United States Patent

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[54] **BUCKET WHEEL RECLAIMER**
7 Claims, 12 Drawing Figs.

[52] **U.S. Cl.** **198/36,** 198/211; 126, 308/182; 190, 52/726, 214/10, 37/190
[51] **Int. Cl.** **B65g 65/28,** F16c 33/61
[50] **Field of Search** ..... 214/10; 198/36, 103, 211, 126; 37/189, 190, 70; 308/182, 190; 238/(Inquired); 52/726, 648(Inquired)

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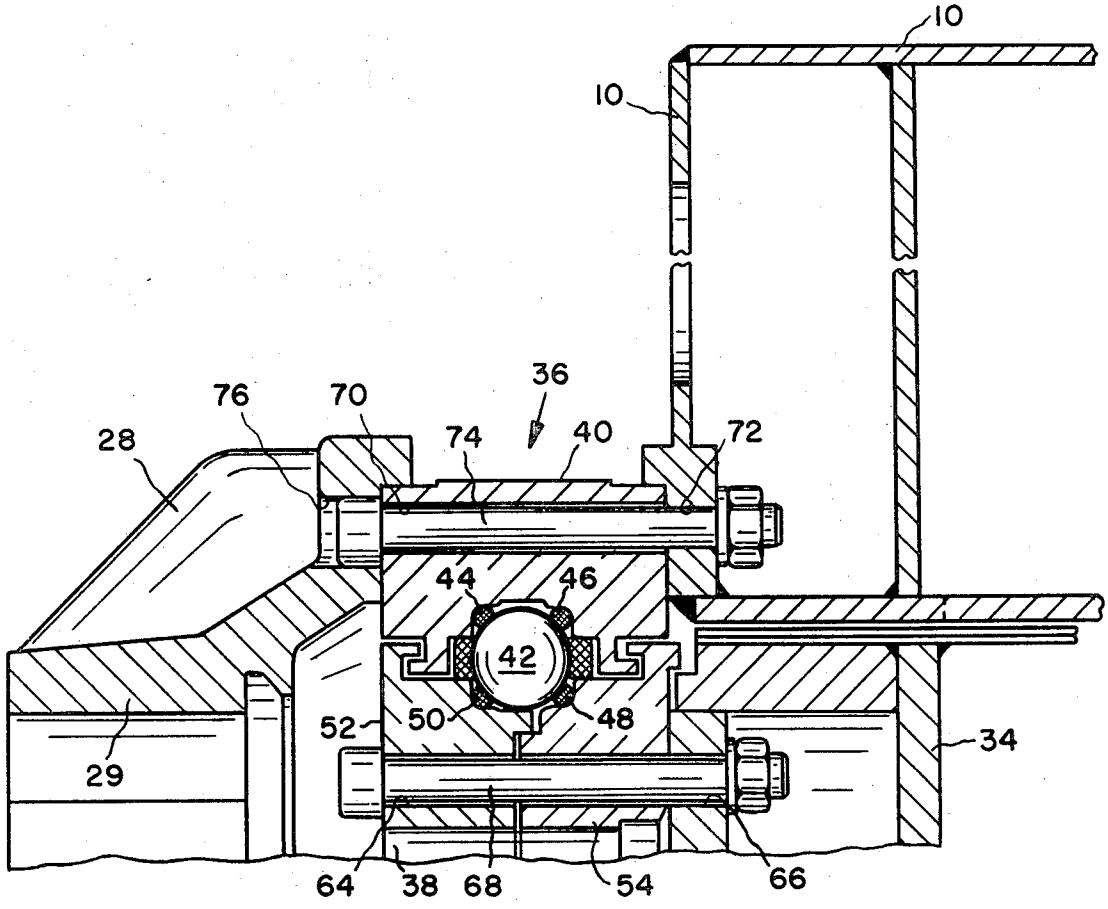
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ABSTRACT: A bucket reclaiming machine of the type having a bridge which is advanced toward the material to be reclaimed. The bucket wheel is rotatably supported by an annular bearing which encircles the bridge. The bearing is formed of continuous inner and outer concentric races. The wheel is connected to the outer race and the inner race is supported on a movable carriage. The wheel drive means extends between the carriage and the outer race. The bridge is formed of separable sections which can be tilted with respect to each other sufficiently to permit passage of the bearing races between the sections of the bridge.



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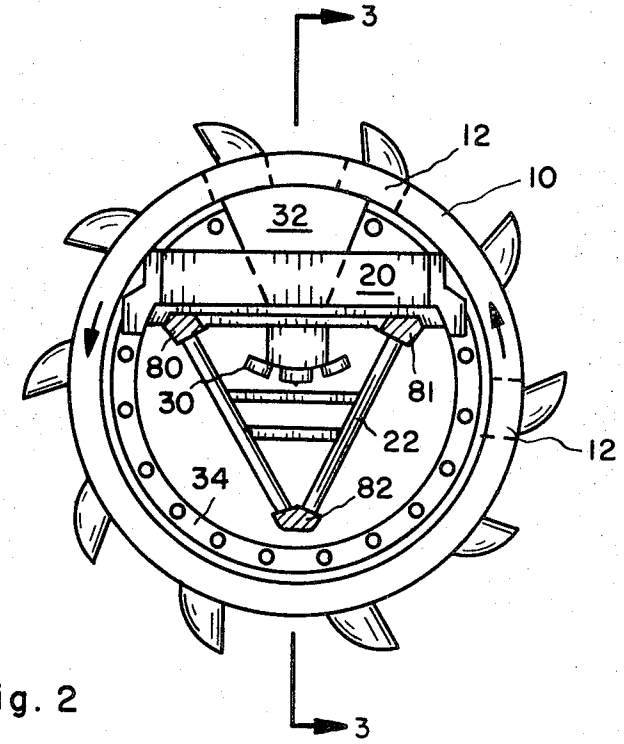


Fig. 2

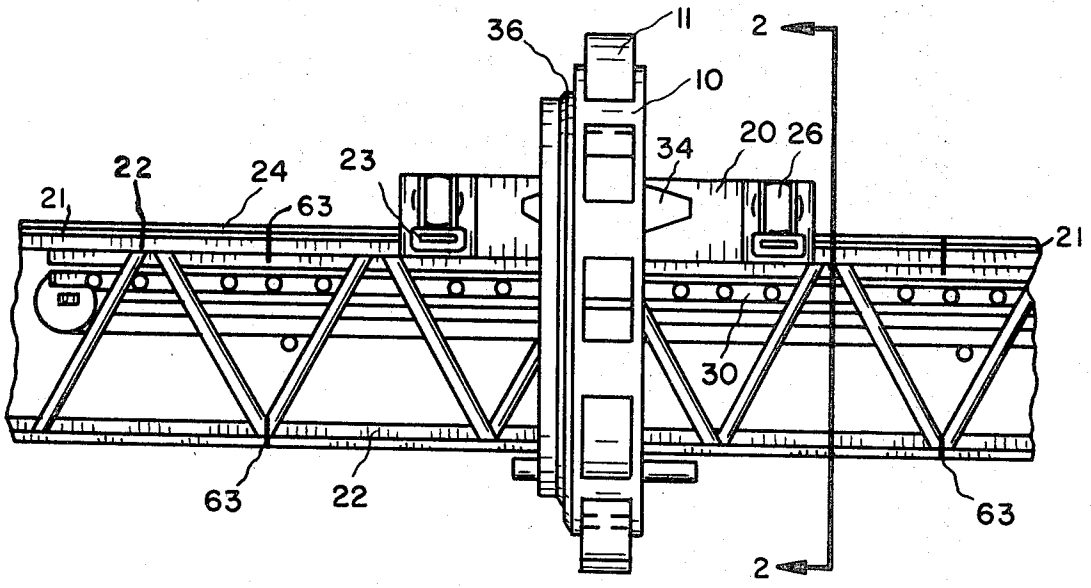


Fig. 1

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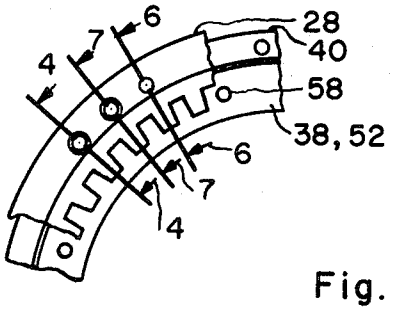


Fig. 5

Fig. 4

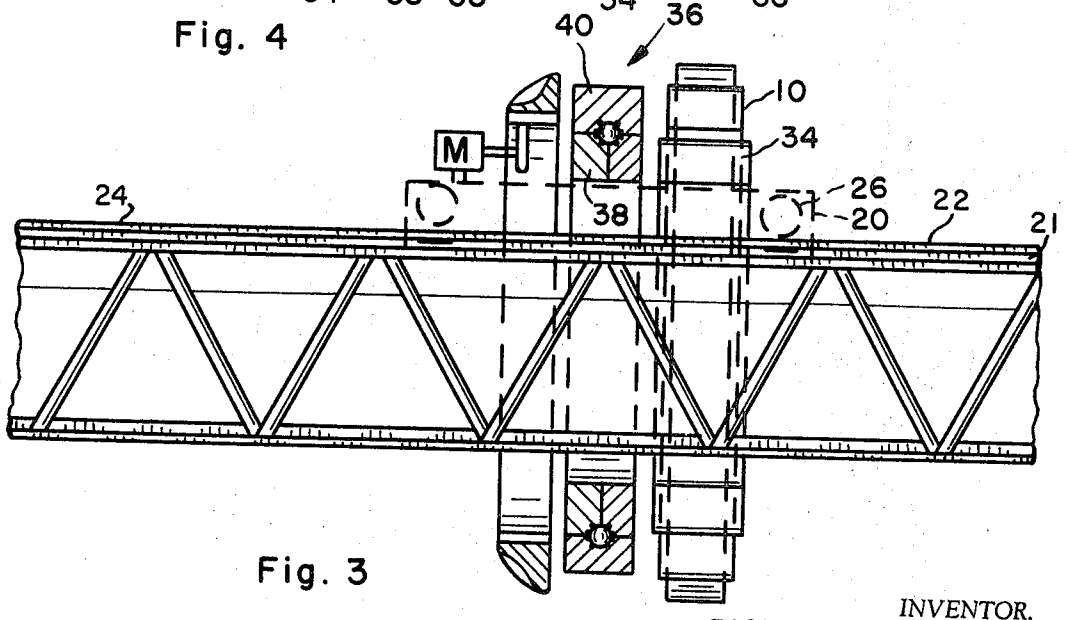


Fig. 3

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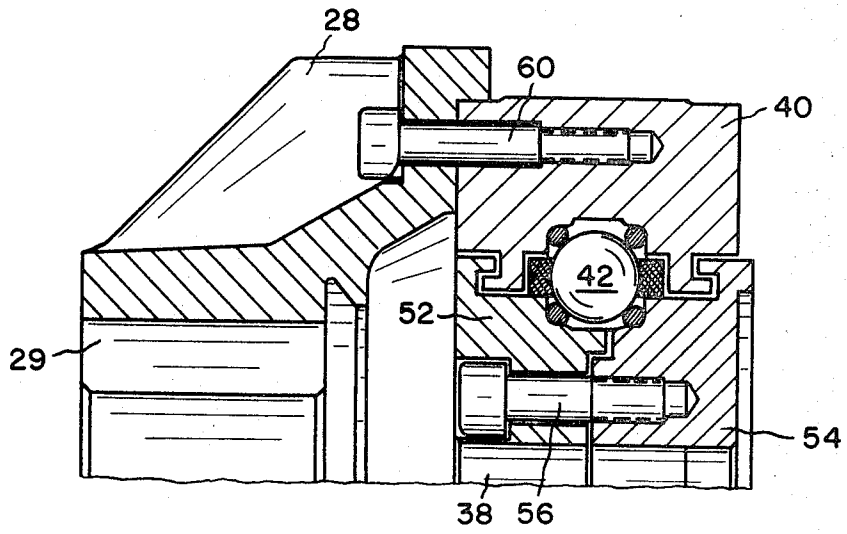


Fig. 6

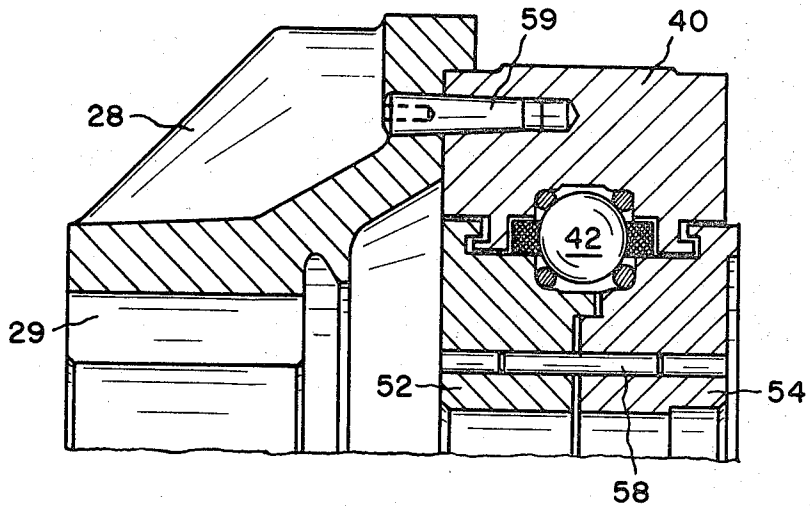


Fig. 7

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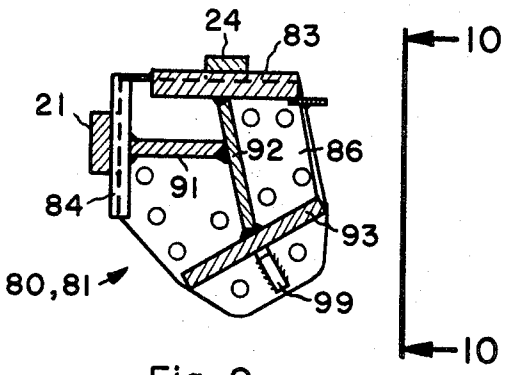


Fig. 9

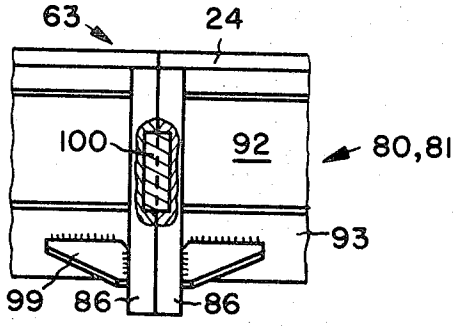


Fig. 10

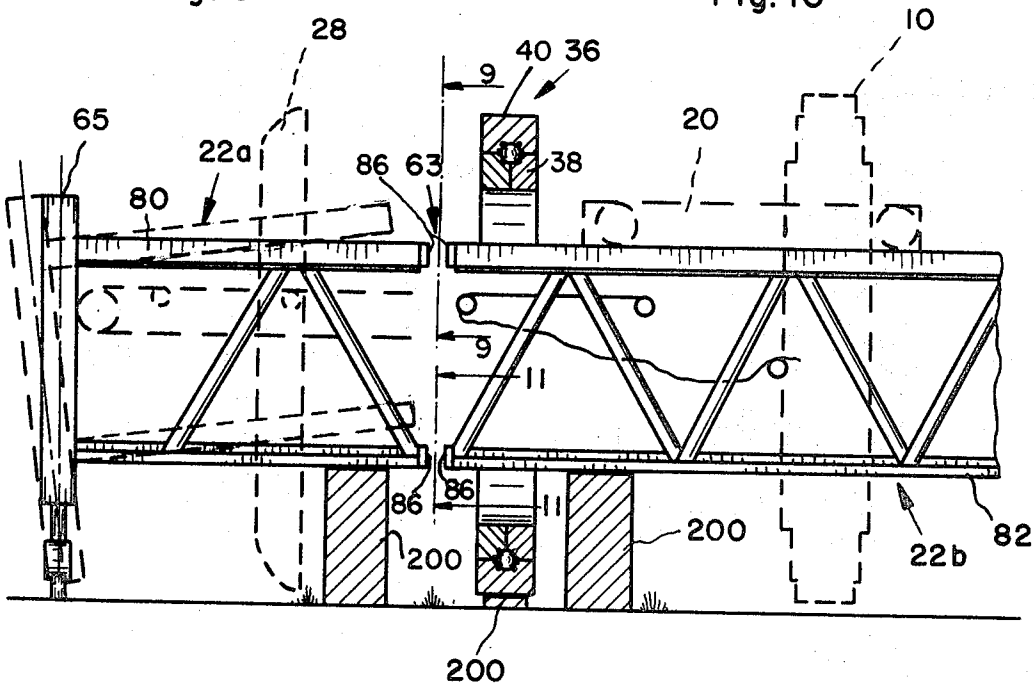


Fig. 8

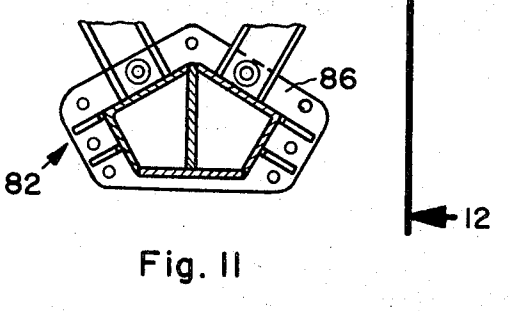


Fig. 11

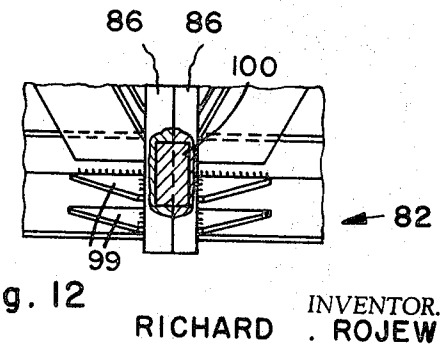


Fig. 12

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BUCKET WHEEL RECLAIMER

This is a continuation of application Ser. No. 528,035, filed Feb. 17, 1966 now abandoned.

This invention relates to a bucket wheel reclaiming machine and in particular to a means for supporting a digging wheel for rotation in a vertical plane.

The known arrangements for mounting a bucket wheel include those in which the wheels are centrally pivoted on a shaft mounted on bearings and those in which the wheel comprises an annular structure supported by rollers within the inner periphery of said structure. The latter type has the advantage of requiring only a single conveyor means passing axially through the digging wheel for conveying material discharged from the wheel to the sides of piles of material being reclaimed and only one transfer point is required. However, digging wheels of the latter type must be quite large in diameter in order to accommodate the axial conveyor and the wheel supporting means within the periphery of the wheel as well as, in many instances, the truss which supports the wheel and its traversing carriage.

When the wheel is supported on a central shaft auxiliary material transfer means must be used to transfer the material from the wheel to a bridge or boom mounted conveyor. Thus, although with this type of machine the wheel may be of a smaller size than a bridge encircling wheel, additional structure is necessary for mounting the wheel, and material degradation will be increased as compared to a machine where there is a single transfer between the bucket wheel and the bridge conveyor.

One of the well known bucket wheel reclaimers of the type shown in the accompanying drawing includes a carriage frame which is located concentrically within the bucket wheel. The bucket wheel is provided with circular tracks mounted internally of the bucket wheel which engage rollers mounted on the carriage frame.

Often the rollers are mounted on equalizing supports and side guiding rollers are usually necessary. This known arrangement results in a bucket wheel of large diameter having a significantly great mass. The traversing carriage upon which the carriage frame and bucket wheel are mounted must therefore be made strong, and as a result massive, and the bridge which ultimately supports the traversing carriage must also be strong and massive enough to support the loads imposed; which are governed significantly by the diameter of the wheel, *i.e.*, the wheel size. According to this invention, the roller structure is replaced with a relatively light weight roller bearing which allows the bucket wheel diameter to be significantly reduced and therefore a like reduction in the massiveness of the bucket wheel. As a result, the traversing carriage upon which the roller bearing and bucket wheel are mounted need not be made to sustain as large a mass as heretofore and the traversing carriage may be less massive than previously. The same is true of the bridge over which the carriage is moved; it is less massive. The cumulative result is significant in that economies are realized in the amount of steel required and the time and equipment necessary to build the various elements making up the reclaimer.

In addition, since the bucket wheel is smaller in diameter, the bridge may be positioned closer to the ground so that the bridge supports can be made less expensively. Further, since the bucket wheel diameter is smaller, the forces or loads imposed by the bucket wheel on the traversing carriage and ultimately on the bridge and transferred to the side supports are smaller in a considerable degree.

Another advantage of a small diameter bucket wheel achieved by this invention is that the wheel size may now be governed primarily by the reclaiming action desired, *i.e.* bucket loading due to the specific gravity of the material being reclaimed and the reclaiming capacity required.

This invention also provides a relatively inexpensive bucket wheel support, *i.e.* the roller bearing, in which the bearing parts are readily protected from corrosion and abrasion so that maintenance requirements are minimized. Also significantly, the roller bearing bucket wheel support according to this invention is more rigid and stronger than the known bucket wheel support for reclaimers, or digging wheels for other uses.

An object of this invention is to provide a digging wheel mounting structure wherein the size of the structure, such as the carriage and associated frame or bridge which movably supports the wheel, can be materially reduced in size and weight.

A further object of the invention is to reduce the weight and size of the bucket or digging wheel itself for the same capacity and service as the known devices as well as the weight and size of the carriage and the associated bridge structure which supports these elements so as to make it possible to greatly reduce the size of the overall digging or reclaiming machine. This results in a substantial reduction in the cost of such machine. For example, up to as much as one-third of the weight of the known machines of the type wherein the wheel surrounds the bridge can be eliminated through use of the improvements set forth herein.

Another object is to provide a reclaimer of reduced size and weight for the same capacity and service as known reclaimers, which has continuous means for providing rotative support for the digging wheel and thus provide a support that does not have discontinuities which render machining and assembly more difficult and expensive and which contribute to rapid wear.

A further object is to provide a reclaimer having a wheel structure as set forth with means for removing and replacing the means for providing rotative support.

Yet another object is to provide a bucket wheel supported for rotation in a vertical position by an antifriction bearing means.

Still a further object is to provide a wheel support in which the bearing provides both vertical and lateral support for the wheel and takes all digging and other forces acting on the wheel.

It is also an object to provide a structure in which the drive for rotating the wheel can be simplified and connected to the wheel in a simple and yet rigid and direct manner.

A still further object is to provide a wheel support and drive in which the inner race of a bearing can be fixedly secured to a carriage or similar support and both the digging wheel and a drive gear can be fixedly connected to and supported by the outer race of said bearing. This provides a simple structure which can be readily fabricated, assembled and inspected and repaired, if necessary, yet because of the simple manner in which the parts can be provided (machined, etc.) and rigidly connected, there is less likelihood of need for repair.

It is also an object to provide a rotative support for a bucket wheel which does not have central shaft yet wherein the bearinglike support of the wheel can be effectively sealed from rain, dust and abrasive materials. Still another object of the invention is to provide a rotatably supported bucket wheel useful both for truss surrounding installations, as well as axle supported wheels, which is more structurally sound, requires less maintenance and has an open central area which can be useful in facilitating discharge from the buckets and the placement of conveying means in association therewith.

The foregoing objects and additional objects and advantages will be apparent from the following detailed description of the presently preferred embodiment shown in the accompanying drawings in which:

FIG. 1 is a fragmentary rear elevational view of a reclaimer incorporating the digging wheel and the supporting means therefore according to the invention.

FIG. 2 is a sectional elevational view taken on line 2,2 of FIG. 1 looking in the direction of the arrows.

FIG. 3 is an exploded partly sectional, schematic rear elevational view of an assembly including a bearing, bridge and carriage according to the invention as applied to a reclaimer system and taken generally on line 3,3 of FIG. 2.

FIG. 4 is a fragmentary, enlarged detailed view, in section, of portions of the bucket wheel, bearing assembly and rim gear schematically shown in FIG. 3, and is taken along line 4–4 of FIG. 5.

FIG. 5 is a fragmentary view of a rim gear forming part of the wheel rotating drive.

FIG. 6 is a fragmentary enlarged sectional view showing the rim gear and bearing taken along line 6–6 of FIG. 5.

FIG. 7 is a fragmentary enlarged sectional view of the same elements shown in FIG. 6 but taken along line 7–7 of FIG. 5.

FIG. 8 is a schematic partly sectional, rear view in elevation showing the bridge, bucket wheel, rim gear, bearing and carriage and illustrating the manner in which the bridge is formed of sections which can be disengaged for removal and replacement of the bearing.

FIG. 9 is a detailed vertical section taken along line 9–9 of FIG. 8.

FIG. 10 is a view taken as indicated by line 10–10 of FIG. 9

FIG. 11 is a detailed vertical section taken along line 11–11 of FIG. 8.

FIG. 12 is a view taken as indicated by line 12–12 in FIG. 11.

Referring now to the drawing: FIGS. 1 and 2 illustrate a reclaimer system in which a rotary bucket wheel 10 is mounted on a self-propelled, wheeled carriage 20 for movement longitudinally back and forth on the bridge or truss 22. Wheels 26 movably support the carriage 20 on longitudinally extending rails 24 of the bridge 22 and similar side rails or tracks 21 and side rollers 23 guide the carriage 20 which is well known. Motor means for moving the carriage on the bridge are well known also. As the bucket wheel rotates in the direction of the arrows (FIG. 2) it scoops material from the stack of material to be reclaimed (not shown) and delivers it to the bridge conveyor 30 via a carriage hopper 32. The hopper 32 is connected to or integral with carriage 20 and is thus fixed in position for receiving material from the digging wheel 10. The material, scooped into a bucket as the wheel rotates, is passed through opening 12 of the wheel to the hopper 32 and onto conveyor 30.

A wrap-around frame 34 which is supported on, and forms part of the carriage 20, terminates at the hopper 32. The material deposited on the conveyor 30 via the wheel 10 and the hopper 32 is then conveyed to one end of the bridge 22 and transferred to another conveyor (not shown). After each pass of the digging wheel across the face of the stack, the bridge member 22 carrying the digging wheel is advanced toward the stack of material for the next cut in a manner which is well known and forms no part of the present invention.

As is known, a harrow (not shown) which is preferably supported on the carriage 20, moves over the face of the pile of material being reclaimed. In fact, all the elements described above and their functions are known in several specific forms and combinations in the art.

Referring now to FIGS. 3 and 4, the assembly therein illustrated for supporting the digging wheel 10 comprises a wrap-around frame 34, of suitable construction, which substantially surrounds bridge 22 and is rigidly attached in any suitable manner to the carriage 20. The bucket wheel 10 is concentrically arranged around the exterior of the wrap-around frame 34. The wrap-around frame, as known in the art carries means which, prevents material scooped up by the buckets from passing through the compartments 12 until a bucket and the associated compartment 12 reach the top of the wheel. At this location, the hopper 32 is present which provides an opening in the wrap-around frame through which material scooped up by the bucket wheel can pass to the conveyor 30.

The bucket wheel 10 is both supported on the frame 34, and rotatable about the frame, by means of a ball bearing assembly generally designated 36. The ball bearing assembly 36 preferably comprises an inner fixed ring 38 and outer movable ring 40 separated by a plurality of balls 42. The races on which the balls bear are formed by circular rods or wires 44, 46, 48 and 50. The race rods 44 and 46 are preferably removably secured on the inner peripheral surface of the outer movable bearing ring 40. The opposite rods 48 and 50 are likewise secured to the outer peripheral surface of the inner bearing ring 38. It will be noted from FIGS. 4, 6 and 7 in particular, that the inner bearing ring 38 consists of a pair of separable bearing ring halves 52 and 54. Each of these halves is provided with one of the race rods 48 and 50. The split inner ring 38 thus provides a convenient and ready means for disassembling the bearing so that a damaged race rod, or ball 42, can be replaced without replacing the whole bearing assembly. Also, of course, reassembly of a repaired bearing in the field will require less time than field assembly of a new bearing.

As seen in FIGS. 4, 5, 6, and 7, the outer bearing ring 40 is attached to the digging wheel 10 by a plurality of radially spaced bolts 74 which are received in spaced openings 70, extending through the outer bearing ring 40, and openings 72 in the bucket wheel which are coaxial with openings 70 in the ring 40. Recesses 76 are provided in the gear rim 28 to accommodate the heads of the bolts 74. The inner bearing ring 38 is fixed to the wrap-around frame 34 in a similar manner as best seen in FIG. 4. That is, by a plurality of radially spaced bolts 68 which pass through coextensive openings 64 in each of the inner race halves, opening 64 is coaxial with opening 66 in the wrap-around frame 34 into which bolts 68 also extend.

As seen in FIG. 6, the gear rim 28 is attached to the outer bearing ring 40, at the side opposite the bucket wheel 10, by a plurality of radially spaced bolts 60. The inner split bearing ring halves are removably secured together as a unit by a plurality of screws 56 which are likewise spaced radially about the inner bearing ring 38. As seen in FIG. 5, the various bolts and screws described above are placed on different radii.

From FIGS. 4, 6 and 7 it will be seen that suitable seals for preventing lubricant leakage and excluding dirt and moisture, are also provided. A plurality of radially spaced spiral pins 58, (FIG. 7) fitting tightly in aligned openings, are provided as shown for preventing relative rotational movement between the inner bearing ring halves 52 and 54. The tapered pins 59 serve a similar function in that they prevent relative movement between the gear ring 28 and bearing ring 40. Several pins 59 are radially located in the gear rim and outer bearing ring of the bearing.

As seen in FIG. 3, the gear ring 28 has internal teeth 29 which engage with a motor driven, drive gear mounted on carriage 20 for imparting movement of the bucket wheel 10 through the outer bearing ring 40.

Referring now to FIGS. 8, 9, 10, 11 and 12:

The bearing rings 38 and 40 are continuous and in the event that one or both of these rings must be replaced, the bridge 22 must be provided with a splice 63 which is capable of being open (FIG. 8) in order to remove a bearing ring. Therefore, the bridge 22 comprises spliced sections forming longitudinally extending beams 80, 81 and 82 shown generally in FIG. 2 and in detail in FIGS. 9, 10, 11 and 12. The beams 80, 81 and 82 are united by columns to form the bridge 22 in the known truss construction.

Referring most particularly to FIGS. 9 and 10, it will be seen that the splice 63 is provided by terminating adjacent sections of the beams 80, 81 and 82 with terminal plates 86. On beams 80 and 81 plates 86 are connected to horizontal plates 83 and vertical side plates 84. Plates 83 and 84 carry the rails 21 and 24 for guiding and supporting the carriage. The rails 21 and 24 are connected to the plates 83, 84 in any suitable manner. The plates 83, 84 are braced as shown in FIG. 9 by additional plates 91, 92 and 93 as shown according to structural engineering practices. The terminal plates 86 which are bolted together at the splice 63 are additionally braced by a pair of wing plates 99 welded in place as indicated in the FIGS. 9 and 10. Between the terminal plates 86 a sheer plate 100 is provided according to known structural engineering practice.

The lower beam 82 of a boxlike construction is shown in FIGS. 11 and 12 and at the terminal plates 86 of this beam wing plates 99 are also welded to the terminal plates 86 and

the box beam sections as indicated. A shear plate **100** is also provided. see FIG. **12**.

The end sections **22***a* of the bridge **22** are connected to the center section **22***b* by the disconnectable splices **63**. Not only do the splices provide a means for removing and replacing bearings but they additionally provide a convenient device for field assembly of shop assembled parts consisting of the bucket wheel, its drive rim and the ball bearing ring and the wrap-around frame.

The need for at least one splice resides in the fact that the ball bearings in rings **40** and **38** should preferably roll on circumferentially continuous surfaces. The race rods or wires **44**, **46**, **48** and **50** and their supporting members **40**, **52** and **54** are thus made as unbroken annular members. However, this creates a problem: when replacement is necessary these rings and race rods must either be passed over end frame **65**, which is impossible due to the size of the latter, or the end frame-bridge connection must be broken or some other method, which will make it possible to enjoy the advantage of the bearing construction, must be provided. As now indicated, the concept of the use of the bearing includes the provision of splicing the bridge, and FIG. **8** illustrates how the splice makes it possible to assemble and disassemble the element.

Referring now to the latter FIG.: Blocks **200** are placed under the sections **22***a* and **22***b* adjacent the splice. The splice is then opened. Next, the end section **22***a* and its associated end frame **65** are tilted by jacking or the like to move the splice terminal plates **86** of the end section **22***a* away from the plates **86** of the central section sufficiently to permit passage of the bearing through the opening. The bearing members are detached from the wheel **10** and gear ring **28** and placed in the position shown in FIG. **8** prior to blocking up the members. The bearing can be supported by a hoist or the like.

While a preferred embodiment of the invention has been shown and described above, it will be understood that the latter may be embodied otherwise than as herein specifically illustrated or described and that in the illustrated embodiment certain changes in the details of construction and in the arrangement of parts may be made without departing from the underlying idea or principle of the invention.

I claim:

1. Apparatus comprising a powered digging bucket wheel for reclaiming piled bulk material which is to be conveyed, said digging bucket wheel having spaced apart annular side members, a frame, an annular bearing means rotatably mounting said digging bucket wheel on said frame, the improvement in said apparatus wherein said bearing means comprises an inner and an outer ring means, said outer ring means having a first side and a second side, said outer ring means positioned to one side of said digging bucket wheel, said outer ring means having said first side thereof affixed on one of said side members so as to avoid interfering with the radially inward flow of material from buckets through the wheel, said inner ring means positioned to one side of said bucket wheel and affixed to said frame, said inner ring means and said outer ring means having concentric surfaces with rolling means interposed therebetween which cooperate with said concentric surfaces to rotatably support said digging bucket wheel on said frame, drive means comprising a gear means affixed to the second side of said outer ring means for driving said outer ring means and said digging bucket wheel relative to said inner ring means and said frame.

2. Apparatus defined in claim **1** wherein said means for driving said digging bucket wheel comprises a ring gear means.

3. Apparatus defined in claim **1** wherein said inner ring means comprises a pair of bearing ring halves and means for removably connecting said pair of rings together.

4. A reclaimer comprising a bridge truss, a carriage means movably supported on said bridge truss, a frame member surrounding said bridge truss and connected to said carriage means, a powered digging bucket wheel for reclaiming piled bulk material which is to be conveyed, said digging bucket wheel having spaced apart annular side members which concentrically surround said frame, and annular bearing means rotatably mounting said digging bucket wheel on said frame, the improvement in said reclaimer wherein said bearing means comprises an inner and an outer ring means, said outer ring means having a first side and a second side, said outer ring means positioned to one side of said digging bucket wheel, said outer ring means having said first side thereof affixed on one of said side members so as to avoid interfering with the radially inward flow of material from buckets through the wheel, said inner ring means positioned to one side of said bucket wheel and affixed to said frame, said inner ring means and said outer ring means having concentric surfaces with rolling means interposed therebetween which cooperate with said concentric surfaces to rotatably support said digging bucket wheel on said frame, drive means comprising a gear means affixed to the second side of said outer ring means for driving said outer ring means and said digging bucket wheel relative to said inner ring means and said frame.

5. A reclaimer according to claim **4**, wherein said bridge truss includes at least one horizontal supporting rail for movably supporting said carriage on said bridge truss, said bridge truss being formed of separable sections and adapted to be secured together by a splice which enables said carriage to be mounted for movement on said rail from one section to another, said splice including splice plates being secured to each of said sections and means for connecting said plates together when said plates on one of said sections are brought into abutting relationship with the corresponding plates on the other of said sections, the rail on each of said sections terminating at the location of splice so that when the two truss sections are spliced together a substantially continuous rail is formed extending from one truss section to another.

6. A reclaimer according to claim **5**, wherein said connecting means releasably couple the abutting plates together so as to facilitate separation of the bridge sections for replacement of either of the rings.

7. The reclaimer according to claim **4** wherein said bridge truss is formed of separable sections having rails mounted on each of said bridge truss sections for movably supporting said carriage, structural splice means releasably securing said bridge sections together, said rail means on said bridge sections being aligned when joined by said splice means whereby said carriage may be moved from one bridge truss section to another.