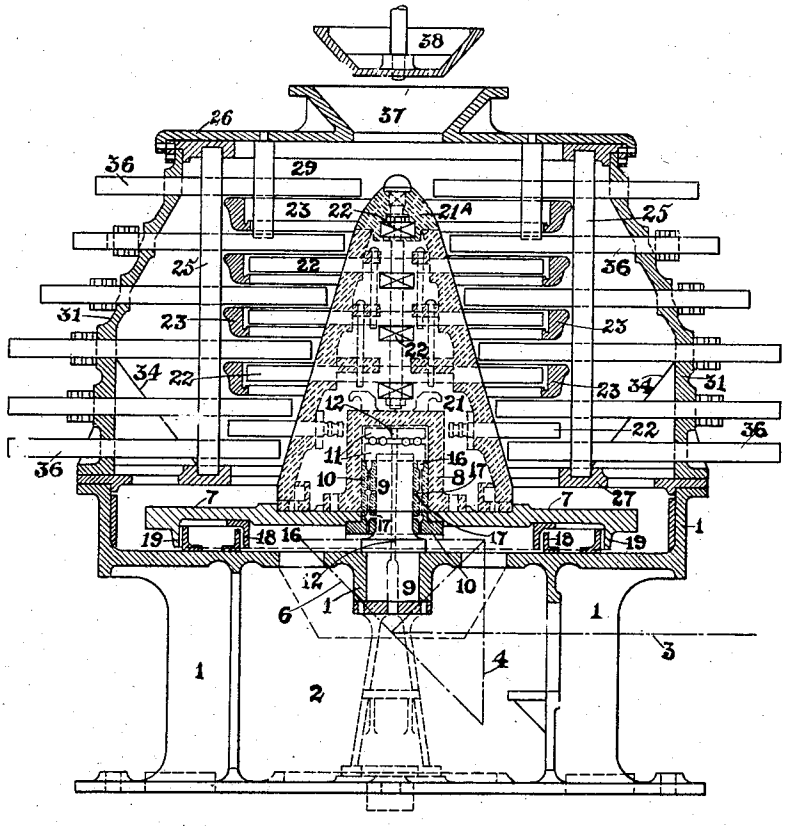
Aug. 9, 1927. 1,638,381

F. E. WHITHAM

APPARATUS FOR REDUCING ORES OR OTHER SUITABLE MATERIALS

Filed March 17, 1926 3 Sheets-Sheet 1

FIG. 1.



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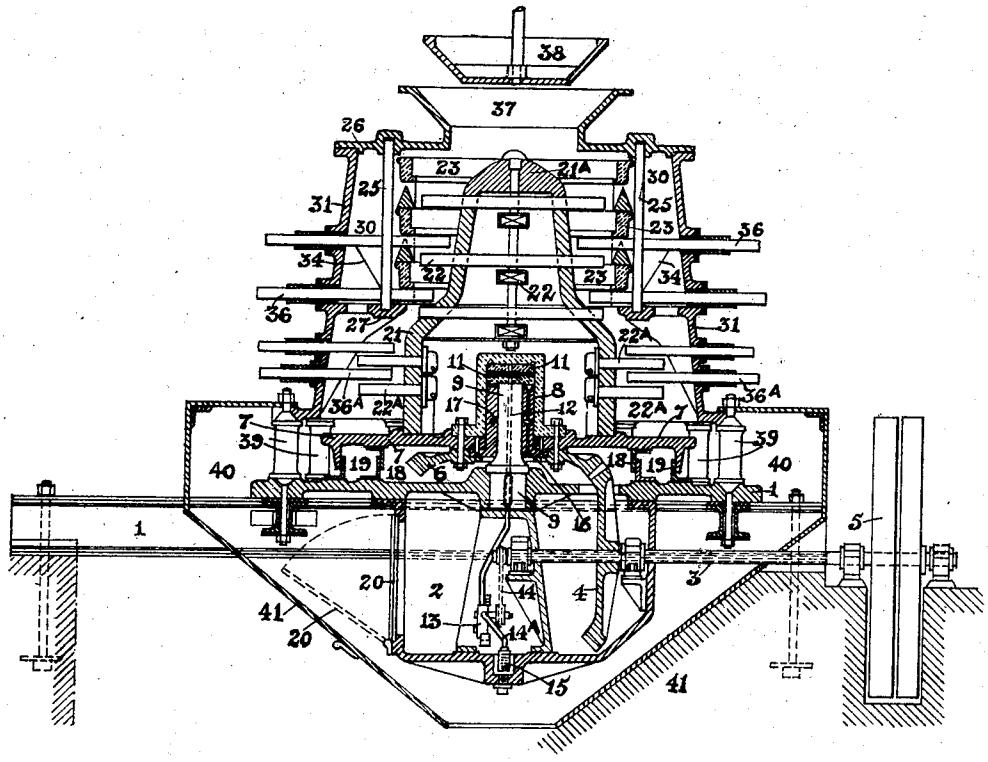
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APPARATUS FOR REDUCING ORES OR OTHER SUITABLE MATERIALS

Filed March 17, 1926 3 Sheets-Sheet 2

FIG. 2.



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APPARATUS FOR REDUCING ORES OR OTHER SUITABLE MATERIALS

Filed March 17, 1926 3 Sheets-Sheet 3

FIG. 3.

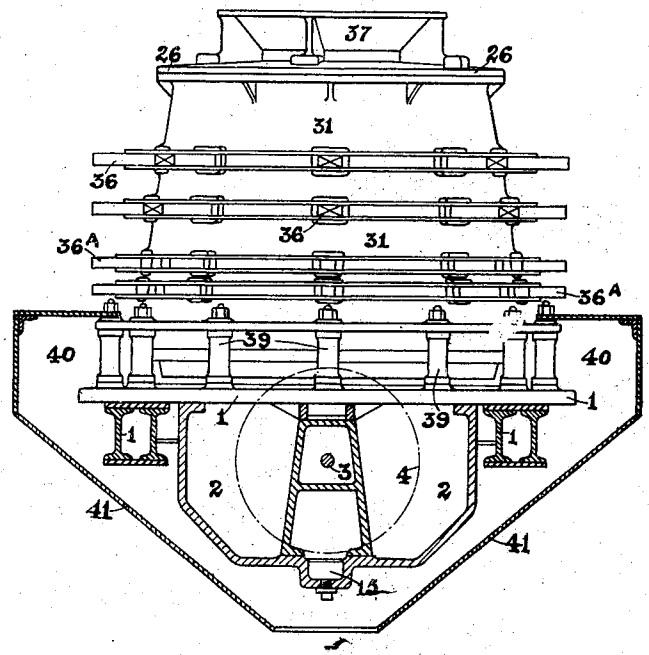


FIG. 4.

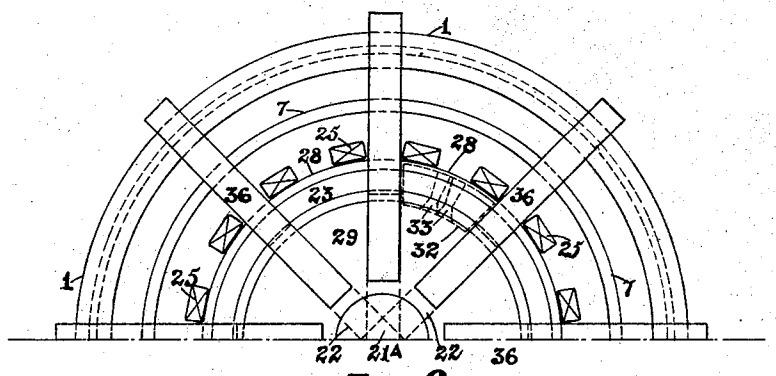


FIG. 6.

FIG. 5.

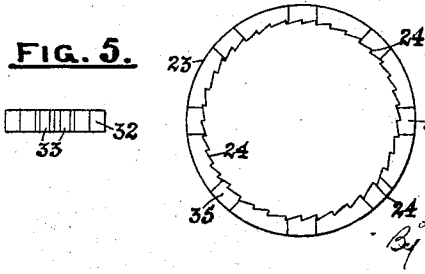
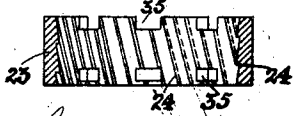


FIG. 7.



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Patented Aug. 9, 1927. 1,638,381

UNITED STATES PATENT OFFICE.

FREDRIC EDWARD WHITHAM, DECEASED, LATE OF HALIFAX, ENGLAND; BY ABRAHAM REED, EXECUTOR, OF HALIFAX, ENGLAND.

APPARATUS FOR REDUCING ORES OR OTHER SUITABLE MATERIALS.

Application filed March 17, 1926, Serial No. 95,481, and in Great Britain March 19, 1925.

This invention relates to a new or improved apparatus adapted to reduce comparatively large pieces of suitable materials such as ores, slag, stone, granite, clinker or other more or less refractory materials to definite sizes for use as road metal or for other suitable purposes, by subjecting such materials upon entering the apparatus to engagement by impact whilst suspended in air or between two points, by percussive means rotating at high speed; or such tough materials as cork, leather, gutta-percha, indiarubber, paper pulp, or the like, by similar means exercising a cutting or slicing action thereon.

Obviously the means employed and the functioning thereof constitute a new principle in reduction compared with what are known as one point contact machines such as breakers, crushers, grinders involving rotating cones and discs, or gyratory, napping or stamping mechanisms, all of which require an enormous amount of power to drive them out of all proportion to the volume of the product obtained thereby.

This means consist essentially of a controlled hopper into which the material to be reduced is delivered by hand or by any suitable or well known mechanical means. The hopper communicates with a reduction chamber in which is a rotating cone or turret carrying projecting arms or beaters. Surrounding the cone and beaters is a cage of suitable construction, and surrounding this cage is the outer shell or frame of the machine.

Secured within bearings in the shell and cage are preferably fixed arms or beaters adapted to mesh with the rotary beaters. The cone or turret is secured to a disc or fly-wheel and the latter is secured to a cock-head resting on ball or similar antifriction bearings mounted upon a fixed spindle which serves as a guide or hub for the rotating disc and turret, the disc or wheel being driven by a gear wheel secured thereto from a lay shaft.

Provision is made for effecting a continuous supply of lubricant to the rotating cock-head and gear wheels and for preventing dust or foreign matter gaining access to these parts.

The arms or beaters in each superposed set projecting from the cone or turret, or from the cage, are preferably staggered relatively to the corresponding set of beaters immediately above or below, also, the number of beaters or the like in each set, tier or horizontal plane and the distance between each tier of beaters preferably differ in accordance with the material to be treated, whilst the clearance between each pair of beaters in both the shell and the cone represent a certain break or stage in a progressive reduction which only terminates with the material being delivered to the disc or fly-wheel which centrifugally discharges the same from the machine into a suitable rotary screen or screens of known construction in which the reduced material may be graded and delivered therefrom in separate heaps in different and definite sizes.

These objects are attained by the means illustrated in the accompanying drawings, in which:—

Fig. 1 is a sectional elevation of this improved apparatus for reducing more or less refractory materials.

Fig. 2 is a similar view of a slightly modified form of Fig. 1.

Fig. 3 is an elevation of Fig. 2 partly in section.

Fig. 4 is a half plan of the turret and outer shell shown at Fig. 1, and the arrangement of the arms or beaters therein.

Fig. 5 is a front view of a suitable gauge through which may pass during the operation of the machine pieces of material of a predetermined size.

Figs. 6 and 7 are plan and sectional elevation respectively of a modified form of ring employed in forming the cage surrounding the rotating turret.

Similar reference characters refer to similar parts throughout the several views.

In constructing this apparatus it is necessary it should be of exceptional power and ample strength for the heavy duties it is called upon to fulfill. It consists of a massive base preferably placed as near to the ground as possible and preferably upon a concrete foundation to which it is secured, by foundation bolts or similar means to bearing plates embedded therein, or in any other suitable or well known manner.

Referring to the drawings, the base 1 is secured to a cast-iron or steel tunnel or the like 2 which contains a lay shaft 3 carrying a gear wheel 4 which is driven by pulley 5 or other suitable or well known means from any

suitable source of power. The wheel 4 mitres with a companion wheel 6 which is secured to a disc or fly-wheel 7 mounted upon a massive cock-head 8. A vertical stationary spindle 9 is mounted in the centre of the aforesaid base and a bush 10 interposed between the cock-head 8 and the spindle 9 is also secured to the underside of said wheel 7. The cock-head rests preferably upon a double ball-bearing 11 mounted upon the head of the spindle and both bearing and spindle are bored from end to end, the bore serving as a path 12 for lubricating oil under pressure raised by a pump 13 from a separator or sump 15 in the floor of the tunnel or the like aforesaid, the pump being driven by a chain 14 from the shaft 3 and connected to separator by pipe 14A. The bush 10 is also perforated longitudinally at 16, the bore or bores 16 being provided with other passages 17. The lubricating oil delivered to the top of the ball-bearing by the pump 13 flows back to the separator after flooding the ball races through the passages 16 and 17, and between the contacting surfaces of the bush and spindle, ensuring ample lubrication to these parts, subsequently descending to the wheels 4 and 6 to lubricate the teeth thereof in like manner, in its descent to the separator for purification.

Upon the underside of the aforesaid disc 7 and upon the upper side of the base 1 are two sets of concentric seal rings or flanges 18 and 19, the rings 18 being to collect the spent oil for return to the separator or sump 15, and the other set of rings 19 are for preventing dust or the like from entering the chamber or tunnel 2 and fouling the oil. It will be understood that the said tunnel or channel and base are made dust-tight but accessible by means of the hinged door 20, and any air present under the said disc is dead air due to centrifugal action set up by the rotation thereof.

Upon the upper side of the running disc 7 is mounted a hollow conical or stepped conical casting or turret 21 perforated and adapted to carry superimposed horizontally projecting arms or beaters 22 preferably rectangular in shape in cross-section and adapted for breaking large pieces of refractory material, the whole being surmounted by a massive cap 21A. Thus, it will be seen there is a fly-wheel or disc driven by mitre wheels having at its centre a turret with projecting arms or beaters, revolving integrally therewith, the arrangement of the beaters being such that the upper set or sets form a first or preliminary break at the point where there is the greatest power and the least speed, namely near the centre of the rotating disc.

Encircling the rotating turret 21 are a number of superimposed rings 23 preferably ordinary steel railway wheel tyres or rings having castellated or other suitable irregular internal surfaces 24 shown more clearly at Figs. 5 and 6, and surrounding these rings are a series of vertical steel rails 25 which are socketed in the top and botom plates 26, 27 of the machine and spaced forming a cage. The arrangement of the rings 23 and rails 25 is such that apertures 28 in the sides of the cage offer communication between the reducing chamber 29 and a further chamber 30 surrounding the cage within the outer shell 31. Suitable gauges 32 having apertures 33 representing a predetermined degree of reduction, (see Figs. 4 and 5), may be fitted into apertures 28 and reduced material upon entering this chamber 30 falls upon a chute 34, and (see Fig. 1) is guided thereby on to the rotating disc 7. The surrounding outer shell 31 and recesses 35 in the rings 23 provide facilities for mounting similar superimposed sets of preferably fixed horizontal arms or beaters 36 adapted to mesh with the radial beaters 22 in the rotary turret 21. Each set of beaters in both the turret and outer shell are staggered, or more or less break joint with the corresponding set of beaters immediately above or below, and their number may be varied in accordance with the material to be reduced or the degree of reduction required. The machine is surmounted by a hopper 37 and a gauge 38 which also may act as a means for preventing or eliminating foreign matter passing into the apparatus, and may also serve for stopping the feed, if desired. The gauge is raised or lowered out of or into the hopper by any suitable mechanical means.

The slag or other suitable material in large pieces is delivered by a suitable conveyor, chute or other mechanical means into the hopper 37 choked more or less by the gauge 38 in accordance with the maximum size of the pieces to be admitted, from which it descends or falls into the reducing chamber 29 below. Whilst the material is in suspension or in the air, it is engaged by impact by the first set of beaters 22 rotating with the turret 21 at high speed and violently dashed against the corresponding fixed arms or beaters 36 and the sides of the cage as well. The parts of material broken to the required size pass through the gauges 32 into the chamber 30 from which they descend on to the upper surface of the disc 7 and are discharged from the latter by the action of centrifugal force.

The pieces of material which have not been broken to the desired size by the first series of percussive blows administered, are subjected to a further series of blows as they descend the reducing chamber, by one or more beaters at different levels in the turret, a percentage being taken and passed through the gauges as in Fig. 1, being subsequently guided by chute 34 therein on to

the disc 7. In the embodiment of the invention illustrated in Figure 2 the vertical bars 25 are considerably shorter than in the apparatus shown in Figure 1, their lower ends being supported by a relatively elevated ring support 27A.

Referring to Figure 2 also it will be noted that the material discharged by the chute 34 will be acted upon by auxiliary beaters 22A, 36A, before reaching the discharge disc 7.

In this embodiment of the invention the disc 7 discharges the material outward between a series of pillars 39 rising from the base 1, above a hopper 40, 41, and supporting a cover for such hopper and the shell 31. The material received in the hopper 41 may be removed by any suitable means.

In a modification there may be constructed the cone or stepped turret shown at Fig. 2 in two superimposed parts, the upper cone which is of less diameter than the lower cone is detachably secured to the latter. The outer shell 31 may also be correspondingly divided to give greater accessibility and convenience in the handling of the machine, this applies where the shell is a fixed one, but if the shell is made to rotate in a direction opposite to that of the cone or turret 21, a shell as an integral whole is preferable.

The aforesaid apparatus may also be employed in the reduction of waste leather, indiarubber, cork and similar tough or elusive materials, by substituting for the beaters 22, 36 of Fig. 1, suitable knives or cutters radially arranged in tiers upon both cone and shell, adapted to exercise a cutting or slicing action upon the material in its descent to a disc 7 in the manner before described.

If desired, the reduced material thrown out of the machine may be passed into a suitable rotary screen connected up to each outlet, adapted to grade and deposit the same in corresponding heaps where required.

What I claim as this invention, and desire to secure by Letters Patent is:—

1. In an apparatus of the character described, the combination of a distributing disc, means for rotating said disc about a vertical axis, a turret-like body rising from and adapted to rotate with said disc, percussive members supported by said turret, a radially apertured cage surrounding the turret and supported independently thereof, relatively stationary breaker means extending radially into said cage and cooperating with the percussive means of the turret to break up pieces of material passing downward between the turret and cage onto the distributing disc, and means for delivering material to be treated into the upper end of the space between the turret and cage.

2. In an apparatus of the character described, the combination of a distributing disc, means for rotating said disc about a vertical axis, a turret-like body rising from and adapted to rotate with said disc, percussive members supported by said turret, a radially apertured cage surrounding the turret and supported independently thereof, relatively stationary breaker means extending radially into said cage and cooperating with the percussive means of the turret to break up pieces of material passing downward between the turret and cage onto the distributing disc, a hopper communicating with the upper end of the spaces between the turret and cage, and means adjustable with relation to the hopper for determining the size of pieces of material that will be supplied to the apparatus.

3. In an apparatus of the character described, the combination of a distributing disc, means for rotating said disc about a vertical axis, a turret-like body rising from and adapted to rotate with said disc, percussive members supported by said turret, a radially apertured cage surrounding the turret and supported independently thereof, relatively stationary breaker means extending radially into said cage and cooperating with the percussive means of the turret to break up pieces of material passing downward between the turret and cage onto the distributing disc, means outside of the cage for receiving particles passing through the radial apertures therein and delivering the same toward the turret and the discharging disc, and means for delivering material to be treated into the upper end of the space between the turret and cage.

4. In an apparatus of the character described, the combination of a distributing disc, means for rotating said disc about a vertical axis, a turret-like body rising from and adapted to rotate with said disc, percussive members supported by said turret, a radially apertured cage surrounding the turret and supported independently thereof, relatively stationary breaker means extending radially into said cage and cooperating with the percussive means of the turret to break up pieces of material passing downward between the turret and cage onto the distributing disc, and a casing surrounding said disc, turret and cage and provided at its top with a hopper that communicates with the space between the turret and cage.

5. In an apparatus of the character described, the combination of a distributing disc, means for rotating said disc about a vertical axis, a turret-like body rising from and adapted to rotate with said disc, percussive members supported by said turret, a radially apertured cage surrounding the turset and supported independently thereof, a casing surrounding said disc, turret and cage, relatively stationary breaker arms supported by the casing and cage and extending radially into the latter to cooperate with the percussive means of the turret to break

up pieces of material passing downward between the turret and cage onto the distributing disc, said disc also receiving the particles passing through the radial apertures in the cage, and a hopper for directing material to be treated into the upper end of the space between the turret and cage.

6. In an apparatus of the character described, the combination of a distributing disc, a turret-like body rising from and adapted to rotate with said disc, a gear secured to the lower face of the disc, a driving wheel meshing with said gear, a fixed vertical spindle, a cock head secured to said disc and mounted upon bearings surmounting the spindle, a bushing between the spindle and cock head, percussive members supported by the turret, a radially apertured cage surrounding the turret and supported independently thereof, relatively stationary breaker means extending radially into said cage and cooperating with the percussive means of the turret to break up pieces of material passing downward between the turret and cage onto the distributing disc, and means for delivering material to be treated into the upper end of the space between the turret and cage.

In testimony whereof I have signed my name to this specification.

ABRAHAM REED,
Executor of Fredric Edward Whitham, deceased.