July 15, 1969 C. V. ADAMS 3,455,208

PERCUSSION HAMMER

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FIG. 1

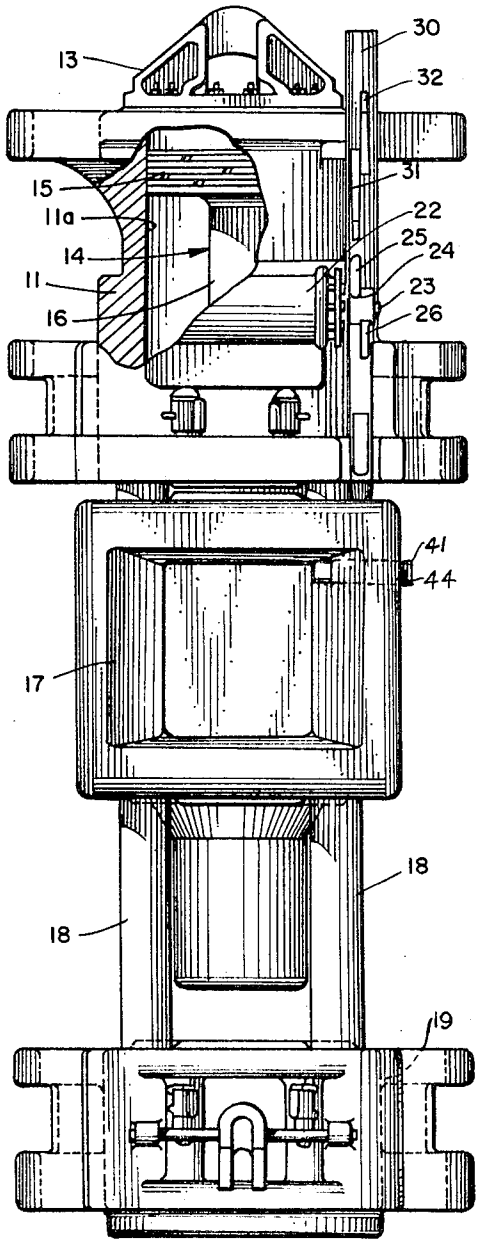

FIG. 2

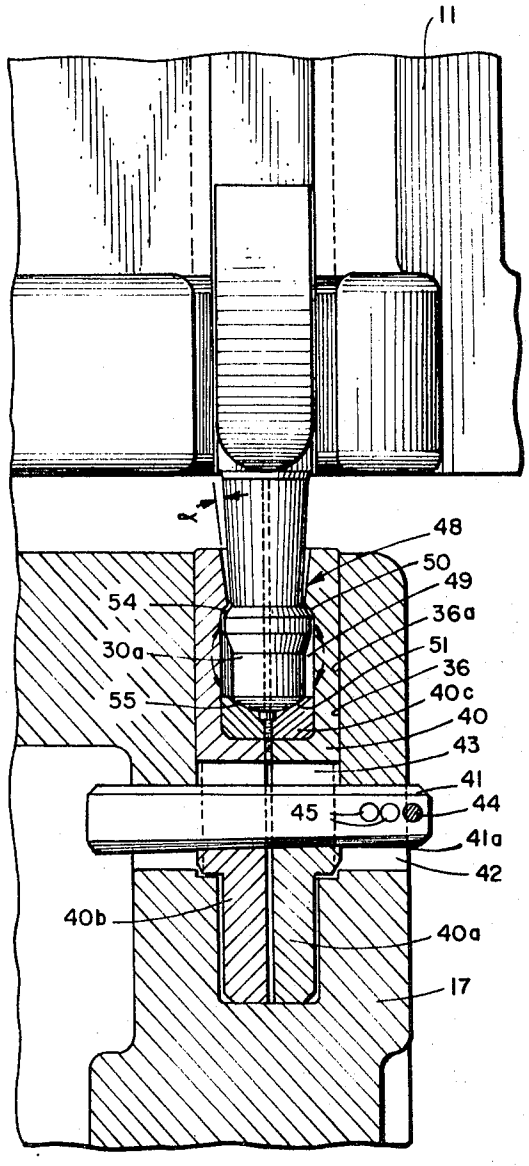

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FIG. 3

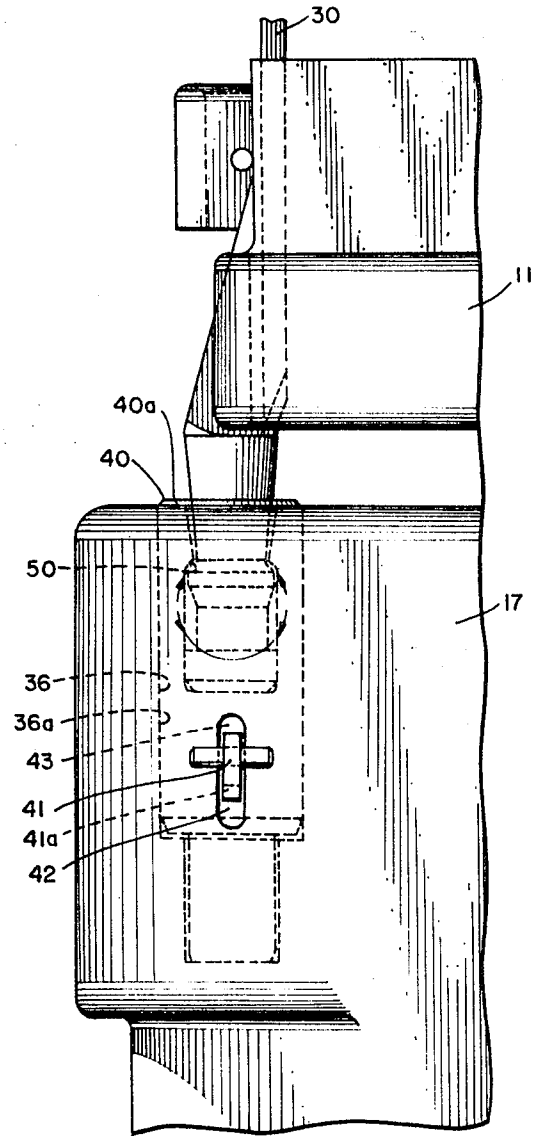
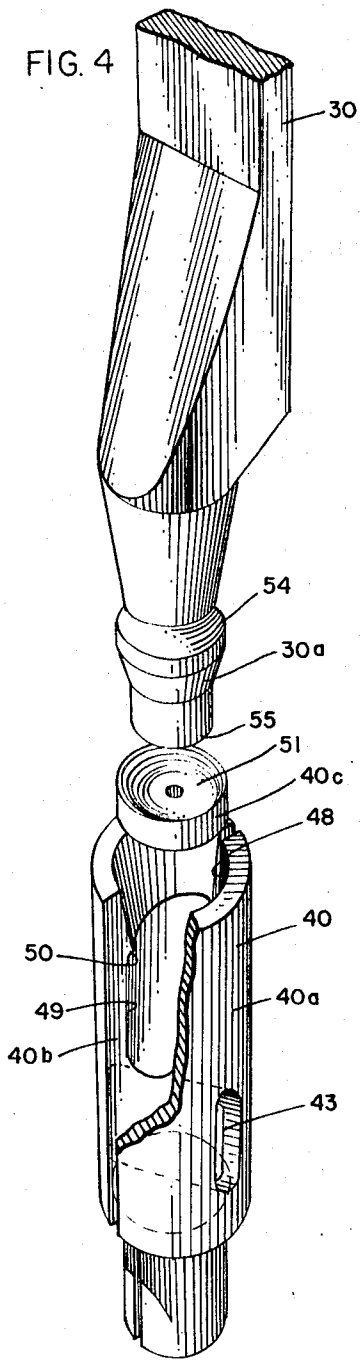


FIG. 4



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PERCUSSION HAMMER

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Int. Cl. F01l 31/18
U.S. Cl. 91—352 9 Claims

ABSTRACT OF THE DISCLOSURE

There is provided a pile driving hammer including a cylinder, a piston operated in the cylinder, and a ram reciprocated by the piston. It is conventional in such hammers to provide valve mechanism for controlling the supply of motive fluid to the cylinder so as to cycle the piston and the associated ram. A slide bar connected to the ram is provided for controlling the valve mechanism. The pile driving hammer is provided with an improved pivotal connection between the ram and the slide bar.

The present invention relates to a percussion hammer particularly useful as a pile driving hammer but also applicable to other percussion hammer applications. One such known percussion hammer is described in my earlier Patent 2,004,180 granted June 11, 1935.

The hammer illustrated in my earlier patent is of the type including a cylinder, a piston operated within the cylinder, and a ram reciprocated by the piston for imparting impact blows to an anvil or pile head. A valve assembly is provided for controlling the supply of motive fluid to the cylinder in the desired manner to cycle the piston and the associated ram through its up and down strokes. A slide bar is connected to the ram for reciprocation therewith and controls the operation of the valve mechanism.

The means generally used commercially for securing the slide bar to the ram fastens the slide bar rigidly to the ram. This may be accomplished by passing a key through a slot in both the ram and the slide bar. The looseness of the ram on its guides while it is reciprocated requires that the slide bar, which is guided by a groove in the cylinder housing, have sufficient play provided in attachment to the ram to assure proper orientation with the guiding groove in the cylinder housing. Thus ample freedom of movement without binding is essential. However such commercial assembly has not been entirely satisfactory in this regard and has resulted in binding and failure of the members involved.

Accordingly one object of the present invention is to provide a new and improved percussion hammer which avoids the above mentioned difficulty.

Another object of the present invention is the provision of an improved means for securing the slide bar to the ram of a percussion hammer.

Yet another object of the present invention is to provide a new and improved percussion hammer.

Further objects and advantages of the present invention will become apparent as the following description proceeds and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

The present invention is intended for use with a known type of percussion hammer particularly of the type used in driving piles, and including a cylinder housing defining a cylinder and having a piston operated in the cylinder with a ram reciprocated by the piston. Valve mechanism is provided for controlling the supply of motive fluid to

the cylinder to cycle the piston and the associated ram. A slide bar is connected to the ram for reciprocation therewith and controls the operation of the valve mechanism.

In accordance with the present invention the slide bar is connected to the ram by a pivotal connection which will accommodate reasonable misalignment between the component parts. In a preferred embodiment the pivotal connection is formed by a ball and socket joint wherein the socket is defined within a gripper member, and the gripper member is secured to a ram by a key connection.

Thus the method of attaching the slide bar to the ram according to the present invention avoids all the restraints to universal movement of slide bars encountered in connection with present commercial methods of attachment while additionally providing a simple, easy means of assembly and the securement thereof in a hole provided in the ram by the utilization of a key or similar securing device.

For a better understanding of the present invention reference may be had to the accompanying drawings wherein:

FIG. 1 is an elevational view of a percussion hammer incorporating the present invention;

FIG. 2 is a detail cross sectional view of a slide and ram connection in the hammer of FIG. 1 in accordance with the present invention;

FIG. 3 is a side view of the slide and ram connection of FIG. 2; and

FIG. 4 is an exploded perspective view of the connecting components of the slide bar and ram.

Referring now to the drawings, there is illustrated a percussion hammer **10**, FIG. 1, having an improved slide bar to ram connection according to the present invention and including a cylinder housing **11** defining an internal cylinder **11***a* closed at its upper end by a cylinder head **13**. A piston assembly **14** is provided including a piston **15** reciprocable within the cylinder **11***a* and including a piston rod **16** extending through the lower end of the cylinder **11***a* connected to a suitable ram **17** guided for reciprocal movement on a plurality of guides **18** and adapted to strike against an anvil or pile. The reciprocal movement of the piston **15** is under the control of a known valve mechanism **22** which controls the admission and exhaust of motive fluid into and out of the cylinder **11***a*. The valve mechanism **22** includes a valve element **23** which is adapted to be rocked by a trip **24** including a pair of trip elements **25** and **26**. The trip **24** of the valve mechanism **22** is operated by a slide **30** guided within a slide groove **31** for reciprocal movement with the ram **17**, and connected at its lower end to the ram **17**. The slide **30** is provided with suitable cams **31** and **32** adapted to engage the trip elements **25** and **26**, respectively, for rocking the valve element **23** in response to reciprocation of the ram **17** and associated piston **15**. The structure thus far described is known and may, if desired, be similar to that described in my earlier patent mentioned above.

In accordance with the present invention there is provided a pivotal or swivel connection between the slide bar **30** and the ram **17**. Such connection in the illustrated drawings takes the form of a ball and socket joint between these members. More specifically, to this end, the ram **17** is provided with a bore **36** in its upper surface for receiving the lower end of the slide bar **30** and enlarged at its upper end as illustrated at **36***a*. A gripper plug assembly **40** is secured within the bore **36** by a suitable wedge key **41** driven through aligned slots **42**, **43** in the ram **17** and the gripper plug assembly **40**, respectively. The key **41** has a tapered lower surface **41***a* so that the gripper plug assembly **40** may be driven tight within the bore **36**. A pin **44** inserted

within a selected one of a plurality of holes **45** in the key **41** prevents accidental release of the key **41**.

The gripper plug assembly **40** is provided with an upwardly opening chamber **48** (FIGS. 2 and 4) terminating in an inner enlargement **49** having upper and lower spherical surfaces **50** and **51**, respectively. In the illustrated embodiment of the present invention, the gripper plug assembly includes an outer housing split longitudinally into sections **40***a* and **40***b* to provide for insertion of the slide bar, and includes a removable lower end block **40***c* secured in the lower end of the chamber **48** to define the spherical surface **51** in its upper surface. The lower end of the slide bar **30** is provided with a ball or enlargement **30***a* having an upper and lower spherical surface **54, 55**, respectively, mating with the spherical surfaces **50** and **51** in the gripper plug assembly **40**.

To provide lateral clearance between the slide bar **30** and the chamber **48**, the upper portion of the chamber **48** is tapered upwardly and outwardly relative to the slide bar **30**, as defined by angle α, FIG. 2, to provide pivotal clearance between the slide bar **30** and the sides of chamber **48**. In the illustrated embodiment the slide bar **30** has a portion extending upwardly from the enlargement **30***a* thereof tapering upwardly and outwardly, and consequently the chamber **48** has an adjacent portion tapering upwardly and outwardly at the angle α greater than the taper on the portion of the slide bar.

From the foregoing description it will be understood that the slide bar may pivot or swivel in all directions relative to the ram. Therefore, there is avoided all the restraints encountered on the slide bar and ram in the present commercial methods of attachment. Additionally, the enlargement at the lower end of the slide bar is readily gripped within the gripper plug assembly **49** prior to its positioning within the bore **36** of the ram. Once the gripper bar assembly **40** is in place, the key **41** is driven through the cooperating slots **42, 43** and is thus secured within the ram. The key **41** prevents the gripper plug assembly from rotating but permits rotational and oscillative movement of the slide bar **30** relative thereto.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. The improvement in a pile driving hammer of the type including a cylinder housing defining a cylinder, a piston operated in said cylinder, a ram reciprocated by said piston, valve means for controlling the supply of motive fluid to said cylinder to cycle said piston and associated ram, and a rigid slide bar directly connected with said ram for longitudinal reciprocation therewith and for controlling the operation of the said valve means, said improvement comprising a pivotal connection between said ram and said rigid slide bar.

2. The improvement as set forth in claim **1** including guide means defined in said cylinder housing for guiding said slide rigid bar.

3. The improvement in a pile driving hammer of the type including a cylinder housing defining a cylinder, a piston operated in said cylinder, a ram reciprocated by

said piston, valve means for controlling the supply of motive fluid to said cylinder to cycle said piston and associated ram, a slide bar connected for reciprocation with said ram controlling the operation of the said valve means, said improvement comprising a pivotal connection between said ram and said slide bar; said valve means including trip means, and said slide bar including cam means engageable with said trip means.

4. The improvement in a pile driving hammer of the type including a cylinder housing defining a cylinder, a piston operated in said cylinder, a ram reciprocated by said piston, valve means for controlling the supply of motive fluid to said cylinder to cycle said piston and associated ram, a slide bar connected for reciprocation with said ram controlling the operation of the said valve means, said improvement comprising a pivotal connection between said ram and said slide bar; said ram including a bore for receiving the slide bar, and a gripper plug means within said bore and including an upwardly opening chamber terminating in an inner enlargement having upper and lower spherical surfaces, the lower end of said slide bar being provided with an enlargement having upper and lower spherical surfaces for engaging the first mentioned spherical surfaces.

5. The improvement as set forth in claim **4** wherein said chamber has an upper portion extending from said inner enlargement tapered upwardly and outwardly relative to said slide bar to provide pivotal clearance with said slide bar.

6. The improvement as set forth in claim **5** wherein the portion of the slide bar extending into said upper portion is tapered upwardly and outwardly, and said upper portion is provided with a greater upward and outward taper than said slide bar.

7. The improvement as set forth in claim **4** wherein the lower spherical surface of said chamber is defined in a removable end block received in said gripper plug means to lock said slide bar in place.

8. The improvement as set forth in claim **4** wherein said gripper plug means is split longitudinally to provide for insertion of said enlargement on said slide bar.

9. The improvement as set forth in claim **4** wherein said gripper plug means and said ram are provided with transversely aligned slots, and wherein there is provided key means through said slots securing said gripper plug means to said ram.

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U.S. Cl. X.R.

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