July 20, 1954 D. E. HENDRICKSON ET AL 2,684,162

MATERIAL HANDLING MACHINE

Filed May 24, 1951 2 Sheets-Sheet 1

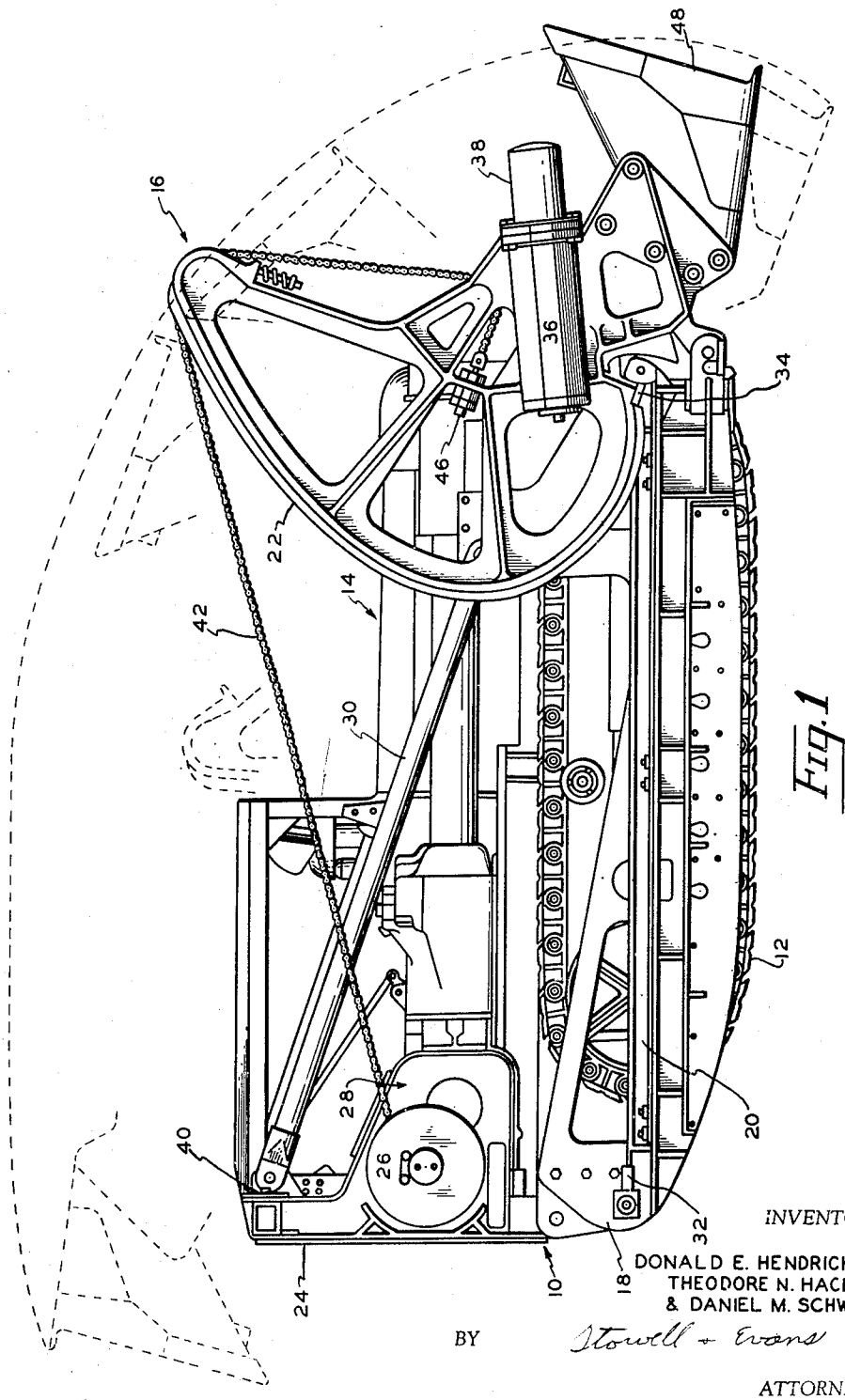


Fig. 1

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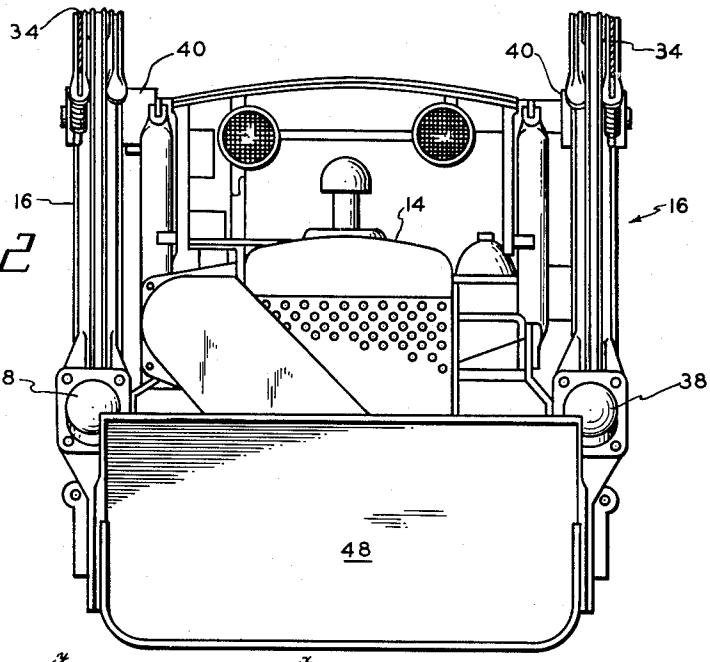


FIG. 2

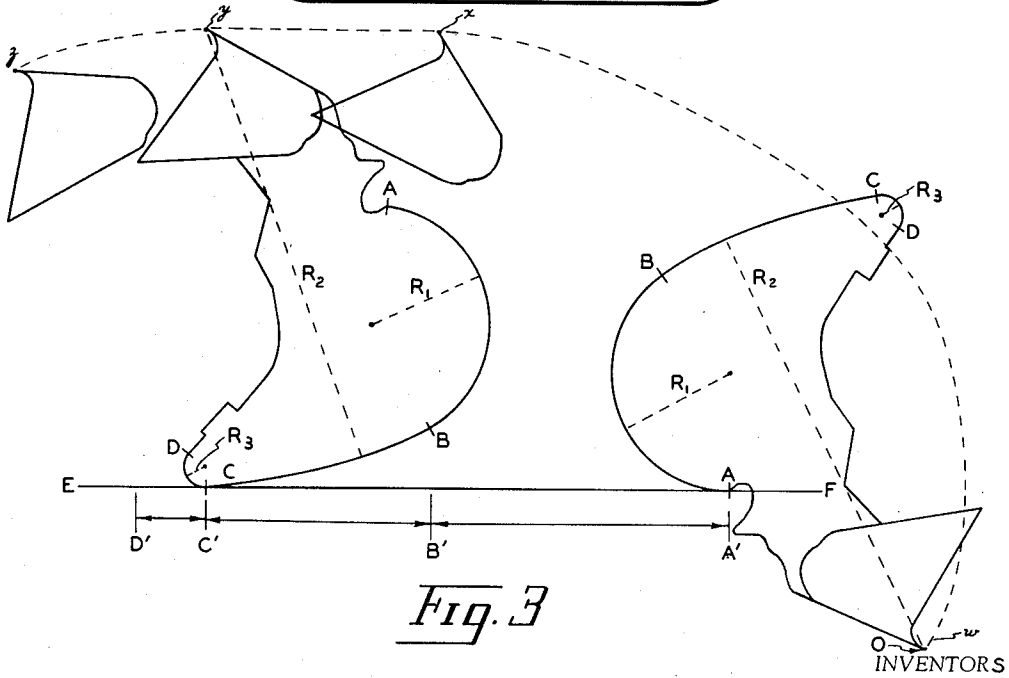


FIG. 3

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MATERIAL HANDLING MACHINE

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Application May 24, 1951, Serial No. 228,082

3 Claims. (Cl. 214—131)

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This invention relates to material handling machines having an overhead material handling bucket.

It is a principal object of the invention to provide a rugged self-propelled machine for loading and handling bulk material which is particularly adapted for use in mines and tunnels where low head room requirements and compactness are essential features.

An object of the invention is the provision of such a device for lifting, transporting and loading materials in substantial capacities.

Another object is to provide a material handling structure for an overhead material handling machine provided with variable torque ratio rocker arms, characterized by a digging and lifting portion, a transporting portion and a discharge portion.

A further object is to provide a material handling structure of the class described wherein the material handling bucket travels in a straight line parallel to the base level of the machine during the transportation portion of the digging, transporting and discharge cycle of operation.

These and other objects and advantages of the material handling machine of the invention will be apparent from the following description of a preferred embodiment of the invention with reference to the accompanying drawings in which:

Fig. 1 is a right side elevation of the overhead material handling machine of the invention;

Fig. 2 is a front view of the machine shown in Fig. 1 of the drawings; and

Fig. 3 is a diagrammatic view of the variable torque ratio rocker arm assembly with the shovel bucket at various stages of elevation.

Generally, the material handling machine of the invention comprises an automotive vehicle and a power actuated material gathering receptacle carried thereon, means for transferring the receptacle from a depressed material gathering position at one end of the vehicle to an elevated material dumping position at the other end of the vehicle comprising rail members extending along each side of the vehicle and paired rocker members each having an extended curved surface adapted to roll along the top face of one of the rail members, means connecting the receptacle in an extended position to the rocker members adjacent one end of the extended curved surfaces thereof, the curved surfaces comprising a plurality of arcuate portions, the sums of the radii of curvature of one of the arcuate portions of the curved surfaces about the point of approximate furthest extension of the shovel bucket and the

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elevations of the supporting structure above the base level of the machine at the corresponding points of contact of the arcuate portions with the supporting structure being substantially constant, whereby the point traverses a rectilinear path parallel to the base level of the machine when the arcuate portion is in rolling engagement with the supporting structure, and power actuated means for constraining the rocker members to roll along the rails on the extended curved surfaces from the end adjacent the receptacle to the opposite end thereof.

Thus it will be seen that regardless of whether the supporting tracks for the over-head material handling structure are parallel to the base level of the machine or are inclined or curved toward either the rearward or forward end of the machine with respect to the base level, the radii of curvature of the arcuate portion of the curved surfaces, which provide the low head room feature of the loading machine, about the point of furthest extension of the shovel bucket are of such length that the point of furthest extension is maintained in a rectilinear path when the arc is in rolling engagement with the supporting tracks.

With reference to the illustrative embodiments of the invention and in particular to Figs. 1 and 2, there is shown a material handling machine embodying the principles of the invention which generally comprises a main frame or body 10 mounted on crawler or self-laying track units 12. At the forward end of the frame is the power plant generally designated 14.

The main frame 10 carries the material handling superstructure and an overhead bucket assembly 16.

In the illustrated form of the invention the material handling superstructure and the overhead bucket assembly are suspended from the base of the main frame of the machine affording maximum stability and a minimum of head room when handling material under a wide variety of conditions.

The superstructure of the material handling machine generally comprises a pair of main side frames 18, secured to the main frame 10 of the loader. The upper edge of these frames carries the rails or tracks 20 which are engaged by the curved surfaces of the side frames 22 of the overhead bucket assembly.

A bumper frame 24 which also serves as a support for the bucket reels 26, and the bucket drive mechanism, generally designated 28, is supported at its lower ends from side frames 18. The upper

end of the bumper frame is secured by a pair of bumper struts 30 to the main frame of the loader.

The overhead bucket assembly of the material handling machine is of the overhead rocker type.

The side frames 22 of the rocker structure have curved lower surfaces, as will be more fully described hereinafter, for rolling engagement with the rails or tracks 20. The curved surfaces have inboard and outboard grooves to receive guide cables 32 and 34 which ends are connected in reverse manner to the rocker structure and the material handling superstructure.

In the wide section of the rocker frames are mounted spring loaded bumpers 36 which are designed to absorb the high discharge momentum of the rocker bucket, without causing the front end of the machine to lift upwardly. In the dumping position the spring loaded pistons 38 of the bumpers 36 contact bumper plates 40 secured to the top of bumper frame 24.

Flat chains or cables 42 are attached at one end to the bucket reels 26 and the other ends are secured to the rocker arms by chain end bolts 46, whereby rotation of reels 26 raises and lowers the shovel bucket 48 as the curved surfaces of the rocker frames roll along the tracks 20.

With reference to Fig. 3 of the drawings, there is shown a diagrammatic view of one form of the rocker arm structure of the invention wherein the supporting tracks are parallel to the base level of the machine, with the shovel bucket at various stages of elevation. The curved surfaces of the rocker arms which have rolling contact with tracks 20, shown diagrammatically as line E—F, comprise three arcuate portions: A—B, B—C and C—D; having radii R_1, R_2, and R_3, respectively.

Each arc, during the digging and lifting, transporting, and discharge cycle of the material handling machine, contacts the rolling path E—F between points A'—B', B'—C', and C'—D', respectively, and the tip of the bucket lip O describes a corresponding arcuate path *w—x*, *x—y*, and *y—z*.

It will be seen that the arc described by lip O of the shovel bucket reaches its maximum height above the track line E—F, at point *x* which corresponds to point B of the digging and lifting arc A—B. Point *x* is therefore the minimum head room that can be obtained for the given combination of bucket and rocker arms. From point *x* to point *y* the lip of the bucket traverses a rectilinear path parallel and equal to the track line B'—C', and from point *y* the arc described by the lip curves sharply downwardly to the discharge point *z*.

The digging arc A—B of the curved rocker arm has a relatively small radius R_1 to provide for relatively fast raising of the bucket, and the bucket lip traverses a substantial distance *w—x* compared to the distance A'—B' that the rocker arms travel along the tracks 20.

The second arcuate portion B—C has a radius R_2 centered at point O on the bucket; therefore, when the rocker arms roll on the tracks from point B' to C', the bucket lip travels an equal distance *x—y*, and the path described by point O, the center of the circle having a radius R_2, is a straight line parallel to the rolling path of the arc B—C.

The third or discharge arc C—D has a very small radius R_3; therefore, the bucket lip moves a substantial distance *y—z* for a very small distance C'—D' covered at the rolling path, thus providing a substantially rotative movement to the bucket which facilitates material discharge therefrom.

While the rocker arms shown in the drawings comprise three arcuate portions which together form the digging and lifting, transporting and discharge cycle of the overhead loader, any convenient number of arcs, may be employed, or one or more of the arcuate portions of the curved rocker arms may be of a continuously increasing or decreasing radii of curvature, wherever increasing or decreasing torque demands are desired. For example, the digging and lifting portion A—B and the discharge portion C—D of the curved surfaces of the rocker arms may be provided with continuously increasing arcs, in conjunction with the arc B—C which provides the low head room rectilinear transporting feature of the overhead shovel assembly.

Similarly, the arc B—C which provides the low head room feature of the loading machine will have an increasing or decreasing radii of curvature on transportation loaders which have rails or tracks which are not horizontal, but slope either toward the rearward or forward ends of the material handling machine. For example, on installations where it is desired to have the tracks 20 slope upwardly toward the rearward end of the machine to provide for more positive return of the shovel bucket from the discharge position to the digging position, arc B—C will be of continuously decreasing radius of curvature, approximately about the point of furthest extension of the shovel bucket. The decrease in the radius of curvature will be proportional to the increase in height from the horizontal of tracks 20 between points B' and C', the rolling path traversed by arc B—C.

The structure herein described may be variously modified and changed as to details and operation to suit different requirements and conditions, and the form of the loader adapted to carry the overhead bucket assembly may be of any convenient design.

From the foregoing description it will be seen that the invention provides a material handling machine comprising a supporting structure and a bucket assembly including a rocker structure having curved surfaces for rolling engagement with the supporting structure and a shovel bucket supported by and extending from the rocker structure, the curved surfaces comprising a plurality of arcuate portions, one of the arcuate portions having a curvature such that the point of furthest extension of the shovel bucket traverses a rectilinear path when such arc portion is in rolling engagement with the supporting structure, whereby the aims, objects and advantages of the invention are fully accomplished.

Related subject matter is disclosed and claimed in the following applications: Serial No. 191,807, filed October 24, 1950; Serial No. 191,808, filed October 24, 1950; Serial No. 230,365, filed June 7, 1951; Serial No. 261,834, filed December 14, 1951; Serial No. 261,835, filed December 14, 1951.

We claim:

1. A material handling structure for an overhead material handling machine comprising paired rocker arms and a shovel bucket supported by and extending from said arms, curved surfaces on said rocker arms adapted for rolling engagement with trackways on the material handling machine, a portion of said curved surfaces being shaped such that the point of furthest extension of the shovel bucket traverses an extended rectilinear path from a point substantially

at the center of the machine to a point substantially at the rear of the machine along the highest level reached by said point above the machine when said portion is in rolling engagement with the material handling machine.

2. A material handling structure for an overhead material handling machine as defined in claim 1 wherein said portion is intermediate the ends of said curved surfaces.

3. A material handling structure for an overhead material handling machine comprising paired rocker arms and a shovel bucket supported by and extending from said arms, curved surfaces on said rocker arms adapted for rolling engagement with trackways on the material handling machine, an intermediate portion of said curved surfaces being a circular arc about the point of furthest extension of the shovel bucket whereby

said point traverses an extended rectilinear path from a point substantially at the center of the machine to a point substantially at the rear of the machine along the highest level reached by said point above the machine when said circular portion is in rolling engagement with the material handling machine.

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