Dec. 10, 1940. K. GROCHOLL 2,224,647

SAND CENTRIFUGING CLEANING MACHINE

Filed May 1 ,1931 3 Sheets-Sheet 1

Fig. 1

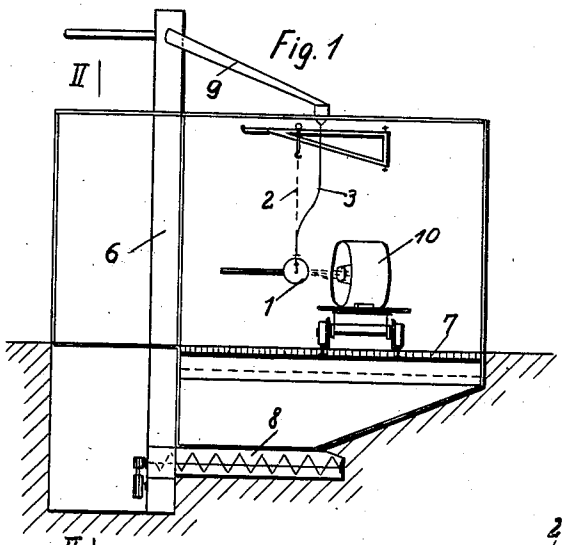


Fig. 2

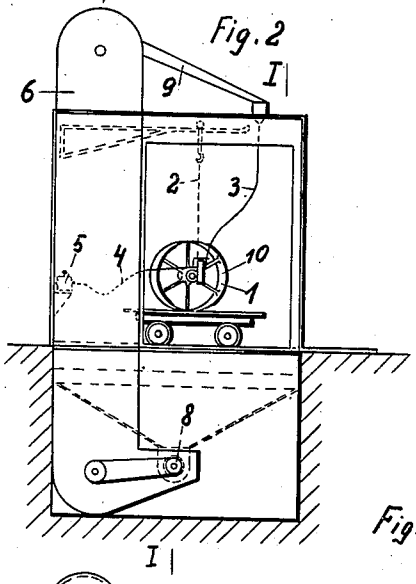


Fig. 3

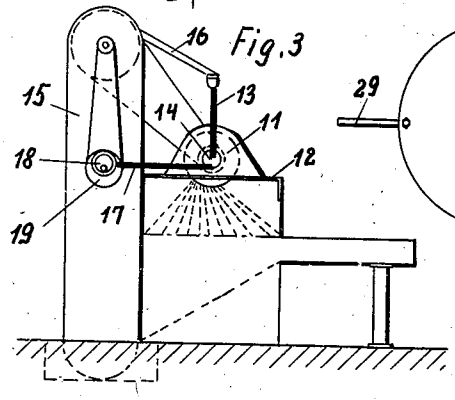


Fig. 4

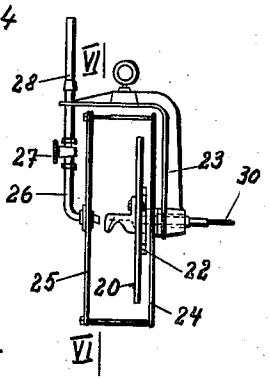


Fig. 5

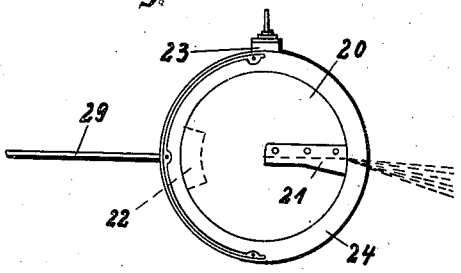


Fig. 6

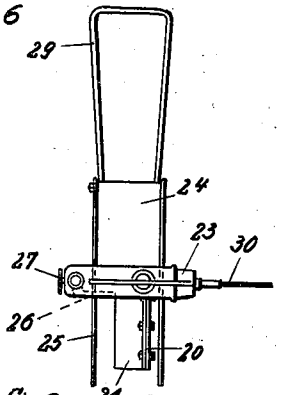


Fig. 7

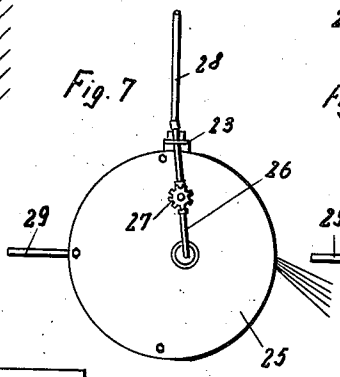
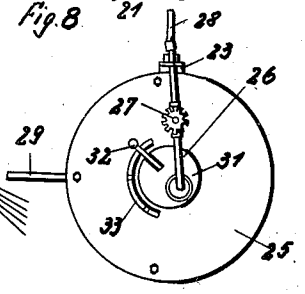


Fig. 8



Inventor:
Karl Grocholl
by
Attorney

Dec. 10, 1940. K. GROCHOLL 2,224,647

SAND CENTRIFUGING CLEANING MACHINE

Filed May 1 ,1931 3 Sheets-Sheet 2

Fig. 12.

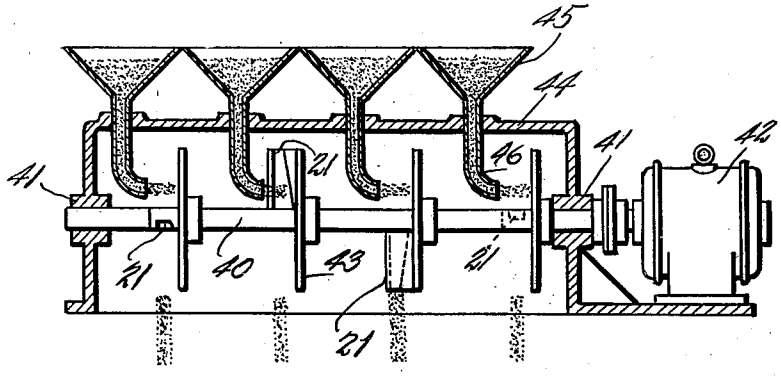


Fig. 9.

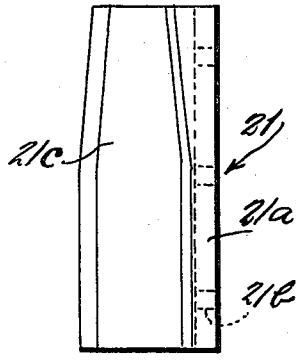


Fig. 10.

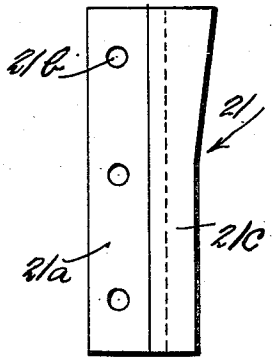
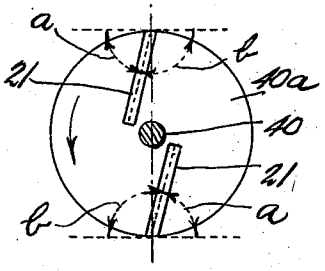


Fig. 13.



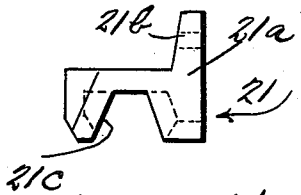


Fig. 11.

Inventor
Karl Grocholl.

By Bryant & Lowry
Attorneys

Dec. 10, 1940. K. GROCHOLL 2,224,647

SAND CENTRIFUGING CLEANING MACHINE

Filed May 1 ,1931 3 Sheets-Sheet 3

Fig. 9

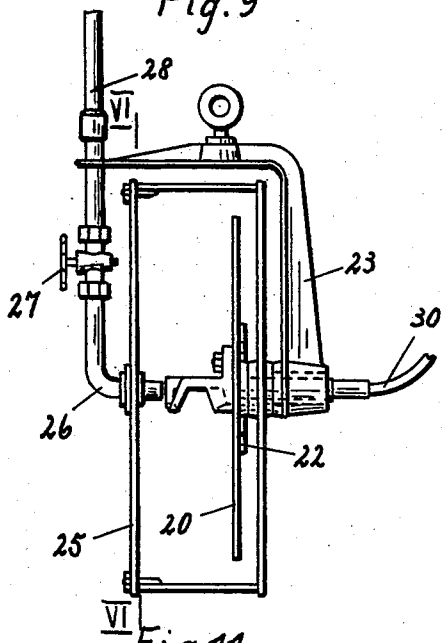


Fig. 10

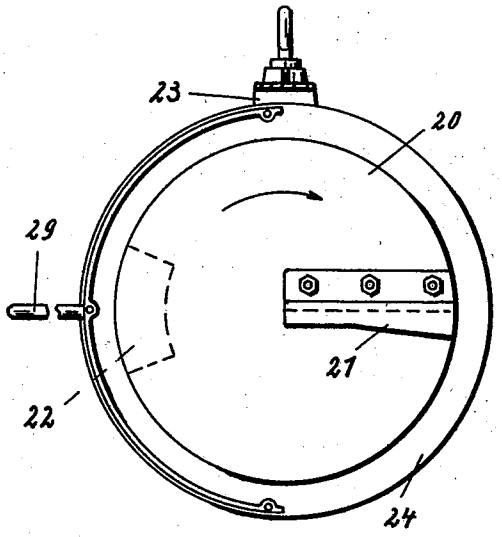


Fig. 11

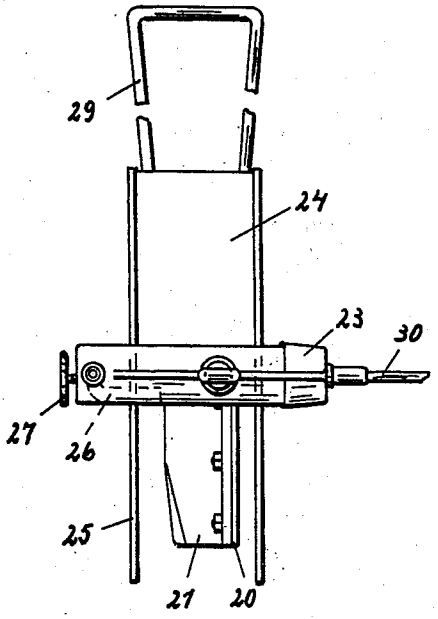
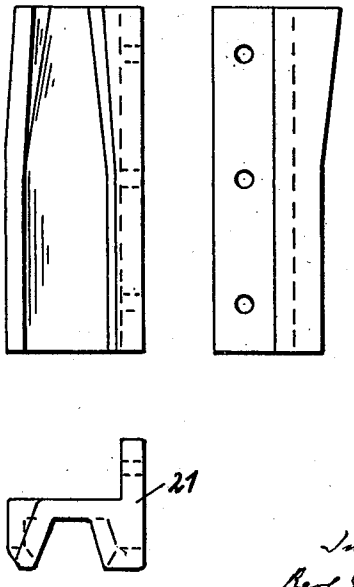


Fig. 12



Inventor:
Karl Grocholl

Patented Dec. 10, 1940

2,224,647

UNITED STATES PATENT OFFICE

2,224,647

SAND CENTRIFUGING CLEANING MACHINE

Karl Grocholl, Kronach, Bavaria, Germany

Application May 1, 1931, Serial No. 534,249
In Germany May 10, 1930

11 Claims. (Cl. 51—9)

This invention relates to a sand centrifuging cleaning machine utilizing the centrifugal effect for foundries and other works.

Cleaning machines are already known, in which the cleaning medium consisting of sand or similar granular material is flung by rapidly rotating bodies on to the articles to be cleaned. The rotatable bodies consist of drums, cell wheels, centrifugal nozzles, centrifugal wheels and the like. The disadvantages of these machines are chiefly too little cleaning power and too great and expensive wear of the parts coming into contact with the cleaning medium. The too little cleaning power is due chiefly to the fact that the known machines do not throw out the cleaning medium in closed masses or quantities. The rotating centrifuging bodies thereof, drums, cell wheels, centrifugal nozzle, centrifuging wheel and the like, have either too large or too many, twelve or more, driving surfaces, blades and the like, so that they take up and distribute the cleaning medium in too finely divided form. The too great and very expensive wear is caused by the manner of feeding the cleaning material, by the complicated shape of the centrifuging bodies and by the too large or too many driving surfaces, blades and the like. The feed of the cleaning medium is effected either on the circumference of the centrifuging body path or polar laterally or in the middle of the plane of revolution of the centrifuging bodies. If the feeding is effected on the circumference of the centrifuging body path or polar laterally to the plane of revolution both the centrifuging bodies themselves and also the cleaning medium are detrimentally affected by the movement suddenly imparted to the cleaning medium in that the speed of travel at the periphery is very great and the cleaning medium strikes very heavily against the centrifuging bodies. The granular cleaning medium according to its degree of fineness is more or less disintegrated, thus also considerably detracting from its cleaning power. Owing to the hard boring or biting of the cleaning medium into the centrifuging bodies in this method of feeding, the wear is very great, and the sliding centrifuging of the cleaning medium on the centrifuging bodies is impeded and thereby the cleaning power further reduced. With the large or numerous driving surfaces, such as are employed in the known machines, the individual grains of the cleaning medium can only be carried in a thin layer side by side on the driving surface and not in a thick layer side by side and superposed. Consequently, to a certain extent every individual cleaning medium grain participates in the biting or scratching into the driving surface of the centrifugal body, thus causing very rapid complete wear. In the case of the cleaning medium being fed in the middle perpendicularly to the plane of rotation, the hard striking together of the centrifuging body and the cleaning medium does not occur, but this method of feeding requires special parts for imparting the desired direction to the medium including a partly circumferential guide path. These parts are subject to very heavy wear and also damaging the cleaning medium, or a complicated centrifuging apparatus, cell wheels, gyrating nozzles or the like, is necessary which, besides being unpractical, as it centrifuges radially in all directions, cannot be economically used, in spite of its comparatively slight wear. Owing to all the above mentioned circumstances the known suggestions could not be employed in practice.

The cleaning machine according to the invention comprises a centrifuging wheel without a circumferential guide path which, in order to obviate the above mentioned disadvantages, has only very few centrifuging blades (preferably only one blade) with very small propelling surfaces and in which the feeding of the cleaning medium to the centrifuging blade is effected at a point in proximity of the theoretical axis of the place of rotation or at a point with comparatively very low circumferential speed. The feeding can be effected transversely or parallel to the plane of revolution. In order to take into consideration the regulations relating to the prevention of accidents the centrifuging wheel may be provided with a guard, such as is arranged on rotary grind stones and similar machines.

Several embodiments of the invention are illustrated by way of example in the accompanying drawings, in which—

Fig. 1 is a section on line I—I of Fig. 2 of a machine for cleaning larger rough castings, cleaning house arrangement;

Fig. 2 is a section on line II—II of Fig. 1;

Fig. 3 shows in lateral section a machine for cleaning small castings, turntable arrangement;

Fig. 4 shows in front elevation the actual cleaning medium centrifuging apparatus for the cleaning house arrangement;

Fig. 5 is a section on line V—V of Fig. 4;

Fig. 6 is a top plan view of Fig. 4;

Fig. 7 is a side elevation of Fig. 4;

Fig. 8 shows a modified form of construction in side elevation;

Figure 9 is a front elevational view of the centrifuging blade;

Figure 10 is a side elevational view of the blade;

Figure 11 is an end elevational view of the blade;

Figure 12 is a side elevational view, partly in section of a sand centrifuging cleaning machine with four centrifuging disks; and

Figure 13 is a side elevational view of a centrifuging disk equipped with two blades.

In Figs. 1 and 2 the cleaning medium centrifuging apparatus 1 is suspended by means of an intermediate element 2, chain or the like, adjustable in length, on the travelling hook of a jib arm. A cleaning medium supply hose 3 extends from the apparatus 1, and a flexible shaft 4 connected to a motor 5 serves for driving the centrifuging apparatus 1. 6 is a bucket elevator for raising the cleaning medium supplied through the floor grating 7 to the conveyor worm 8. 9 designates a connecting pipe between the bucket elevator 6 and the supply hose 3, 10 being a casting shown as a belt pulley subjected to the cleaning process.

In Fig. 3, 11 designates the cleaning medium centrifuging apparatus proper, built in a hood 12 of the turntable cleaning space. 13 is the cleaning medium supply hose, 14 a driving pulley of the centrifuging apparatus 11, 15 a bucket elevator for raising the cleaning medium, supplied through the turntable. 16 is a connecting pipe between the elevator 15 and the supply hose 13, 17 being an eccentric rod surrounding an eccentric disc 18 and serving for regulating the cleaning medium supply. 19 designates a pulley for driving the eccentric disc 18.

The cleaning medium centrifuging apparatus according to Figs. 4 to 11 consists substantially of a rotary disc or wheel 20 with a blade 21 fixed thereon and balanced by a counterweight 22, of a bearing arm 23 for the pivot pin of the rotary disc 20, of the protecting casing 24 with cover 25, of the cleaning medium supply pipe 26 loosely mounted at its lower end in the cover 25 and guided at its upper end in the bearing arm 23 and provided with a shut-off cock 27 and with a cleaning medium supply hose 28, of a handle 29 fixed on the casing 24 and of a flexible shaft 30 for the driving disc 20. As shown in Figures 9 to 11, the blade 21 includes a base 21*a* having spaced bolt receiving openings 21*b* to facilitate attachment of the blades to a disk 20. The blade further has an angle flange 21*c* extending longitudinally of the base 21*a* for guiding the cleaning medium. In Fig. 7 the cleaning medium supply pipe 26 is loosely mounted on a stationary point of the cover 25. In Fig. 8 this bearing of the cleaning medium supply pipe 26 on the cover 25 leads into the casing through an aperture in a disc 31, built into the cover 25 and of a catch lever 32 on this disc engages in a notched segment 33 on the cover and serves for changing and fixing the position of the disc on the cover 25 and therefore the point of feed from the pipe 26.

The operation of the cleaning medium centrifuging apparatus in the cleaning house arrangement is as follows:

The disc 20 is rotated and the cleaning medium fed thereto. The cleaning medium falls by gravity in the supply pipe 26 and arrives in stream form into the interior of the casing 24, where it is cut off into sections by the blade 21, carried along and flung immediately in radial tangential outward direction against the article to be cleaned, owing to the centrifugal action. The blade 21, severing the cleaning medium near the center of the plane of rotation, is fluted and this according to the kind of cleaning medium to be used either tapering toward its outer end or of equal width all over its whole length, in order to make the cleaning medium converge to form a solid mass before it is centrifuged, so that the speed of the cleaning medium on the paddle and the cleaning force are increased. Owing to the high speed of rotation of the blade 21, the centrifuging of the cleaning medium may be described as occurring in a continuous stream, as the quantitative centrifuging of the cleaning medium in portions occurs in very short intervals. At the point, where the blade cuts off a portion of the stream of cleaning medium, the blade 21 has only a low circumferential speed, whereas the circumferential speed at the outer end of the blade 21 is many times greater. By this method of feeding the cleaning medium, the wear on the centrifuging blade is very slight and a splitting up of the cleaning medium cannot occur. As the heavy impacting of the centrifuging blade and the cleaning medium is prevented, the centrifugal effect, and therefore the cleaning power of the cleaning medium, is correspondingly increased. As only one centrifuging blade is preferably used, for cutting off the longest possible length from the string of cleaning medium at each revolution, the renewal of the centrifuging blade, is of more importance owing to its simple shape and light weight it being preferably made of chilled casting or some other hard material and is fixed as a rough casting. The centrifuging blade may be fixed radially directed or deviating from the radial line and have a wide surface at the front at the point at which the cleaning medium is fed and groove-like surface at the discharge end. For guiding the slightly conical centrifuging stream of cleaning medium, the handle 29 is either lowered or raised, thereby causing the casing 24 to turn with the cover 25 in anticlockwise or clockwise direction in the suspended bearing arm 23 and consequently changing the direction of the centrifuging stream to a simliar extent. During this operation the supply pipe 26 shifts slightly up and down in the guide of the bearing arm 23 so that the cleaning medium meets the blade earlier or later according to the direction of movement of the pipe. In order to be able to direct the centrifuged stream of cleaning medium to be centrifuged to various heights, when retaining the handle 29 always in the same position, the cleaning medium supply pipe is pivotally mounted in a rotary disc 31, mounted in the cover 25 and carrying a catch lever 32 engaging a notched segment 33 on the cover so that the position of the cleaning medium supply is shifted, allowing the desired effect to be obtained in the necessary degree. Evidently besides the adjustment of the catch lever 32, the handle 29 can also be suitably shifted for greater differences in height, The centrifuging stream is indicated in dotted lines in the drawings.

In the turntable arrangement the construction and operation of the cleaning medium centrifuging apparatus proper is similar to that in the cleaning house arrangement. The construction of the protecting casing, the bearing of the centrifuging apparatus and its drive in this case are shaped and arranged to suit the turnable arrangement. The shifting of the slightly conical

stream of centrifuged cleaning medium on the entire width of the turntable coming into question is effected by mechanically regulating the cleaning medium supply. The mechanism consists of a rotary disc (similar to that of the modified construction of the centrifuging apparatus, illustrated in Fig. 8), fitted laterally on the casing and oscillated by the eccentric rod 17 in short movements to the right and to the left, similar oscillations being carried out by the cleaning medium supply pipe, the lower end of which is mounted in this rotary disc. The supply pipe for cleaning medium may also be mounted on a point which remains permanently stationary, at the side of the protecting casing (in this instance the rotatable disc and the eccentric rod 17 are omitted), and in this case for shifting the slightly conical stream of centrifuged cleaning medium over the entire width of the turntable coming into question, the whole cleaning medium centrifuging apparatus slides on the cover 12 or is reciprocated in some other manner or receives a gyrating movement. The driving gear for the cleaning medium centrifuging apparatus is in this case somewhat altered.

Evidently in the turntable arrangement and for other purposes cleaning medium centrifuging apparatuses with two or more rotary discs or centrifuging wheels with accessories may be employed to the centrifuged streams of which different directions are preferably given. When employing a plurality of wheels, these wheels are preferably keyed on a single driving shaft and consequently driven in common as a group of centrifugal wheels. The construction actually coming into question depends upon the type of cleaning machine. It is not at all necessary that the rotatable elements designated as "centrifuging wheel" comprises a rotary disc. The blade or blades may also be fixed in a different manner, for example on blade hubs or directly on the driving shaft. Such a centrifuging wheel unit, as is illustrated in the drawings, consist of a cleaning medium supply pipe 26 with accessory parts and of the blades belonging thereto supplied by this one cleaning medium supply pipe. As shown in Figure 12, a plurality of disks is assembled on a single rotatable shaft, the shaft 40 being rotatable in bearings 41 and driven by a motor 42 or other convenient means. The disks 43 are secured to the shaft 40 in spaced relation and each of said disks 43 carries a radially positioned blade 21 mounted on a side face thereof. A support 44 is arranged above the shaft 40 and upon which hoppers 45 are mounted for the cleaning medium that is delivered from said hoppers by means of conduits 46 for delivery to the disks 43 and blades 41 at points eccentrically thereof and within the peripheral edges of the disk. From an inspection of Figure 12, it will be observed that the several disks 43 are fixed and positioned on the shaft 40 for equi-distantly spacing the respective blades 21 circumferentially about the shaft to balance the assembly.

The disk 40*a* shown in Figure 13 is equipped with two blades 21. In this arrangement, the two blades are mounted in a position deviating from the radial direction in such a manner that the gliding surface of the grooved blades as shown by the dotted line *a* has a smaller tangent angle on the turning side than on the rear side in comparison with the tangent marked by the dotted line *b*. Also with this blade arrangement, the cleaning medium is eccentrically fed at a point in proximity of the axis of the disk or rotating shaft 40. The degree of the deviation from the radial depends upon the character of cleaning medium employed. Some cleaning mediums require a small deviation of the blades from the radial, in which case the blades or their gliding surfaces are straight, while other cleaning mediums require a great deviation of the blades from the radial, and in which case, the blades or their gliding surfaces are curved opposite the direction of rotation. The deviation of the blades from the radial is adopted especially for the end of the blade in view of the influence of the wear and in order to obtain the best possible centrifuging force. As the cleaning medium is eccentrically fed to the blades at a point in proximity of the axis and as this point is stationary in radial directions, it therefore follows that the blade or its gliding surface is spaced at a small deviation from the radial, while at a great deviation from the radial opposite the direction of rotation, it will be executed in a more or less curved form.

As cleaning medium any granular material can be employed, such as quartz sand, gravel, steel sand and the like. Preferably steel gravel or steel sand is employed, in which case a magnetic drum can advantageously be provided for separating this material from the mould sand. The employment of the cleaning machine according to the invention, especially when using steel sand or steel gravel, prevents the formation of dust, which is so injurious to health and a dust exhaust can be omitted.

The formation of dust in the compressed air sand jet blowers is caused chiefly by the outflowing air current, which whirls up the moulding sand, removed from the castings, and also the disintegrated cleaning medium.

The principle of the cleaning medium centrifuging apparatus can be applied to equal advantage to a centrifugal sand moulding machine, that is for filling and at the same time packing mould boxes.

The structures thus disclosed provide a number of important characteristics, some of which will be described in detail.

For instance, the blade is shown as extending from the vicinity of the axis of rotation of the disk to the disk periphery with the blade projecting laterally of the disk; in Fig. 5 the bottom of the blade groove is indicated as extending approximately radial while in Fig. 13 it is indicated as extending angular to such disk radius; but in each instance, the inner end of the blade lies in the general vicinity of the axis of rotation. However, the position of the nozzle through which the cleaning material is fed, as indicated in Figs. 7 and 8, indicates that the stream of material does not extend in correspondence with the axis of rotation but is spaced from such axis, with the result that it intersects the travel path of the blade adjacent to but spaced from the axis of rotation and therefore in the vicinity of the inner end of the blade.

Because of the delivery of the stream within this zone of the blade length, a number of important advantages are secured. As will be understood, the velocity of the blade increases in the direction of the periphery of the disk—the outer end of the blade; at the axis of rotation the velocity conditions are substantially absent, but in passing outwardly along the radius there is a gradual progression until the peripheral speed at the outer end of the blade is reached, this presenting the maximum. Under these conditions acceleration of particle advance along the

face of the blade gradually increases due to the centrifugal force characteristic that is set up, and reaches its maximum at the outer end of the blade, thus providing the flight velocity of the particle after leaving the blade.

However, this difference in velocity of the blade that is present between the inner end zone of the blade and the outer end, provides an additional advantage to that of the acceleration characteristic of the particle referred to. The advantage results from the fact that the stream is delivered to the blade path of travel at a point where the blade velocity is relatively low as compared with that at the outer end of the blade. A blade traveling at high speed and suddenly brought into contact with a particle located within the path sets up the characteristic of an impact, the value of which depends upon the velocity with which the blade is advancing at the point of contact with the particle; as the velocity increases the power of the blow also increases. Hence, the inner end zone of the blade will have a relatively small power blow effect, while at the outer end zone of the blade, such power blow effect becomes relatively large. By delivering the stream to the blade path of travel within the inner end zone of the blade, therefore, there is little or no likelihood of the particle being thrown forward in the direction of the path of travel of the blade face with which the particle contacts, whereas if the contact took place within the outer end zone of the blade, the large power blow value of the blade will cause the particle to be thrown forward from the blade face and therefore away from such face, thus losing the contact condition which renders the centrifugal force active on the particle.

In this connection the channel structure takes on an additional value. Primarily, the channel serves to segregate the charge from the projected stream through the fact that the channel presents a recess characteristic which permits the charge to be isolated from the projected stream. Since the channel sets up the conditions of side-walls, and the stream is projected to intersect the inner end-zone of the blade travel path (where the power blow effect is least) the impact blow effect is not only small but the side walls of the channel serve to prevent movement of the particle laterally out of the channel, so that the advancing face could rapidly overtake any particle that had been moved from the face by the impact blow, if such movement were present; hence, the particle will rapidly come to rest on the face of the blade and become subject to the centrifugal force activity, with the result that the particles will generally have substantially the same length of travel over the blade face, and thus be discharged from the blade with more or less uniformity of velocity value.

In addition, the converging side walls of the channel in the outer end zone of the blade is of value. This is due to the fact that the charge length—determined by the width of the channel—is gradually decreased as the centrifugal force value increases, so that the volume of the charge is changed somewhat in shape and becomes more concentrated, thus tending to decrease the area of dispersion and assure a more concentrated distribution of the particles at the point of service. Since the particles are being discharged with a general uniformity of velocity, this concentration in dispersion is necessarily more effective in cleaning the work areas. The concentration effect within the channel does not tend to choke the channel, since one face of the latter is completely open, thus permitting the particles, moving by centrifugal force, to freely adjust themselves as the change in the form of the charge—by decreasing its length—takes place.

A feature of major importance, however, is provided by the feeding of the material. As indicated in Fig. 12, the material is shown as passing from the nozzle in a direction toward the disk and thus across the path of travel of the channel, the view indicating a movement of the stream substantially parallel with the axis of rotation of the disk. In other words, the material is being fed with a velocity sufficient to overcome the effects of gravitation on the stream particles. The same effect is obviously present in the structures of Figs. 1 to 3, since the fall of the material en route to the nozzle is greater than is shown in Fig. 12.

The value of this condition lies in the fact that after the particle leaves the nozzle, gravitation becomes ineffective in the control of its movements. When the particle is segregated from the projected stream as a part of the charge, it immediately comes under the control of centrifugal force, with the latter the effective agency for controlling the development of the particle velocity. Since the stream flow is at a definite point with respect to the axis of rotation, not only do the particles of a charge have a generally similar acceleration by centrifugal force through approximately the same length of travel over the bottom face of the blade channel, but successive charges present the same condition, so that the substantial uniformity of particle velocity when discharged from the blade is preserved. This is due to the fact that gravitation effects are substantially eliminated, and the acceleration is provided by centrifugal force, gravitation acceleration being absent through the fact that gravitation does not become effective.

The advantage of this is not limited to the uniformity of particle velocity when discharged. It is obvious that because the control of the travel of the particle is limited to the centrifugal force action, that it becomes more or less immaterial as to the particular point in the angular travel of the blade the latter may intersect the stream—after intersection of the stream the action on the charge is similar at all points within the travel path. However, since the acceleration period is constant in length, a change in the path of stream projection would similarly change the position of discharge of the particles from the blade, although the particle velocity on discharge remains constant. Hence, by adjusting the position of the discharge nozzle, as indicated for instance, in Fig. 8, it is possible to vary the point of discharge of the particles from the assembly and thus permit centering the cleaning to definite areas, doing this without affecting the velocity of the particle being discharged. A similar result would be set up by the handle movements in Fig. 7, due to the fact that the shift of the casing would alter the position of the nozzle, an effect that is present in Fig. 8, with the latter additionally adjustable as to the angular position of the nozzle.

In other words, by overcoming gravitational effects in delivering the stream particles into the path of travel of the blade, it is possible to limit control of the particle movements to centrifugal force activity, and thereby obtain greater uniformity in control of the particle velocity as well

as its point of delivery, and, additionally, through the concentrating action referred to, provide a greater concentration of the particles upon the work areas, since it is possible to control the centrifugal force values through speed variations of the disk in this way as is well-known in the art. With the ability to concentrate the dispersion of the charge on the work, and the ability to readily change the point of delivery of the charge from the impeller by adjustment of the nozzle, it is possible to rapidly provide the desired cleaning action on the work.

As will be understood, the delivery of the stream particles in this manner will carry the stream into contact with the disk, thus tending to set up splattering of the particles. However, this does not materially affect the charge, due to the fact that the channel is itself spaced from the disk, although the blade is carried by the disk, so that the charge is not made from the splattered content but is taken from the stream itself, such splattered particles as may be picked up being relatively few in number.

Hence, it will be understood that I have provided a cleaning system in which the material is forcibly thrown upon the work by centrifugal action and in which the system includes an impeller, carrying a blade, with the impeller rotatable at high speed—made possible by the feed of the material in the zone of the inner ends of the blade under conditions where the impact-blow effect is low or absent—and feeding means for the impeller, with these co-operating to provide delivery of the particle stream into the path of travel of the blade in such way as to overcome gravitation—as by stream delivery at a velocity sufficient to produce this result—and with the delivery of the stream at such point as to provide a lengthy acceleration path in which acceleration is controlled entirely by centrifugal force activity, to thereby provide substantial uniformity in the delivery velocity of the stream particles. In addition, variation in the point of delivery is obtained in simple manner by adjusting the position of the supply nozzle to provide particle delivery at the desired point, this being made possible through the fact that the acceleration path is substantially uniform in length regardless of nozzle position.

I claim:

1. A sand centrifuging cleaning machine comprising in combination, a disk rotatable at a great speed, a blade adjustably fixed to the disk, a cleaning medium supply pipe for the disk terminating in close proximity to the axis of the disk and at one side of the axis, a rotatably arranged disk carrying the mouth-end of the feed pipe adapted to change the direction of throw of the cleaning medium and means for adjusting and fixing said disk.

2. A sand centrifuging cleaning machine comprising in combination, a disk adapted to be rotated at a great speed, a blade adjustably fixed to the disk, means for feeding a cleaning medium to the disk, said means having a discharge end terminating adjacent to and eccentric of the axis of the disk and adjustable means for supporting said discharge end for changing the direction of throw of the cleaning medium relative to the disk and blade.

3. A sand centrifuging cleaning machine comprising in combination, a rotatable disk, means carried by the disk and positioned to deviate from a radial line to effect the centrifuging of the cleaning medium, and means for feeding a cleaning medium to the centrifuging means on the disk eccentrically thereof and at a point in proximity of the axis of the rotating disk, the centrifuging means extending substantially from the center of the disk to the peripheral edge thereof and being adjustable relative to the disk to vary the degree of deviation from the radial line.

4. A sand centrifuging cleaning machine comprising in combination, a disk rotatable at great speed, a blade adjustably fixed to the disk, a cleaning medium supply pipe for the disk terminating in close proximity to the axis of the disk and at one side of the axis, a rotatably arranged plate concentric with the disk carrying the mouth-end of the feed pipe adapted to change the direction of throw of the cleaning medium, an arm carried by the plate for manual operation of the same and means adapted to be engaged by said arm for holding the plate in rotatably adjusted position.

5. A sand centrifuging cleaning machine comprising in combination, a rotatable shaft, several disks fixed to said shaft and rotatable at a great speed therewith, an adjustable blade on each disk, said disks being positioned on the shaft for equidistantly spacing the respective blades circumferentially about the shaft to balance the assembly, cleaning medium supply means for each disk terminating eccentrically of and adjacent the axes of rotation of the disks, the blades being adjustable to positions deviating from radial directions.

6. A sand centrifuging cleaning machine comprising in combination, a rotatable shaft, several disks fixed to said shaft and rotatable at a great speed therewith, means on each disk to effect the centrifuging of a cleaning medium, said disks being positioned on the shaft for equidistantly spacing the respective centrifuging means on the disks circumferentially about the shaft to balance the assembly, cleaning medium supply means for each disk terminating eccentrically of and adjacent the axes of rotation of the disks, the centrifuging means deviating from radial lines.

7. A sand centrifuging cleaning machine comprising in combination, a rotatable shaft, several disks fixed to said shaft and rotatable at a great speed therewith, means on each disk to effect the centrifuging of a cleaning medium, said disks being positioned on the shaft for equidistantly spacing the respective centrifuging means on the disks circumferentially about the shaft to balance the assembly, cleaning medium supply means for each disk terminating eccentrically of and adjacent the axes of rotation of the disks, the centrifuging means deviating from radial lines, and inclining in directions opposite to the direction of rotation of the disks.

8. A sand centrifuging cleaning machine comprising in combination, a rotatable shaft, several disks fixed on the shaft and rotatable at a great speed therewith, a blade on each disk, said disks being positioned on the shaft for equidistantly spacing the respective blades circumferentially about the shaft to balance the assembly, means for feeding a cleaning medium to the blade of each disk eccentrically at a point in proximity of the axis of the rotating disk, each blade adapted to be mounted on its disk in a manner to deviate from a radial direction.

9. A centrifugal abrading machine comprising, in combination, a blade carrier adapted to rotate at high speed, a blade carried thereby and

extending outwardly from the vicinity of the carrier axis to provide a face to support a charge of comminuted material delivered to the travel path of the blade and thereby cause the charge to be forcibly thrown outwardly of and from the blade within a zone representing a short arc of the movement of the blade through its complete circular path, and means for delivering individual charges to the blade travel path to contact the blade face adjacent its inner end, said means being adjustable rotatably to permit delivery of material to so contact the blade in either of a plurality of blade positions spaced angularly in the travel path of the blade to thereby cause the forcible discharge of the charge to be provided at either of a plurality of such zones of the travel path with the zone determined by the adjusted position of the means while maintaining similarity in such thrown charge conditions as to charge and projection values regardless of the adjustment, the said blade carrier being in the form of a rotatable disk, with the blade fixed thereto and extending generally radially, the blade being secured adjustably to permit variation in angularity of blade extension from and relative to a true radius of the disk.

10. A machine as in claim 9 characterized in that the extension of the blade is from a point in the vicinity of the axis of rotation of the carrier to substantially the periphery of the disk, with the direction of blade extension deviating from a true radius of the disk, the blade being affixed adjustably to the disk to permit variation in the degree of such deviation.

11. A centrifuging abrading machine comprising, in combination, a blade carrier adapted to rotate at high speed, a blade carried thereby and extending outwardly from the vicinity of the carrier axis to provide a face to support a charge of comminuted material delivered to the travel path of the blade and thereby cause the charge to be forcibly thrown outwardly of and from the blade within a zone representing a short arc of the movement of the blade through its complete circular path, and means for delivering individual charges to the blade travel path to contact the blade face adjacent its inner end, said means being adjustable rotatably to permit delivery of material to so contact the blade in either of a plurality of blade positions spaced angularly in the travel path of the blade to thereby cause the forcible discharge of the charge to be provided at either of a plurality of such zones of the travel path with the zone determined by the adjusted position of the means, while maintaining similarity in such thrown charge conditions as to charge and projection values regardless of the adjustment, said supply means including a feed tube carried by a rotatably-arranged disk adapted to position the mouth end of the tube in proximity to the axis of rotation of the carrier to thereby deliver the material of the charge into the blade travel path in the vicinity of the inner end of the blade and with the material delivery at either of a plurality of similar points of contact with the blade equi-distant from such axis of rotation of the carrier, said disk carrying an arm for manual adjustment of the disk, and means adapted to be engaged by the arm for holding the disk in a selected adjusted position.

KARL GROCHOLL.

CERTIFICATE OF CORRECTION.

Patent No. 2,224,647. December 10, 1940.

KARL GROCHOLL.

It is hereby certified that error appears in the above numbered patent requiring correction as follows: In the drawings, strike out Sheet 3, containing Figures 9 to 12 inclusive, and in the heading to Sheets 1 and 2 respectively, line 3 thereof, for "3 Sheets" read --2 Sheets--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 31st day of December, A. D. 1940.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.