United States Patent

[11] 3,625,156

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[21] Appl. No. 855,579
[22] Filed Sept. 5, 1969
[45] Patented Dec. 7, 1971
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[54] **BALLAST TAMPING WORKHEAD**
6 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **104/12**
[51] **Int. Cl.** **E01b 27/16**
[50] **Field of Search** 104/12, 7, 8

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ABSTRACT: A ballast tamping workhead having tamping blades rigidly fixed to high-frequency vibratory motors that are carried, through compression-loaded insulating mountings, for up and down movement and swinging movement both toward the rail and toward the ties. Actuation of the workhead drives the vibrating blades into the ballast on either side of a tie, forces the blades in a squeezing action toward the rail, and then forces the blades in a further squeezing action toward and under the tie.

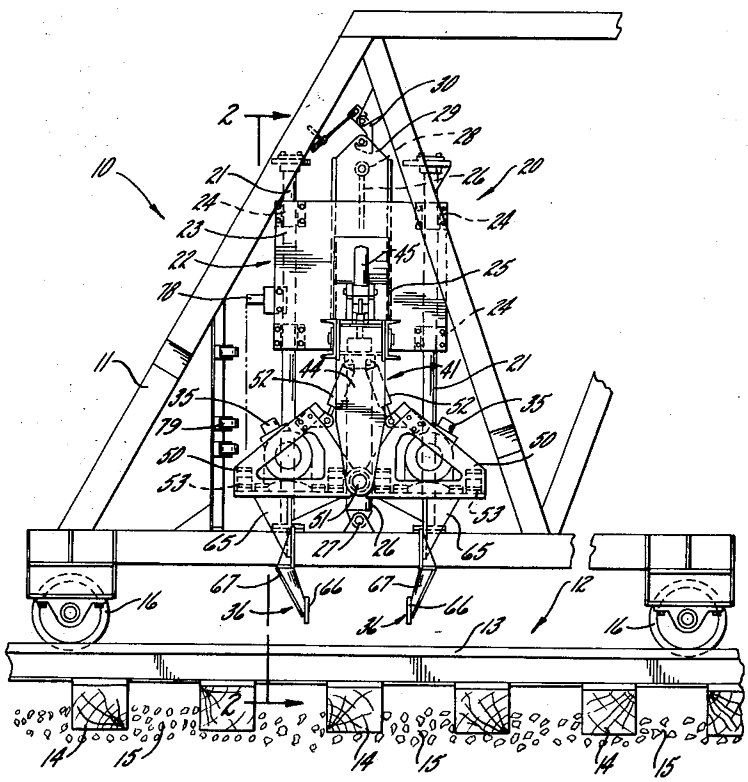

FIG. 1.

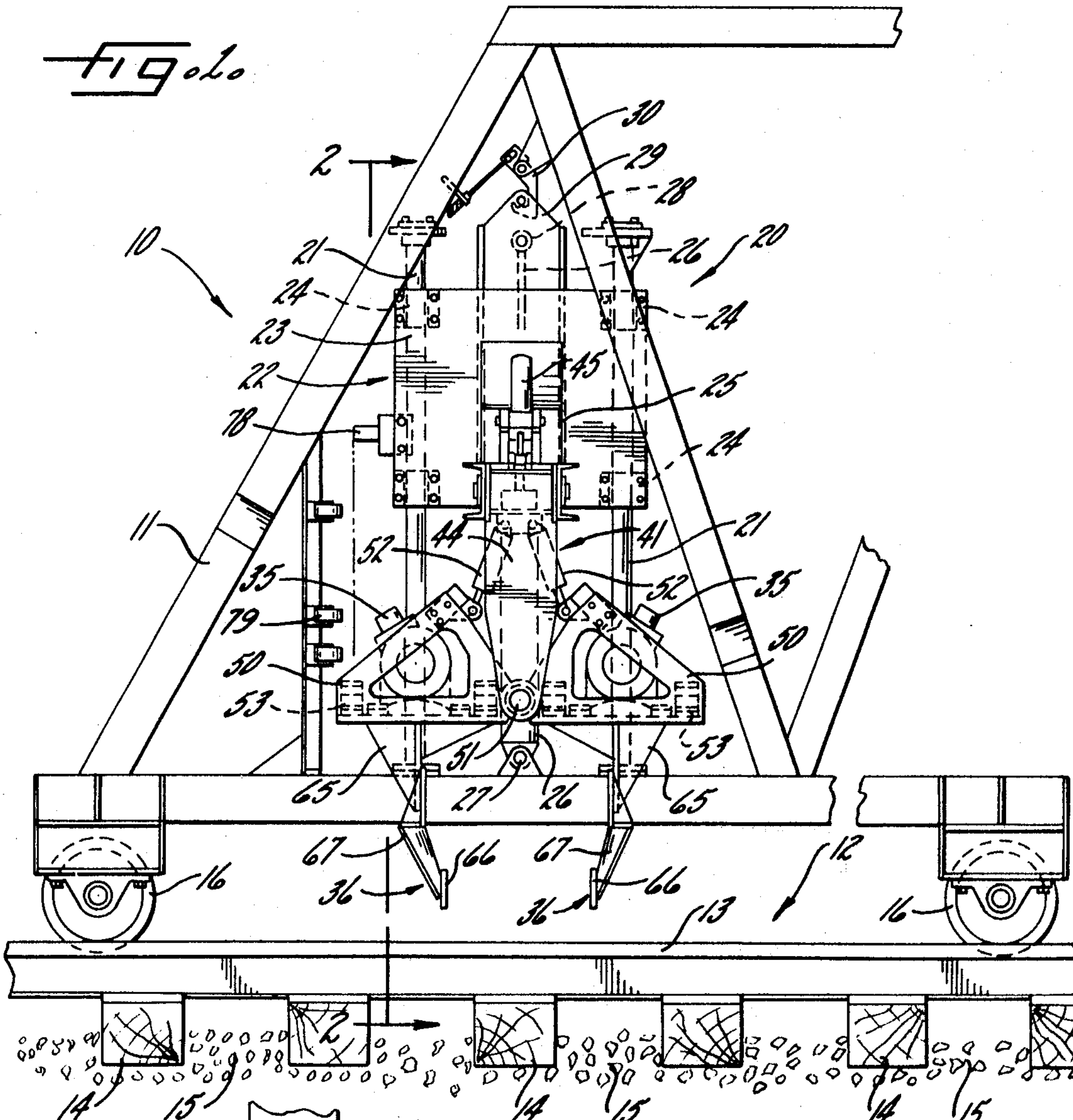

FIG. 5.

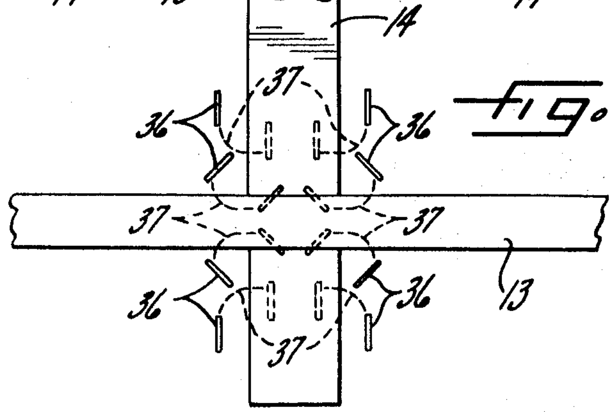

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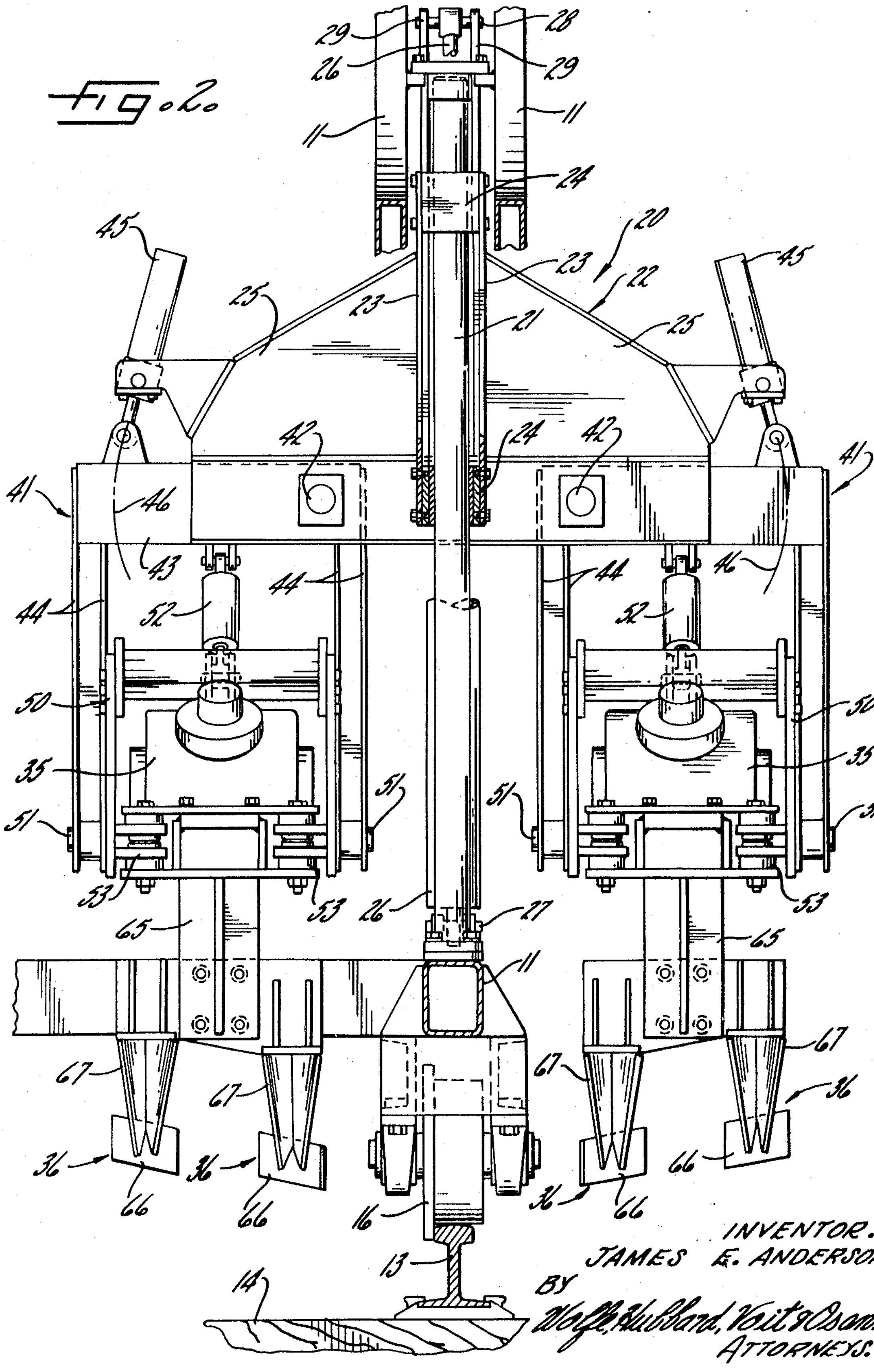
FIG. 2



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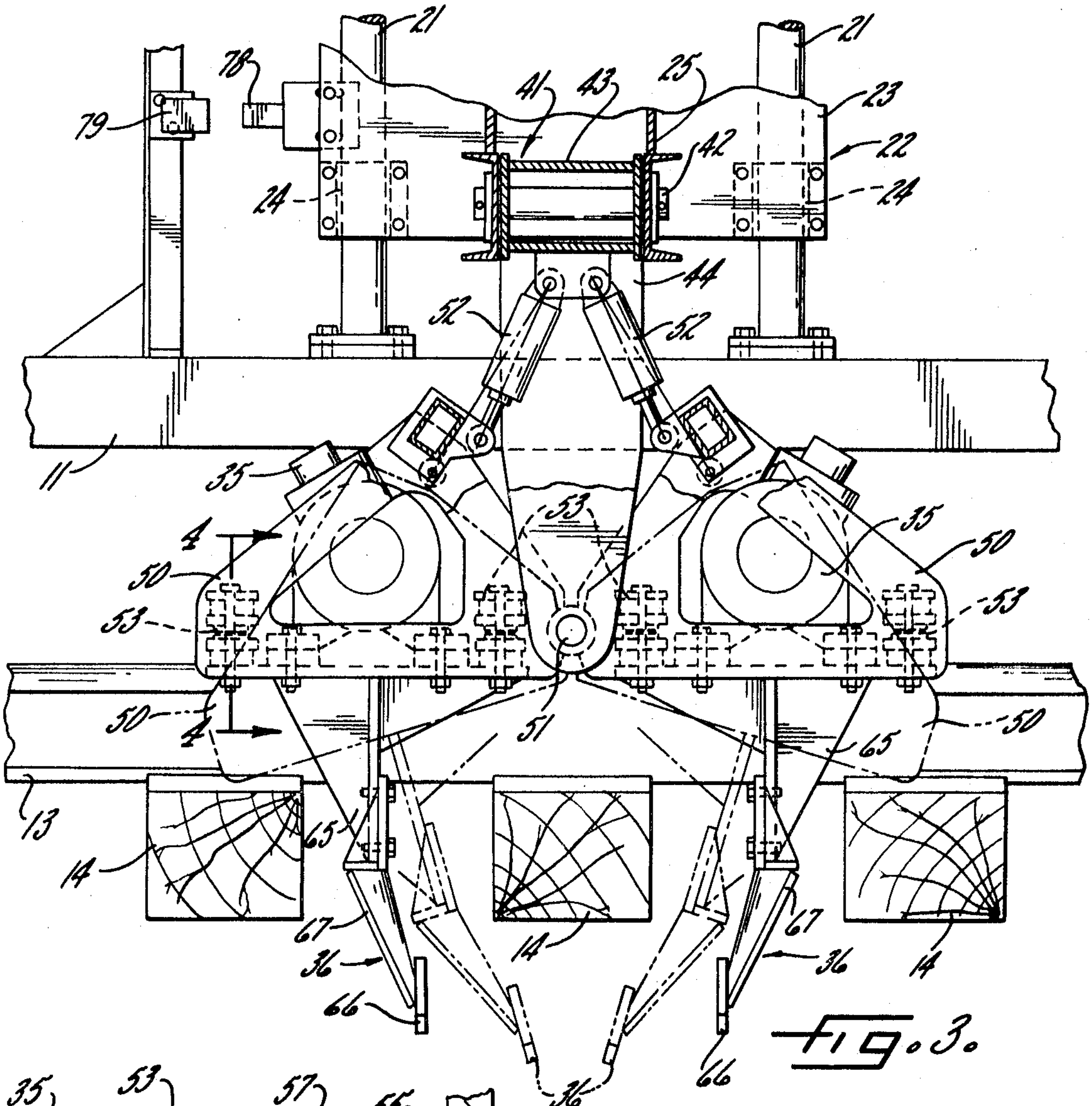

Fig. 3.

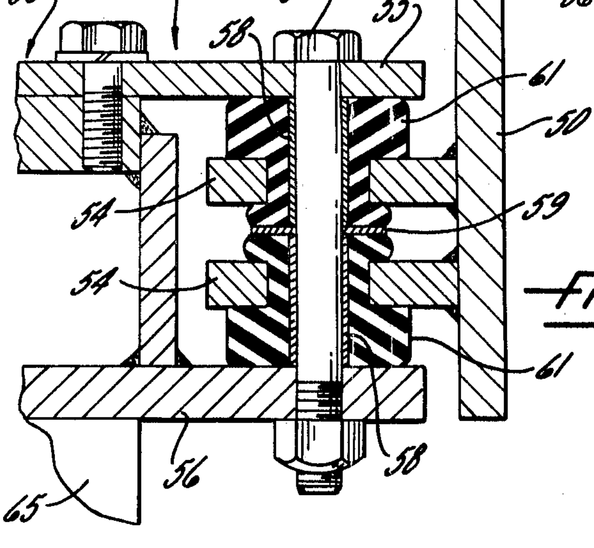

Fig. 4.

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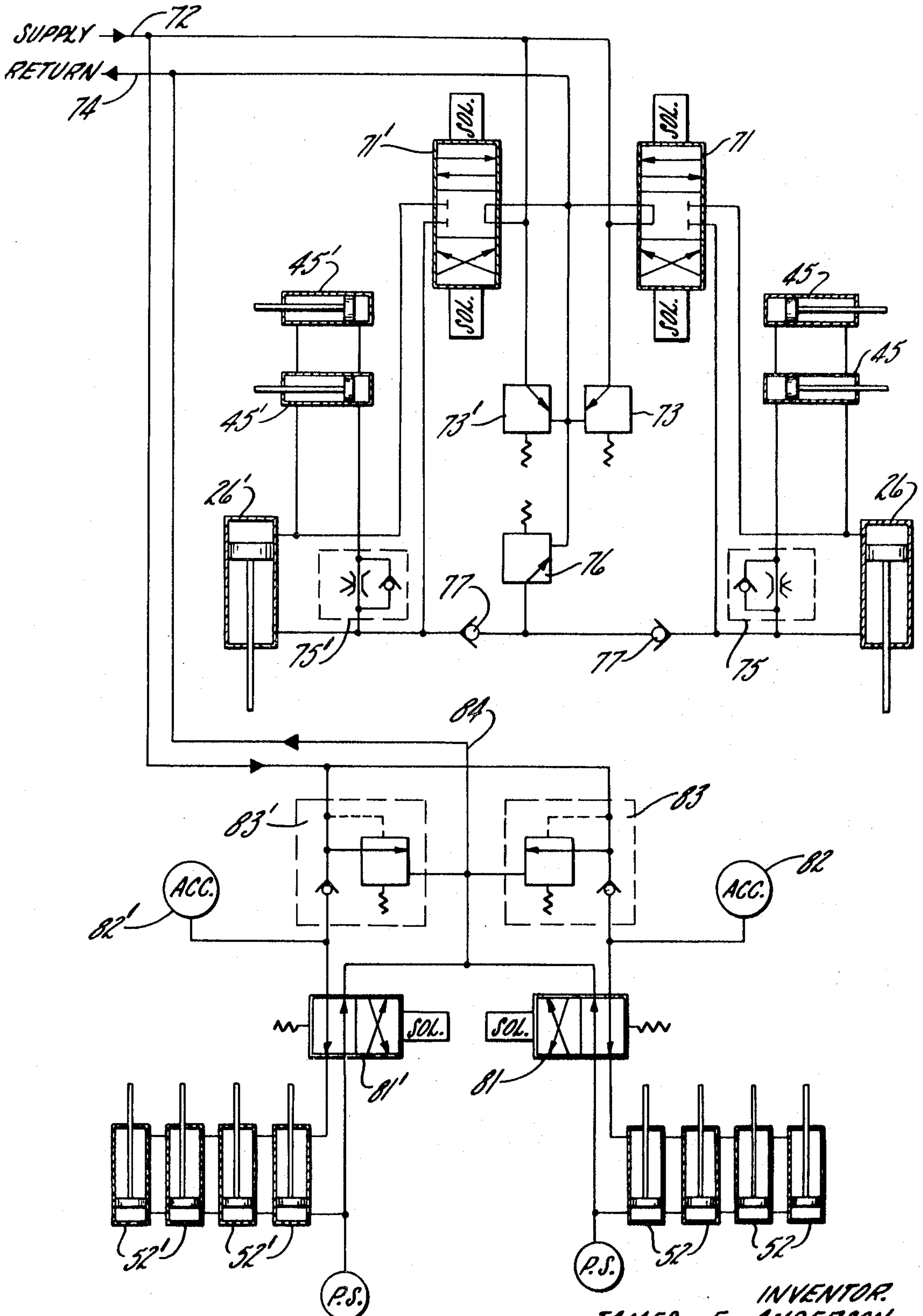

Fig. 6.

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BALLAST TAMPING WORKHEAD

DESCRIPTION OF THE INVENTION

This invention relates to railroad ballast tamping machines and more particularly concerns a workhead for such machines.

Railroad rails are secured to crossties which, in turn, are set into ballast such as crushed rock or stone. In building or maintaining a track, the ballast must be positioned and compacted under the ties to hold the rails in proper position both horizontally and laterally. The most critical ballast region is beneath the tie portions that lie directly under the rails since this region bears the bulk of the traffic loads.

There have been two somewhat different approaches to tamping ballast. First, pressure has been used to force the ballast toward its proper place and degree of compaction. Second, high-frequency vibration has been employed to agitate the ballast into tightly compacted, properly located regions. Some tamping machines have tried to combine the effects of vibration with forcing or squeezing the ballast into position, but the design considerations for each approach have not been compatible and prior tamping machines have been primarily of one type or the other.

It is the primary aim of the present invention to provide a tamping workhead that combines true high-frequency vibration tamping with effective and forceful squeeze-type tamping.

Another object of the invention is to provide a tamping workhead of the above character which positively and directly acts on the critical ballast region beneath the tie portions under the rails. Stated another way, not only is high-frequency vibration imparted to the ballast being tamped, but a squeezing action is developed both from opposite sides and toward the tie, and from opposite sides and toward the rail.

A further object is to provide a tamping workhead as characterized above which is well suited for the rough, heavy-duty use to which such equipment is normally subject.

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings, in which:

FIG. 1 is a side elevation of a portion of a tamper embodying the invention;

FIG. 2 is an enlarged fragmentary elevation taken approximately along the line 2—2 of FIG. 1;

FIG. 3 is an enlarged side elevation of a portion of the structure shown in FIG. 1 with the parts in a different operating position;

FIG. 4 is an enlarged fragmentary section taken along the line 4—4 in FIG. 3;

FIG. 5 is a diagrammatic plan showing the movement of the tamper blades in the tamper of the invention; and

FIG. 6 is a simplified hydraulic diagram showing the actuating circuits for the structure of FIG. 1.

While the invention will be described in connection with a preferred embodiment, it will be understood that I do not intend to limit the invention to that embodiment. On the contrary, I intend to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention.

Turning first to FIG. 1, there is shown a portion of a tamper **10** having a frame **11** adapted to move along a railroad track **12**. The track **12** includes a pair of rails **13**, only one of which is shown, mounted on a plurality of crossties **14** placed in ballast **15**. In the illustrated construction, the tamper **10** rides on flanged wheels **16** which are journaled on the frame **11** for guiding the tamper along the track **12**.

Those familiar with this art will understand that tamping involves placing and compacting the particles making up the ballast **15** under the ties **14** and, for this purpose, the tamper includes a pair of workheads, of which only the workhead **20** over the rail **13** is illustrated. It will be understood that, preferably, a similar workhead is mounted on the tamper **10** over the opposite rail which does not appear in the drawings.

A pair of generally vertical guides in the form of rods **21** are fixed to the tamper frame **11** longitudinally of the track **13**, and the workhead **20** includes a crosshead **22** mounted on the rods **21** for vertical sliding movement above the rail **13**. In more detail, the crosshead **22** is formed by generally square sideplates **23** sandwiching bearing sleeve assemblies **24** at their four corners which slide on the rods **21**. A pair of boxlike arms **25** are fixed to the sideplates **23** and extend laterally of the rail **13** from either side of the rods **21**.

For moving the crosshead **22** up and down, a double-acting hydraulic actuator **26** is anchored at **27** to the frame **11** between the guide rods **21** with the end of its piston rod being secured at **28** to ears **29** extending upwardly from the crosshead sideplates **23**. Extending the actuator **26** raises the crosshead **22**, and contracting the actuator drives the crosshead downwardly. A hook **30** (see FIG. **1**) is pivoted on the frame **11** to engage a pin on the crosshead to lock the crosshead in raised position for transport.

In accordance with the invention, the crosshead **22** carries four high-speed vibratory motors **35** mounting blades **36** which, when tamping, are moved down into the ballast **15**, in toward and under the rail **13**, and then squeezing toward and under the tie **14**. Diagrammatically, the blades **36** move along the paths **37** shown in FIG. **5**.

The crosshead actuator **26** moves the blades **36** into and out of the ballast **15**. For moving the blades toward and under the rail **13**, a pair of depending supports **41** are pivoted on axes **42** on the crosshead arms **25** for swinging movement down and toward the rail **13**. Each support **41** includes a short beam **43** and pairs of depending plates **44**. A pair of double-acting hydraulic actuators **45** are anchored to the crosshead with their piston rods connected to respective ones of the supports **41** so as to hold the supports in this FIG. **2** position and to also swing the supports along the arcs **46**, thus carrying the blades **36** toward and under the rail **13**.

For moving the blades **36** toward and under the ties **14**, two pairs of motor carriers **50** are mounted on the crosshead **22** with one pair being pivoted on a common axis **51**, at the lower end of each of the depending support plates **44**, for swinging movement down and toward opposite sides of a tie **14**. Each motor carrier **50** is controlled by a double-acting hydraulic actuator **52** connected between the support beam **43** and the respective carriers **50**.

The motor carriers **50** are formed as boxlike frames containing the vibratory motors **35**. The motors are electrically powered and are positioned with their rotors paralleling the ties **14** and having eccentrics at each rotor end so that forceful, high-frequency oscillatory vibration — preferably on the order of 4,500 v.p.m. — is created parallel to the rail **13**.

To insulate this vibration from the other parts of the workhead **20** while maintaining directional control of the blades **36**, compression-loaded mounting assemblies **53** secure each motor **36** at its four corners within its respective carrier **50**. Each assembly **53** sandwiches a pair of mounting lugs **54** secured to the carrier **50** between upper and lower motor mounting plates **55** and **56**, respectively. A bolt **57** surrounded by steel sleeves **58** with an intermediate washer **59** runs between the motor mounting plates **53** and through holes in the lugs **54** so that drawing the bolt **57** tightly locks the plates **55**, **56**, sleeves **58** and washer **59** rigidly. A pair of elastic T-shaped grommets **61** are fitted over the sleeves **58** with their heads between the plates **55**, **56** and the adjacent one of the lugs **54**. Drawing the bolt **57** tight flares out the shank ends of the grommets **61** between the washer **59** and the adjacent lugs **54** (see FIG. **4**). The result is a compression-loaded vibration absorbing assembly **53** which still allows movement of the carrier **50** to control movement of the motor **35** and the attached blades **36**.

As a feature of the invention, two blades **36** are fixed to each motor **35** through a bracket **65**, with the blades **36** having flat, working ends or pads **66** mounted on shanks **67** with V-shaped cross sections, and the four blade working ends **66** closest to the rail **13** are angled so as to face, in a horizontal plane, the intersection of the rail and tie (see FIG. 5). In this way, the tamping work is done by the working ends or pads **66** with the V-shaped shanks **67** simply cutting through the ballast **15**, and the working ends **66** compact the ballast in the most important regions — under the tie and, in particular, under that portion of the tie beneath the rail **13**.

In describing the control and sequencing of the workhead actuators **26, 45** and **52**, a circuit will be described in connection with FIG. 6 which includes corresponding actuators **26'**, **45'** and **52'** for performing corresponding functions with a workhead, not illustrated, which operates over the opposite rail. The workheads may be operated independently of each other, and in describing the controls for the workhead **20**, the corresponding parts for the opposite workhead will be given the same reference numeral with a prime mark added.

The tamper operator institutes a tamping cycle by energizing electrically controlled three-way valves **71** and **71'** so that, when the valves shift downwardly as shown schematically, fluid pressure is directed from a supply **72** to the ends of the actuators **26, 26'** that cause them to contract. This drives the crossheads including the crosshead **22** downwardly. Pressure relief valves **73** and **73'** control the amount of down pressure available to the actuators **26, 26'**. When the valves **73, 73'** open at their set pressures, fluid is returned directly from the supply **72** to a return line **74**.

In carrying out the invention, sequence valves **75** and **75'** send fluid under pressure to the actuators **45, 45'** after a predetermined amount of pressure is developed in the actuators **26, 26'**. In this way, the blades **36** are first driven down into the ballast and then, at a down pressure determined by the setting of the valves **75, 75'**, the actuators **45** are energized to tilt the supports **41** and drive the blades **36** toward and under the rail **13**. An overload valve **76** and a pair of check valves **77** are provided in the circuit as safety factors.

Once the blades **36** are fully into the ballast, a fact determined by a magnet **78** on the crosshead **22** coming into alignment with a magnetic switch **79** on the frame **11** (see FIGS. **1** and **3**), the actuators **52, 52'** are brought into play by the switch **79** controlling a two-way valve **81** that directs fluid to the actuators **52**. A similar valve **81'** controls the actuators **52'**. Energizing the valve **81** causes the actuators **52** to drive the blades **36** in a squeezing action toward and under a tie **14**.

As a feature of the invention, the actuators **52, 52'** receive fluid under pressure from accumulators **82** and **82'**, respectively, which are kept charged by piloted valves **83** and **83'**. The piloted valves **83, 83'** deliver hydraulic fluid to the actuators **82, 82'** until their set pressure is reached, whereupon fluid is bypassed from the supply **72** through a line **84** to the return line **74**. In this way, through the use of the accumulators **82, 82'**, the tamping blade squeezing action is quick and powerful, and is not directly dependent upon the supply of fluid from the line **72**.

The squeezing action of the blades **36** under a tie **14** is limited by hydraulic pressure sensitive switches **85** and **85'** which, when the operator set pressure is reached, open the circuits to the solenoids controlling the valves **81, 81'** and thus allow these valves to be restored and the actuators **52, 52'** to return to their initial positions. The amount of squeezing pressure exerted by the blades **36** is thus controlled by setting the switches **85, 85'**, which can be done by the tamper operator.

The tamper operator, by controlling the three-way valves **71, 71'** can make repeated tamping insertions of the blades **36** into the ballast **15** and then raise the workhead for movement over the next tie **14**. With each insertion, the sequential action bringing the actuators **45, 45'** and then the actuators **52** and **52'** into operation is repeated.

It can therefore be seen that the workhead **20** effectively combines true high-frequency vibration tamping with effective and forceful squeeze-type tamping. This has been attained in a rugged structure well suited for heavy-duty, production use on railroad track. The blades **36** are mounted and moved in a fashion which insures proper tamping not only beneath the ties but also beneath that critical portion of the tie that underlies the track rails.

I claim as my invention:

1. In a tamper having a frame adapted to move along a railroad track including a rail mounted on crossties placed in ballast, a tamping workhead comprising, in combination, generally vertical guides mounted on said frame, a crosshead mounted on said guides for generally vertical movement above said rail, a pair of depending supports pivoted on said crosshead for swinging movement down and toward said rail, two pairs of motor carriers with one pair being pivoted at the lower end of each of said supports for swinging movement down and toward opposite sides of one of said ties, four high-speed vibratory motors mounted one on each of said motor carriers so as to produce oscillatory vibration parallel to said rail, blades affixed to each of said motors, means for moving said crosshead down so as to drive said blades into the ballast on either side of a tie, means for positively swinging both of said supports so as to tilt said blades under pressure toward and under the rail, and means for positively swinging all four of said carriers so as to move the blades under pressure toward and under said tie.

2. The combination of claim **1** in which two blades are fixed to each motor with the blades having flat working ends aligned generally parallel to the ties, the four blade working ends that are closest to the rail being angled so as to face, in a horizontal plane, the intersection of said rail and said tie.

3. The combination of claim **2** in which said blade working ends are supported by shanks having a V-shaped horizontal section with the points of the V facing the tie toward and under which the blade ends move.

4. The combination of claim **1** in which said motor carriers are boxlike frames containing said motors, the combination including a plurality of resilient, compression loaded mounting assemblies securing each motor within its carrier so as to isolate motor vibration while maintaining directional control of said blades.

5. The combination of claim **1** in which said last three means are hydraulic actuators, the combination including a control circuit for said actuators causing said supports to be swung after the buildup of a predetermined pressure in the actuator moving the crosshead down, and said circuit also causing said carriers to be swung after the workhead reaches a predetermined lowered position.

6. The combination of claim **5** in which said circuit includes accumulators for giving a fast surge of power to the actuators swinging said carriers, and said circuit also including a settable pressure responsive switch for stopping the swinging movement of said carriers after a predetermined pressure has been exerted by the blades on the ballast.

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