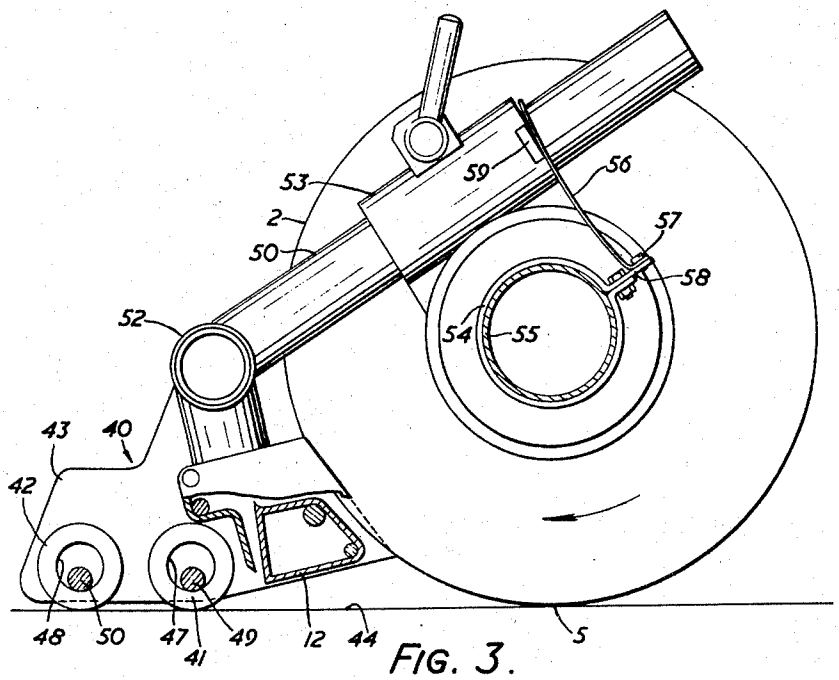


FIG. 3.

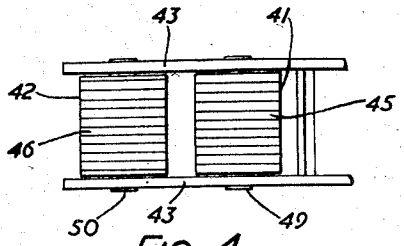


FIG. 4.

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DUST EXTRACTION SYSTEMS FOR GRINDING WHEELS

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Claims priority, application Great Britain August 29, 1955

8 Claims. (Cl. 51—273)

This invention relates to dust extraction systems for grinding wheels, for example portable hand grinders, swing-frame grinders and stand grinders and one object is to provide an improved extraction head for the collection of dust generated at the working portion of the wheel.

In accordance with the present invention a dust extraction head for a grinding wheel includes ducting for the collection of dust particles generated at the working portion of the wheel and a bearing member carried by the head and arranged to make contact with the surface of the work during grinding.

The bearing member may fulfill one or more of two or three functions—to act as a dust guard, to locate the head in relation to the work, and to take the weight of head—and accordingly may be in one of several forms.

Thus according to one aspect of the present invention the bearing member comprises a dust guard arranged to make contact with the work and capable of yielding to conform with the contours of that surface for stopping dust particles leaving the working portion of the wheel tangentially while the ducting has a mouth directed to collect dust particles stopped by the dust-guard.

The mouth may be in the region between the wheel and the dust guard, or may be on the side of the guard remote from the wheel, to pick up dust after the guard has passed over it, or there may be two ducts.

Preferably the dust guard comprises a roller so that as it is moved along the surface of the work there is little friction and in one form of the invention the roller is built up from a number of annular discs, for example of steel, mounted side by side on a rod which is smaller than the holes in the discs so that they can move relatively to each other in accordance with irregularities in the surface of the work.

Where the guard comprises two rollers one behind the other with the discs of one staggered in relation to those in the other, a ducting mouth may be added between them.

The ducting may have an additional mouth directed to withdraw dust particles travelling around with the wheel. This latter ducting mouth may contain a vane, for example an aerofoil-section strip to tend to deflect the dust into the mouth and to assist in the withdrawal of the dust by improving the airflow through the mouth.

In a preferred form the extractor head comprises a box-like structure mounted close to the rim of the wheel to define a short circumferential passage with it and supporting a built-up roller. The interior of the box is coupled to a source of suction and has two mouths, one opening just above the region between the wheel and roller and the other, which contains an aerofoil, opening close to the rim of the wheel.

It has been found that substantially all of the large dust particles, and some of the fine dust particles, are thrown tangentially from the working portion of the grinding wheel and these can be stopped by the dust guard which will create turbulence in the region between the working

portion of the grinding wheel and the dust guard and the dust particles can then be withdrawn from this region through the first mouth of the ducting. It has been found that for a 6" radial grinder with a peripheral speed of about 9,000 feet per minute, the dust at about 3" from the working portion of the wheel where the dust guard may conveniently be mounted, travels at quite a high velocity. In the absence of the dust guard the ducting mouth might have to be directed towards the approaching dust particles if it were to be an efficient dust extractor even with a very high source of suction, but the dust guard effectively checks the dust particles and allows the conducting to remove them. It has been found that in the example just quoted a vacuum of about 3'6" to 5' of water gives efficient dust extraction.

The remainder of the fine dust particles rotate round with the grinding wheel and it appears that a single duct mouth directed towards the rim of the grinding wheel will remove a large portion of this dust while any dust not so removed can probably not be removed at all. Accordingly the additional mouth for this dust can be positioned quite close to the working portion of the wheel with the result that the complete extractor head need take up but little room and need obscure only perhaps 30° of the surface of the grinding wheel. This is a great advantage since in practice it is desirable to see as much as possible of the edge of the wheel.

However the bearing member may also serve to locate the mouth of the ducting in relation to the surface of the work and according to a second aspect of the invention the bearing member comprises a roller carried at the mouth of the ducting and positioned so that when the grinding wheel and the roller are both in contact with a plane surface the mouth of the ducting is close to the surface.

Thus as the roller rides over irregularities in the surface of the work the mouth of the duct will be moved to clear them also and will be maintained close to the region where the particles are generated so long as the roller is in contact with the surface of the work.

The roller can roll easily over the surface without causing much drag, and its axis may be parallel with that of the grinding wheel if the edge of the grinding wheel is to be used or may be perpendicular if the side face is to be used. Of course, the roller may consist of a ball and be capable of rotation about any axis. Preferably the roller is carried by the cowl.

With any dust extraction head as defined above at least the portion carrying the bearing member, dust-guard or roller may be rotatably mounted about an axis parallel with that of the grinding wheel while a spring is mounted to tend to rotate this part of the head about that axis in order to keep the bearing member, dust guard or roller in contact with the surface of the work. In this way the operator does not have to take special precautions to keep the bearing member in contact with the surface of the work.

The head may include a stop of wheel-dressing material, and means for adjusting the position of the head in relation to the wheel which means and stop are so related that in adjusting the extractor head towards the rim of the wheel the stop makes contact with the wheel rim first.

Preferably its surface is tangential to the wheel. The ducting in the extractor head may have a mouth directed towards the rim of the wheel on the side of the stop towards the working portion of the wheel.

The stop, which may for example be of tungsten carbide, enables the extractor head to be adjusted in relation to the grinding wheel while the grinding wheel is running, without damaging the extractor head, and also acts as a stop obstructing fine dust particles travelling

around with the wheel, which after being stopped can be withdrawn by the ducting. The stop also acts to dress the surface of the wheel.

The extraction head is conveniently mounted for adjustment relatively to the grinding wheel along a radius of the grinding wheel passing through the extraction head.

The invention may be carried into practice in different ways but one specific embodiment will be described by way of example with reference to the accompanying drawing of which:

Figure 1 is a side elevation partly in section of a preferred extractor head 1 fitted to a portable peripheral-faced grinding wheel 2,

Figure 2 is a front elevation of the head shown in Figure 1, and

Figure 3 is a view similar to Figure 1 of a modified embodiment of extractor head incorporating two dust guard rollers one behind the other, and Figure 4 is a fragmentary underneath plan view of the dust guard of Figure 3.

In the embodiment of the invention illustrated in Figures 1 and 2, there is shown a portable 6" edge-faced grinding wheel 2 fitted with a dust extraction head generally indicated at 1. The head 1 carries what will be termed a flexible roller dust guard 3 and is formed with ducting 4 for the extraction of dust generated at the working portion 5 of the wheel.

The flexible roller 3 comprises a number of annular steel discs 6 carried on a rivet 7 secured by a split pin between two side plates 8 of the extractor head. There are sufficient discs for the roller to be rather wider than the grinding wheel 2. The holes in the discs 6 are substantially larger than the cross-section of the rod 7 so that the discs can move readily in planes perpendicular to the axis of the rod. The operator uses the grinding wheel by holding the wheel 2 and roller 3 in contact with the surface of the work and the discs 6 can move, one relatively to another, to conform with irregularities in the surface of the work. Where the operator uses the edge of the grinding wheel 2, the discs 6 have sufficient play to be able to align themselves with a flat surface of the work if the grinding wheel is tilted through an angle of up to about 20°.

During grinding, substantially all of the large particles of the detritus from the work and the wheel and some of the fine particles leave the wheel tangentially and strike the roller 3 which causes considerable turbulence in the region between it and the working portion 5 of the wheel 2. Since it can conform with the surface of the work the roller is effective to stop most of the particles.

The extractor head ducting 4 is formed by bent plates 11, 12 and 13, held on pins 14 secured between the plates 8 by riveting and is formed with a mouth 15 just above the region of turbulence between the roller 3 and the working portion 5 of the grinding wheel. The extractor head is coupled through pipes 16 to a source of suction of about 5 feet of water so that the dust particles in the region of turblence are sucked through the mouth 15 and withdrawn through a suitable filter to a dust receptacle. The lip of the mouth near to the working portion of the grinding wheel is lower than the other lip to avoid high velocity dust particles moving tangentially from the wheel adhering to and eventually blocking the mouth.

The remainder of the fine dust particles move circumferentially with the wheel. Consequently these particles enter the circumferential passage defined between the rear surface 21 of the extractor head and the rim of the wheel, and the ducting is formed with a second mouth 22 opening into this passage for the extraction of these dust particles. The second mount 22 contains an aerofoil member 23 for deflecting particles into the mouth and for improving the flow of air through the mouth. On the side remote from the working portion of the grinding wheel the mouth 22 has a lip formed by the plate 13 which is shaped to carry a stop 25 of tungsten carbide, a grinding-wheel-dressing material. This stop has a broad face tangential to the rim of the grinding wheel.

The extractor head is mounted for radial adjustment in relation to the grinding wheel. Thus the pipe 16 is mounted in a sleeve 28 formed on the end of a shaft 29 which is carried in a releasable clamping sleeve 31 with its axis parallel to a radius 32 of the grinding wheel passing through the extractor head 1. The sleeve 31 is carried by means of a collar 33 clamped around the grinding wheel casing. Thus the clamp 31 can be released by unscrewing a lever 34 to allow the shaft 29 to be moved in a direction parallel with the radius 32. The shaft 29 is also spaced from the grinding wheel planes as seen in Figure 2.

It will be seen that the extractor head can be used for grinding wheels within a wide range of diameters for example from 2" to 8" since the head extends through but a small angle of the wheel. As the head is adjusted radially the tungsten carbide stop 25 first comes into contact with the rim of the wheel and locates it, after which the lever 34 can be screwed up to clamp the shaft 29 in position. The stop 25 dresses the grinding wheel until it has a minimum clearance and in this way it acts to restrict as much as possible any flow of dust particles between it and the rim of the wheel. It also enables an operator to adjust the extractor head even while the wheel is rotating, by pushing the roller 3 against the work. Adjustment of the extractor head in the direction of the grinding wheel axis can be obtained by sliding the pipe 16 along the sleeve 28 which can afterwards be clamped around the pipe by means of lugs and a nut and bolt 36.

Although the invention has been described as applied to a portable hand grinder it is equally applicable to a swing frame grinder and can be incorporated in the tool rest of a stationary grinder.

It may be noted with reference to the flexible roller that due to rolling of the discs and rubbing between them dust particles deposited on the roller are knocked off and the roller is in effect self-cleaning. However, the upper one of the pins 14 in the part of the head formed by the plate 12 is removable to allow the part to be moved as shown in chain lines for cleaning the ducts.

In another embodiment of the invention the head carries a solid metal roller at the leading end of a duct for collecting the dust and arranged so that when it and the wheels are in contact with the work the duct mouth is close to the surface of the work.

In the embodiment illustrated in Figures 3 and 4, the head 40 carries two flexible roller dust guards 41 and 42 mounted between side plates 43 of the head so that both the rollers 41 and 42 are in rolling contact with the work indicated at 44, with the roller 42 mounted behind the roller 41 so as to intercept any particles of dust from the working region 5 of the wheel which manage to pass the nearest roller 41. Each of the rollers 41 and 42 comprises a number of annular steel discs 45 or 46 formed with holes 47, 48 which are substantially larger than the cross-sections of the rods 49, 50 on which the discs 45, 46 are respectively mounted, so that as before the discs of each roller can move independently of one another transversely to their supporting rods so as to conform with irregularities in the surface of the work. As indicated in Figure 4, the discs 45 of the roller 41 are staggered in relation to the discs 46 of the roller 42 so as to reduce any possibility of dust particles passing between the discs of both rollers. In this embodiment, moreover, the shaft 51 secured to the suction tube 52 to support the head is clamped by means of a clamp 53 to a sleeve 54 rotatably mounted on the casing 55 of the shaft of the grinding wheel 2. A leaf spring 56 secured by means of a bolt 57 to a support 58 secured to a fixed part of the grinder casing bears against a lug 59 on the clamp

53 to urge the whole head structure 40 to rotate about the axis of the sleeve 54 in the direction towards the work.

Thus it is only necessary for the operator to hold the wheel against the work and the leading end sector will be urged round by the spring to keep the rollers in contact with the surface of the work and thus to keep the head positioned to collect as much of the dust as possible.

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

1. A dust extraction head for a grinding wheel, which comprises ducting for the collection by suction of dust particles generated at the working portion of the wheel, and a dust guard arranged to make contact with the work to intercept dust particles thrown tangentially from the working portion of the wheel, the dust guard comprising a roller arranged to make rolling contact with the work and yielding mounting means by which the roller is mounted on the head, the mounting means enabling the roller to yield in conformity with irregularities in the surface of the work while remaining in rolling contact with the work.

2. A dust extraction head as claimed in claim 1 in which the mounting means includes a spindle secured to the head and in which the roller is constituted by a number of annular discs each having a transverse hole in its central portion, the discs being pivotally mounted side by side on the spindle which passes through the holes in the discs, and the spindle being of smaller diameter than the holes in the discs through which it passes, allowing the discs to move transversely to the spindle independently of each other in accordance with irregularities in the work surface.

3. A dust extraction head as claimed in claim 2 in which the dust guard includes a second roller constructed similarly to the first roller and mounted behind the first roller, the discs of the second roller being staggered in relation to the discs of the first roller.

4. A dust extraction head as claimed in claim 1 including a suction mouth connected to the ducting and

disposed between the dust guard and the working region of the wheel to collect dust particles intercepted by the dust guard.

5. A dust extraction head as claimed in claim 4 including a second suction mouth connected to the ducting and disposed close to the surface of the wheel downstream of its said working region, and a stripper vane of aerofoil section extending across the suction mouth transversely to the wheel and directed towards the surface of the wheel, the suction in the ducting inducing a dust-bearing air stream to flow outwardly from the wheel surface past the downstream side of the stripper vane into the ducting.

6. A dust extraction head as claimed in claim 1 in which the whole dust guard is pivotally mounted for rotation about an axis parallel to that of the grinding wheel and which includes a spring acting on the dust guard to tend to rotate it about its pivotal axis so as to keep the roller in contact with the work.

7. A dust extraction head as claimed in claim 1 including means for adjusting the position of the head radially in relation to the wheel, and including a stop of wheel-dressing material carried by the head and so disposed in relation to the said adjusting means as to make contact with the peripheral surface of the wheel when the head is moved towards the wheel.

8. A dust extraction head as claimed in claim 7 in which the head is adjustable radially by means of the said adjusting means along a radius of the wheel which passes through the dust guard.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,819,571 January 14, 1958

Frederick Francis Llewellyn Morgan

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the grant, line 1, and in the heading to the printed specification, line 4, name of inventor, for "Frederick Francis Llewellyn" read -- Frederick Francis Llewellyn Morgan --.

Signed and sealed this 25th day of February 1958.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents