Dec. 27, 1938. J. H. OLSON 2,141,694

CONVEYING APPARATUS FOR HOT MATERIALS

Filed May 24, 1937 3 Sheets-Sheet 1

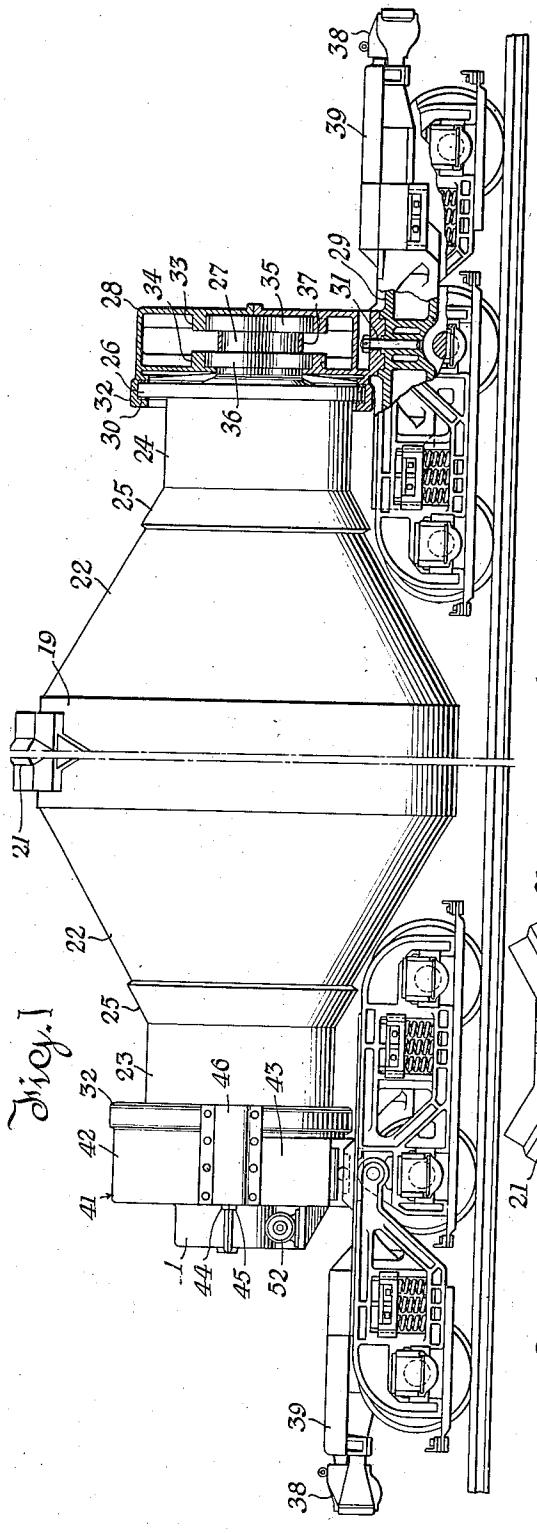


Fig. 1

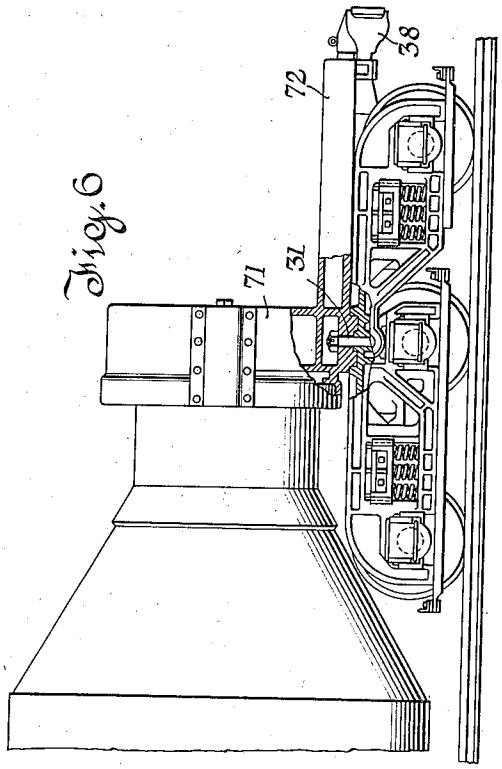


Fig. 6

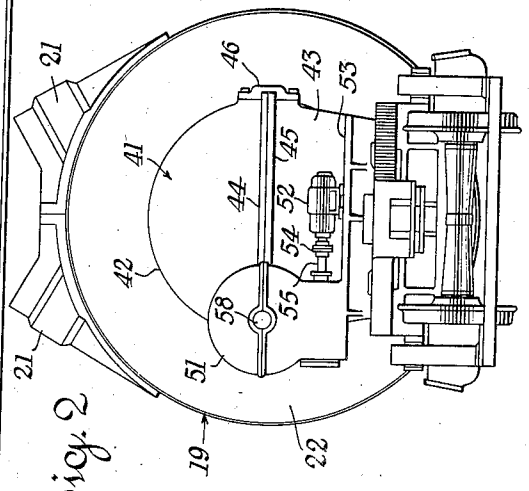


Fig. 2

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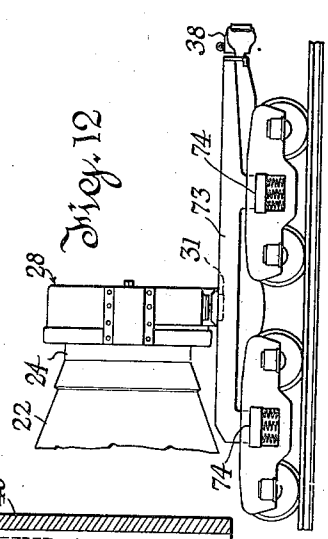


Fig. 12

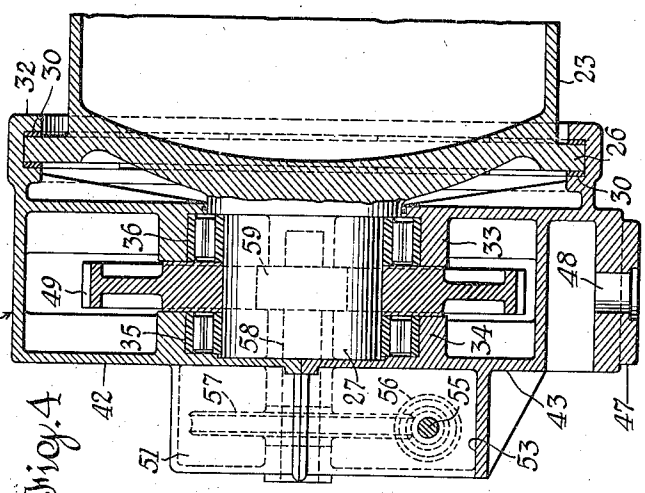


Fig. 4

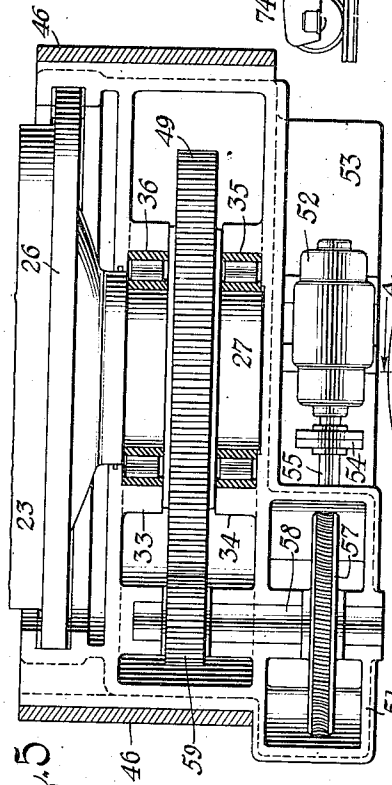


Fig. 5

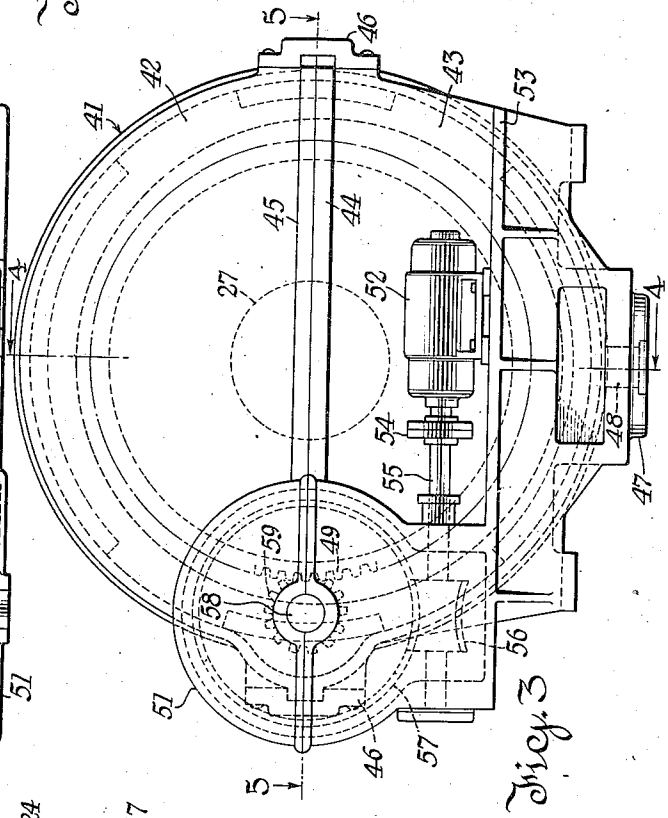


Fig. 3

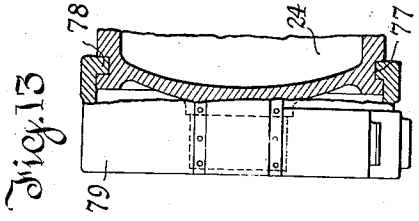


Fig. 13

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CONVEYING APPARATUS FOR HOT MATERIALS

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Fig. 10

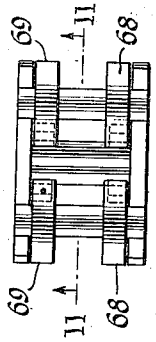


Fig. 11

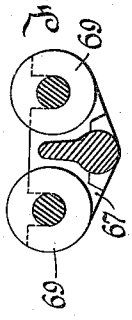


Fig. 8

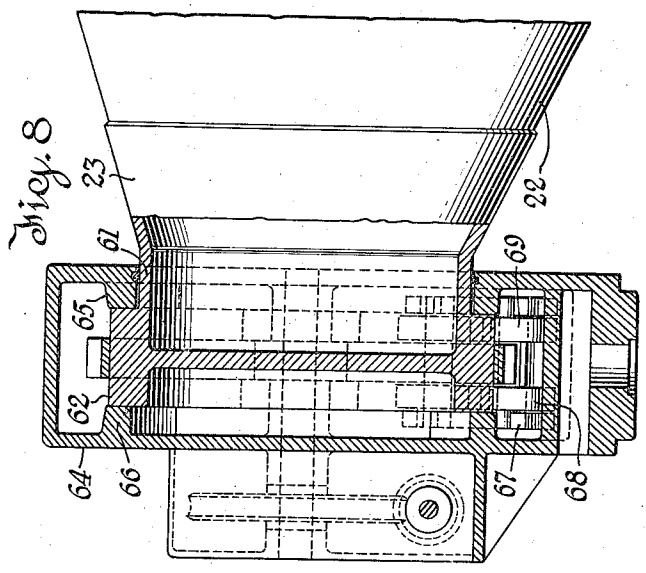


Fig. 9

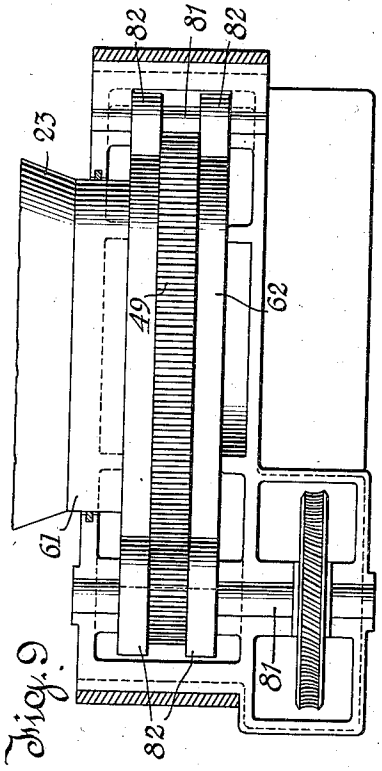
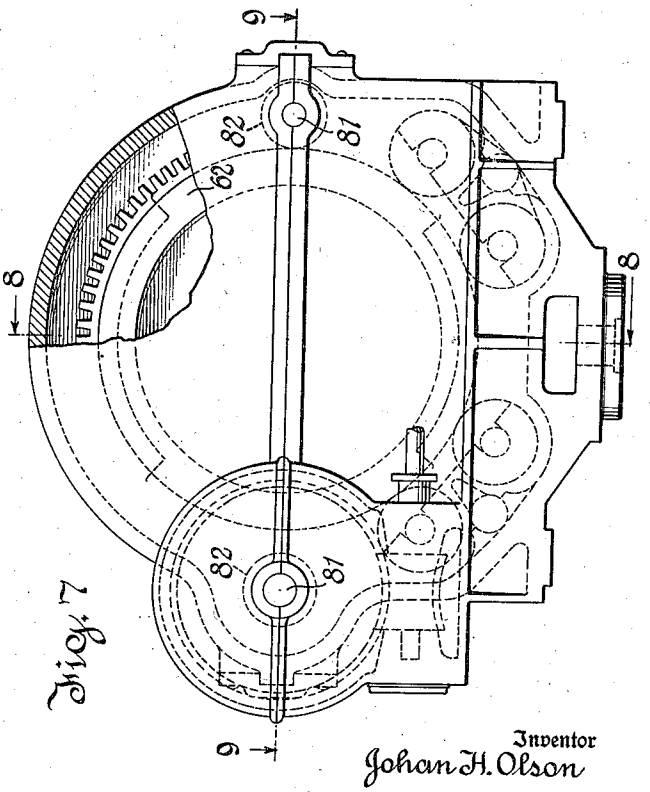


Fig. 7



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Patented Dec. 27, 1938 2,141,694

UNITED STATES PATENT OFFICE

2,141,694

CONVEYING APPARATUS FOR HOT MATERIALS

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Application May 24, 1937, Serial No. 144,506

10 Claims. (Cl. 105—271)

This invention relates to conveying apparatus for hot materials and particularly to hot metal cars for conveying hot molten metal from one point to another.

Hot metal cars at the inception of their use rarely had capacities exceeding 75 tons, but demand for larger cars has carried the capacity up to approximately 225 tons. Although there is a demand for cars of even greater capacity, there are now controlling or limiting factors such as track clearance and permissible wheel loads, so that if any further increases are to be made, the dead weight of the car must be reduced, and those factors which in the past have contributed to excessive car weight and length must be eliminted.

It is now the practice to build cars having no undercarriage and hence the car body or ladle is a structural element of the car, subject not only to the dead weight of metal but also to draft and buffing stresses. A ladle car handling hot metal is necessarily operating under conditions unfavorable to the maintenance of the best structural strength, and, furthermore, the effects of an accident would be disastrous. Consequently, the greatest attention must be given to design factors, particularly at the weakest point in the structure, namely, the neck of the ladle, which must resist not only the dead weight of the ladle and its charge of molten metal, but all draft and buffing stresses as well as the bending moments which exist and are, to a certain extent, reversible.

Heretofore it has been the practice to support the ladle neck on a long trunnion supported in two spaced trunnion bearings connected together on a unit base which swivels on the king pin of the truck. This construction is needlessly long, undesirably heavy and expensive to manufacture.

The basic thought behind the present invention is the use of a single trunnion bearing which supports the weight of the ladle and acts in conjunction with a large ring bearing or turntable which transmits, or assists in transmitting, not only the draft and buffing stresses, but also the bending moments. This structure produces advantages, the more outstanding of which are shorter bearing construction, lighter weight, simpler form for manufacture, and as good, or better, load resisting characteristics.

According to the principles of this invention, it is proposed to provide a car of maximum capacity contemplated by present practice with but a single trunnion support at each end of the body or ladle, and to so construct the trunnion supports that while the structure is actually lighter than that heretofore used, it is capable of withstanding stresses greater than could be withstood by the structures of the prior art.

Numerous advantages of the invention will be evident from the following specification when read in connection with the accompanying drawings in which:

Figure 1 is a side view of one form of hot metal car embodying the present invention, the center of the car being broken away and one of the trunnion supports shown in section;

Fig. 2 is an end view looking toward the right in Fig. 1, and showing the ladle tilting mechanism;

Fig. 3 is a view in elevation of one end of the car body or ladle shown in Fig. 1, and illustrating the details of one form of motor-operated dumping or tilting mechanism which may be utilized in connection with structures embodying this invention;

Fig. 4 is a section of the trunnion support at the left hand end of Fig. 1, the section being taken substantially on the line 4—4 of Fig. 3;

Fig. 5 is a horizontal section taken on line 5—5 of Fig. 3;

Fig. 6 is a side elevation of a modified form of truck and trunnion connection with parts broken away to show the interior construction;

Fig. 7 is a side view, partly in section, of a modified form of ladle trunnion support which may take the place of the structure shown in Fig. 3;

Fig. 8 is a section on line 8—8 of Fig. 7;

Fig. 9 is a section on line 9—9 of Fig. 7;

Fig. 10 is a detail view of one form of bearing suitable for use in connection with the modified form of invention shown in Figs. 7 to 9;

Fig. 11 is a section on line 11—11 of Fig. 10;

Fig. 12 is a partial side elevation of a car embodying the present invention, but employing an eight wheel truck; and

Fig. 13 is a detail view showing a still further embodiment of the ladle trunnion support.

Referring now to Fig. 1 of the drawings, reference character 19 designates the usual hot metal car body or ladle having conical end portions 22 rigidly connected to trunnions 23 and 24 terminating in reduced portions or journals 27. The body 19 is lined with the usual refractory and is provided with the usual sets of pouring spouts 21 as best shown in Fig. 2. The trunnions 23 and 24 are similarly constructed except that trunnion 23 has attached to it means for dumping or tilting the ladle, to discharge the contents from the pouring spouts 21. Since these trunnions are duplicates, a description of one of

them only will be necessary. Trunnion 24, for example, comprises a central cylindrical body portion terminating at one end in a flared flange 25 fitting closely over the end portion 22 of the ladle. The opposite end of trunnion 24 comprises, as here shown, an annular bearing ring or flange 26 and a reduced portion or journal 27.

A pedestal housing 28 upstanding from the truck bolster 29 and attached to it by a pivotal connection or center bearing 31, has an annular enclosing flange or bearing portion 32 adapted to enclose the ring 26 and to engage its lateral faces in load carrying contact. Filler pieces 30 may be interposed between flange 32 and ring 26. The housing 28 is preferably, and as shown, constructed of two hollow arcuate sections, containing two bearing supporting flanges 33 and 34 spaced from one another and receiving the races of two sets of roller or other anti-friction bearings 35 and 36. An annular member 37 is carried by the journal 27 between the two bearings 35 and 36, and takes the place of the ring gear at the left-hand end of the ladle. It serves as a spacer for the bearings.

Truck bolster 29 may be of conventional construction but is here shown as mounted on a six wheel truck in which the draft gear connection 38 is made directly to the bolster and is provided with a coupler pocket 39. It will be noted that the arrangement of the connection 38 is such that all forces transmitted from the truck to the ladle must be withstood by the pivot connection or trunnion center bearing 31. Although the drawbar pull will be applied in all cases substantially in line with the center bearing, in the preferred form of the invention the draft gear connection is made directly to the truck below the center bearing. As will be indicated hereinafter, the draft gear connection can also be made to the trunnion support above the center bearing.

In utilizing a hot metal car embodying the present invention, it will be possible to tilt the ladle by providing it with lugs to which the hook of a crane may be attached. However, it is preferred that motor operated dumping means be provided in accordance with the usual present practice, and the ladle so mounted that its center of gravity is slightly below the center line of the supporting trunnions. This is the usual arrangement provided as a safety precaution in case the ladle tilting mechanism should break or become disconnected.

The tilting mechanism and the method of associating it with a trunnion of the ladle will now be described, reference being had to Figs. 3 to 5 which show the structure of the left end of Fig. 1.

The housing 41 is preferably constructed in two sections 42 and 43 terminating in mating flanges 44 and 45. These flanges may be secured together by straps 46 bolted to the two sections as indicated in Fig. 1. This is a simple, effective, and strong method of securing the two housing sections together and one permitting their separation by simply removing a few bolts, rather than the expensive and time consuming construction usually provided, in which the two mating flanges have bolts passing through them at short intervals entirely around the housing. The bottom half 43 of the housing terminates in a trunnion support 47 cored at 48 to receive the king-pin of the center bearing and adapted to rest in an annular cup in the bolster 29. As previously described, the housing carries enclosing flanges 32 which embrace the lateral sides of ring 26 on the end member or trunnion 23. The journal 27, as previously described, is supported in two sets of roller bearings 35 and 36 confined and supported inside of the bearing supporting flanges 33 and 34. The journal 27 carries a ring gear 49 rigidly secured thereto between the flanges 33 and 34 and serving to space the bearings as indicated in Fig. 4.

The two housing sections 42 and 43 are extended to form a gear housing 51 supporting and enclosing drive gearing to connect motor 52 with the ring gear 49. The lower housing section 43 carries an extended platform 53, upon which motor 52 is mounted. The motor is coupled at 54 with a shaft 55 journalled in the lower half of housing 51 and having attached to it a worm 56 which meshes with a worm wheel 57 carried on a shaft 58. Also mounted on shaft 58 is a pinion 59 which meshes with the ring gear 49. It will be seen that this provides a very low ratio reduction gearing between the motor 52 and the ring gear 49. Since the trunnions of the ladle are supported in anti-friction bearings, and a low driving ratio is provided between the ladle and the motor, a motor of very much smaller size than used heretofore may perform the function of tilting the ladle. Furthermore, the arrangement is such that the two end members 23 and 24 may be of identical construction regardless of whether they are located at the drive end or dead end of the ladle. Consequently, the same reference characters have been applied to both trunnions, except to distinguish one end of the ladle from the other where connection is made to the ladle end portions 22.

The simplest method of enclosing and supporting the trunnion supporting thrust flange and the trunnion bearings is that illustrated in Figs. 3 to 5. This construction has the advantage that all vertical stresses are supported by the journals 27 whereas all horizontal stresses are borne by the ring bearing construction comprising the flanges 26 and 32. It is to be understood that other constructions embodying the principles set forth herein may be utilized to advantage. One such alternative construction is that illustrated in Figs. 7 to 11, wherein the trunnion 23 of the ladle is extended to form a cylindrical portion 61 terminating in a wide combined bearing ring and journal 62. In other words, instead of providing a trunnion having a journal of reduced diameter and a flange for cooperation with a bearing ring of larger diameter than that of the journal, a single member of large diameter performs the two functions. In this form of the invention the lateral faces of journals 62 absorb and carry the horizontal stresses, whereas the peripheral surface of 62 bears the vertical stresses.

This modified construction is best shown in Fig. 8 of the drawings, wherein the housing 64 is made up of two sections of generally similar construction to those indicated 42 and 43 in Fig. 3, and held together in a similar manner. The bottom section of the housing 64 cooperates with the bolster 29 in the same manner as before and also carries the same supporting flange for the driving motor. The interior of the housing, however, is of somewhat narrow construction and forms two annular supporting flanges 65 and 66 adapted to engage the sides of the ring 62. In this form of the invention, the ring 62 rests on two sets of roller bearings indicated in Fig. 8. Each set of bearings consists of a rocker mount 67 carrying two sets of spaced rollers 68 and 69, cooperating with the lateral peripheral portions

of the ring 62, and having a self aligning characteristic.

As indicated in Figs. 7 and 9, these roller bearings are carried in the lower half of the housing 64, and support the bottom of the trunnion. The weight of the parts is sufficient to insure bearing contact between the thrust flange and the bearings at all times without the use of bearings at the top of the housing. Two lateral confining roller bearings 81 are journalled between the two parts of the housing and include rollers 82 engaging ring 62 on either side of the ring gear 49 or equivalent spaces. Inasmuch as the driving motor and gearing used in this form of the invention may be identical with that already described in connection with Fig. 3, further description of the same will be unnecessary.

The dead end trunnion may be supported similarly to that shown in Fig. 8, the ring gear 49 of course being omitted, and a spacer substituted. Where the ring gear is omitted, the rollers 68 and 69 may, if desired, extend across the entire face of the bearing ring 62 in order to increase the bearing contact. It will be obvious that instead of the roller bearings shown, other types of anti-friction bearings may be provided. It will also be possible to support the trunnion directly in the housing without the interpositioning of anti-friction members.

So far in this description, it has been assumed that the draft gear connections are made directly to the truck bolster in the manner indicated in Fig. 1, the coupler pocket also being attached to that bolster below the point of contact between the bolster and the trunnion. In some instances, however, it may be possible and desirable to mount the coupler pocket on the trunnion bearing as indicated in Fig. 6 of the drawings, wherein the six wheel truck is generally similar in construction and arrangement to that shown in Fig. 1. In this instance, however, the coupler pocket 72 is attached to and preferably forms an integral part of the housing 71. Both forms of the invention are practicable. The drawbar pull takes place through the center bearing 31 in each case and is in line with the same. In practice, the form of Fig. 1 will generally be preferred because of the increased facility with which the parts operate when the car is passing around a sharp curve, whereas, in case of a collision between cars such as to tend to lift the coupling support with or without the truck, the bending moment exerted upon the ring bearing will be considerably less in the form of the invention shown in Fig. 1 than in that of Fig. 6, and for that reason the form of Fig. 1 is preferred. However, the construction of Fig. 6 may be utilized and offers many of the advantages of the preferred form.

Although in the description so far given, all of the trucks have been illustrated as of the six wheel type, obviously the invention is not limited to any particular type of truck so long as it provides for a single trunnion bearing pivoted with respect to the truck and having sufficient strength to perform the desired functions. Whereas, in practice, it will generally be found desirable to use a six wheel truck, no limitation to that type truck is to be implied. In order to make it clear that the invention is of general application, there has been illustrated in Fig. 12 a construction in which an eight wheel truck is used.

Referring to Fig. 12 reference character 22 designates the end portion of the ladle as before, terminating in a trunnion supported in a housing 38. The lower section of the housing 28 has a center bearing 31 cooperating with a truck bolster 73 having the usual connections to the springs as indicated at 74. Here the drawbar pull is communicated directly from the coupling 38 to the bolster and this coupling is supported and guided by the bolster 73 as shown. Inasmuch as the structure of the trunnion bearing and ring bearing inside of the housing 28 may conform to either of the constructions already described and illustrated or their equivalents, no specific description thereof will be necessary. It will be understood that here as in previously described constructions the drawbar pull takes place in a line passing through the center bearing 31, and any suitable changes may be made in the details to facilitate the passage of the car around curves or through other difficult locations to be encountered.

The ring bearing carried by the ladle and interlocking with cooperating flanges on the trunnion housing is but one embodiment of the principles of the present invention. The inventive concept is not limited to this precise arrangement. Obviously, any interlocking connection for arresting all horizontal stresses between the ladle and the housing, and to permit tilting of the ladle, and in which the diameter of the member on the ladle is comparable with the ladle diameter may be utilized. For example, as indicated in Fig. 13, the parts shown in Fig. 1 may be reversed so that the ring 78 is carried by the housing 79 and cooperates with a groove 77 in the end member 24. In this construction as in that shown in Fig. 1, vertical stresses are borne by the journal bearing while all horizontal stresses are carried by the ring bearing structure. While as a practical matter the arrangement of Fig. 1 is preferred, other structures such as those illustrated may be utilized without departing from the spirit of the invention.

It will be clear from the foregoing description that the above invention may be embodied in various forms, any one of which results in a simplified construction which decreases both the cost and weight of the car. The provision of large diameter ring bearings carried by the trunnions of the ladle provides strength and effective support, making it possible to substitute a single trunnion bearing where two such bearings have heretofore been considered necessary. The provision of suitable anti-friction bearings reduces the amount of power required to tilt the ladle and, therefore, results in a marked economy from the use of a materially smaller motor for performing the tilting operation. Practice of the invention, therefore, effects a material decrease in the amount of heavy metal used in the construction of the car, a smaller motor for tilting the ladle and numerous other reductions in the amount of material required. Consequently, the ladle may be made of increased capacity and one car be made to carry out the purpose which has heretofore required a plurality of cars, or in any event, the number of cars required to handle a given quantity of metal may be greatly reduced.

The cars herein shown and described have been referred to as hot metal carrying means, but obviously they may find application for transporting other materials either solid or liquid. Consequently, no limitations are to be implied except where the language of the claims renders it necessary.

What is claimed is:—

1. A dump car for conveying hot metal and the

like comprising a pair of separated trucks, each having a pivot means; a hollow car body tiltably supported on said trucks; a single housing pivotally connected to each truck in substantially vertical alignment with said pivot means; and having a pair of spaced annular flanges; a trunnion at each end of said body; anti-friction bearings in said housings for supporting said trunnions; and a single annular bearing ring carried by each of said trunnions inwardly of said bearings and embraced by said pair of flanges to absorb the horizontal forces incident to supporting said body and transporting the same.

2. A hot metal car comprising a plurality of trucks each having a bolster with a circular seat; a single pedestal upstanding from said seat and pivoted therein, said pedestal comprising a plural-part housing having a pair of annular bearing supporting flanges in close axial proximity to one another, and an annular ring bearing member at one side of said flanges adjacent said body; a car body having reduced ends terminating in trunnions embraced by said flanges to carry vertical stresses and an annular flange cooperating with said ring bearing member and embraced thereby to form annular interlocking engagement between said trunnions and said pedestals to carry horizontal stresses only; and means associated with one of said pedestals and with said body for tilting said body to dump the same.

3. In a dump car construction a pedestal comprising a hollow housing made up of upper and lower hollow sections having mating flanges at their open ends and adapted when assembled to form a drum-shaped structure open at one side; a pair of annular and axially spaced trunnion supporting flanges formed by assembly of said sections; a pair of axially spaced radial flanges on the housing at the open side thereof; and a king pin bearing projection carried by the lower section of said housing.

4. A dump car comprising an elongated body terminating at each end in a trunnion; a plurality of trucks one for supporting each end of said body, each truck having pivot means and a single housing pivotally mounted thereon with its pivot in substantial vertical alignment with the truck pivot means; trunnion supporting means in each of said housings for receiving vertical stresses imposed by the car body; and a single annular interlocking connection between each of said housings and its associated trunnion, said connections being disposed axially between the car body and the trunnion supporting means, and arranged to receive and arrest the horizontal stresses transmitted between the housings and the trunnions but to be substantially free of vertical stresses.

5. A dump car comprising an elongated body terminating at each end in a trunnion; a plurality of trucks one at each end of said body for supporting the same, each truck having pivot means and a single housing pivotally mounted thereon with its pivot in substantial vertical alignment with the truck pivot means; trunnion supporting means in each of said housings for receiving vertical stresses imposed by the car body; anti-friction bearing means for said trunnions; and a single annular interlocking connection between each of said housings and the car body and located axially inward of said trunnion supporting means, said connections being arranged to receive and arrest the axial stresses transmitted between the housings and trunnions and to withstand the bending moments produced by said body on said housings while permitting tilting movement of said body, said connections also being substantially free of radial stresses.

6. A dump car comprising an elongated body terminating at each end in a trunnion; a single annular flange only carried by said body at each end thereof and having a diameter approximating that of said trunnions; a plurality of trucks at each end of said body for supporting the same, each truck having a center bearing; a single upstanding load-supporting pedestal housing pivotally connected to each of said trucks at one point only in substantially vertical alignment with said center bearing, said housing having a trunnion bearing therein for receiving vertical stresses; and means integral with said housings for enclosing and engaging both lateral faces of said annular flanges to absorb horizontal stresses acting between the body and housings.

7. A dump car comprising an elongated body terminating at each end in a trunnion; an annular flange having substantially flat lateral faces adjacent each end of said body; a plurality of trucks one for supporting each end of said body, said trucks each having a pivot means; a single housing on each truck and pivoted at a single point thereto in substantially vertical alignment with said pivot means; anti-friction bearing means in each of said housings for supporting one of said trunnions therein; and means comprising axially spaced annular flanges carried by said housings for enclosing and engaging both lateral faces of the first mentioned annular flanges to absorb horizontal stresses acting between the body and housings, the ring bearing formed by said flanges being located at least in part between said body and said pivot means.

8. A hot metal car comprising a pair of trucks each having a center bearing and each having a single pedestal thereon and having a pivot means in substantially vertical alignment with said center bearing; a car body mounted between said trucks and having tapered ends terminating in trunnions supported by said pedestals; and means comprising an annular bearing having a diameter of the order of that of said trunnions located between each of said pedestals and said body for absorbing only the horizontal acting buffing and drawing stresses imposed upon the car.

9. A hot metal car comprising a car body having conical ends terminating in trunnions each having a single annular flange having a diameter of the order of that of the trunnions and having both lateral and peripheral bearing surfaces; a truck at each end of said body for supporting the same, said truck having a center bearing, a single upstanding load-supporting pedestal housing only on each truck and having a single housing means for enclosing one of said flanges; a single pivot means between said pedestal housing and said truck, said pivot means being in substantially vertical alignment with said center bearing; annular members projecting axially inward of said housing for engagement with the lateral faces of said flanges to absorb axial stresses; and anti-friction bearing members between the bottom of the housing and said flanges and bearing against the periphery of said flanges for absorbing radial stresses.

10. A hot metal car comprising a car body having conical ends terminating in trunnions; a truck at each end of said body for supporting the same; a single radially projecting flange on each of said trunnions, said flange having lateral bear-

ing faces for receiving axial stresses, an extended annular periphery for receiving vertical stresses and a diameter of the order of that of the trunnions; a single upstanding load supporting pedestal housing only pivotally mounted on each of said trucks, and comprising a housing means having two annular bearing surfaces engaging the two lateral faces of each of said flanges, said flanges and said pedestal mounting being in substantially vertical alignment with said center bearing; and bearing means in said housings for cooperation with the peripheral bearing surfaces of said flanges.

JOHAN H. OLSON.

CERTIFICATE OF CORRECTION.

Patent No. 2,141,694. December 27, 1938.

JOHAN H. OLSON.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, first column, line 5, claim 1, strike out the semicolon after "means"; and second column, line 8, claim 6, after the word "trucks" insert one; line 11, same claim, after "housing" insert only; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 7th day of February, A. D. 1939.

Henry Van Arsdale.

(Seal) Acting Commissioner of Patents.