

July 11, 1961

G. L. SELLARS
ROCK CRUSHING MACHINE

2,991,949

Filed May 14, 1959

4 Sheets-Sheet 1

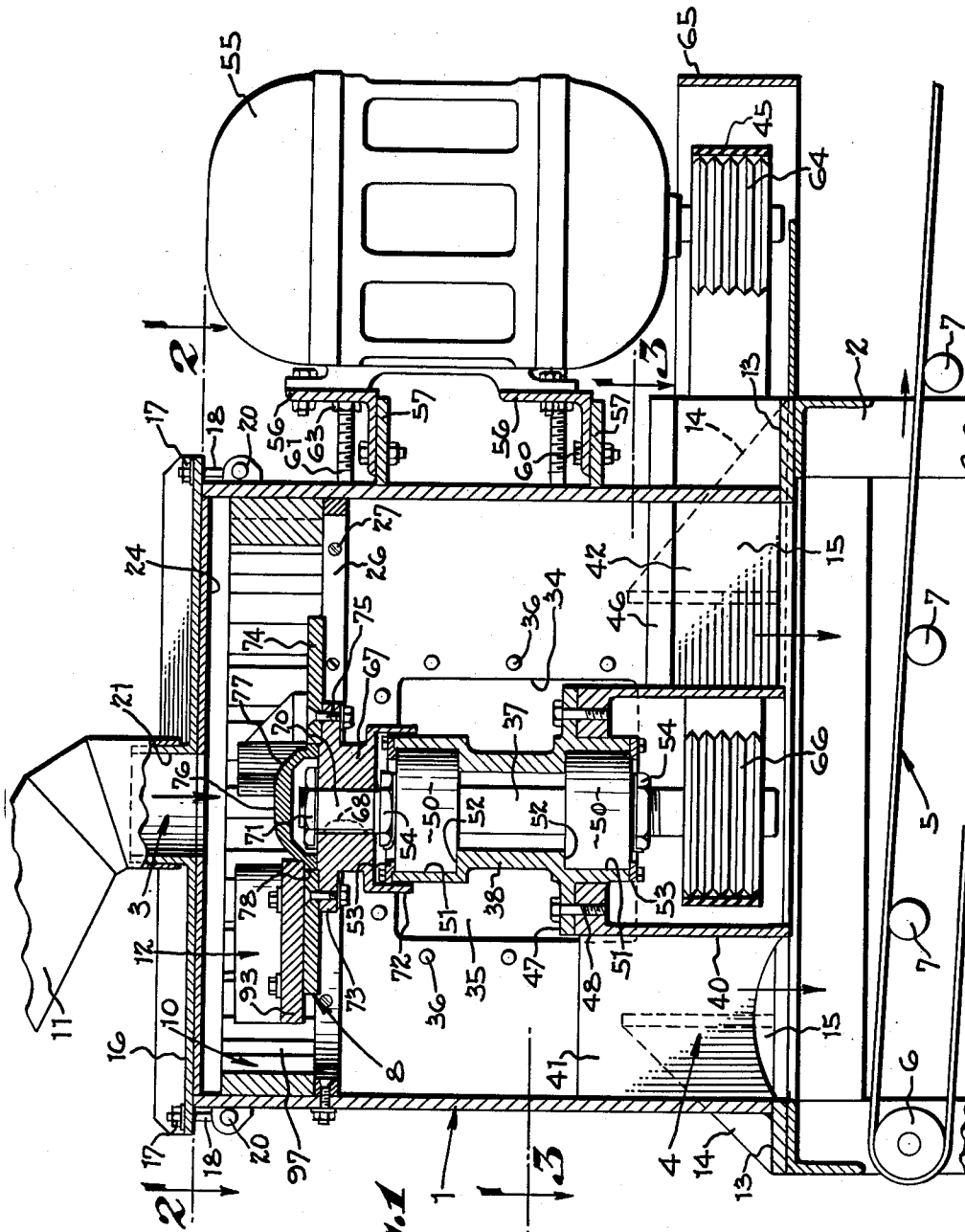


Fig. 1

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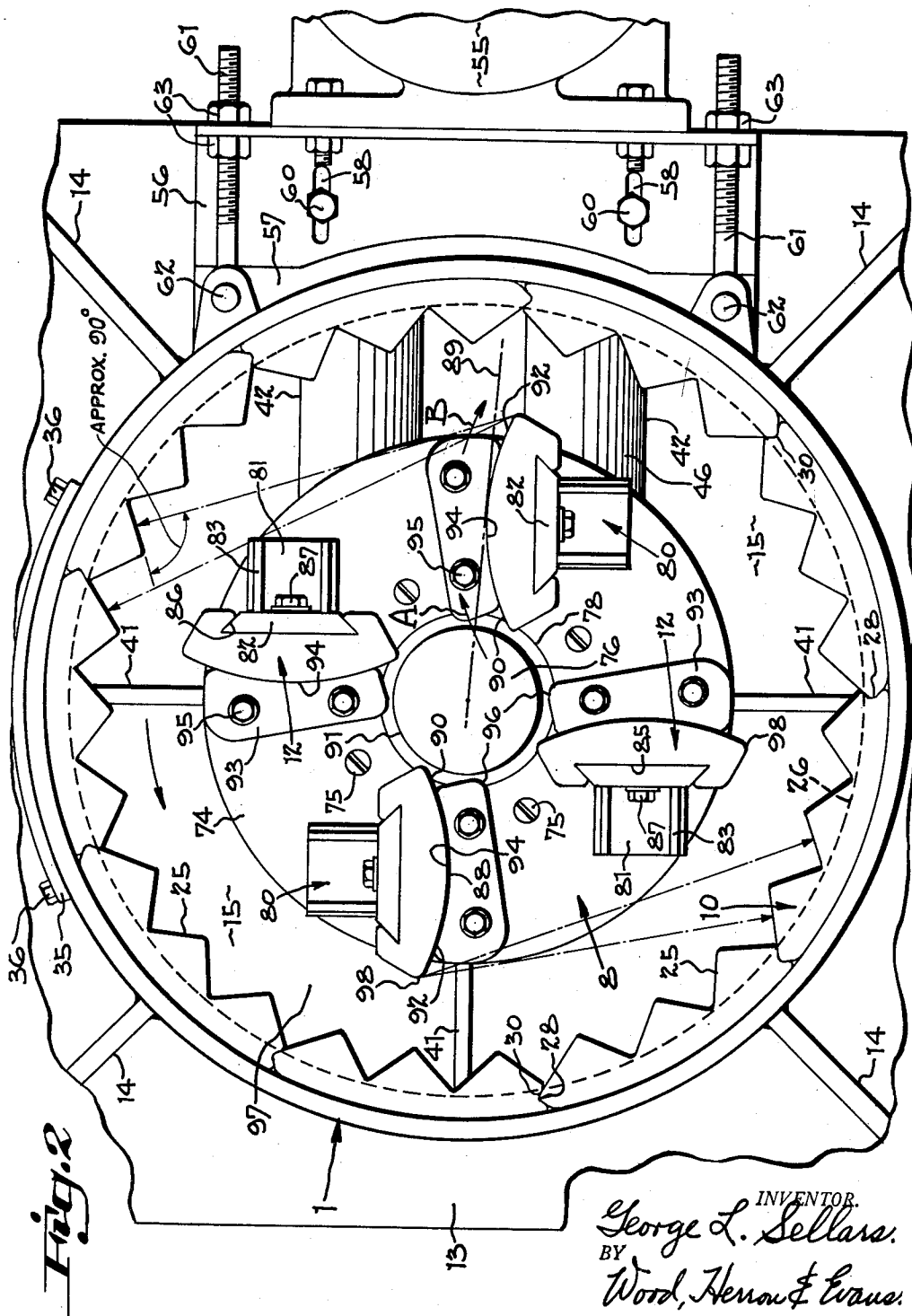
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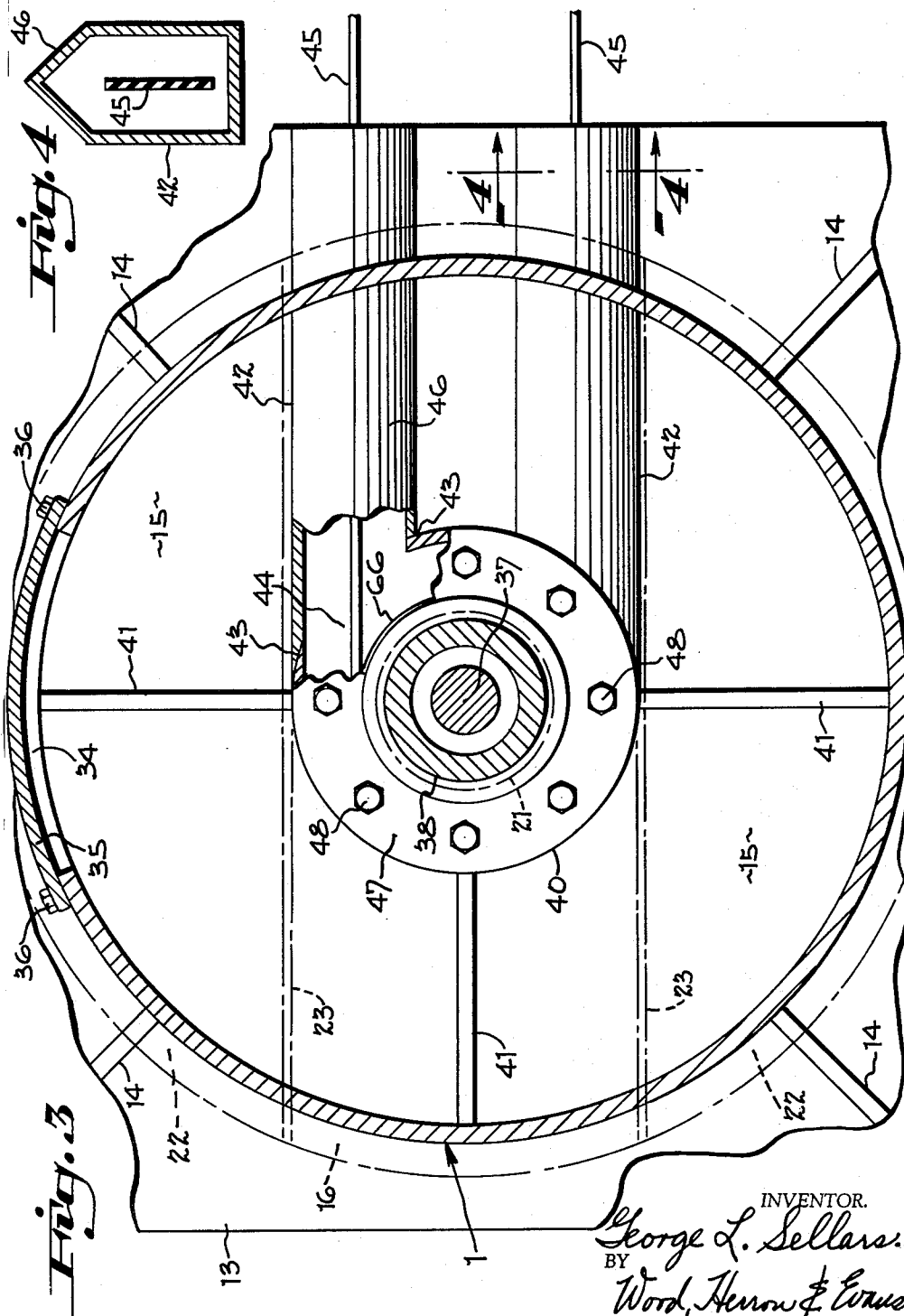
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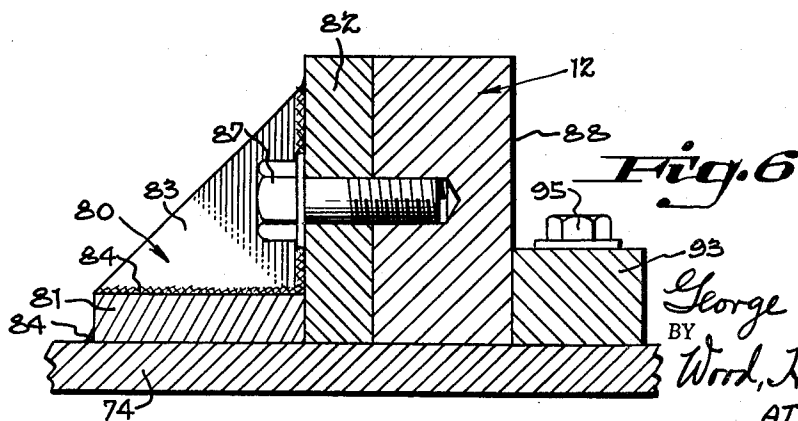
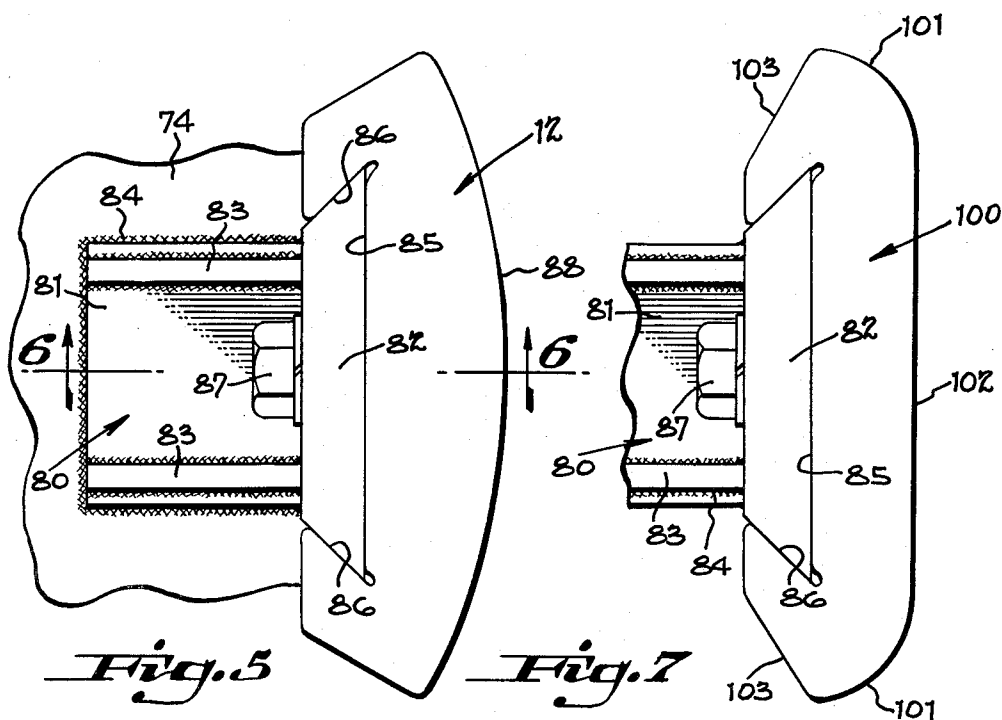
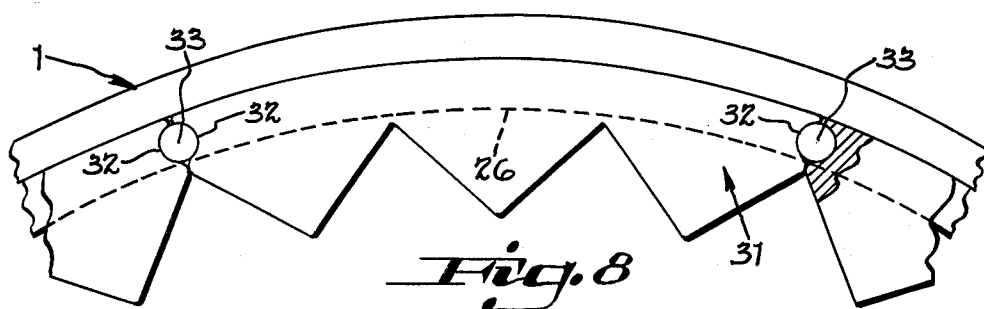
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4 Sheets-Sheet 4



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ROCK CRUSHING MACHINE

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Filed May 14, 1959, Ser. No. 813,306
6 Claims. (Cl. 241-275)

This invention relates to rock crushers of the centrifugal type for the production of crushed gravel or stone, wherein the particle size of gravel or stone is reduced by impact force. The crushed gravel or stone so produced is widely used, for example, in road building and in construction work generally.

In general, the present machine comprises an upright shell or housing of cylindrical shape, having a throwing wheel or slinger in its upper portion, the housing having liners which surround the slinger and present impact or breaker surfaces. The materials to be reduced are fed to the throwing wheel at or near its vertical axis of rotation while the wheel is rotated at high speed. As the material is fed in, it is intercepted by shoes on the slinger, accelerated to high velocity and projected against the stationary surfaces, where the pieces are shattered by impact, then drop by gravity from the housing ready for use.

One of the primary objectives of the invention has been to provide a crushing machine of this character, which provides more efficient operation, that is, which is capable of crushing a greater amount of material in a given period of time than is possible with conventional machines of comparable size and power.

According to this aspect of the invention, the slinger shoes, which intercept and accelerate the stones, have active faces which are curved in a direction generally radial to the axis of rotation of the wheel. As the stone is fed into the slinger, each piece is intercepted by a shoe and accelerated while advancing across the curved face of the shoe, its line of motion being the resultant of the rotation of the shoe and the path of the stone outwardly across the curved face. Experiment has shown that this curvature greatly improves the crushing action, apparently by increasing the velocity which is imparted to the stone, as it is thrown from the outer edge of the shoe toward the breaker surface, thus increasing the production rate. The curvature also increases the effective working area of the shoe in relation to a flat surface having the same length; the increased area is also believed to improve the production capacity.

In order to further improve the crushing action, the internal circumference of the collective liners, which is presented to the slinger, is serrated so as to delineate flat breaker surfaces which reside substantially at right angles to the path of motion of the stones as they are propelled outwardly at high velocity by the rotating slinger. The right angular disposition of these breaker surfaces brings about more direct impact action which increases the shattering effect upon the projected stones. Moreover, the direct acting faces reduce the oblique glancing of stones, causing the crushed material to pass more directly through the machine without interference in the crushing area surrounding the slinger.

It has been another objective of the invention to provide a machine in which the slinger shoes and stationary liners, which are subject to attrition and wear, may be replaced quickly and conveniently, whereby the machine need not be shut down for substantial periods of time for maintenance.

According to this feature, the slinger shoes slidably interfit respective dovetail plates which are permanently mounted in the slinger, each shoe being secured by a

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single bolt to the dovetail plate for rapid removal and replacement. The stationary liners, which surround the slinger, have adjoining edges which mate with one another to collectively lock the liners in assembled relationship against the internal circumference of the housing. The lower ends of the liners rest upon a ring mounted within the housing; the liners are otherwise unattached and may be disengaged and removed simply by slipping one of the liners upwardly out of engagement with adjacent liners for removal and replacement of the entire set.

A further advantage of the present apparatus arises from the fact that the machine is self-cleaning and is capable of crushing gravel or stone fragments while in a wet condition without danger of clogging the internal parts, as is the case with conventional machines. The exact reason for this action is not known; it is probably caused by the high velocity generated by the curved faces of the shoe, in combination with the direct acting breaker faces. This feature is significant because in most instances the raw gravel is taken directly from the gravel pit and naturally contains surface water in varying amounts and also absorbed moisture.

The various features and advantages of the present invention will be more clearly apparent to those skilled in the art from the following detailed description taken in conjunction with the drawings.

In the drawings:

FIGURE 1 is a vertical sectional view of the rock crusher showing the general arrangement of parts.

FIGURE 2 is a plan view of the machine taken along line 2-2 of FIGURE 1, further illustrating the throwing wheel and associated liners.

FIGURE 3 is a sectional view taken along line 3-3 of FIGURE 1, illustrating the discharge portion of the machine.

FIGURE 4 is a sectional view taken along line 4-4 of FIGURE 3, detailing one of the tubular belt housings.

FIGURE 5 is an enlarged fragmentary plan view of one of the slinger shoes shown in FIGURE 2.

FIGURE 6 is a sectional view taken along line 6-6 of FIGURE 5, further detailing the slinger shoe.

FIGURE 7 is a view similar to FIGURE 5, showing a slightly modified slinger shoe.

FIGURE 8 is an enlarged fragmentary view showing a modified mounting structure for the liners.

General arrangement

Described generally with reference to FIGURE 1, the present gravel crusher comprises an upright cylindrical shell or housing 1 rigidly mounted upon a structural steel framework 2, the upper end of the housing having an inlet passageway 3, and its lower end being open to provide an outlet passageway 4. Beneath the outlet passageway 4, there is provided a belt-type conveyor 5 arranged to receive and convey the crushed stone to a delivery point. The conveyor is of a conventional type having an idler roller 6 journaled in the framework 2, and having a series of belt support rollers 7 tracking against the upper belt run to support the crushed material. Since the conveyor is conventional, the driving system and other components have been omitted from the drawings.

A throwing wheel or slinger, indicated generally at 8, is mounted for rotation in the upper portion of the housing 1, and the area surrounding the slinger is provided with liners 10 fabricated from heavy metal providing impact or breaker surfaces. The gravel or stones are fed into the inlet passageway 3 by way of the duct 11 and drop by gravity to the central portion of the slinger where they are acted upon by the shoes 12 of the slinger and accelerated to high velocity for projection against

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the liners. Upon striking the liners, the impact force fractures the stones into smaller pieces which drop downwardly through the outlet 4 to be carried away by the conveyor 5.

Cylindrical housing

Described in detail (FIGURES 1 and 2), the housing 1 is fabricated from a heavy grade of plate steel and its lower end is welded to a base plate 13, which in turn, is welded to the framework 2. It is to be noted at this point, that the several components of the machine are all supported by the housing 1, and in order to provide rigidity, the housing is stiffened by a series of welded diagonal ribs or braces 14 which join the lower portion of the housing to the base plate. The base plate 13 is provided with a circular opening 15 corresponding to the inside diameter of the housing and delineating the outlet passageway, previously indicated at 4.

The upper end of the housing 1 above the slinger 8 includes a top plate 16 (FIGURE 1) which is secured in place by nuts 17 threaded upon tie bolts 18, which are pivotally anchored as at 20 to housing 1. The inlet passageway, previously indicated at 3, is delineated by a collar 21 rising from the top plate 16 at the central axis of the housing and interfitted the feed duct, previously indicated at 11.

In order to provide access to the liners and other parts in the upper portion of the cylindrical housing, the top plate 16 preferably includes door sections 22 which are hingedly connected to the top plate 16 along opposite sides of the collar 21, as indicated by the broken lines 23 in FIGURE 3. These door sections conform to the cylindrical shape of the housing, preferably having marginal edges overhanging the same as shown in FIGURE 1. The door sections 22 may include suitable hold-down devices, such as the tie bolts 18 of the type shown in FIGURE 1 to hold the same in closed position. The undersurface of the top plate 16 and hinged doors 22 are protected by internal liner plates 24 (FIGURE 1).

The liners 10 are of sectional construction and the exposed face of each liner section is serrated as at 25 to provide an impact or breaker surface. The liners 10 rest upon an internal ring 26 (FIGURE 1) which is secured by screws 27 to the internal surface of the housing. The liners are detachably mounted within the housing for convenient replacement upon being worn after prolonged service. For this purpose, the opposite vertical edges of each liner are configured to interfit one another and thereby to lock the liners collectively against the inside circumference of the cylindrical housing, while the lower ends of the liners rest upon the support ring 26. In the form illustrated in FIGURE 2, one vertical edge of each liner is in the form of a tongue 28 generally right angular in cross section, while the mating edge of the adjoining liner has a groove 30, also generally right angular in cross section to receive the tongue 28. The arrangement is such that the collective liners are locked in position upon endwise insertion, with the tongue and grooves interengaged and holding the liners firmly in contact with the internal circumference of the cylindrical housing. In order to replace the liners, one liner of the set is withdrawn upwardly to disengage the tongue and groove connection, thereby releasing the entire set of liners for replacement.

According to the modified arrangement shown in FIGURE 8, the opposite vertical edges of each liner 31 are provided with semi-circular grooves 32—32, such that the ends of the adjoining liners present circular recesses. These liners rest upon the support ring 26, as described above, and retainer pins 33 are forced endwisely into the semi-circular grooves 32. Upon insertion of the pins 33, the adjoining ends of the liners are locked to one another, and the several liners collectively form a ring which is seated against the internal surface of the cylindrical housing. If desired, one or more of the pins 33 may be tapered lengthwise to provide a wedging action

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as it is driven in place, thereby expanding the collective liners with respect to the cylindrical housing.

In order to service the lower portion of the machine, particularly the bearings for the slinger or impeller 8, the wall of the cylindrical housing 1 is provided with an access opening 34 (FIGURE 1) which is provided with a cover plate 35. The cover plate is secured in place by bolts 36.

Slinger construction

The impeller or slinger 8 is mounted for rotation about an axis which is common to the vertical axis of the cylindrical housing 1. Described with reference to FIGURE 1, the slinger is mounted upon a vertical drive shaft 37 journaled in a column 38, which is mounted upon the top of a cylindrical base or pulley housing 40. The base 40 is rigidly supported relative to the housing 1 by a series of vertical plates 41 extending radially from the base to the internal surface of the cylindrical housing. These plates are rigidly welded to the base 40 and housing 1 and extend edgewise across the outlet passageway 4, as indicated in FIGURES 1 and 3.

In addition to the plates 41, the base 40 further includes a pair of elongated tubular belt housings 42—42. The inner ends of the belt housings are of curved configuration and are welded as at 43 to the periphery of the cylindrical base 40 (FIGURE 3). These inner ends communicate with respective belt openings 44 formed in the cylindrical base 40 for passage of the belt 45 which drives the slinger, as described later.

As detailed in FIGURE 4, each belt housing 42 is in the form of a rectangular tube having a pitched top surface as at 46. The outer end portions of the belt housings pass through the wall of the cylindrical housing 1, with the bottom of the belt housing flush with the top surface of base plate 13. The outer ends of the belt housings are welded to the housing 1 and base plate 13. The vertical plates 41 and belt housings 42 support the cylindrical base 40 and column 38 rigidly in concentric relationship with the cylindrical housing 1 so as to resist the forces which are generated during the crushing operation.

The column 38 includes a base flange 47 secured by bolts 48 to the top of the cylindrical base 40 (FIGURE 1). The drive shaft 37 is journaled within the column by upper and lower roller bearings having outer races 50—50 mounted within counter bores 51—51 formed in the upper and lower ends of the column 38. The outer races are seated against the respective shoulders 52 delineated by the counter bores 51 and are clamped against shoulders by the respective retainer rings 53—53 secured to the opposite ends of the column. The roller bearings are of conventional design having inner races (not shown) which are engaged by respective nuts 54—54 threaded upon the drive shaft and locked in adjustment. These bearings resist both radial and axial loads and journal the slinger for high speed rotation with low frictional loss.

The drive shaft is powered by an electric motor 55, preferably of the variable speed type, which is adjustably supported with respect to the housing 1 for belt tension. As shown in FIGURES 1 and 2, the motor is bolted to upper and lower angle irons 56—56, each angle iron slidably supported by a respective bracket 57 welded to the housing 1. The horizontal web of each angle iron is slotted as at 58 (FIGURE 2) and the slot is traversed by screws 60 which clamp the motor in adjusted position. The motor is shifted for belt tension by upper and lower pairs of adjustment screws 61—61 having ends pivotally connected as at 62 to the housing 1. The outer portions of the screws 61 pass through the vertical webs of the angle irons 56 and the angle irons and motor are clamped in adjusted position by the nuts 63—63 threaded on the adjustment screws.

The shaft of motor 55 includes a multiple V-belt pulley 64, and the belt 45 tracks upon the pulley, as shown

in FIGURE 1. The motor pulley is enclosed by a suitable guard 65 which surrounds the pulley and portions of the belt which pass beyond the belt housings.

The lower end of the drive shaft 37 includes a driven pulley 66 similar to pulley 64 and having a slightly larger diameter. Pulley 66 is detachably keyed to the lower end of the drive shaft and may be removed if necessary. It will be noted in FIGURES 1 and 3 that the drive pulley 66 is surrounded by the cylindrical base 40; the belt and pulley are therefore protected from damage by crushed material which passes through the outlet passageway 4.

The impeller or slinger 8 comprises a hub 67 keyed as at 68 to the upper portion 70 of the drive shaft and clamped in place by a nut 71. The lower portion of hub 67 includes a cylindrical skirt 72 which loosely surrounds the upper portion of the column 37 to protect the bearings from particles of abrasive stone which are present in this area during operation of the machine.

The upper end of hub 67 includes a horizontal flange 73. The slinger 8 comprises a circular disk 74 seated upon flange 73 and secured in place by a series of screws 75. The central opening of the disk provides clearance for the nut 71 which locks the slinger to the drive shaft. This nut is enclosed by a cap 76 having a generally convex external profile, as indicated at 77 (FIGURE 1). The base flange 78 at the open end of the cap fits snugly into the central opening of disk 74, as indicated in FIGURE 2. The cap is held in this position by a series of wear plates, as explained below.

As noted earlier, the slinger is provided with shoes 12 which act upon the gravel or stone as it is fed in through the inlet passageway 3. As best shown in FIGURE 2, the shoes are mounted in positions generally radial to the axis of the drive shaft. Each shoe is detachably secured to a bracket indicated at 80 (FIGURES 5 and 6) consisting of a base plate 81 seated upon the disk 74, and having a vertical dovetail plate 82. Each bracket includes a pair of reinforcement ribs 83 rigidly connecting the dovetail plate to its base plate. The base plates 81 are permanently welded to the top surface of the disk 74 and the ribs are also welded in place, the welding lines being indicated at 84.

As best shown in FIGURE 5, the rearward surface of each shoe, in the direction of disk rotation, is provided with a vertical dovetail slot 85 corresponding in cross section to the dovetail plate 82 and providing a slip-on connection therewith. The inclined opposite sides of the dovetail plate, as indicated at 86, hold the shoe in place as it is slipped upon the dovetail plate 81. The shoe 12 is locked to the dovetail plate by a bolt 87 passing through the plate 82 and into threaded engagement with the shoe (FIGURE 6). The forward or active surface of each shoe, as viewed in FIGURE 2, is curved as indicated at 88.

It will be noted that this curvature sweeps forwardly in the direction of rotation of the slinger, as indicated by the arrow in FIGURE 2. The curvature of each shoe forms starting portion as indicated at 90, which is substantially tangent to the base diameter 91 of the cap 76. The curvature 90 sweeps forwardly in the direction of rotation until it intercepts a line 89 (FIGURE 2) which is radial to the central axis of the drive shaft. Beyond this point of interception, the curve sweeps in a trailing direction with respect to the direction of rotation as indicated at 92. The purpose of this arrangement is described later with reference to the operation of the machine.

In addition to the shoes 12, the surface of the disk 74 is provided with respective wear plates 93 residing in advance of the active curved face 88 of each shoe (FIGURES 2 and 6). The trailing edge of each wear plate is curved as at 94 to interfit the curved face of the shoe 12. The wear plates 93 are secured in place by respective pairs of bolts 95 having lower ends threaded into

the disk 74. It will be noted in FIGURE 2, that each wear plate has a corner portion as at 96 overlying the base flange 78 of the cap 76 to block the cap in position in the central opening of disk 74. The shoes 12 and wear plates 93 are subject to substantial wear and are interchanged from time to time, simply by removing the bolts which clamp these elements in place on the slinger. The cap 76, which is also subject to wear, may conveniently be replaced at this time since it is held in position by the wear plates, as noted above.

As viewed in FIGURE 2, the effective diameter of the slinger, as delineated by the outer edges of the shoes 12, is smaller than the diameter constituted by the liners 10, thus providing an annular clearance or crushing zone indicated at 97. During operation of the machine, the pieces of gravel or stone are propelled at high velocity from the outer edges 98 of the shoes across the clearance 97 and are shattered upon striking the serrated breaker surface 25 presented by the liners. Upon being projected from the slinger, the stones move in a path somewhat at a tangent to the circumference of the slinger and the serrated face 25 of the liners present breaker surfaces which are generally at right angles to this path of travel for direct impact action and to eliminate, as much as possible, oblique glancing of the stones and consequent interference in this zone.

The modified shoe shown in FIGURE 7 is intended to be mounted interchangeably on the dovetail plate 82 for use in crushing materials having a particle size larger than the gravel, for example, broken stone fragments which are to reduce in size. As viewed in FIGURE 7, the endwise portions of the shoe 100 are curved as at 101—101, the curvature blending into a flat face 102. The endwise portions on the trailing side of the shoe are tapered inwardly as at 103 on opposite sides of the dovetail mounting slot 82, and the shoe is secured in place by a bolt 87 as described earlier.

Operation

During operation of the machine, the slinger 8 is rotated at high speed by the motor 55 and the material to be crushed is fed in by way of the conduit 11 as a continuous stream from a suitable source of supply. The proper speed of the slinger is in the neighborhood of 1500 r.p.m. depending upon the type of material being crushed and the particle size desired. As a general rule, the higher slinger speeds produce finer particles while lower speeds produce coarser particles. In crushing a given material, the desired particle size is obtained experimentally by regulating the motor speed as samples of the material are run through the machine.

As the material, for example coarse gravel, drops through the inlet passageway 3, it strikes some point on the convex surface 77 of cap 76, which as shown in FIGURE 1, has a base diameter approximately equal to the diameter of the inlet opening 3. Upon striking the cap, a given piece of gravel or stone is deflected outwardly and is intercepted by the starting portion 90 of the curved face 88 of a slinger shoe (FIGURE 2). Upon being intercepted, the stone receives an impact blow then, as the stone is accelerated, the force of inertia presses it against the curved face, causing the stone to follow this curved path as it advances across the rotating shoe.

It will be observed that in advancing across the starting portion 90 of the shoe, the stone follows a path which is somewhat tangent to the base diameter of cap 76, as indicated by the arrow A since the curve 90 is tangent to the cap, as noted earlier. As the stone passes across the mid-section of the curve, as indicated by the broken line 89, its path is generally radial to the axis of the slinger; thereafter, the curved path sweeps rearwardly from the radial line 89 in the trailing curve 92, as indicated by the arrow B. Accordingly, as the stone is accelerated, it moves along a path which is the resultant of two lines of motion, the first comprising the circular motion of shoe about the axis of the slinger, the second being delineated

by the curved face of the shoe, as indicated by the arrows A and B.

After leaving the edge of the shoe, the stone strikes the face 25 of the serrated liner with a shattering impact causing it to be crushed. The broken particles then drop directly without rebound from the annular clearance space 97 and through the outlet passageway 4 to be carried away by the conveyor 5.

It is believed that these results are brought about by the action of the curved faces of the shoes 12 in combination with the serrated breaker faces 25 of the liners. Although the exact reason is unknown, it is believed that the curved face generates a modified tangential path of motion which is somewhat radial to the axis of rotation to create a higher velocity, thus producing more work for a given unit of energy.

As viewed in FIGURE 5, the curved face 88 presents a greater working area than would be presented by a flat face of the same length. The curvature therefore has the added advantage of increasing the working area, and as a consequence, of making the shoe capable of acting upon a greater quantity of material per unit of time. The curved face therefore increases the volume of material produced as well as increasing the stone velocity and overall efficiency of the machine.

The wear plates 93, which are mounted in front of the curved faces 88, act upon those stones which are intercepted near the lower edge of the curved face. Such stones normally pass across the top surface of the disk 74, at least at some points, causing the disk to be worn excessively in these areas. The wear plates 93, thus protect the disk against excessive wear in the critical areas and also aid in propelling the stones from the slinger.

The modified shoe configuration shown in FIGURE 7 provides substantially the same action with respect to larger stone fragments, as distinguished from gravel. However, the curved endwise portions 101—101 and the flat face 102, with which the curve sections blend, apparently modify the acceleration and act more efficiently with respect to the larger pieces of stone.

As noted earlier, the conventional rock crushers of the centrifugal impact type, have a tendency to choke up when operating upon wet gravel or stone, with the result that the crushing action decreases or fails altogether. It has been found that the present machine is capable of operating under these conditions without clogging or build-up of materials, and without a decrease in efficiency presumably through the direct impact faces which prevent bouncing or glancing of the stones in the critical zone surrounding the slinger.

Having described my invention, I claim:

1. In an impact-type crushing machine, a cylindrical shell residing upon a vertical axis and having a discharge passageway at the lower end thereof, a drive shaft journaled within said shell and rotatable about said vertical axis, power means connected to said shaft for driving the same, a slinger wheel secured to said drive shaft for rotation in a horizontal plane within the shell, inlet means above said slinger wheel for feeding crushable material to the central portion of the slinger wheel, a plurality of slinger shoes mounted upon the slinger wheel, each of said shoes having a working face which is generally radial to the axis of the shaft and which curves forwardly in the direction of rotation of the slinger wheel, a detachable wear plate mounted on said slinger wheel at the base of each slinger shoe, said wear plate residing in advance of the working face of the slinger shoe and presenting a generally horizontal wear resistant surface, and an impact surface surrounding said slinger wheel and spaced outwardly therefrom to delineate an annular crushing zone, the curved working faces of the shoes adapted to intercept crushable material which is fed through said inlet means, thereby to accelerate the same during passage across said curved faces during high speed rotation of the slinger wheel for projection at high veloc-

ity toward said impact surface, said surface having impact faces which are disposed substantially at right angles to the path of said projected materials to shatter the same, adapting the shattered material to drop downwardly through said annular crushing zone to the outlet passageway.

2. In an impact-type crushing machine, a cylindrical shell residing upon a vertical axis and having a discharge passageway at the lower end thereof, a drive shaft journaled within said shell and rotatable about said vertical axis, power means connected to said shaft for driving the same, a slinger wheel secured to said drive shaft for rotation in a horizontal plane within the shell, an inlet passageway above said slinger wheel for feeding crushable material to the central portion of the slinger wheel, a plurality of slinger shoes mounted upon the upper surface of the slinger wheel, each of said shoes having a working face which is generally radial to the axis of rotation of the slinger wheel and which curves forwardly in the direction of the slinger wheel, a series of removable liners mounted within said shell, a support ring mounted within said shell and supporting said removable liners, and means expanding said liners collectively into engagement with the inside circumference of the shell, said liners surrounding said slinger and spaced outwardly therefrom to delineate an annular crushing zone, the curved faces of the shoes adapted to intercept crushable material which is fed through said inlet opening, thereby to accelerate the same during passage across said curved faces during high speed rotation of the slinger wheel for projection at high velocity toward said liners, said liners collectively presenting a serrated surface providing impact faces which are disposed substantially at right angles to the path of said projected materials to shatter the same adapting the shattered material to drop downwardly through said annular crushing zone to the outlet passageway.

3. In an impact-type crushing machine, a cylindrical shell residing upon a vertical axis and having a discharge passageway at the lower end thereof, a slinger wheel journaled for rotation in a horizontal plane within the shell, power means for rotating said wheel, inlet means disposed above said wheel for feeding crushable material thereto to the central portion thereof, a plurality of mounting elements projecting upwardly from said slinger wheel, a respective demountable slinger shoe slidably engaging each of said mounting elements, each of said shoes having a working face which is curved in a direction generally radial to the axis of rotation, said curved face having an inner portion which is generally tangent to a circle about the said axis and which sweeps forwardly in the direction of rotation of the slinger wheel, said curved face having an outer portion which sweeps rearwardly in said direction of rotation, and an impact surface within said shell and surrounding said slinger, the inner portion of each curved face adapted to intercept crushable material which is fed through the inlet means, whereby said curved faces accelerate the material during passage across said faces during high speed rotation of the slinger wheel, said curved faces projecting said crushable material outwardly at high velocity toward said impact surface to shatter the same.

4. An impact-type crushing machine comprising, a cylindrical shell residing upon a vertical axis and having a discharge passageway at the lower end thereof, a slinger wheel journaled for rotation in a horizontal plane within the shell, power means for rotating said wheel, a generally cylindrical cap element mounted upon said slinger wheel at the axis of rotation thereof, said cap element having a convex upper surface rising above the plane of the slinger wheel, inlet means disposed above said cap element for feeding crushable material thereto, a plurality of mounting elements projecting upwardly from said slinger wheel, a respective demountable slinger shoe slidably engaging each of said mounting elements, each of

said shoes having a working face which is curved in a direction generally radial to said axis of rotation, said curved face having an inner portion which is generally tangent to the periphery of the cylindrical cap element and which sweeps forwardly in the direction of rotation of the slinger wheel, said curved face having an outer portion which sweeps rearwardly in said direction of rotation, and an impact surface within said shell, said impact surface surrounding said slinger and spaced outwardly therefrom to delineate an annular crushing zone, the convex face of said cap element adapted to intercept crushable material which is fed through the inlet means and to guide the same toward the inner portions of said curved working faces, whereby said curved faces accelerate the material during passage across said faces during high speed rotation of the slinger wheel, said curved faces projecting said material outwardly at high velocity, said impact surface having impact faces disposed substantially at right angles to the path of motion of said crushable material to shatter the same, adapting the shattered material to drop downwardly through said annular crushing zone to the discharge passageway.

5. An impact-type crushing machine comprising, a cylindrical shell residing upon a vertical axis and having a discharge passageway at the lower end thereof, a slinger wheel mounted for rotation in a horizontal plane within the shell, inlet means above said slinger wheel for feeding crushable material to the central portion thereof, a plurality of dovetail elements projecting upwardly from said slinger wheel, detachable slinger shoes slidably engaging said dovetail elements and adapted to be slipped endwisely thereon, said dovetail elements locking said shoes against displacement in a horizontal plane relative to the slinger wheel, respective locking elements securing said slinger shoes to said dovetail elements and resisting endwise displacement of the shoes, each of said shoes having a generally vertical working face which is curved in a direction generally radial to the axis of rotation of the slinger wheel and which sweeps forwardly in the direction of rotation of the slinger wheel, and an impact surface disposed within said shell, said impact surface surrounding the slinger wheel and spaced outwardly therefrom, said slinger shoes adapted to intercept crushable material which is fed through said inlet means and to propel the same outwardly at high velocity against said impact surface during rotation of the slinger wheel, thereby to shatter said crushable material by impact and to cause the same to drop downwardly through said discharge passageway.

6. An impact-type crushing machine comprising, a cylindrical shell residing upon a vertical axis and having a discharge passageway at the lower end thereof, a slinger

wheel mounted for rotation in a horizontal plane within the shell, inlet means above said slinger wheel for feeding crushable material to the central portion thereof, a plurality of dovetail elements projecting upwardly from said slinger wheel, detachable slinger shoes slidably engaging said dovetail elements and adapted to be slipped endwisely thereon, said dovetail elements locking said shoes against displacement in a horizontal plane relative to the slinger wheel, respective locking elements securing said slinger shoes to said dovetail elements and resisting endwise displacement of the shoes, each of said shoes having a generally vertical working face which is curved in a direction generally radial to the axis of rotation of the slinger wheel and which sweeps forwardly in the direction of rotation of the slinger wheel, respective wear plates detachably mounted on said slinger wheel, each wear plate presenting a horizontal surface disposed in advance of the vertical working face of the respective slinger shoe, and an impact surface disposed within said shell, said impact surface surrounding the slinger wheel and spaced outwardly therefrom, said slinger shoes adapted to intercept crushable material which is fed into the machine through said inlet means and to propel the same outwardly at high velocity against the impact surface during rotation of the slinger wheel, thereby to shatter said crushable material by impact and to cause the same to drop downwardly through said discharge passageway.

References Cited in the file of this patent

UNITED STATES PATENTS

271,138	Sharpneck	Jan. 23, 1883
786,088	Benjamin	Mar. 28, 1905
1,228,338	Marks	May 29, 1917
1,267,110	Parsons et al.	May 21, 1918
1,532,742	Hadsel	Apr. 7, 1925
1,565,877	Werner	Dec. 15, 1925
1,608,717	Bell	Nov. 30, 1926
2,012,694	Runyan	Aug. 27, 1935
2,259,939	Garcia	Oct. 21, 1941
2,352,327	Kirn	June 27, 1944
2,360,086	Thurman et al.	Oct. 10, 1944
2,707,314	Horth	May 3, 1955
2,798,674	Denning	July 9, 1957
2,844,331	Adams	July 22, 1958
2,885,156	Fitz	May 5, 1959

FOREIGN PATENTS

309,854	Great Britain	Printed 1930 (Complete not accepted.)
394,478	Great Britain	June 29, 1933