Jan. 23, 1968 C. W. BERKOBEN ETAL 3,365,005

MOBILE IMPACTING MACHINE

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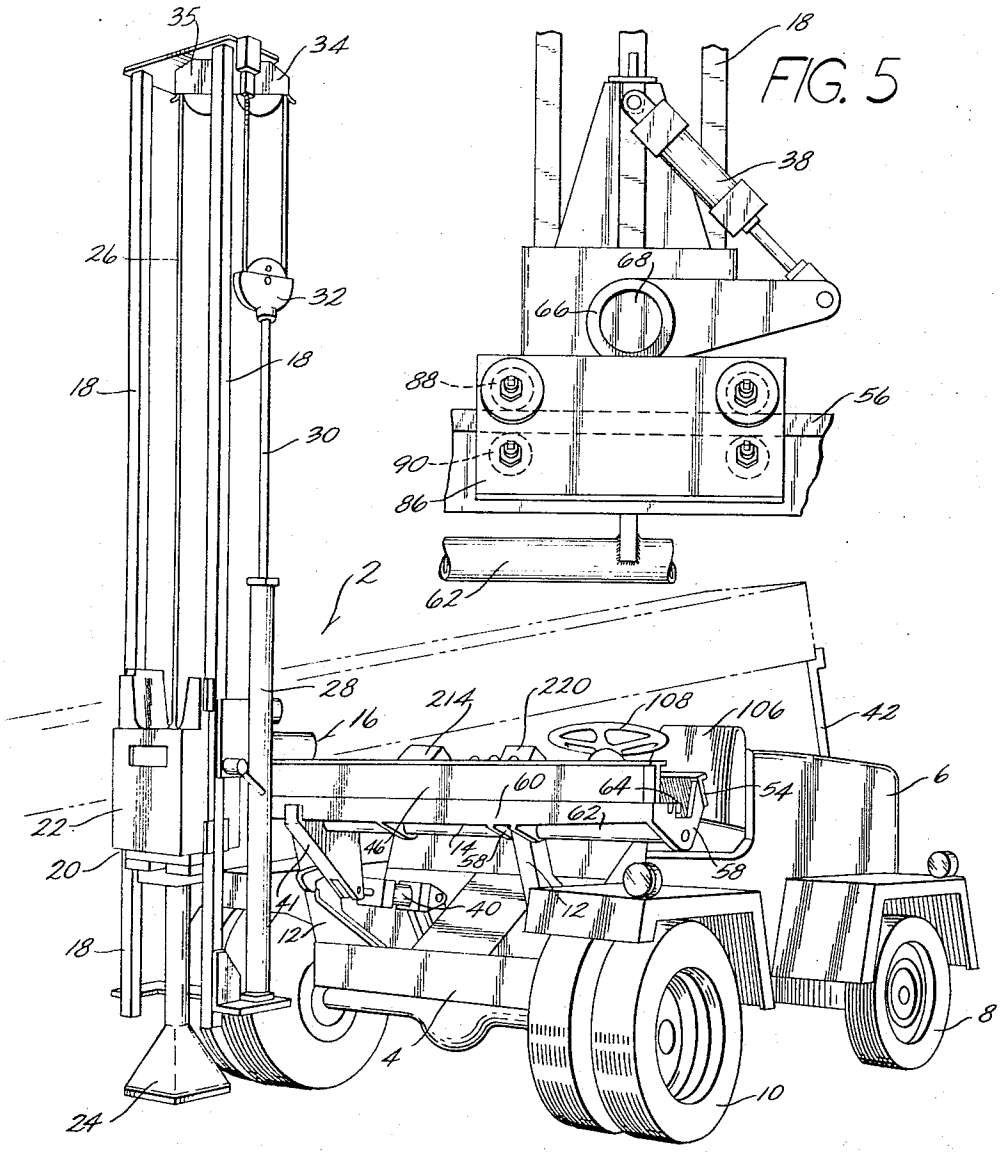



FIG. 1




FIG. 5

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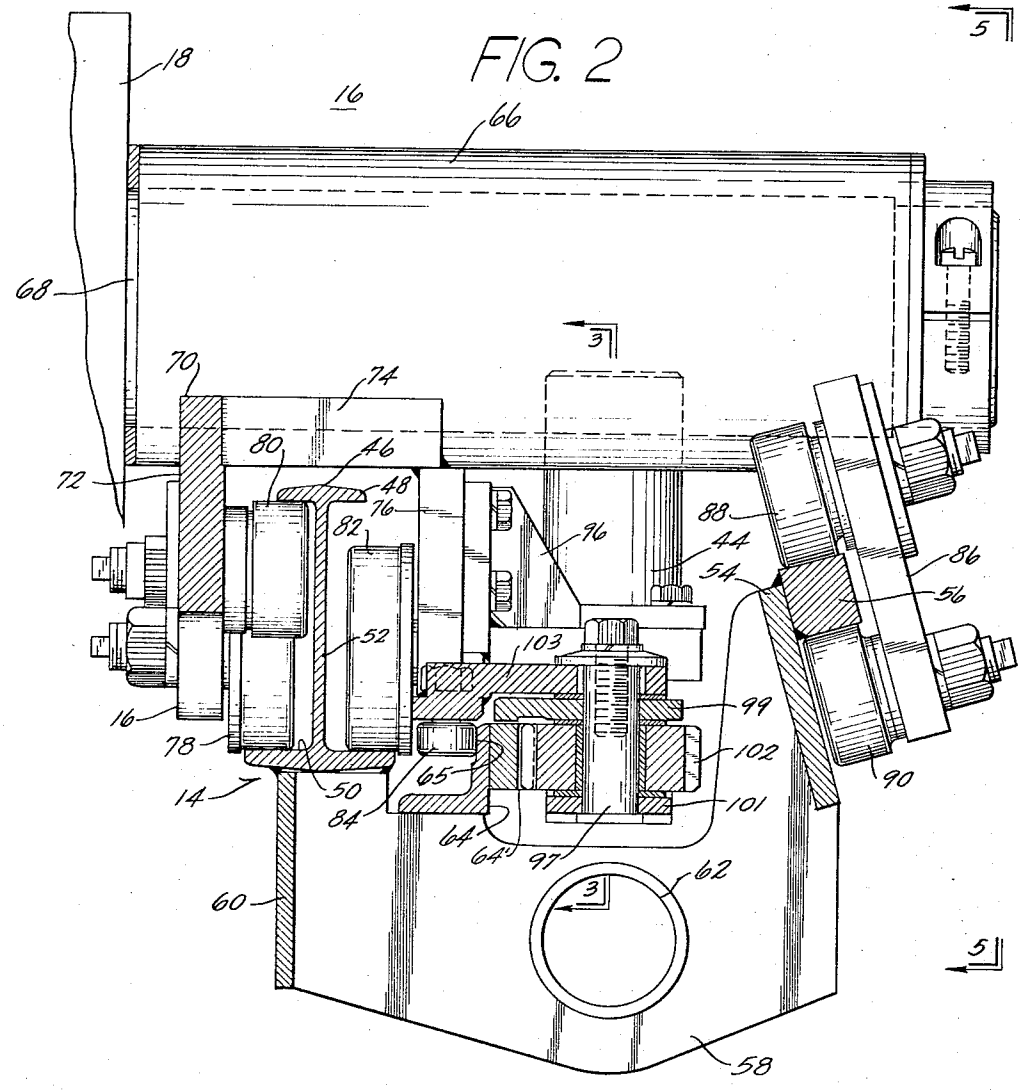
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MOBILE IMPACTING MACHINE

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FIG. 2



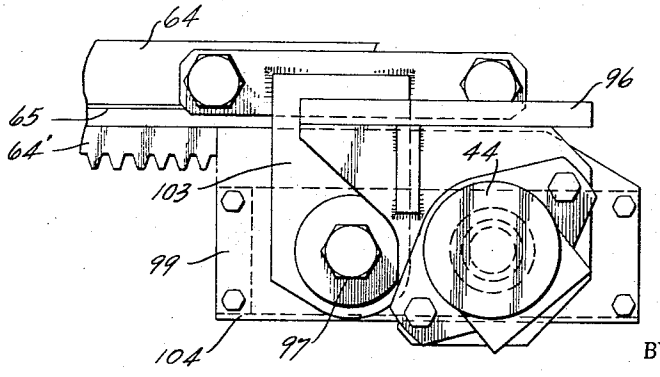




FIG. 4

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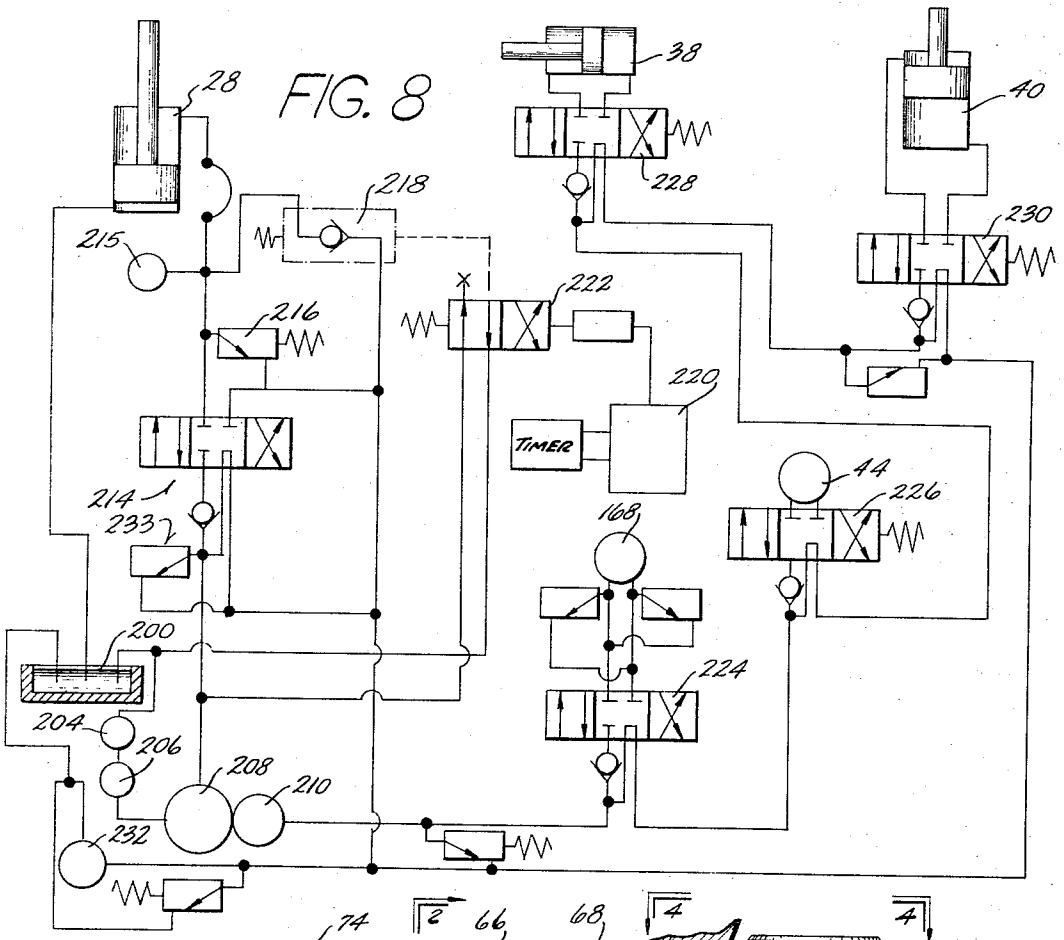
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MOBILE IMPACTING MACHINE

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FIG. 8



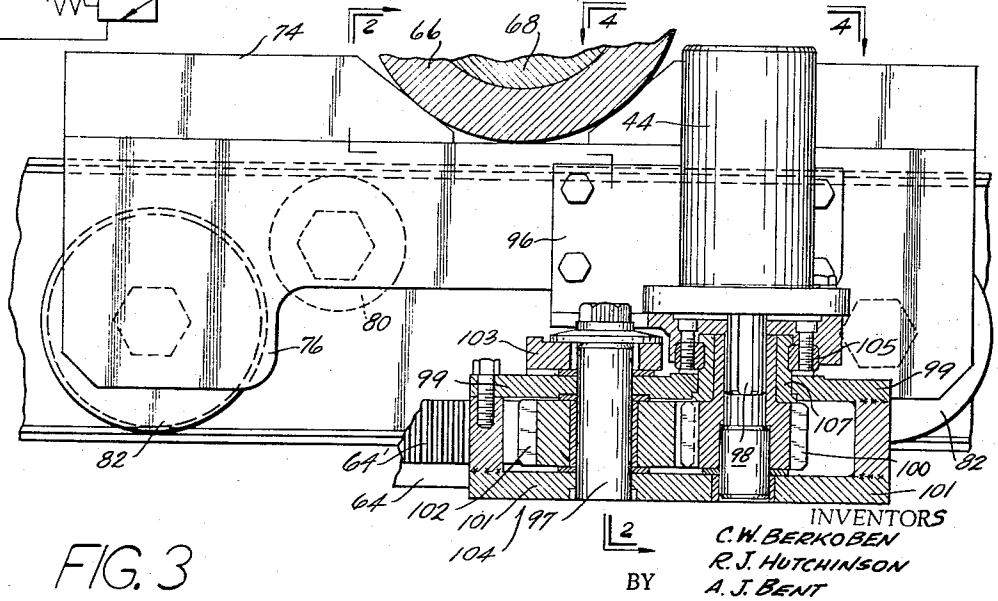




FIG. 3

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FIG. 6

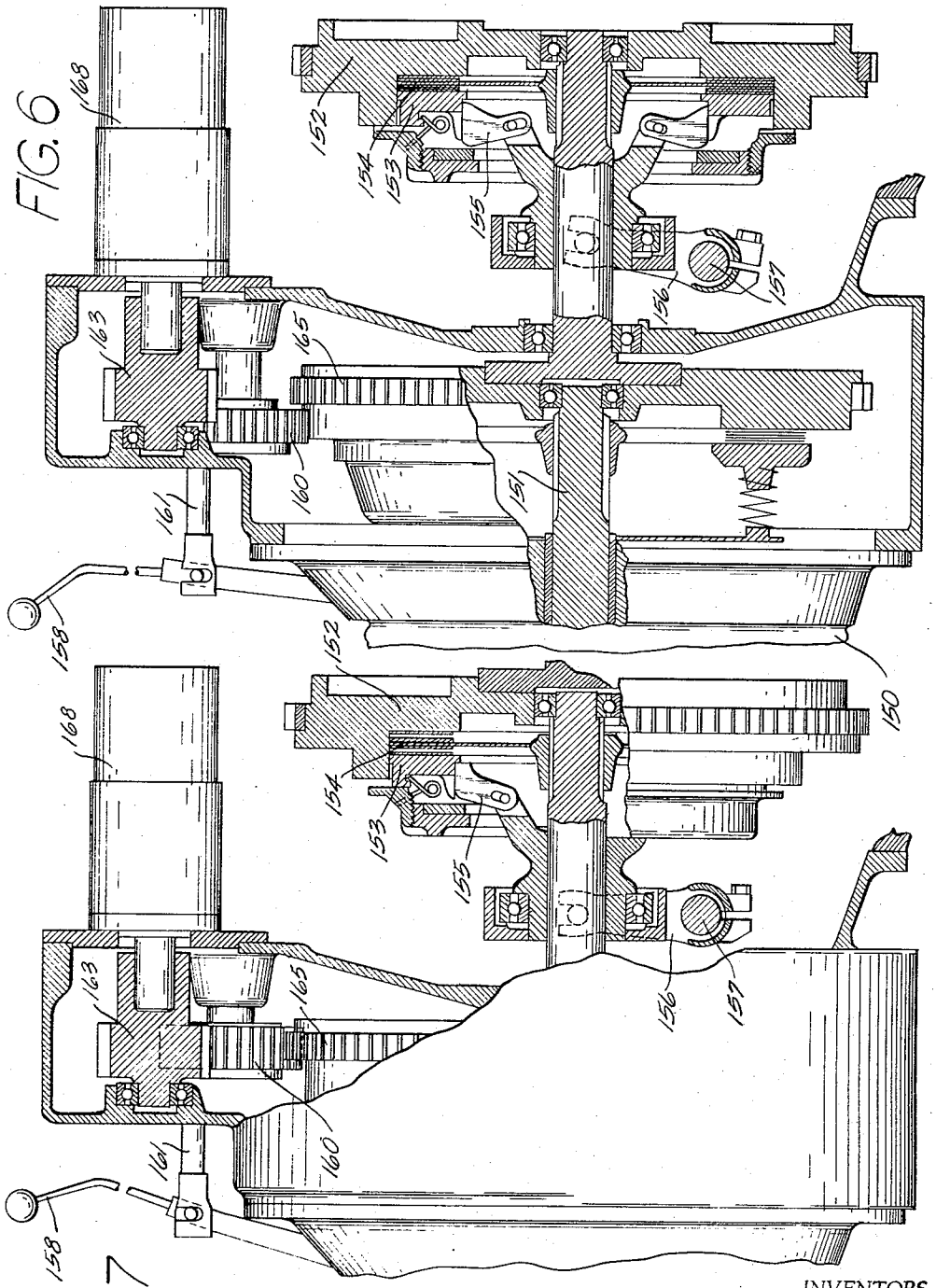



FIG. 7

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3,365,005

# MOBILE IMPACTING MACHINE

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10 Claims. (Cl. 173—43)

## ABSTRACT OF THE DISCLOSURE

A mobile impacting machine having an impacting tool mounted for reciprocation in a mast carried by a power driven vehicle and selectively swingable from an upright working position to an approximately horizontal storage position, the mast being mounted to traverse an end of the vehicle during operation.

### *Background*

Mobile impacting machines perform many jobs in the construction and road building industries requiring a hammering or percussive action, including breaking concrete, driving posts and pilings, cutting asphalt, and tamping back fill. The hammering action is generally provided by raising a weighted impacting or percussion tool along guides and allowing it to descend by gravity rapidly and heavily against the work with the tool being guided in its free fall along a vertical or near vertical mast. The weighted tool and guides are mounted on a power driven chassis by a support member.

To obtain the versatility required of a machine of this type, it is necessary that the machine be easily and quickly adjustable to alter the position of the tool and guides to direct the hammering action where it is needed. For certain operations, a high degree of accuracy is required in the hammering action. In concrete or pavement breaking, it is necessary that the hammering tool be accurately movable in small increments along the work line. In tamping or compacting work with such machines, the force of impact is dependent upon the height to which the tool is raised, and it is desirable to be able to control the drop distance. It is also desirable that the weighted tool and carriage be adjustable to permit high-speed, over-the-road travel to the job site while also allowing for a creeping drive when working. In addition to the above criteria, it is imperative that the mobile hammering machine be ruggedly built to withstand the repititious shocks of the hammering action throughout the useful life of the machine.

As the support member provides the mount for the hammering tool on the machine, the attainment of the abovestated requirements of versatility and ruggedness is particularly focused on the design of the support member, particularly since support members employed in the past have not permitted complete attainment of all these desirable features.

### *Summary*

It is therefore an object of the present invention to provide an improved portable impacting machine which obviates the disadvantages and objections attendant prior machines of this general type.

Accordingly, the present invention provides an improved mobile impacting machine having an improved support member and power actuating and control means for the hammering tool which are mechanically strong enough to resist the shock of the hammer blows yet which permits accurate stroking and positioning of the tool.

Further, the present invention provides an improved mobile hammering machine having a readily adjustable drive and traverse means which is sufficiently flexible to enable positioning and actuation of the hammering tool to a variety of work positions which additionally rendering the same suitable for over-the-road travel.



### *The drawings*

Other features and advantages of the present invention will become apparent from the following specification and drawings, forming a part thereof, wherein:

FIGURE 1 is a perspective view of a typical mobile hammering machine embodying the improvements constituting the present invention;

FIGURE 2 is a fragmentary part-sectional view of the mast support and carriage means employed in the impacter of FIGURE 1, taken along the line 2—2 of FIGURE 3;

FIGURE 3 is another fragmentary part-sectional view of the support and carriage means, taken along the line 3—3 of FIGURE 2;

FIGURE 4 is a fragmentary view taken along the line 4—4 of FIGURE 3 and including the driving means for traversing the mast support and carriage means;

FIGURE 5 is a fragmentary rear view taken in the direction of the arrows 5—5 in FIGURE 2;

FIGURE 6 is a fragmentary section through the drive and transmission mechanism of the transporting vehicle with the parts shown in position for conventional over-the-road travel;

FIGURE 7 is a similar section through the drive mechanism of the vehicle but with the clutch for conventional drive disengaged and the hydraulic creeper drive in effective working condition; and

FIGURE 8 is a schematic diagram of the hydraulic system employed by the mobile impacting machine of the present invention.

### *Detailed description*

Turning now to the drawings, FIGURE 1 shows a mobile impacting machine designated generally by the number 2. The machine has a chassis 4 on which is mounted a rear engine 6. The machine is steered by the wheels 8 and propelled by the wheels 10. Dual drive wheels 10 may be utilized to better support the weight of the hammering or impacting tool. Brackets 12 mounted on the front of the vehicle chassis 4 between driving wheels 10 pivotally positions the tool support member 14 which extends transversely across the front of chassis 4. A carriage 16 on the support member 14 provides a mounting for guides 18 which form the mast and extend vertically upward. Slidably positioned on guides 18 is hammering tool 20 which consists of weight 22 and a workpiece 24 in the nature of a tamping tool, breaker or bit. While a tool suitable for tamping is shown in FIGURE 1, it will be appreciated that the tool may be changed to fulfill the requirements of the job at hand. For example, a sharp-pointed, wedge-shaped tool may be utilized to cut asphalt while a blunt, wedge-shaped tool may be used for breaking concrete. Hammering tool 20 is raised along guides 18 by cable 26.

The operation of the impacting or hammering tool 20 is controlled by the hydraulic system shown in the various figures and shown in schematic detail in FIGURE 8. A hydraulic cylinder 28 mounted on guides 18 controls the raising of hammering tool 20 along its normally vertical guides. The piston rod 30 of hydraulic cylinder 28 has a block and sheave 32 mounted thereon. A cable 26 is strung from hammering tool 20, through blocks and sheaves 34, 35 at the top of guides 18, through block 32 to an anchor at the top of guides 18. A retraction of piston 30 into cylinder 28 serves to raise hammering tool 20 to a predetermined height as determined by a control means hereinafter more fully described.

The sideways tilt of the mast to the left or right is controlled by hydraulic cylinder 38 which controls the positioning of guides 18 about a pivot located on carriage 16. The fore and aft tilt of guides 18 and hammering tool 20 is controlled by a hydraulic cylinder 40 connected to arm 41 which controls the position of pivoted support member 14. By fully extending hydraulic cylinder 40, support member 14, carriage 16, guides 18, and hammering tool 20 may be tilted to the rear along the right side of the vehicle sufficiently to engage a catch 42 as shown in phantom in FIGURE 1. Catch 42 retains the aforementioned structure in the rearward position to permit over-the-road travel. Also, a safety hook or latch may be provided for retaining the mast in its raised working position.

Turning now to the transverse support member 14, such member includes a front rail 46 having an upper flange 48, a lower flange 50, and a connecting web portion 52. Also included is a rear reaction member 54 having a laterally extending guide flange 56 mounted on the upper portion thereof, the flange 56 extending rearwardly away from the front rail 46 as shown. Rail 46 and member 54 are rigidly supported and retained in laterally spaced longitudinal alignment in approximately the same horizontal plane by a plurality of laterally spaced U-shaped members 58 joined by a front beam member 60. Traversing the lower medial portions of the U-shaped brackets 58 is a pivot mounting means 62 extending transversely of the vehicle and adapted to mate with brackets 12 to permit support member 14, carriage 16, and the associated guides 18 and hammering tool 20 to tilt fore and aft. Also mounted on the U-shaped brackets 58 is a toothed rack 64, which extends upward from the brackets 58 and has a running surface 65 on the forward edge thereof.

The carriage 16 includes a tubular member 66 positioned transverse to the support member 14 and to the axis of pivot means 62. A shaft 68 is journalled in tubular member 66 and fastened to the rear of guides 18 to provide a bearing means for the left and right tilting of guides 18 and hammering tool 20. Mounted on the lower portion of tubular member 66 is a channel member 70 having an outer depending portion 72, a top portion 74, and an inner depending portion 76. Channel 70 straddles the front rail 46, and a pair of large flanged rollers 78 are rotatably mounted on outer portion 72 of channel 70 and are peripherally supported on one run of the lower flange 50 of rail 46 adjacent web 52. The rollers 78 are peripherally spaced from the upper flange 48, and a pair of smaller rollers 80 are adjustably mounted on the leg 72 of member 70 to engage upper flange 48 of rail member 46. An additional pair of large flanged rollers 82 are mounted on the inner depending leg 76 of channel member 70 to peripherally engage and travel on the other run of the lower flange 50 of rail member 46. The carriage is thus supported by the rollers 78, 82 which are adapted to travel along the oppositely directed runs of the lower flange 50 of the rail 46. Also, the rollers 80 are adjustable to properly peripherally engage the upper flange 48 of the rail 46 and thus aid in maintaining the rollers 78, 82 in proper peripheral contact with the flange 50.

To complete the support and stabilize the structure, a plate 86 mounted on the rear end of tubular member 66 contains two pairs of unflanged rollers 88 and 90. These rollers are spaced to coact with guide flange 56 of the member 54, and it is preferable to mount the rollers 88, 90 at an angle to the rollers 78, 82 as shown for most effective stabilization and to minimize binding and the need for accurate alignment of the roller axes.

It will be appreciated that the above described structure provides a rugged, yet accurate, mounting for carriage 16 and the attached guides 18 and hammering tool 20. Specifically, the rollers 78, 82 in conjunction with rollers 80 and rollers 88, 90 prevent undesirable vertical movement



of carriage 16 in relation to support member 14. These rollers effectively support and stabilize while also preventing any pivoting of carriage 16 about rail member 46 or plate 54, and the flanges on rollers 78, 82 prevent any longitudinal displacement of carriage 16.

The inner depending leg 76 of channel member 70 has affixed thereto a mounting bracket 96 for a hydraulic motor 44. The motor 44 has a gear 100 keyed to the output shaft 98 which meshes with a pinion gear 102 to drive the same. Pinion gear 102 is, in turn, rotatably mounted on a shaft 97 which is carried by the upper and lower arms 99 and 101 of a frame member 104. These arms of the frame member 104 also contain bearings for the gear 100 driven by output shaft of motor 44 and support shaft 97. The frame member 104 is rotatively supported by means of a clamped split ring 105 surrounding bearing 107. The positioning member 103 loosely receives the shaft 97 at its upper portion. The member 103 serves to carry the rollers 84 which coact with the running surface 65 on the forward edge of rack member 64 to maintain the gears in proper position and alignment. The loose fit of shaft 97 in the member 103 thus permits the attached horizontal frame member 104 along with the pinion gear 102, and shaft 97 to pivot slightly about the output shaft of hydraulic motor 44. In other words, the frame member 104, in cooperation with the rollers 84 and attendant structure, provides a floating support coupling the gears 100, 102 and swingable to a limited extent about the shafts 97, 98 to thereby maintain proper gear pitch line contact while providing for some small amount of lateral displacement between the beam structure 14 with rack 64 and carriage 16 with motor 44.

As shown in FIGURE 1, hammering machine 2 has an operator's control station which includes a seat 106 and steering wheel 108. Also provided at the control station are the clutch, throttle, and gear shift levers of the ordinary type for controlling motor 6 and a plurality of valves and selective controls for controlling the above-described hydraulic cylinders, hydraulic motor and creeper operation. These controls enable the operator to control vehicle travel, proper positioning of the mast and its attendant mechanism, hammer actuation and creeper movement all from a single station.

Referring now to FIGURES 6 and 7, the improved mechanical-hydraulic drive and clutch mechanism for the vehicle is illustrated. A fragment of the conventional vehicle transmission is identified by the numeral 150, and when the vehicle is traveling from site-to-site over a highway, it is driven in a conventional manner through the shaft 151 coupled to the flywheel 152 by the clutch 153 which may be of any well-known type having a face plate or disc 154 engageable as in FIG. 6 to drive the vehicle in a conventional manner. The clutch 153 is retractable through linkage 155, 156 upon shifting of a lever convenient to the operator and coupled with a motion transmission shaft 157. Retraction of the clutch 153 at the will of the operator disengages the disc 154, and the vehicle drive mechanism may then be powered by hydraulic means at a speed sufficiently slow and/or intermittent to permit effective work performance by the impacting tool.

To couple the vehicle drive mechanism to the hydraulic system, a shift lever 158, also convenient to the operator, is connected to a shiftable gear 160 as by means of throwout or actuating shaft 161 and suitable linkage. Thus, with the conventional transmission uncoupled as shown in FIG. 7, movement of the lever 158 to the right will shift the gear 160 into mesh with the gears 163 and 165 to thereby complete the drive chain from the hydraulic motor 168 to the vehicle drive shaft 151. The hydraulic motor will accordingly drive the vehicle at a desired creeper or slow and/or intermittent rate of speed which may be readily timed with or adjusted to the hammer operation by the operator by selection of gear ratio through standard transmission 150 and actuation of hydraulic con-

trol as hereinafter described. The hammer carrying vehicle may therefore be selectively driven either in a conventional manner for over-the-road travel by mechanical means or by hydraulic power for creeper or slow speed travel during hammer operation.

FIGURE 8 schematically illustrates the hydraulic system employed on the machine 2 for controlling operation of the impact tool, tilting of the mast and attendant structure, and creeper or slow speed hydraulic operation of the vehicle. This system includes a main hydraulic control 214 which is located in a position convenient to the operator and which provides for both manual and automatic operation. As shown, hydraulic fluid is supplied from a reservoir 200 through a pair of filters 204, 206 located in the discharge lines from the reservoir. The outlet or discharge line from the hydraulic reservoir 200 is connected to a tandem hydraulic pump 208, 210 (through filters 204, 206) for supplying operating fluid thereto. The hydraulic pump 208, which is preferably of greater capacity than the pump 210, is employed for raising the impact tool 20, the lift of which is controlled by the cylinder and piston 28. The hydraulic pump 210, is, in turn, employed to operate the hydraulic motor 44 for driving the carriage along the transverse support 14, for operating the hydraulic cylinders 38 and 40 to tilt the mast and its attendant structure both sidewise and fore-and-aft, and for supplying pressurized fluid to operate the creeper motor 168.

As previously indicated, the impact forces of the workpiece 24 are dependent upon the free fall height of the hammer, and it is proposed herein to control this free fall height by a timer 220 which accurately controls the flow of pressurized operating fluid to the lift cylinder 28. The automatic timer 220 is likewise located conveniently to the vehicle operator and when set, this timer operates a pilot operated check valve 218, as through the solenoid valve 222, to regularly and at predetermined timed intervals conduct fluid under pressure to the upper end of the cylinder 28 to thereby lift the hammer and impact tool to a predetermined and regulated drop height and to subsequently interrupt fluid pressure flow at such regulated heights. As a safety measure in order to provide protection against overpressurizing of the hydraulic system, a relief valve 233 is interposed in the hydraulic line between the control valve 214 and the hydraulic pump 208. An accumulator 215 and relief valve 216 are preferably interposed in the line between valve 214 and cylinder 28 in order to relieve sudden fluctuations in pressure due to pulsations in the system in normal and abnormal operation. Thus, the control 214 provides for raise, drop, and hold positions of the hydraulic cylinder 28 together with the weighted tool actuated by such cylinder, and the automatic timer 220, as set by the operator, is operable to regulate fluid pressure flow automatically and at regularly timed intervals to the lift cylinder 28 for lifting the hammer and impacting tool to predetermined drop heights when the control 214 is in raise position.

The operation of the hydraulic creeper motor 168 from fluid pressure created by the pump 210 is controlled by means of a control valve 224. As above described, the hydraulic motor 168 is connectable to the power train for driving the vehicle upon disengagement of the conventional vehicle drive from the usual power source by means of the clutch 153, and this hydraulic creeper motor is adapted to propel the machine 2 at speeds much slower than those which may be obtained (with conventional means) from the motor 6. The creeper drive may thus be utilized to advantage when operating the impact mechanism of the machine so that the tool and its carriage traverse the transverse support 14 as the vehicle is either slowly or intermittently moving in a forward or rearward direction as determined by the operator, and this feature is particularly useful in pavement breaking operations and the like wherein it is desired to work upon relatively wide successive sections of roadway.

A control 226 may also be provided in the output line of the pump 210 for the purpose of controlling operation of the hydraulic motor 44 which is mounted on the carriage 16. When fluid under pressure is conducted from the pump 210 to the motor 44 as controlled by the operator, the carriage and the associated guides or mast 18 along with the hammering tool 20 are driven by the motor along the support member 14 transversely of the vehicle.

In addition, a control 228 may similarly be provided for controlling flow of fluid under pressure from the pump 210 to the hydraulic cylinder 38 which is employed for sidewise tilting of the mast and guides 18 thereof along with the hammer tool 20. Additionally, a control 230 may be provided for controlling fluid flow from the pump 210 to the hydraulic cylinder 40 utilized for positioning the guides 18 and mast in fore-and-aft or upright and layback positions.

The return lines from valves 214, 216, 218, 230 to the reservoir 200 are preferably provided with a suitable oil cooler 232 in a conventional manner.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

We claim:

1. A mobile impacting machine comprising:
a power-driven wheeled chassis;
a means on said chassis providing a pivotal mounting at one end thereof;
a support member carried by said pivotal mounting and formed with a pair of laterally spaced tracks disposed in parallel relation to the pivot axis;
one of said tracks having a pair of spaced flanges and the other of said tracks having a single flange;
a carriage having sets of laterally spaced rollers engaged with said tracks to permit movement of said carriage therealong in a path extending transversely of said chassis;
one set of said rollers including at least one roller peripherally engaged with one of the spaced flanges of said first mentioned track and at least one other roller engaged with the other flange of said first mentioned track, and the other set of said rollers including at least one roller peripherally engaged with one side of the flange of said second mentioned track and at least one other roller engaged with the other side of the flange of said first mentioned track;
guide means mounted on said carriage for movement therewith along said tracks;
an impacting tool carried by said guide means for reciprocating movement therealong; and
means connected with said impacting tool for raising the same to predetermined drop heights.

2. A mobile impacting machine according to claim 1, wherein the rear track is angularly inclined relative to the front track.

3. A mobile impacting machine according to claim 1, wherein the rollers which are engaged with the upper flange of the front track are adjustably mounted for movement toward and away from the lower flange of said front track.

4. A mobile impacting machine according to claim 1, wherein the rollers peripherally engaged with the lower flange of the front track include at least one roller on one side of said track and at least one other roller on the opposite side of said track.

5. A mobile impacting machine comprising:
a power-driven wheeled chassis;
means on said chassis providing a pivotal mounting at one end thereof.
a support member carried by said pivotal mounting and formed with a pair of laterally spaced tracks and an intermediate rack all disposed in parallel relation to the pivot taxis;

said rack having teeth extending from one side thereof and a plain guide surface on the opposite side thereof;

a carriage having rollers engaged with each of said tracks to permit movement of said carriage therealong in a path extending transversely of said chassis;

said carriage also having a gear drivingly engaged with the teeth of said rack and a roller peripherally coacting with the plain guide surface thereof;

means mounted on said carriage for driving said gear to move said carriage along said tracks;

guide means mounted on said carriage for movement therewith;

an impacting tool carried by said guide means for reciprocating movement therealong; and

means connected with said impacting tool for raising the same to predetermined drop heights.

6. A mobile impacting machine according to claim 5, wherein the gear which drivingly engages the rack is carried by a shaft which is loosely mounted to provide a floating support for said gear.

7. A mobile impacting machine according to claim 5, wherein the gear which drivingly engages the rack is driven by a hydraulic motor through a gear mounted on the motor shaft, the driven gear being carried by a shaft which is loosely mounted on the carriage to permit said driven gear to float to a limited extent.

8. A mobile impacting machine according to claim 1, wherein a hydraulic cylinder is mounted on the mast and has an extendable piston conneced with the impacting tool, the cylinder being connected with a source of pressurized operating fluid, a timer being provided for controlling the flow of pressurized operating fluid to actuate the tool.



9. A mobile impacting machine according to claim 1, wherein hydraulically operable means is connected between the chassis and the support member for swinging the support member and the guide means carried thereby from a substantially vertical position to a substantially horizontal position overlying the chassis.

10. A mobile impacting machine according to claim 1, wherein first and second power transmission means are provided together with means for selectively coupling and uncoupling said first and second power transmission means with the wheels of the chassis to thereby drive the wheels and transport the chassis at normal and abnormal rates of speed respectively.


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