July 17, 1923. 1,461,777

F. KOCH

CENTRIFUGAL SEPARATING MACHINE

Filed July 27, 1921

Fig. 1

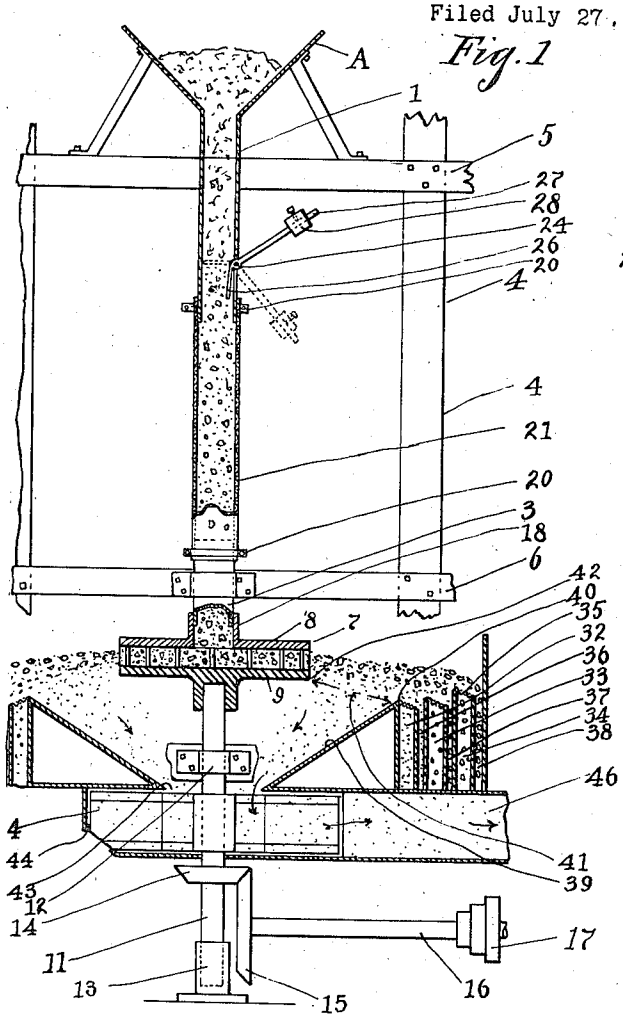


Fig. 3

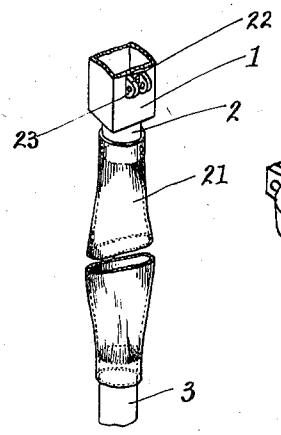


Fig. 5

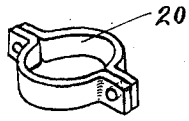


Fig. 6

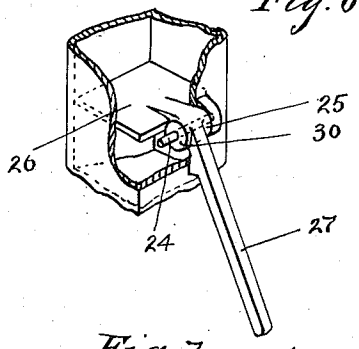


Fig. 7

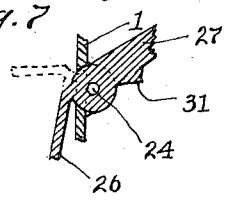


Fig. 2

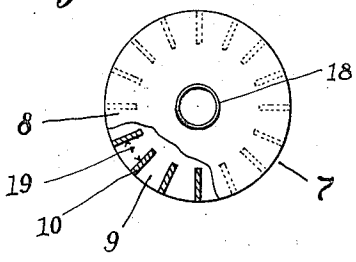


Fig. 8

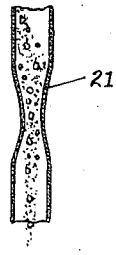
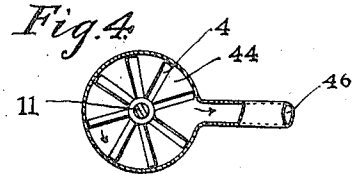


Fig. 4



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UNITED STATES PATENT OFFICE.

FRITZ KOCH, OF ST. PAUL, MINNESOTA.

CENTRIFUGAL SEPARATING MACHINE.

Application filed July 27, 1921. Serial No. 487,899.

To all whom it may concern:

Be it known that I, FRITZ KOCH, a citizen of the United States, residing at St. Paul, in the county of Ramsey and State of Minnesota, have invented certain new and useful Improvements in Centrifugal Separating Machines, of which the following is a specification.

This invention relates to centrifugal separating apparatus, for grading gravel, sand, cement ore, grain, crushed stone, and the like, wherein a horizontally disposed rotor is employed to receive the material from above, from the discharge opening of a chute or conduit, said conduit being positioned, either longitudinally coincident with, or constructed so as to lead to the axis of the rotor, so that its discharge opening will be in open communication with the interior of the rotor in approximately air tight relation.

In the United States Patent issued to me on November 9, 1920, Number 1,358,375, upon a separator apparatus of the type described, I employ a shrouded rotor B, having straight, radially disposed vanes 7, joined to its upper and lower shroud plates and formed of a length equal to about one fifth of the diameter of the rotor, whereby is formed, a central receiving chamber between the inner ends of the vanes from whence the material is thrown outwardly through the radial corridors formed by said vanes.

As is clearly set forth in detail in said patent, the material, which consists of particles of various sizes, weights and densities, is centrifugally thrown outwardly so that each particle will describe, with its center of gravity, a trajectory curve in accordance with its special physical characteristics, whereby particles describing similar trajectory curves, form in the aggregate, a curtain of flow. Thus, a plurality of curtains of flow are created, which depend, for their continued movement in a definite trajectory curve, upon the uniform action of the rotor. Any modification in rotor action, as, for example, spasmodic changes of speed, or other changes of normal conditions, would effect a change in the trajectory curve of all the curtains of flow, thereby rendering separation of the particles into groups, ineffective. I have found in practice, that the rotor runs with uniformity, so long as the mass of material in the conduit, for a distance above the rotor is sufficient to prevent air from entering the interior of the rotor. When a thin stream of material commingling with air is falling through the conduit into the rotor, the latter operates as a centrifugal air pump, the rotor sucking the air through the conduit and discharging same in the form of wind with the material, thereby disturbing the normal curtains of flow and causing the falling particles to change their course. It is an object of the present invention to prevent these disturbances by providing means whereby the conduit, will automatically, at all times, be sealed by material against ingress of a sufficient amount of air to materially divert the falling particles out of their normal trajectory curves.

Air may be prevented from entering the conduit with the material (in volumes sufficient to cause the rotor to blow) in several ways; for instance, as by throttling the conduit to change its sectional area as the size of the stream of material changes; or by having valve mechanism in the conduit.

In the accompanying drawings, I have shown a form of mechanism for automatically controlling the supply conduit to prevent air from entering in a manner above described.

Figure 1 is a vertical sectional view of a part of the apparatus shown in the patent mentioned in the foregoing equipped with my improved feed control, the rotor having been necessarily altered for purposes to be hereinafter explained.

Figure 2 is a plan view of the rotor shown partly broken away.

Figure 3 is a perspective view of the flexible conduit section.

Figure 4, is a horizontal sectional view of the fan chamber showing the fan in full.

Figure 5 is a perspective view of the clamping collar for said flexible conduit section.

Figure 6 is a fragmentary perspective view of the automatically operated valve,

Figure 7 is a vertical sectional side view of the pivot mounting of the valve, and

Figure 8 is a vertical sectional view of the flexible conduit section.

A designates a hopper adapted to receive the material to be separated, it being preferably formed of an upper vertical conduit section 1, of rectangular cross section having a tubular downwardly opening discharge nozzle 2, in vertical alinement with, and in spaced relation to the tubular dis-

charge spout 3. The hopper is mounted on the frame 4, the latter having cross beams 5 and 6, whereon the hopper and spout are rigidly supported. Below the section 3 and concentrically aligned therewith, is the horizontally disposed rotor 7. The rotor comprises circular top and bottom plates 8 and 9, said plates being parallel and spaced and joined together by a plurality of radially disposed vanes 10, whereby are formed peripheral discharge openings. The rotor is rigidly mounted on the top end of the vertical shaft 11, and is journaled in the journal box 12 on the frame and the vertical end journal box 13 at its lower end. Rigid on the shaft, is the miter gear 14, in mesh with the gear 15, the latter being rigidly mounted on the drive shaft 16 which is provided with a cone pulley 17, whereby it may be connected with a source of power. The top plate 8 of the rotor, is formed centrally with a tubular extension 18, telescopically fitting over the end of the spout 3, and constituting an inlet opening, as it is in open communication with the space between the plates of the rotor and the radial corridors 19 formed by the vanes. The spout 3 telescopes into the extension in a manner to form an approximately air tight connection, and yet permit the rotor to rotate freely. Having telescopic connection at its respective ends, with the tubular nozzle 2 and the tubular spout 3, and firmly secured thereon as by means of the clamping collars 20, is the flexible conduit section 21, said conduit section being made of suitable materal such as strong fabric rendered impervious to air as by a coating of rubber.

The rectangular portion 1 of the conduit, is relatively long, and has in its side positioned adjacent the nozzle 2, the aperture 22, and an outstanding lug 23 on either side thereof. Supported by the lugs is the horizontally disposed pivot pin 24, rotatable in the cylindrical hub 25, which latter has an outstanding rectangular valve plate 26, formed to loosely fit the opening of the conduit. A lever arm 27 extending from said hub, opposite the valve, plate and at an angle thereto, extends loosely through the counter weight 28, the latter having a set screw 29 whereby the weight may be adjustably held positioned. As shown in Figure 7, the hub 25 is fitted with its curved surface and flat ends 30 into the aperture so as to approximately seal the same against ingress of air. The valve is restricted in its upward movement by the contact lug 31, which latter engages with the side of the conduit when the valve is in horizontal position, in which position the conduit is closed. When so closed, the incoming material will accumulate above the valve, and establish a downward pressure thereon, in direct proportion to the height of the column of material. Obviously, the weight may be set on the arm 27, to effectively counterbalance a column of material of the extent desired. Thus, the valve automatically maintains in the conduit above, a predetermined quantity of material which exerts a definite pressure in accordance with the character thereof, or in other words, holds the conduit sealed by the material against the ingress of air from above, the valve opening only when this predetermined pressure is exceeded or raised to the normal pressure exerted in the passing of the material. The conduit 1 is sufficiently high to permit the valve to be adjusted so as to remain in open position so long as there is material in the hopper. When the rotor is running at a constant speed, a suction action is set up in the conduit while at the same time the material descends into the rapidly revolving rotor and is centrifugally projected through the corridors between the vanes in a multiple of trajectory curves of varying extent as indicated in Fig. 1, thereby forming circular concentric curtains of flow progressively reducing in diameter in direct proportion to the size and density of the particles. To separately catch the particles, circular bins, concentric with the rotor, as 32—33—34, are provided, each bin having a suitable inwardly inclined screen 35 to separate the particles as to size, those of greater size falling into the intermediate bins, 36—37 and 38. Concentric with the rotor and below same, is the circular outwardly and upwardly flaring wall 39, the rim 40 thereof being appreciably greater in diameter than the rotor, and located below same and preferably joined to the inner wall of the bin 32, thus forming an annular relatively wide intake opening 41, opposite edges 42 and 40 thereof lying in a plane approximately parallel with the general direction in which the material is thrown. All of the projected material will therefore pass in adjacent relation directly over the intake opening. The lower edge of the wall forms the circular opening 43, arranged concentric with the rotor, and communicating with the fan chamber 44, wherein is rotatably mounted on the shaft 11 the fan 45, said fan having its intake side facing upwardly. The chamber is provided with a discharge conduit 46, so that when the fan is actuated, a suction action will be set up at the intake opening 41, whereby all matter, which is too light to be thrown across said opening by centrifugal force will yield to said suction action and be discharged through said discharge opening. As this matter consists largely of very small particles equivalent to dust, it is obvious, that air currents which may occur either immediately above or in the area below the rotor, will agitate the body of flying particles and

disturb the normal operation of the device. To avoid the creation of such currents, the rotor and its supporting shaft are constructed with smooth outside surfaces, no projection such as ribs, lugs or set screws being employed. Referring now to the operation of the flexible conduit, 21, it will be noted, that when the valve 26 has closed because of insufficient pressure to resist the gravity of the weight 28, the material in the conduit below the valve will be gradually drawn into the rotor, the suction of the rotor causing the pressure within the conduit to be reduced which in turn will cause the wall of the flexible conduit to closely hug its contents (Fig. 8) due to the pressure of the atmosphere. While I have shown both the flexible conduit and the valved conduit in connection, I have found that each will operate effectively without the other, but with the flexible conduit in connection, the final material is controlled in interim of awaiting a new supply so as to be uniformly fed into the rotor. By having the opening 43 exactly concentric with the fan and rotor, an even suction is had, whereby maximum results are obtained.

I claim:

1. A separating apparatus comprising centrifugal separating mechanism, said mechanism including a hollow rotor mounted to rotate about a vertical axis and having peripheral discharge openings, a feed conduit coincident with said axis and opening in approximately air tight relation into the interior of said rotor, means for rotating the rotor to create a suction in said conduit, and a flexible conduit section, forming part of said feed conduit, the sides of said flexible section being capable of contraction responsive to the suction action of said rotor.

2. A separating apparatus comprising centrifugal separating mechanism, said mechanism including a rotor mounted to rotate about a vertical axis, a feed conduit coincident with said axis and opening in approximately air tight relation into the interior of said rotor, means for rotating said rotor, a valve fitting in the conduit to block same and having yielding means for yieldingly holding it in blocking position, and a flexible conduit section below said valve the sides of the said flexible section being capable of contraction responsive to the suction action of the rotor.

In testimony whereof I affix my signature.

FRITZ KOCH.