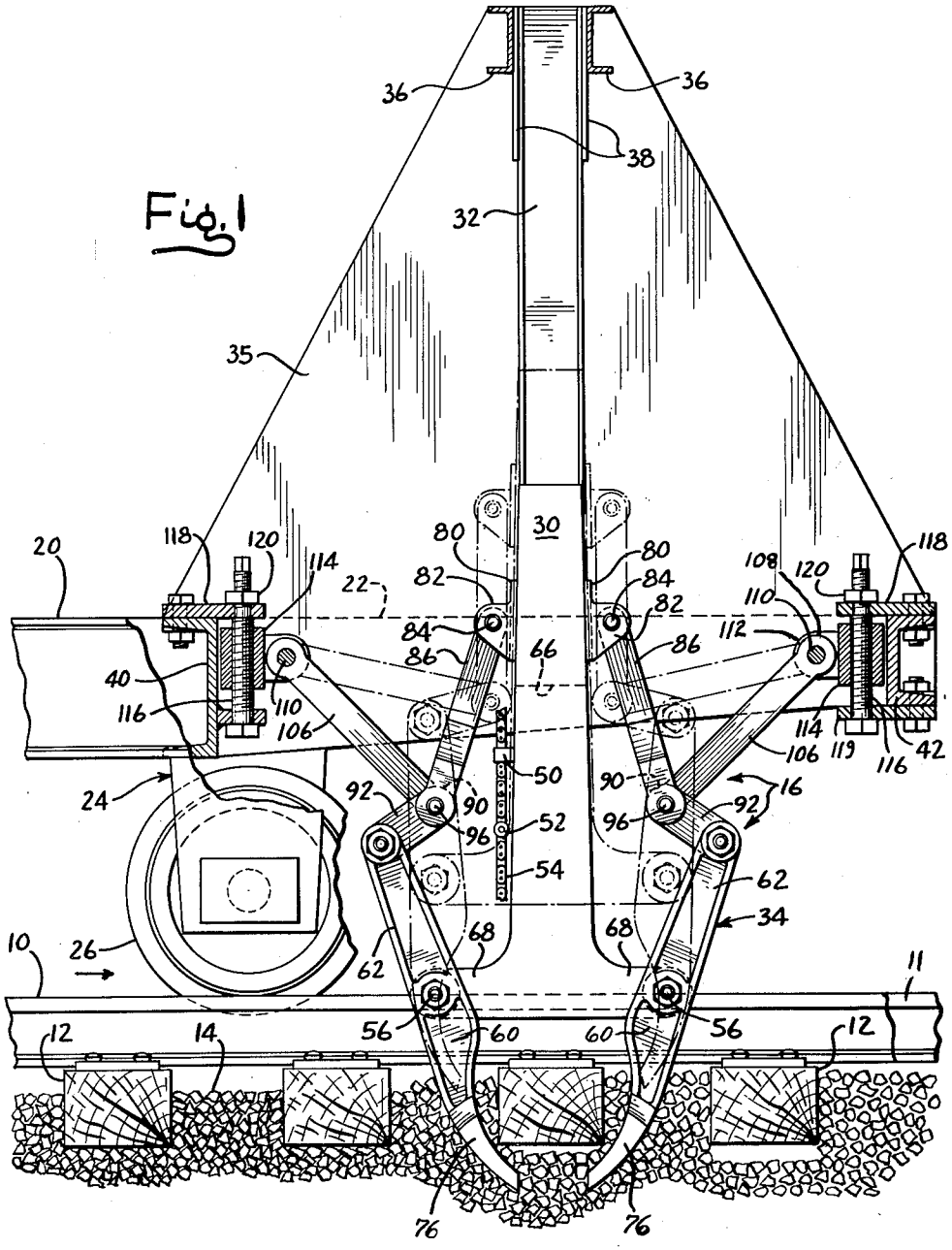
April 10, 1962 F. H. PHILBRICK 3,028,818

BALLAST TAMPING MACHINE WITH TOGGLE ACTION TAMPING MECHANISM

Filed Jan. 13, 1960 4 Sheets-Sheet 1

Fig. 1



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BALLAST TAMPING MACHINE WITH TOGGLE ACTION TAMPING MECHANISM

Filed Jan. 13, 1960 4 Sheets-Sheet 2

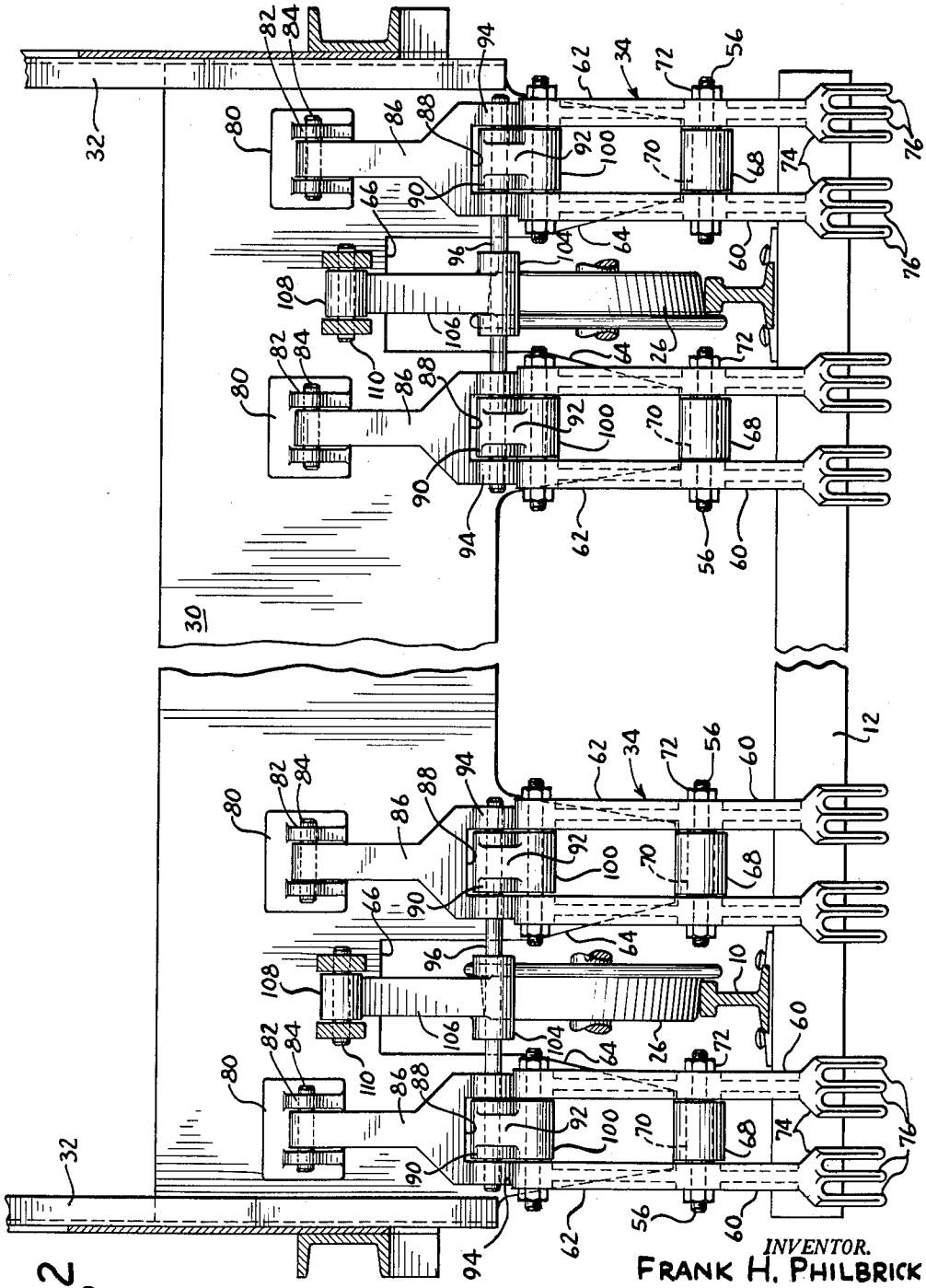


Fig. 2

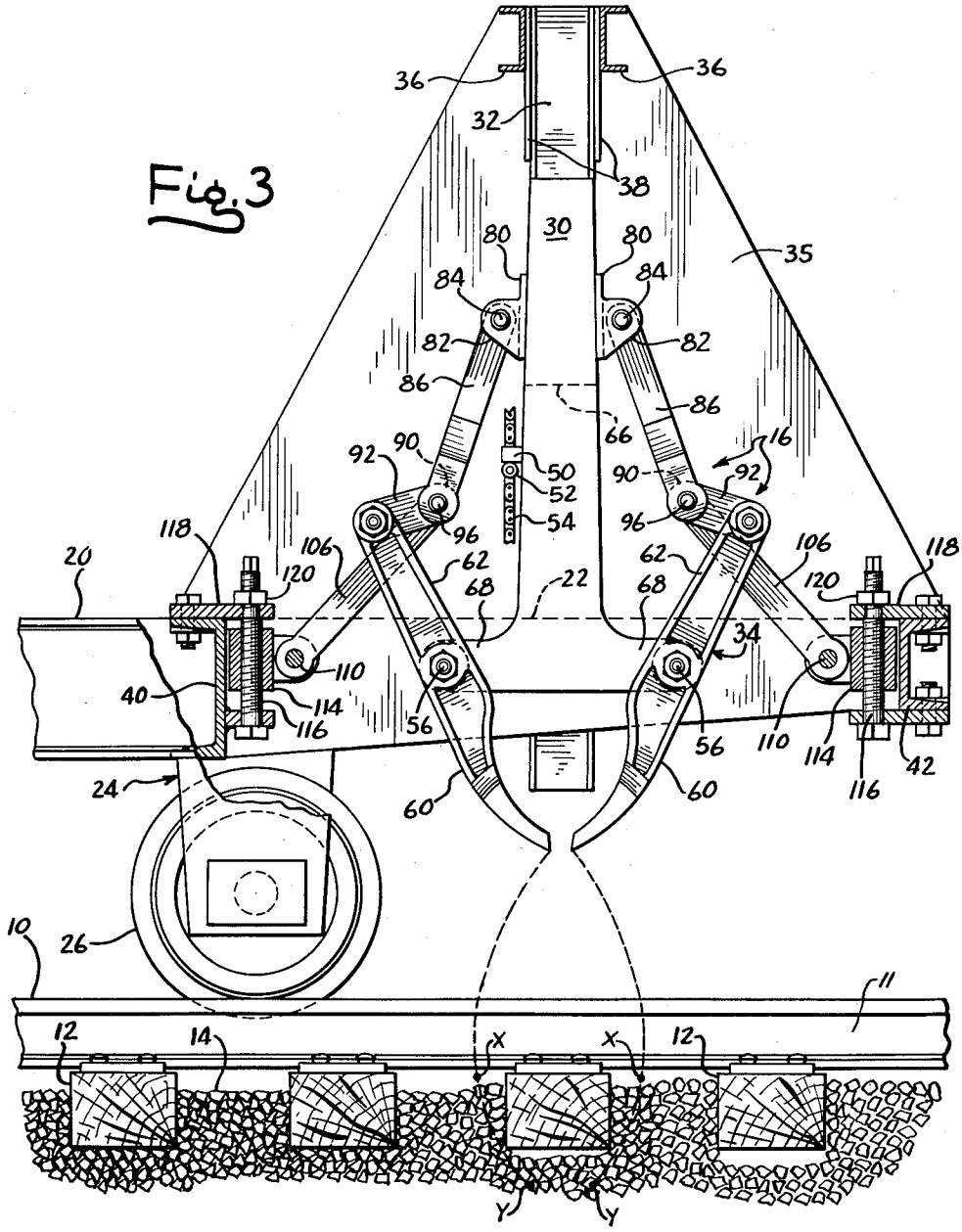
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BALLAST TAMPING MACHINE WITH TOGGLE ACTION TAMPING MECHANISM

Filed Jan. 13, 1960 4 Sheets-Sheet 3

Fig. 3



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BALLAST TAMPING MACHINE WITH TOGGLE ACTION TAMPING MECHANISM

Filed Jan. 13, 1960 4 Sheets-Sheet 4

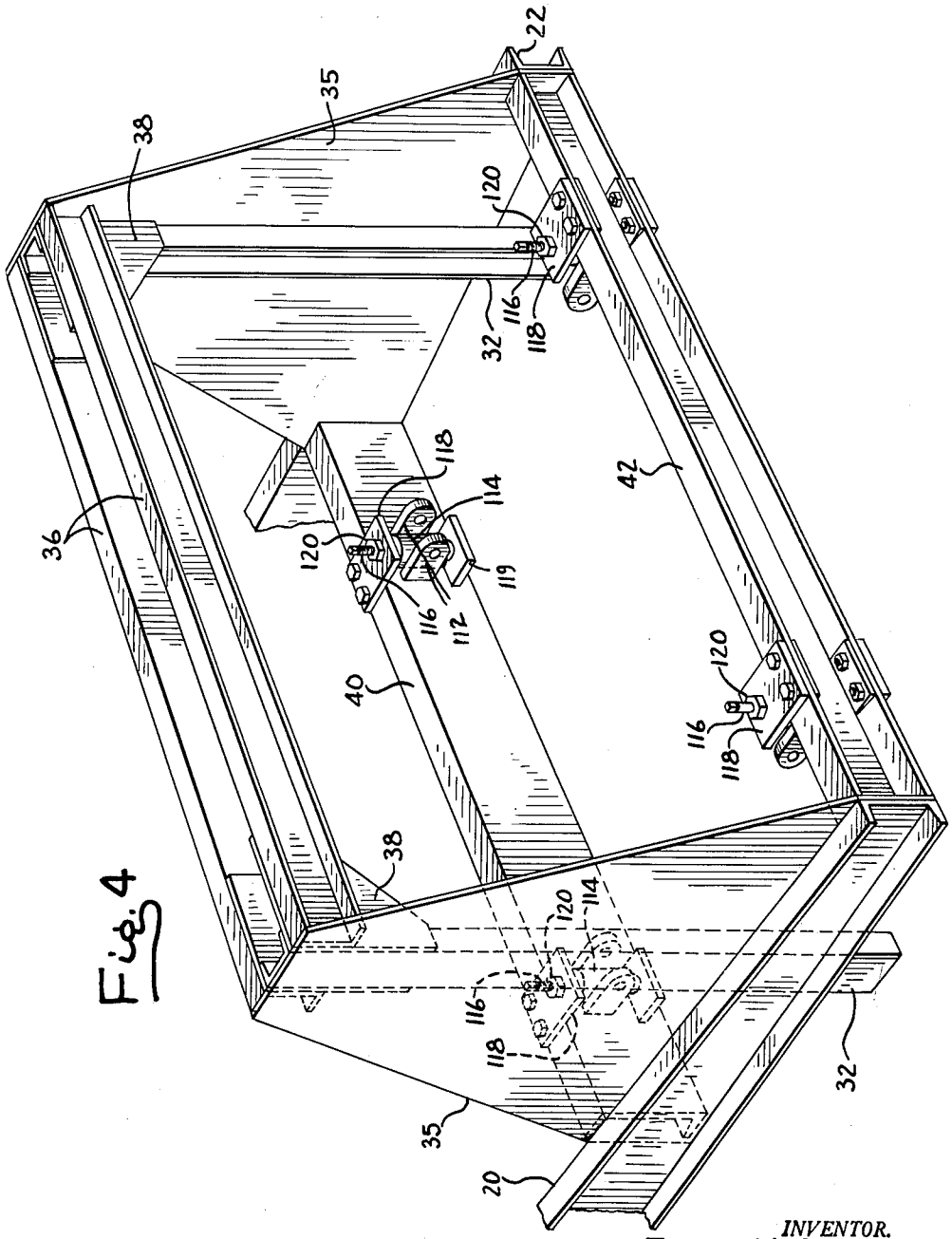


Fig. 4

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3,028,818
BALLAST TAMPING MACHINE WITH TOGGLE ACTION TAMPING MECHANISM

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Filed Jan. 13, 1960, Ser. No. 2,180
8 Claims. (Cl. 104—12)

The present invention relates to tie tamping or ballasting machines of the general type shown and described in my United States Patent No. 2,536,887, granted on January 2, 1951, and entitled "Ballast Tamping Machine," and, in certain respects, the present invention is an embodiment and adaptation of certain features disclosed in such patent. The invention is also an improvement upon and an adaptation of the ballast tamping machine shown and described in my United States Patent No. 2,482,123, granted on September 20, 1949.

It is among the general objects of the present invention to provide an improved ballast tamping machine of the type shown and described in my above mentioned United States patents wherein the tamping shoes or elements are positively actuated under the control of a drop-head to apply pressure to the ballast and force the same under the ties by a positive impacting thrust, as distinguished from that class of machines wherein a vibratory action of the tamping elements is relied upon to "slither" the ballast by gravity beneath the ties and into any pockets or voids which may be present to receive the ballast, and wherein the machine is highly efficient in packing the ballast under the ties so that the latter will be raised against the rails and forced into firm contact with the latter.

Another general object of the invention is to provide an improved machine of this character wherein the tamping head and all of the tools which are operatively mounted thereon are operatively positioned at the front end region of the supporting truck therefor and in such a manner that the front and rear wheels of the truck may at all times be supported on portions of the railway track which are firmly supported on ties which previously have been packed with ballast.

The ballast tamping machines shown and described in my two above mentioned patents, as well as certain other machines of this general type, rely for their tamping action upon the free fall by gravity of a relatively massive drop-head and the motion of the drop-head is transmitted to the tamping elements proper through a cam and lever mechanism wherein a change in cam direction is encountered after the tamping shoes have actually entered the ballast. Such direction change in the cam slope takes place near the bottom of the free fall of the drop-head and it involves the loss of considerable power which, otherwise, would be applied to the task of forcing the tamping shoes inwardly and beneath the tie. It also involves an appreciable impact force directly on the machine framework which better could be applied to the tamping shoes and which results in undesired vibration and shock to the machine as a whole. More important, however, is the fact that the cam employed for guiding the linkage mechanism which controls the operation of the tamping shoes is heavy and cumbersome and tends to throw the machine off balance, especially when the drop-head is positioned at the front of the machine and overhangs the front wheels. Still further, the width of the cam structure, particularly at the bottom regions thereof where the direction change takes place, is, of necessity, sufficiently great that it precludes positioning the drop-head close to the front wheels and, as a consequence, the drop-head must be positioned forwardly of the front wheels an appreciable distance, thus further contributing

toward machine unbalance and, on occasions, causing the rear wheels to leave the track.

The present invention is designed to overcome the above noted limitations that are attendant upon the construction and use of conventional ballast tamping machines and, toward this end, the invention contemplates the provision of a machine wherein the cumbersome cam mechanism is dispensed with and, instead, the accelerating motion of the drop-head is transmitted to the tamping shoes by a leverage system alone, such system involving a toggle action wherein the moment of tamping force applied to the tamping shoes to produce inward pressure on the ballast tending to force the latter beneath the tie constantly increases as the drop-head falls, and as the drop-head approaches its lowermost position, this tamping moment is at its maximum, it having increased several fold from the time the tamping shoe enters the ballast until its movement is finally arrested by the damping action of the ballast against which the tamping force is dissipated.

The provision of a ballast tamping machine of the character briefly outlined above being among the principal objects of the invention, a still further and important object is to provide such a machine wherein the toggle and other linkage is of improved design and is so constructed that it does not interfere with placement of the drop-head and the supporting structure therefor close to the front wheels of the machine, thus providing a machine which has an adequate degree of stable equilibrium so that the same will at all times find firm support on the track undergoing installation or repair.

It is still another object of the invention, in a machine of this sort, to provide an improved linkage mechanism wherein the path of movement of the working end of the tamping shoe, after it has initially entered the ballast, is such that it will follow a more effective tamping path through the ballast than has heretofore been possible with machines having cam-operated tamping shoes.

A still further object of the invention is to provide a control linkage for effecting operation of the tamping shoes and having associated therewith means whereby the "throw" of the tamping shoes associated with the machine may be adjusted to accommodate different heights of track rails.

Finally, it is an object of the invention to provide a toggle action linkage mechanism for controlling the operation of a series of tamping shoes on a ballast tamping machine wherein, although high toggle forces are applied to the tamping shoes, the linkage mechanism is incapable of locking itself in a dead-center position so that the drop-head is always capable of being readily elevated at the end of each operating cycle.

Numerous other objects and advantages of the invention, not at this time enumerated, will become readily apparent as the following description ensues.

In the accompanying four sheets of drawings forming a part of this specification, one illustrative embodiment of the invention has been shown.

In these drawings:

FIG. 1 is a fragmentary vertical sectional view taken through a portion of the machine framework in the vicinity of the tamping instrumentalities, showing the tamping elements in their operative working position against the ballast;

FIG. 2 is a fragmentary side elevational view of portions of the structure shown in FIG. 1;

FIG. 3 is a side elevational view similar to FIG. 1 showing the tamping elements in their raised inoperative position; and

FIG. 4 is a fragmentary perspective view of a portion

of the machine framework in which the drop-head is guided in its vertical movements.

Referring now to the drawings in detail, the rails of a railway track are designated at **10** and **11**, respectively, and they are supported in the usual manner on ties **12** beneath and around which the ballast **14** is adapted to be packed. The ballast tamping machine of the present invention is adapted to be tractionally supported on the rails **10** and to travel therealong in a forward direction as indicated by the arrow in FIG. 1 with the entire weight of the machine being supported on ties **12** beneath which ballast **14** has previously been packed or tamped by the tamping instrumentalities **16** associated with the machine. In other words, the machine operates upon forward ties to pack the ballast therebeneath and then travels forwardly in a progressive manner so that as the tamping instrumentalities seek new ties for tamping purposes, the machine moves onto a portion of the rail which is supported by ties which have just been operated upon.

The tamping instrumentalities **16** of the present invention may be operatively installed on a wide variety of machines of the drop-head type and the particular machine selected for illustration herein has been fragmentarily shown with only such parts as pertain to the guiding of the drop-head in its vertical movements as well as certain linkage reaction points on the machine framework being illustrated. Otherwise, the machine illustrated herein may be substantially the same as that shown and described in my Patent No. 2,536,887 referred to above. The invention is concerned solely with the tamping instrumentalities and the drop-head on which they are mounted, at least in part, and with the manner in which these instrumentalities are operated from fixed reaction points on the machine framework by relative movement between the drop-head and framework. For a full understanding of the machine which has been only fragmentarily illustrated herein and of the manner in which vertical movements are applied to the drop-head, reference may be had to such patent.

The machine on which the tamping instrumentalities **16** of the present invention are mounted includes a car truck frame having side frame members **20** and **22** which are supported upon conventional car wheel assemblies **24**, the latter including flanged car wheels **26** designed to travel on the rails **10**. Only the front car wheels have been illustrated herein since only the extreme front end region of the machine which supports the tamping instrumentalities **16** bears a specific relationship to the present invention. A portion of the side frame members project forwardly beyond the forward car wheel assemblies **24** and may be regarded as a forward extension of the machine framework.

The tamping instrumentalities **16** are operable under the control of a drop-head **30** which extends transversely of the truck framework and is mounted to slide vertically in channel-like guides **32** (FIG. 4) which are fixedly supported in the machine framework. The drop-head **30** carries the tamping elements **34** and functions as a drop hammer for operating the elements to tamp the ballast **14** beneath the ties **12** on which the rails **10** are laid. The guides **32** are attached to side plates **35** which, in turn, are secured to the side frame members **20** and **22** and which serve to reinforce and brace the vertical guides **32** against vertical misalignment. The upper ends of the guides are rigidly cross-connected by channel beams **36** and gusset plates **38** while the lateral ends of the plates **35** are rigidly cross-connected by channel beams **40** and **42**. From the above description, it will be seen that the assembly just described and which forms the disclosure of FIG. 4 provides a rigid cage-like structure on the machine framework forwardly of the front wheels **26** including spaced apart channel beams for the operation between them of the drop-head **30** and the various tamping instrumentalities associated with the same.

The drop-head **30** is operable by power from an internal combustion engine carried by the machine framework through mechanism (not shown herein) which lifts the drop-head throughout a predetermined distance and then releases it for a drop-hammer stroke, during which stroke the various tamping elements **34** are caused to move bodily with the drop-head and, in so moving, they are brought into tamping relation with respect to the tie **12** being treated and with respect to the adjacent ballast **14**. The motor and mechanism by means of which the drop-head is thus actuated and caused to move in its vertical path within the guides **32** forms no part of the present invention and, for a full disclosure of such mechanism, reference may be had to my Patent No. 2,536,887 previously mentioned. Briefly, however, it may be stated that the drop-head **30** is raised to the fullest extent of which it is capable of being raised as shown in FIG. 1 by a trip action wherein certain abutments such as have been shown at **50** in FIG. 1 and which are carried by the drop-head **16** are engaged by rollers **52** mounted on an endless chain **54**. The chain is provided with a vertical straightaway portion and the various rollers **52**, as they move upwardly along the straightaway portion pick up the abutments on one side of the drop-head and apply successive lifting movements to the drop-head with the rollers releasing the abutments as they move away therefrom and travel around the uppermost of two sprockets (not shown) on which the endless chain **54** is mounted. As the abutments are released, the drop-head will fall by gravity from the elevated position wherein it is shown in FIG. 3 to the lowered position wherein it is shown in FIG. 1.

A gang of the tamping elements **34** are provided at each side of the drop-head **30**. These elements are in the form of elongated first class levers which are pivoted medially of their ends to the lower region of the drop-head **30** in a manner that will be described presently. The lower arm **60** of each element **34** constitutes the tamping shoe or tool proper, while the upper arm **62** constitutes a lever arm forming an element of the toggle link mechanism by means of which the tamping shoe is actuated.

As best seen in FIG. 2, the drop-head is formed with two pairs of spaced downwardly projecting lower extensions **64**, each pair being disposed on opposite sides of a slot **66**. One of the slots **66** is in vertical alignment with the track rail **10** while the other slot is in vertical alignment with the rail **11**. The extreme lower end of each extension has formed thereon a pair of oppositely and laterally extending attachment ears **68**. The ears on each side of the drop-head are aligned and each ear receives therethrough a pivot shaft **70** with the shaft projecting completely through the ear. The tamping elements **34** are arranged in pairs with one element being disposed on each side of an ear **68** so that the ear serves to space the elements of each pair apart. Fastening nuts **72** are applied to the threaded ends of the various shafts **70** to maintain the tamping elements in their pivoted relation relative to the drop-head **30**. The extreme lower end of each arm **60** is formed with an enlarged tamping head **74** of fork-like design and having a series of downwardly projecting tamping fingers **76** associated therewith designed for ballast penetration and packing in a manner that will be set forth presently.

The tamping elements of the gangs on opposite sides of the drop-head **30** are disposed in opposed relationship. These tamping elements move bodily with the drop-head, rising with the latter during its upstroke and descending therewith during its downstroke while at the same time the tamping elements on opposite sides of the drop-head **30** swing toward each other in such a manner that the opposed pairs of arms or tamping shoes proper **60** engage the ballast **14** therebetween and pack the same beneath the various ties **12**.

The actuation of the various tamping elements **34** is

effected, according to the present invention, under the control of a toggle linkage mechanism including linkage elements certain of which are pivotally connected to the drop-head 30, others of which are pivotally connected to the tamping elements 34, and still others of which are pivotally connected to fixed reaction points on the machine framework. This linkage mechanism is designed to impart to the various tamping elements 34 inward swinging movements of a character which are more effective than heretofore has been possible utilizing cam controlled tamping elements, while at the same time, eliminating the use of heavy and cumbersome cam tracks which, by necessity, interfere with the close positioning of relatively massive drop-head 30 and the front wheel assemblies 24.

Referring now to all views of the drawings, on opposite sides of the drop-head 30 a series of raised bosses 80 are formed and each of these bosses provides a pair of spaced ears 82 between which there extends a pivot pin 84. Pivotally attached to each pin 84 is the upper end of an elongated thrust link 86. The lower end of each thrust link 86 is bifurcated as at 88 and the upper enlarged end 90 of a relatively short thrust link 92 extends between the furcations 94 of the link 86 and receives therethrough a floating pivot shaft 96. In the embodiment of the invention illustrated herein there are two such floating pivot shafts 96 on each side of the drop-head 30, one of which spans the slot 66 above the rail 10 and the other of which spans the slot 66 above the rail 11. It is within the purview of the invention, however, to provide a single elongated pivot shaft 96 on each side of the drop-head 30, such shaft extending completely through all four of the aligned pairs of ears 82.

The lower end of each short thrust link 92 is formed with an enlargement 100 which extends between the upper ends of each pair of tamping elements 34 and which is pivotally connected thereto by means of a pivot pin 102. Fastening nuts 104 are received on the threaded ends of the pins 102. The medial region of each floating shaft 96 receives thereover the lower end 105 of a guide link 106 and the upper end 108 of such link is pivotally connected to a reaction pin 110 which extends between a pair of ears 112 (FIG. 4) welded to a threaded sleeve 114 threadedly mounted for vertical adjustment on an adjusting screw 116 which passes through upper and lower plates 118 and 119 carried by one of the channel beams 40 or 42, as the case may be. A lock nut 120 serves to maintain the sleeve 114 in any desired position of vertical adjustment.

It is to be noted that the length of the thrust link 86 is slightly less than the length of the guide link 106 but appreciably greater than the length of thrust link 92, and that the combined length of these two thrust links is greater than the length of the guide link 106. Additionally, in any position of the drop-head, the length of the guide link 106 is less than the shortest distance between the fixed reaction pin 110 and a straight line connecting the pivot pin 84 and the pivot pin 102. By such an arrangement, the links 86 and 92 and the tamping elements 34 connected thereto are constrained to move in predetermined paths and in a predetermined manner, as will now be described in detail.

In the operation of the tamping mechanism described above, the machine will be positioned on the rails 10 and 11 so that the tie under which ballast is to be packed or tamped will underlie the drop-head 30 with the various pairs of opposed tamping elements 34 being disposed in vertical planes which straddle the tie forwardly and rearwardly of the tie. With the machine motor in operation, the various rollers 52 carried by the endless chain 54 will successively engage the abutments 50 on the drop-head 30 and pick up the drop-head, so to speak, and elevate the same to the position wherein it is shown in FIG. 3. As the rollers 52 move out of the vertical plane of the straightaway portion of the endless chain in passing around the uppermost chain sprocket, the abutments will be released so that the drop-head 30 may fall under the influence of gravity toward the position wherein it is illustrated in FIG. 1. During such fall of the drop-head 30, the tamping elements 34 will be carried downwardly bodily with the drop-head and, in so moving, the relatively long thrust links 86 will exert a generally axially directed thrust upon the relatively short thrust links 92 tending to force the upper ends of the arms 68 associated with the tamping elements 34 outwardly away from the drop-head 30. As best seen in FIG. 3, when the drop-head 30 is in its raised position the thrust links 86 and 92 extend at a wide obtuse angle to each other. As soon as the drop-head 30 commences its free downward fall, the guide link 106 will swing outwardly away from the drop-head, while the thrust link 86 will swing inwardly toward the drop-head, thus causing the floating pivot pin 96 to describe an arc of a circle. In so moving, the floating pivot pin 96 will first apply tension to the short thrust link 92 tending to move the upper ends of the tamping elements 34 inwardly toward the drop-head 30 to thus spread the tamping shoes proper 60 outwardly away from each other and away from the drop-head. This spreading of the tamping shoes proper 60 will allow the same to initially engage the ballast at relatively widely spaced regions on opposite sides of the particular tie 12 undergoing treatment.

The movement of the tamping elements 34 before the same engage the ballast is relatively unimportant except insofar as it operates to cause these elements to engage the ballast at widely spaced regions. Movement of the tamping elements 34 after the same have initially engaged the ballast is extremely important since the effectiveness of the tamping action is dependent solely upon the movement of the shoes through the ballast. After the shoes 60 have initially engaged the ballast 14, the guide link 106 has forced the two thrust links 86 and 92 away from their initial approximately aligned position so that the parts assume the dotted line position shown in FIG. 1 with the links 86 and 92 extending at an acute angle from each other. Thereafter, continued downward movement of the drop-head 30 causes the link 106 to again tend to straighten out the two links 86 and 92 by a true toggle action so that they assume a wide obtuse angle with respect to each other as previously described and so that a very powerful thrust is applied to the upper arm 68 of the tamping element 34 with the extreme tamping end of the shoe 60 following the broken line path shown in FIG. 3. In the upper regions of the path of movement of the shoe 60 after it has engaged the ballast, the increments of motion of the shoe are substantially vertical so that the ballast will be forced downwardly in the roadbed. Subsequently, increasing increments of inward motion are applied to the shoe 60 so that the ballast will effectively be forced beneath the tie 14. The various links associated with the linkage mechanism just described serve to positively control the motion of the tamping shoes 60 inasmuch as there is no lost motion involved in this linkage system. The guide link 106, upon initial descent of the drop-head 30, effects a rapid "breaking" of the toggle action near the top of the stroke and a gradual straightening out of the toggle thrust links 86 and 92 near the bottom of the stroke so that a powerful toggle spreading action is attained tending to exert extremely high tamping forces on the tamping shoes 60, these forces gradually increasing as the drop-head approaches the limit of its downward movement.

From the above description, it is thought that the construction, use and many advantages of the herein described ballast tamping mechanism will be readily apparent. The invention is not to be limited to the exact arrangement of parts shown in the accompanying drawings or described in this specification as various changes in the details of construction may be resorted to without departing from the spirit of the invention. For ex-

ample, while these tamping instrumentalities have been illustrated herein in connection with a machine embodying a single drop-head 30, the principles of the invention are equally applicable to machines of the type having split or separately operable drop-heads, in which case each drop-head or section thereof will embody a mechanism such as has been illustrated in FIG. 1. Only insofar as the invention has particularly been pointed out in the accompanying claims is the same to be limited.

Having thus described the invention what I claim as new and desire to secure by Letters Patent is:

1. In a machine for tamping ballast between and beneath the ties of a railway track, in combination, a supporting framework having wheels mounted thereon for travel along the two rails comprising said track, a drop-head designed for vertical alignment with a tie about which ballast is to be tamped, a pair of opposed guideways on opposite sides of the framework respectively and within which said drop-head is vertically slidable between an elevated and a lowered position, a pair of opposed tamping elements pivotally mounted on opposite sides of the drop-head for swinging movement about respective horizontal axes intermediate the ends of the elements, each element including a lower arm presenting a tamping tool proper and an upper lever arm, a thrust link pivotally connected to said lever arm, a thrust link pivotally connected to the drop-head, the free ends of said thrust links being pivotally connected together, a guide link pivotally connected at one end thereof to said thrust links at the point of pivotal connected therebetween, the other end of said guide link being pivotally connected to a fixed reaction point on said framework, and means for raising said drop-head to its elevated position and for thereafter releasing it.

2. In a machine for tamping ballast between and beneath the ties of a railway track, the combination set forth in claim 1 including, additionally, means for regulably adjusting the vertical height of the reaction point to which said other end of the guide link is pivotally connected.

3. In a machine for tamping ballast between and beneath the ties of a railway track, a supporting framework having wheels mounted thereon for travel along the two rails comprising said track, a drop-head designed for vertical alignment with a tie about which ballast is to be tamped, a pair of opposed guideways on opposite sides of the framework respectively and within which said drop-head is vertically slidable between an elevated and a lowered position, a pair of opposed tamping elements pivotally mounted on opposite sides of the drop-head for swinging movement about respective horizontal axes intermediate the ends of the elements, each element including a lower arm presenting a tamping tool proper and an upper lever arm, a thrust link pivotally connected to said lever arm, a thrust link pivotally connected to the drop-head, the free ends of said thrust links being pivotally connected together, a guide link pivotally connected at one end thereof to said thrust links at the point of pivotal connection therebetween, the other end of said guide link being pivotally connected to a fixed reaction point on said framework which is spaced from the drop-head a distance less than the length of said guide link, said drop-head being formed with a clearance void therein to accommodate the swinging movement of said guide link and thrust links during movement of the drop-head, and means for raising said drop-head to its elevated position and for thereafter releasing it.

4. In a machine for tamping ballast between and beneath the ties of a railway track, the combination set forth in claim 3 including, additionally, means for regulably adjusting the vertical height of the reaction point to which said other end of the guide link is pivotally connected.

5. In a machine for tamping ballast between and beneath the ties of a railway track, a supporting framework having wheels mounted thereon for travel along the two rails comprising said track, a drop-head designed for vertical alignment with a tie about which ballast is to be tamped, a pair of opposed guideways on opposite sides of the framework respectively and within which said drop-head is vertically slidable between an elevated and a lowered position, a pair of opposed tamping elements pivotally mounted on opposite sides of the drop-head for swinging movement about respective horizontal axes intermediate the ends of the elements, each element including a lower arm presenting a tamping tool proper and an upper lever arm, a first thrust link pivotally connected to said lever arm, a second thrust link pivotally connected to the drop-head, the free ends of said thrust links being pivotally connected together, a guide link pivotally connected at one end thereof to said thrust links at the point of pivotal connection therebetween, the other end of said guide link being pivotally connected to a fixed reaction point on said framework which is spaced from the drop-head a distance less than the length of said guide link, said drop-head being formed with a clearance void therein to accommodate the swinging movement of said guide link and thrust links during movement of the drop-head, the length of said first thrust link being slightly less than the length of said guide link and the combined lengths of said first thrust link and second thrust link being greater than the length of said guide link, and means for raising said drop-head to its elevated position and for thereafter releasing it.

6. In a machine for tamping ballast between and beneath the ties of a railway track, the combination set forth in claim 5 including, additionally, means for regulably adjusting the vertical height to which the reaction point to which said other end of the guide link is pivotally connected.

7. In a machine for tamping ballast between and beneath the ties of a railway track, a supporting framework having wheels mounted thereon for travel along the two rails compirsing said track, a drop-head designed for vertical alignment with a tie about which ballast is to be tamped, a pair of opposed guideways on opposite sides of the framework respectively and within which said drop-head is vertically slidable between an elevated and a lowered position, a pair of opposed tamping elements pivotally mounted on opposite sides of the drop-head for swinging movement about respective horizontal axes intermediate the ends of the elements, each element including a lower tamping shoe portion and an upper lever arm, a first thrust link pivotally connected to the lever arm, a second thrust link pivotally connected to the drop-head, the free ends of said first and second thrust links being pivotally connected together, a guide link pivotally connected at one end thereof to said thrust links at the point of pivotal connection therebetween, the other end of said guide link being pivotally connected to a fixed reaction point on the framework which is spaced from the drop-head a distance less than the length of the guide link, said drop-head being recessed to accommodate the swinging movement of said guide link and thrust links during movement of the drop-head, the length of said first thrust link being less than the length of said guide link and the combined lengths of said thrust link and second thrust link being greater than the length of said guide link, the length of said first thrust link being appreciably greater than the length of said second thrust link, the length of said guide link being greater than the shortest distance between said fixed reaction point and a straight line connecting the point of pivotal connection between the drop-head and first thrust link and the point of pivotal connection between the second thrust link and lever arm in any position of the drop-head, and means for raising said drop-head to its elevated position and for thereafter releasing it.

8. In a machine for tamping ballast between and beneath the ties of a railway track, a supporting framework having wheels mounted thereon for travel along the two

rails comprising said track, a drop-head designed for vertical alignment with a tie about which ballast is to be tamped, a pair of opposed guideways on opposite sides of the framework respectively and within which said drop-head is vertically slidable between an elevated and a lowered position, a pair of opposed tamping elements pivotally mounted on opposite sides of the drop-head for swinging movement about respective horizontal axes intermediate the ends of the elements, each element including a lower tamping shoe portion and an upper lever arm, a first thrust link pivotally connected to the lever arm, a second thrust link pivotally connected to the drop-head, the free ends of said first and second thrust links being pivotally connected together, a guide link pivotally connected at one end thereof to said thrust links at the point of pivotal connection therebetween, the other end of said guide link being pivotally connected to a fixed reaction point on the framework which is spaced from the drop-head a distance less than the length of the guide link, said drop-head being recessed to accommodate the swinging movement of said guide link and thrust links during movement of the drop-head, the length of said first thrust link being less than the length of said guide link and the combined lengths of said first thrust link and second thrust link being greater than the length of said guide link, the length of said first thrust link being appreciably greater than the length of said second thrust link, and means for raising said drop-head to its elevated position and for thereafter releasing it.

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