Sept. 28, 1937. M. J. WATSON 2,094,438

SIFTER SYSTEM

Filed Nov. 22, 1935 2 Sheets-Sheet 1

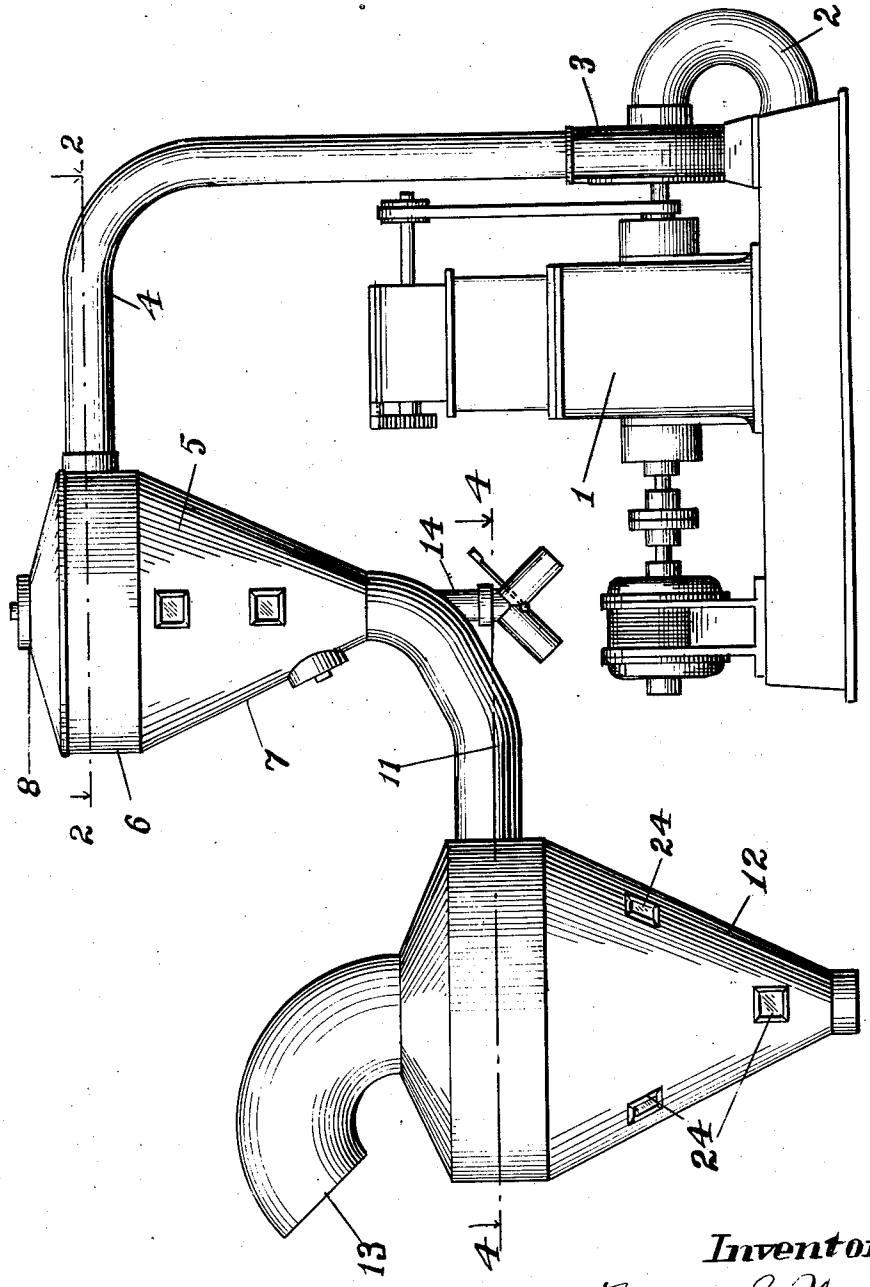


Fig. 1.

Inventor:
Myron J. Watson
by
A. M. Paisted,
Atty.

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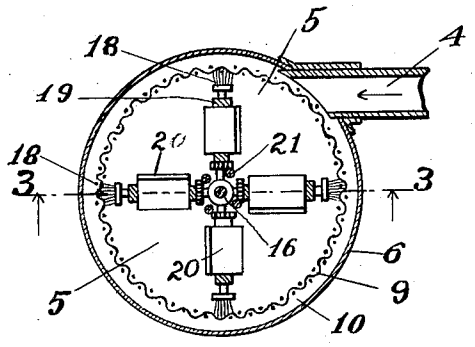


Fig. 2.

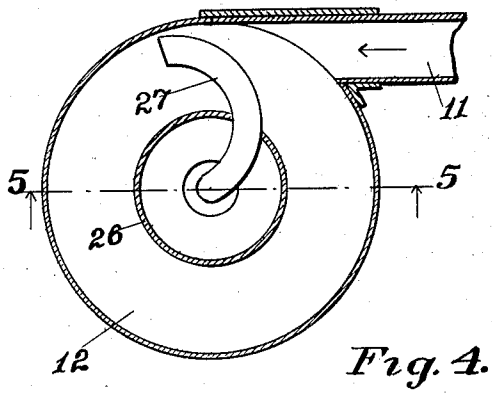


Fig. 4.

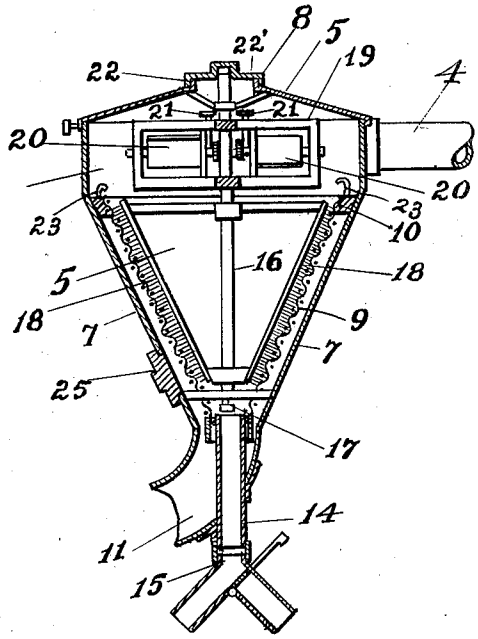


Fig. 3.

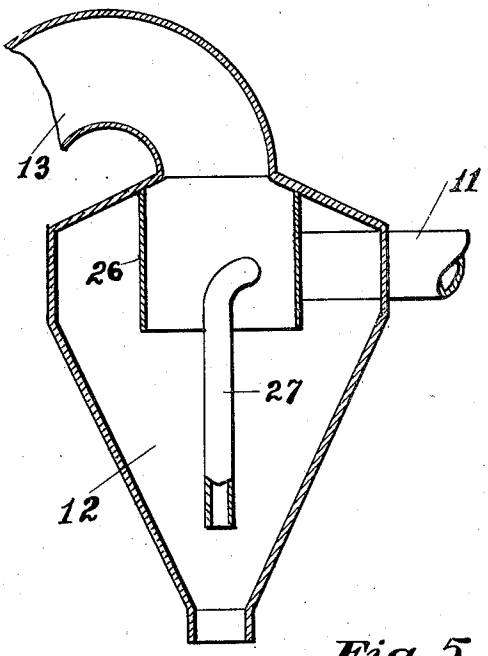


Fig. 5.

Inventor:
Myron J. Watson
by H. M. Plaisted,
Atty.

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2,094,438

SIFTER SYSTEM

Myron J. Watson, Chicago, Ill.

Application November 22, 1935, Serial No. 51,045

4 Claims. (Cl. 209—250)

This invention relates to certain new and useful improvements in sifter systems, the peculiarities of which will be hereinafter fully described and claimed.

My present invention relates to that class of sifter systems in which finely pulverized material, such as grain, rock, mineral or other material, is finely pulverized in a suitable machine and then delivered to my system under compressed air currents in which the material is held in suspension, and by my construction of sifter system is prevented from clogging or undesired deposit within the system, so that said material is continually in motion and divided by the sifter device into the desired grades of fineness, some of which grades are drawn off at definite points of the system, while the balance containing the finest particles of material is finally separated from the blast air and drawn off in its finished condition as a finally finely pulverized product.

With the above objects in view, my system comprises a casing of an inverted conical shape in which is mounted a conical screen having openings of the desired fineness, and a corresponding conical rotary frame carrying brushes which engage the inner side of the screen and by their continual rotary contact, prevent clogging of the openings in the screen, and maintain the particles of the material constantly in motion in the vehicular blast air currents passing through the preliminary sifter to the final cyclone collector in which latter the compressed air is separated from the finest particles, while said particles are drawn off as finished product.

Another object is to provide such construction of the sifter that the frame and brushes, and the screen itself, are easily accessible so that they can be readily removed for change or replacement as desired.

Another object is the provision of a safety device by which the pressure of a possible explosion within said chamber may be relieved and avoid rupture of the system.

Another object is to rotate said brushes by the force of the entering blast air.

Another object is to control the speed of rotation of the said brushes by means operated by the entering blast air, and to increase or lessen the rotative speed as may be desired.

Another object is to provide means for keeping the pulverized material in suspension by agitating and deflecting the entering blast air bearing said material, to avoid its clogging the screen and its tendency to lodge within the sifter.

Other objects will appear from the description or be particularly pointed out in the claims.

The cyclone collector shown herewith is the subject of my Patent #2,074,818, dated March 23, 1937.

In the accompanying drawings in which like reference numerals indicate corresponding parts,

Fig. 1 is an elevation showing my sifter system in combination with a pulverizer and fan;

Fig. 2, a plan view of the sifter chamber on a sectional plane 2—2, Fig. 1, showing deflecting blades and a supporting frame therefor;

Fig. 3, a vertical section on the line 3—3, Fig. 2, showing a brush mechanism operated by fan blades in the path of the entering blast air;

Fig. 4, a plan view of a cyclone collector on a sectional plane 4—4, Fig. 1; and

Fig. 5, a sectional elevation of said cyclone collector on the line 5—5 of Fig. 4.

Referring to the drawings, the numeral 1 designates a pulverizer of suitable type for pulverizing grain, rock, mineral or other material. Such pulverized material is delivered by a pipe 2 to a blast fan 3 which is connected by a pipe 4 to an upright casing 5 having a cylindrical top 6 and a conical bottom portion 7. The cylindrical portion has a top 8 which is detachably mounted thereon and held by set screws or otherwise but may be readily removed to give access to the interior of the casing and remove the operating devices now to be described.

In the conical part of this casing is mounted a conical screen 9 having a packing ring 10 at the top so that the blast air with its pulverized material will be delivered to the inside of the screen. The fines that pass through the screen are delivered by a downwardly inclined pipe 11 to a suitable collector such as a cyclone collector 12 to separate the air from the fines which latter are discharged from the bottom of the cyclone into a bag or other receptacle, while the air, freed of the fines, escapes through the center outlet 13.

The coarse particles of the pulverized material which do not pass through the screen 9, are delivered as tailings through a pipe 14 connected to the bottom of said screen and passing out through said pipe 11 and ending in a sacking spout or other valve device 15 which prevents the escape of the tailings until opened for their discharge.

In the central axis of said screen is mounted a rod or shaft 16 in a bearing at the top and bottom. This shaft is freely rotatable and has an adjusting screw 17 at the lower bearing or is

otherwise adapted to be raised or lowered as desired. On this shaft is mounted a conical frame connected at the top by radiating arms to the shaft and carrying brushes 18 on the inclined portions of said frame, which brushes are substantially in contact with the inner face of said screen 9. The brushes may be adjusted by said adjusting screw to vary their contact with the screen, or by any other suitable means. As these brushes rotate, by means presently to be described, they keep the openings in the screen clear for the passage of fines which pass through the pipe 11 to said cyclone or other collector.

In the cylindrical chamber above the conical portion, is mounted a series of radiating frames 19 carried by said shaft 16 as shown in Figs. 2 and 3. In said frames are pivotally mounted deflecting blades 20 which are varied in their inclination by rotation on their horizontal axes by suitable adjusting means, such as a vertical handle 21 having a pinion and bevelled gear connection with the axis of each blade. Access is had to adjust the inclination of these blades through a capped opening 22.

Rotation is effected by the impact of the material carrying blast air entering the casing and impinging upon said blades as a fan, which causes rotation of the shaft 16 and the conical frame and brushes also carried by said shaft.

While these blades deflect the blast air downward like a fan, they are motivated by the impact of the entering air currents, similar to turbine blades actuated by water impact. The brush-carrying shaft being freely rotatable and having such turbine fan mounted thereon, is therefore driven by the said blades. Also the speed of rotation is varied by adjustment of the inclination of these fan blades, which is a function not possessed by fixed turbine blades.

When said blades are vertically disposed, the velocity of the fan and of the brushes will be greater than when said blades are inclined more or less to the horizontal. When the blades are inclined, the pulverized material in the entering blast air is deflected downward into the conical screen where such material is agitated by the brush frame as it seeks outlet through the screen. The radiating arms 19 of the fan frame likewise agitate the material in suspension as the said frame is rotated under the impulse of the entering air as just described.

Thus any tendency of the pulverized material to lodge or clog the screen or other part of the sifter cone, is practically avoided, and at the same time the said particles are so agitated and kept in suspension, that the fines quickly and readily find exit through the screen openings into the casing and are forced onward into said collector by the pressure of the blast air.

The screen is provided with hooks 23, and the top 8 of said casing when removed therefrom, allows of drawing up the screen by passing a lifting rope under said hooks, when the screen is to be changed to another of different fineness as may be required for the material being sifted.

Likewise the shaft 16 carrying the fan and the conical frame with the brushes, may also be drawn up from the lower bearing in which the shaft is mounted.

The casing 12 is provided with glazed openings 24 at different heights, by which the operation of the brushes may be viewed from outside and adjustment made accordingly. The usual clean out opening 25 near the bottom of the casing gives access for adjustment of the shaft carrying the brushes when desired to make closer or lesser contact of the same with the conical screen.

Thus it will be seen that the rotation of the brushes is effected by means entirely within the casing, and not operated by outside connections; also that the speed of rotation can be controlled by adjusting the inclination of the fan blades to the entering blast air; also that the fan frame and the brush frame cooperate in agitating the air and keeping the pulverized material in suspension so that the fines will be readily passed through the screen and onward to the collector, while the tailings are discharged through the valvular device 15 before mentioned.

As the fines enter the cyclone collector tangentially under the continued impulse of the blast air, the centrifugal motion in the upper part of the cyclone increases as the material descends the conical lower portion, and causes a vortex in the center and an upward motion of the air to the discharge opening 13 connected to the tubular 26 depending from the top of the cyclone.

The velocity of the particle-laden air entering the large upper portion of the cyclone collector is substantially unchanged when the air-carried particles change from their straight tangential entering direction to a circular movement by which a centrifugal action is exerted on the particles causing them to hug the inner wall of the collector chamber. As the diameter of this downwardly tapering cone decreases, the velocity remains substantially uniform, but the rotary motion increases, and likewise the centrifugal tendency while the particles spiral downward, causing practical separation of the pulverized material from its vehicular air and condensation of the latter which seeks exit through the small bottom outlet and upward through the tubular 26 to the said discharged opening 13.

The lightest particles are not so readily separated by centrifugal action from the whirling air currents as the larger particles, and are thus liable to be carried out the upper discharge opening with the purified air unless the diameter of the tubular bears a certain definite relation to the condensed air pressure which would avoid such loss. In the usual more or less approximation to this perfect proportion, many of these lightest particles would escape through the air discharge opening 26 if it were not for a collecting device that I have provided by which most of these lightest particles are taken out of the whirling air currents at or near the point of greatest compression near the bottom outlet of the cone, and are returned by a communicating pipe to a point in the upper part of the cyclone-collector where they will again mingle with the particle-laden air entering the tangential inlet. The air pressure is also distributed by this return pipe, such as through a vertical pipe 27. This pipe is mounted in the axis of the cyclone and its lower end hangs adjacent to the lower discharge opening. The upper portion of said pipe passes outside the tubular and is curved in the direction of the material laden air entering the cyclone as shown in Fig. 4. Thus the air passing upward through said pipe and outward through the curved end adjacent to the cyclone inlet, merges the air currents from said pipe with the entering blast air under the force of the air pressure in the lower portion of the cyclone collector.

Referring again to the sifter casing, the opening 22 has its cap 22' detachably mounted so as to serve as a safety cap and relieve the pressure

within the casing, in the event of an explosion of the dust therein.

I claim:

1. A sifter system comprising an upright casing having a conical bottom and a top forming an upper chamber with a tangential inlet subject to mixed feed of blast air and pulverized material in suspension, a vertical freely rotatable shaft mounted in the axis of said casing, radiating frames supported by said shaft, adjustable fan blades pivotally mounted in said frames in the path of the entering mixed feed blast acting to drive said shaft and inclined so as to deflect said blast downwardly into said conical bottom, means to vary adjustably the inclination of said blades, a conical frame carrying brushes operably connected to said fan blade frames, a conical screen mounted in said conical bottom subjected to rotary downward currents of material in suspension, and outlet pipes for the fines and tails from said screen, substantially as described.

2. A sifter system as in the last claim, the means for adjusting the fan blades consisting of a vertical handle having a pinion and bevel gear connection with each blade.

3. A sifter system comprising an upright casing having a lower portion, and a top portion forming a cylindrical chamber with a tangential inlet for material-laden air currents, a screen in said lower portion, a freely rotatable shaft in the axis of said casing, brushes adjacent said screen and carried by said shaft, and driving means for said shaft characterized by a set of inclined radiating blades mounted in said chamber on said shaft in the path of the entering air currents and driven thereby, and acting to deflect said currents downwardly into said lower portion and against said screen, and outlet pipes for coarse and finer particles.

4. A sifter system comprising an upright casing having a cylindrical top portion with a tangential inlet subject to blast air currents containing pulverized material, a lower portion of said casing containing a screen, a freely rotatable shaft therein carrying screen-cleaning brushes, and provided with outlets for coarse and finer particles, and said top portion containing combined shaft-driving and air-deflecting means, and agitating means for the material in suspension in said air currents,—both said means being actuated by the blast air currents entering by said tangential inlet.

MYRON J. WATSON.