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P. L. GIBBAR ETAL
CRUSHING ROLL CONSTRUCTION

3,090,105

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2 Sheets-Sheet 1

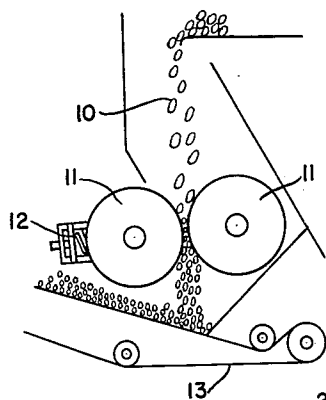


FIG. 1.

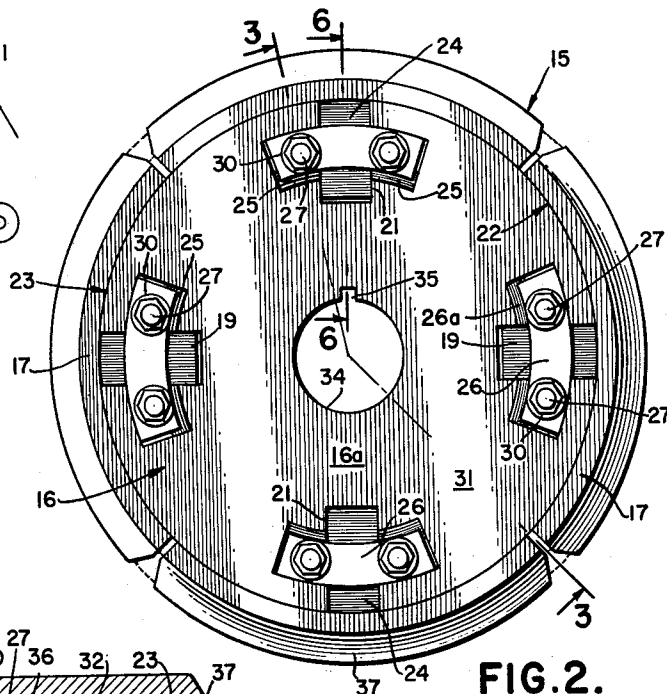


FIG. 2.

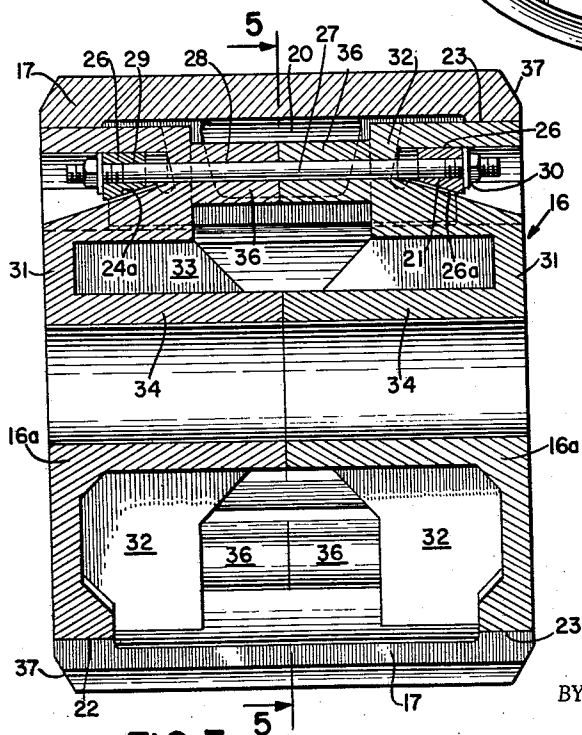


FIG. 3.

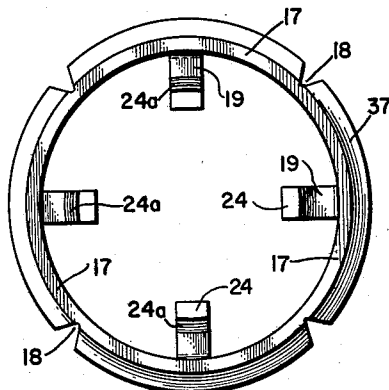


FIG. 4.

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2 Sheets-Sheet 2

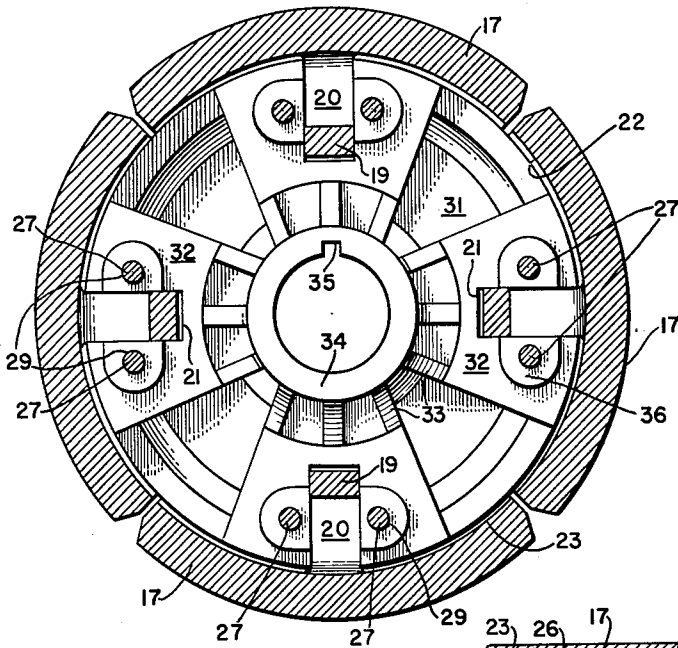


FIG. 5.

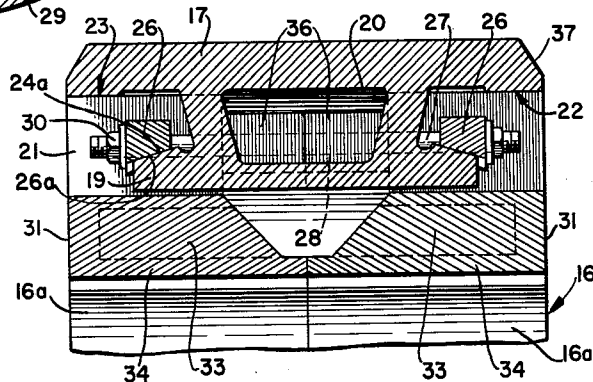


FIG. 6.

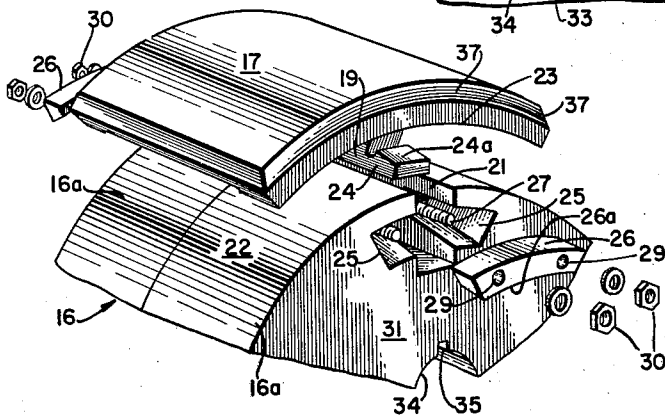


FIG. 7.

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3,090,105
CRUSHING ROLL CONSTRUCTION
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This invention relates to a crushing roll construction designed to supplant the type usually employed in pairs and rotatable toward each other to crush or reduce in size material fed downwardly between them, and while the construction is capable of general use, one example thereof is in the comminution, crushing or reduction of gravel, rocks or the like to the appropriate sizes useful in road building and maintenance.

Up to the present time repairing or replacing crushing rolls of the instant general character has been exceedingly expensive, difficult, and time-consuming with one very objectionable factor traceable to the inaccessibility of the roll as located and mounted in the crushing plant or mill so close to driving gearing with insufficient clearance, and the necessity for sliding the entire roll often with gearing from its drive shaft in a single permissible longitudinal direction. Such removal, discard and replacement of a pair of the known rolls requires the services of four men for three of four days' time with the mill or plant completely shut down or idle, as compared to restoration of the rolls of the mill or plant by two men in one-half day as experienced by us in the actual use of the instant invention.

A prime object is to construct an efficient crushing roll having a novel shell forming the peripheral crushing surface, and replaceably mount the same by novel clamping wedge means on a suitable hub so that the roll will have materially longer life, and encounter greatly reduced expense for maintenance and operation of the plant or mill generally.

Another important object is to form the said crushing shell in similar segments, advantageously four, each of which is removable and replaceable mainly through radial movement with respect to the hub and in connection with which said wedge means pulls the segments radially inwardly to enable continued use of the segments even when worn to maximum thinness since outward stress, which tends to open up cracks, is avoided.

It is also a desideratum to provide the hub in novel sections which are held assembled with the segments in place by the said clamping wedge means.

Another object is attained by producing a roll wherein the same is devoid of projections beyond the ends of the hub, and the hub does not require dismantling from its driving shaft while replacing a crushing segment or segments.

Still another object is to provide a construction wherein a minimum number of accurately machined surfaces suffice for true fitting of the parts without danger of rocking or wobbling, especially of the segments, enabling the same hub to remain effective throughout its life, although accommodating many replacements of the crushing segments.

A further object is to provide a construction wherein it is unnecessary to remove the employed screw and bolt means from the hub in order to remove or replace the crushing shell segments and wherein any stress is accommodated in the end zones of the roll.

Still further it is aimed to provide a structure wherein the end portions of the hub and segments are disposed in effective shape-insuring contact and the edges of the segments are specially shaped to require minimum removal of "lip" rings which invariably result from wear-caused

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longitudinally concaving of the outer surface of the segments.

One more object is to provide each crushing segment with a novel integral inwardly extending attaching and wedging bar to occupy a coacting radial slot in the periphery of the hub, the bars being of such longitudinal extent and strength as to greatly reinforce the segments and overcome or reduce the concaving referred to, the bars coacting at their ends with wedging means housed within the confines of the roll.

Again, an object is to provide a construction wherein the crushing shell is manufactured in integral annular form to facilitate more expeditious machining and handling, but designed for division into one or more segments at a suitable time or times according to requirements.

Various additional objects and advantages will become apparent from a consideration of the description following taken in connection with the accompanying drawings illustrating one embodiment of the invention by way of example and wherein:

FIG. 1 is a diagrammatic view showing crushing rolls constructed according to the invention and in one environment of use;

FIG. 2 is a side elevation of the crushing roll;

FIG. 3 is a cross-sectional view taken on line 3—3 of FIG. 2;

FIG. 4 is an end elevation of the crushing shell in integral or unitary form before division into segments for use;

FIG. 5 is a cross-section on line 5—5 of FIG. 3;

FIG. 6 is a cross-section on the line 6—6 of FIG. 2; and

FIG. 7 is a fragmentary perspective view with the parts exploded to show a crushing segment and the means whereby it is attached to the hub.

Referring specifically to the drawings wherein the same reference characters designate like or similar parts throughout the different views, the diagrammatic partial side elevation or section (FIG. 1) is to be considered as taken through either a mobile or stationary crushing plant. The rock, gravel, or other material to be crushed is suggested at 10 and gravitates or otherwise passes downwardly through a gap of appropriate width between the peripheries of rolls 11 which crush, comminute or reduce the gravel, rock or equivalent into the desired size, one of the rolls preferably being adjustably urged relatively to the other roll by the conventional means indicated at 12. The crushed or reduced material is gathered below the rolls 11 in any suitable manner, as by a conveyor 12 for use, for example, in the present case in road building or repair.

Said conventional crushing rolls 11 after usual wear or otherwise require frequent replacement in their entirety and in carrying out the present invention, each roll 11 is replaced by a roll of the structure shown in FIGS. 2 through 7. Said improved roll is generally designated 15 and has a hub 16 which affords a very rigid and effective mounting for a detachable crushing shell composed of segments 17, advantageously being four in number as shown. In explanation rather than limitation, the hub 16 is usually of cast steel to permit ready machining and the wear and stability requirements for the segments 17 are satisfied by making them of manganese steel. Hub 16 is preferably made in similar preparable halves 16^a designed to abut on the plane of line 5—5 of FIG. 3.

As manufactured, the shell which provides the segments 17 and as shown in FIG. 4, is annular and in one integral piece. In this form the segments are most expeditiously produced and accurately finished as a unit, being thus shipped from the factory or shop for division into the individual segments along the longitudinal peripheral

grooves 18 in any conventional manner as with a cutting torch.

Extending radially inwardly and centrally from each segment 17 is an attaching bar or rib 19 which greatly reinforces the shell segment of which it is an integral part, same preferably being cut away as at an opening 20 without sacrifice of strength but with a view to saving metal. Said bars 19 extend practically the full length of the roll, and they removably occupy longitudinal slots 21 extending radially inwardly from the periphery or outer surface of the hub 16, with the side walls of the bars 19 and side walls in the slots 21 in parallelism snugly contacting each other. There is ample clearance left as shown particularly in FIGS. 2, 5 and 6 to avoid contact of the inner edges of the bars 19 with the base walls in the slots 21, enabling the shell segments to be mounted without play or wobbling and readily individually detached and/or replaced.

The peripheral surface 22 of the hub 16, especially at the end zones of the roll, is in contact with machined concave wall surfaces 23 of the segments to insure maximum rigidity and support of such segments, it being realized that there is substantially complete annular contact and support at both end zones of the roll between said surfaces 22 and 23.

Said bars 19 at their ends are cut away to provide oppositely projecting lugs 24 inwardly spaced from the inner surfaces of the segments and having outer wedge surfaces 24^a at reverse angles extending inwardly toward the axis of the hub and the ends of the latter respectively nearest thereto.

In order to detachably and rigidly unitarily mount or clamp said hub sections 16^a together and said crusher segments 17 to the hub 16 with the bars 19 at their side walls contacting the side walls of the slots 21, said slots 21 have lateral enlargements 25 in the hub at both end surfaces thereof, which removably receive by application through the ends of the slots 21, comparatively short arcuate wedge elements 26 having radially inner angular wedging surfaces 26^a cooperating with surfaces 24^a. A pair of bolts 27 is provided to secure the adjacent wedge elements 26 in place. Said bolts 27 are detachably mounted in openings 28 provided longitudinally in the hub 16, and on which the wedges 26 at two holes 29 are disposed, nuts 30 being threaded on the bolts beyond the wedges to tighten them and draw those on each side of the roll toward the other side of the roll, and accordingly draw and clamp the shell segments 17 and hub sections 16^a inwardly toward the center of the hub, thus relieving the structure of the possibility of any outwardly expansive stresses apt to expand or split cracks in the shell segments 17 especially after wear of the segments to a certain degree, and as well as facilitating continued use of the segments when worn to the minimum extent to assure maximum life therefor. It will be noted that the bars 19 and bolts 27 terminate inwardly of the end walls of the roll, and that the wedge elements 26 are accommodated inwardly of the said walls. In connection with the removal and replacement of a segment, only minimum clearance at the ends of the rolls is required for removal of the wedge segments 26. The construction is such that under such condition the bolts 27 may remain in their usual position occupying the openings 28. In fact it is unnecessary to completely remove the wedge segments 26 from the roll because when the nuts 30 have been removed, said wedge segments may be outwardly displaced in the slots 21 without complete removal from the roll, but only out of the path of radial movement of the bars 19 into or out of the slots 21. It is to be noted that slots 21 are of ample depth to enable tightening of the wedge elements 26 at all times without engagement of the radially inner surfaces of the bars 19 with the base wall of the slot 21.

Reverting to the hub 16, the same may be manufactured in any preferred form within the requirements of

the invention, the same usually being made in halves or sections 16^a as described. Said hub, as far as practical, has solid outer end walls 31, substantially solid block portions 32 in which the slots 21 are provided with spaced radially reinforcing ribs 33 integral with said portions 32 at one end and at the other end integral with journal portions 34 by means of which the roll is mounted on the drive-shafts and in which aligned slots 35 are provided to accommodate a key used to attach the roll to the driving shaft and bosses 36 extending from said block portions and abutting each other on said line 5—5 of FIG. 3.

Actual use has proven that the crusher roll construction of the present invention is practical and withstands the extremely hard usage encountered in comminuting, crushing or reducing of gravel, rocks, stones or the equivalent to the size or sizes required for road building and repairing. It will be clear that the hub is mounted on a driving shaft duly keyed or otherwise attached thereto with the aid of the slot 35. The annular shell or ring shown in FIG. 4 as received from the factory is divided along the longitudinal grooves 18 to provide the segments 17 which are mounted on the periphery of the hub 16. Said segments are applied by inserting their bars 19 radially inward into the slots 21, the walls of the latter being parallel with and contacting the side walls of the bars and efficiently supporting the segments in contact at the surfaces 22 and 23. With the bolts 27 located in the openings 28, the wedge elements 26 at the holes 29 are applied to the bolts, following which nuts 30 are applied to the bolts and tightened to the necessary degree to cause the wedge elements 26 to ride on the inclined or wedge surfaces 24^a and thus rigidly clamp the crusher segments and hub sections in place. It will be realized as previously mentioned that sufficient clearance remains at all times between the radially inner surfaces of the bars 19 and base walls of slots 21, and between the wedge elements 26 and confining walls of the slot extensions 25 to insure efficient mounting of the crusher segments without danger of loosening or wobbling.

It will be realized that in the event of undue wear of the crushing surface of the roll or a segment thereof, it is unnecessary to remove the improved roll from its driving shaft as heretofore. In fact all that is necessary is to remove the conventional feeding hopper for material 10 from the machine, without disturbing the gearing or any other part of the machine, and rotate the roll to bring the desired roll segment to be removed uppermost. Then remove the nuts 30 at said segment, and laterally displace the wedge elements 26 toward the ends of the roll, short of complete removal from the slots 21, and then to remove the worn crusher segment or segments 17 radially outward with respect to the longitudinal axis of the hub, and in the case of the replacement crusher segment, to slide the same radially into place with its bar 19 entered in the slot 21 toward the said longitudinal axis of the hub, and to thereupon replace the wedge elements 26 and move them inwardly and clamp all of the roll parts rigidly together, through tightening of the nuts 30. The other segments 17 may be replaced by rotating the roll to bring the desired segment uppermost and repeating the removal and replacement operations described above, after which the hopper is replaced.

Attention is also called to the fact that as a result of the improved construction, accurate machining of a minimum number of surfaces is required. Further, by reason of the termination of the ends of the bars 19 inwardly of the ends of the roll, sufficient clearance is provided for access by the necessary machines and operation of tools in the manufacture and machining of the crushing shell (FIG. 4). This effects an economy of manufacture by permitting use of larger and more powerful grinding machines to provide the surfaces 23 and 24^a while the segments are joined in the integral ring form as in FIG. 4.

In crushing rolls of the present general type, the crushing surface through use becomes generally concave with

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rings or enlargements at the junction of such surface and end walls which require removal from time to time as by cutting away with a suitable torch. We find in practice that the crushing surface will remain intact longer and such ring formation is minimized by suitably chamfering the annular edges of the roll or segments as at 37 as at any angle greater than 45°.

Various changes may be resorted to, provided they fall within the spirit and scope of the invention.

What is claimed is:

1. A crusher roll having a rotatable hub, said hub having longitudinal slots extending radially inward from its periphery, an annular crushing shell disposed about the periphery of said hub composed of segments, a longitudinal attaching bar extending axially of said segments and radially inwardly from each segment and occupying one of said slots, said bar having at each of its ends a wedge surface, and clamping wedge means engageable with the hub and with said wedge surface at opposite ends of said bars drawing said segments inwardly against said hub.

2. A crusher roll as claimed in claim 1, wherein said clamping wedge means is accommodated completely within the confines of the roll.

3. A crusher roll as claimed in claim 1 wherein each of said slots has at each side of the roll enlargements, said clamping wedge means comprises bolts and clamping wedge devices, one of said bolts passes longitudinally through the hub on each side of each slot and into said enlargements, said clamping wedge devices are engageable with the opposite ends of the bar, extend across the slots and occupy the enlargements, and each bar has at each end thereof an outwardly opening socket the base wall of which is inclined toward the axis of the hub and is contacted by one of said clamping wedge devices.

4. A crusher roll as claimed in claim 1 wherein said hub comprises at least two abutting sections, and said clamping wedge means includes bolts for also holding said hub sections in abutting relation.

5. A crusher roll as claimed in claim 4 wherein said hub sections have block portions having bosses extending axially inwardly from the block portions in abutting relation, said bolts extending through said hub bosses, and said clamping wedge means further comprises wedge devices mounted on said bolts.

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6. A crusher roll as claimed in claim 1 wherein said shell has a crushing surface defined by side edges provided with a chamfer disposed at an angle of at least 45° to the said crushing surface to minimize the lipping of said side edges.

7. A crusher roll as claimed in claim 1 wherein said attaching bars are of less radial extent than the depth of the slots in the hub whereby clearance results so that the bars will not contact the bases of the slots and interfere with the rigid mounting of the segments on the hub by the action of the clamping wedge means.

8. A crusher roll as claimed in claim 1 wherein clearance is provided between the radially inner surfaces of said bars and the bases of the hub slots, the radially outermost surfaces of the clamping wedge means and the radially outer surfaces of the slots in the hub engaged thereby are curved.

9. For use with a crusher roll hub having angularly spaced apart longitudinal slots extending radially inward from the periphery of the hub, an annular crushing shell adapted to be disposed about the periphery of the hub, a plurality of longitudinal attaching bars extending axially of said shell and radially inwardly from said shell in angularly spaced apart relation, one of said attaching bars adapted to be received by each of the hub slots, each of said bars having at each of its ends a wedge surface, and clamping wedge means adapted to engage the hub and to engage each wedge surface at opposite ends of said bars adapted to draw said shell into firm seating engagement with the periphery of the hub when the shell is disposed about the periphery of the hub, said shell having longitudinally extending portions of lesser thickness than that of the remainder of the shell located intermediate said attaching bars for marking the shell for division into segments along said portions of lesser thickness.

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