United States Patent [19]

Shanks et al.

[11] **3,773,118**

[45] **Nov. 20, 1973**

[54] **UTILITY DEVICE**

[76] Inventors: **Douglas G. Shanks,** 5932 Jeffery Ln.; **Richard E. Seed,** 5803 Brainard; **Arthur J. Holmes,** 5833 Winding Way, all of Sylvania, Ohio

[22] Filed: **Jan. 24, 1972**

[21] Appl. No.: **220,268**

[52] **U.S. Cl.** **173/43,** 173/23, 299/70

[51] **Int. Cl.** **E21c 11/02**

[58] **Field of Search** 173/22, 23, 28, 43; 299/37, 70

[56] **References Cited**

UNITED STATES PATENTS

3,470,969	10/1969	Arcangeli	173/43
2,703,222	3/1955	Feucht	173/43 X
3,586,113	6/1971	Grant	173/43 X

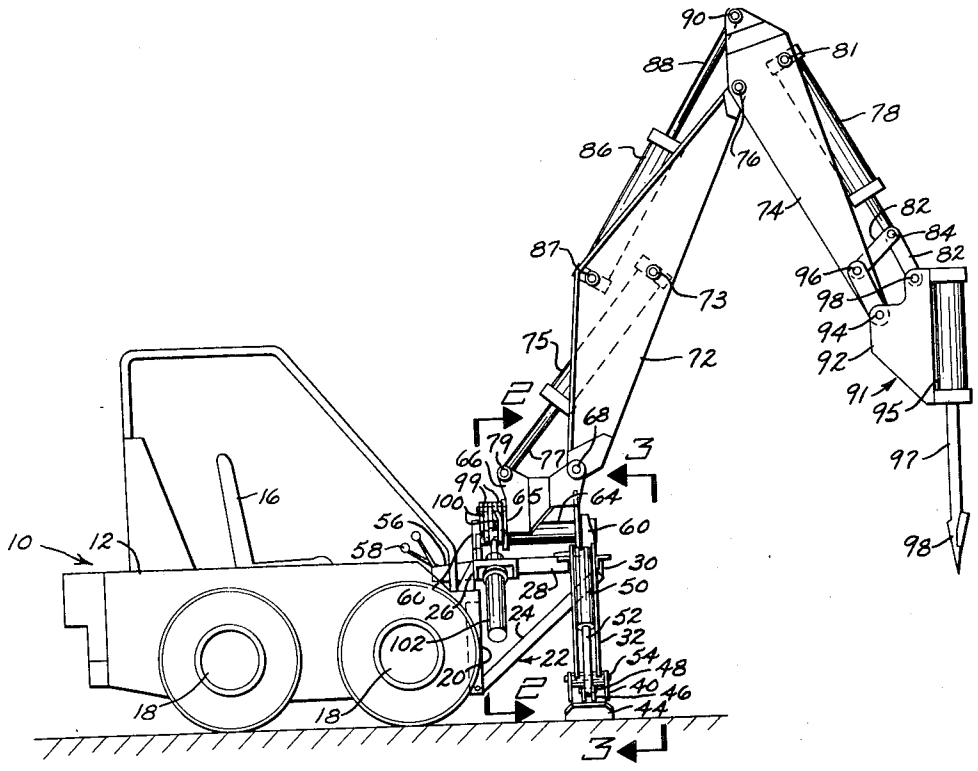
Primary Examiner—Ernest R. Purser

Attorney—Paul R. Martin

[57] **ABSTRACT**

Disclosed is a utility device such as a pneumatic hammer universally mounted upon an extendabe arm and boom arrangement capable of being attached to a vehicle. The pneumatic hammer is mounted in a manner that provides great multidirectional mobility to the hammer.

8 Claims, 6 Drawing Figures



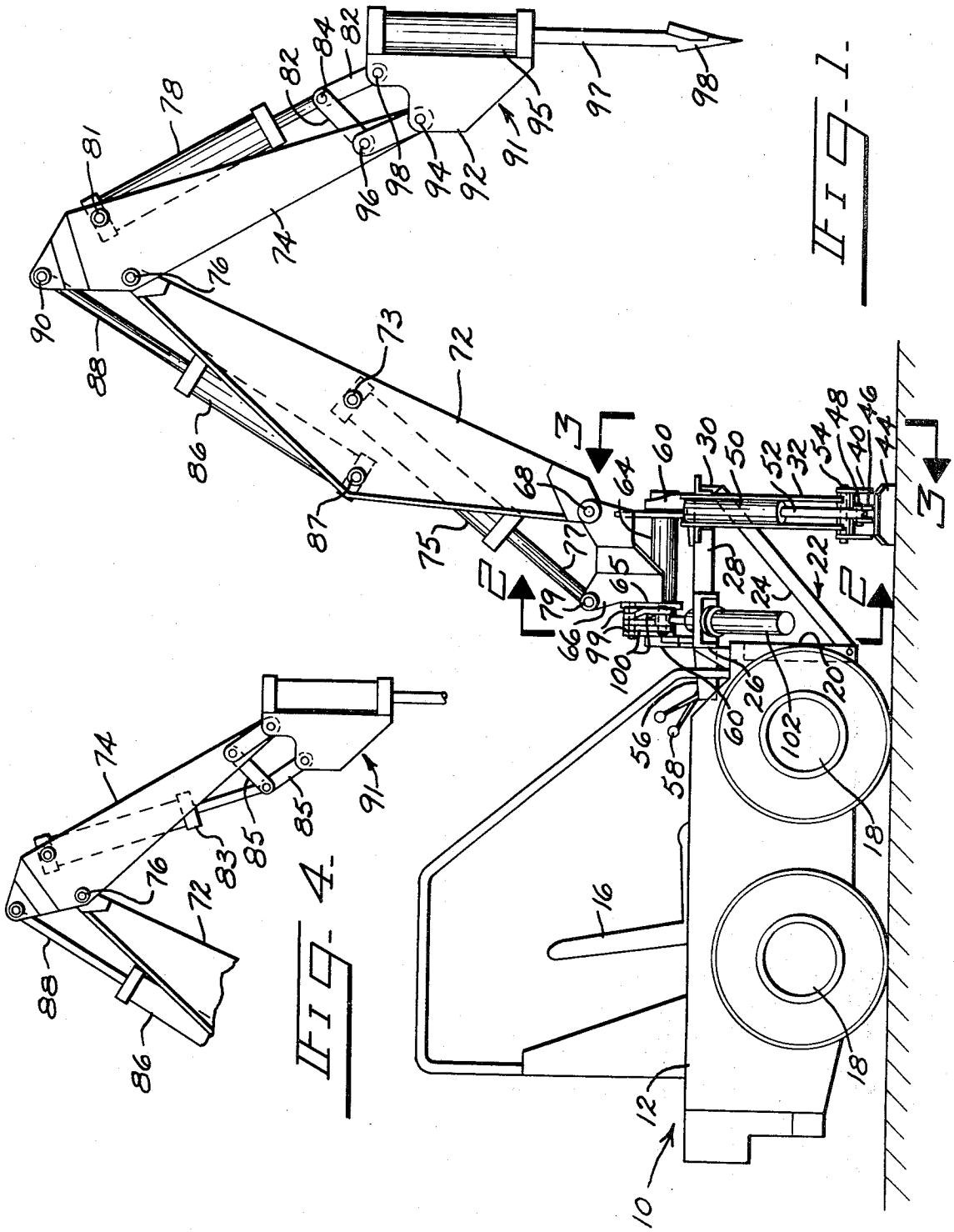

81
78
82
84
82
74
76
90
88
86
96
98
94
92
91
95
97
98
73
72
87
75
77
79
68
64
60
30
50
52
32
54
48
40
46
44
22
28
24
65
66
99
100
102
26
20
56
58
16
18
12
10
74
76
72
83
85
85
91
88
86

FIG. 1.

FIG. 4.

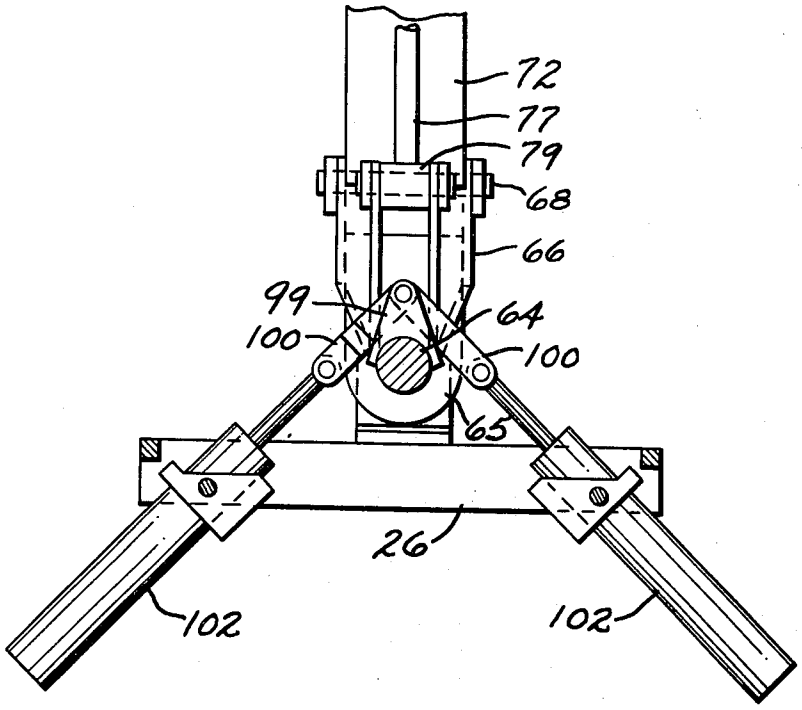

72
77
79
68
66
99
64
100
100
65
26
102
102

FIG. 2.

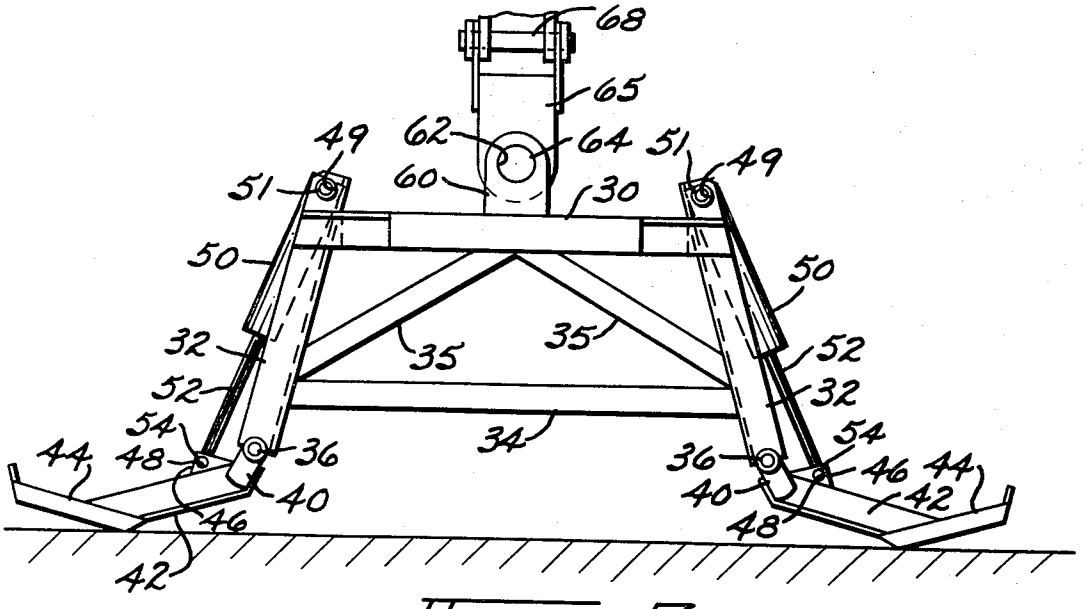

68
65
49
62
64
51
49
51
60
30
50
50
32
35
35
52
52
32
54
54
44
48
36
34
36
46
44
40
40
42
46
48
42

FIG. 3.

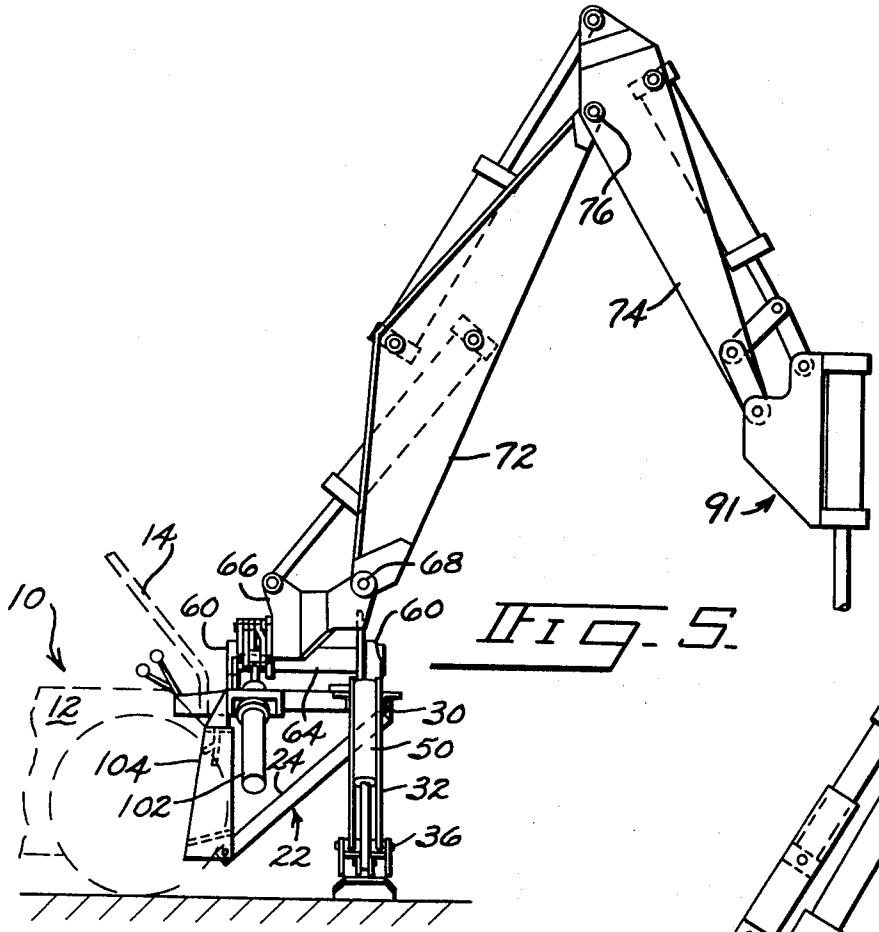

76
74
72
91
14
66
68
10
60
60
12
64
30
104
24
50
102
32
22
36

FIG. 5.

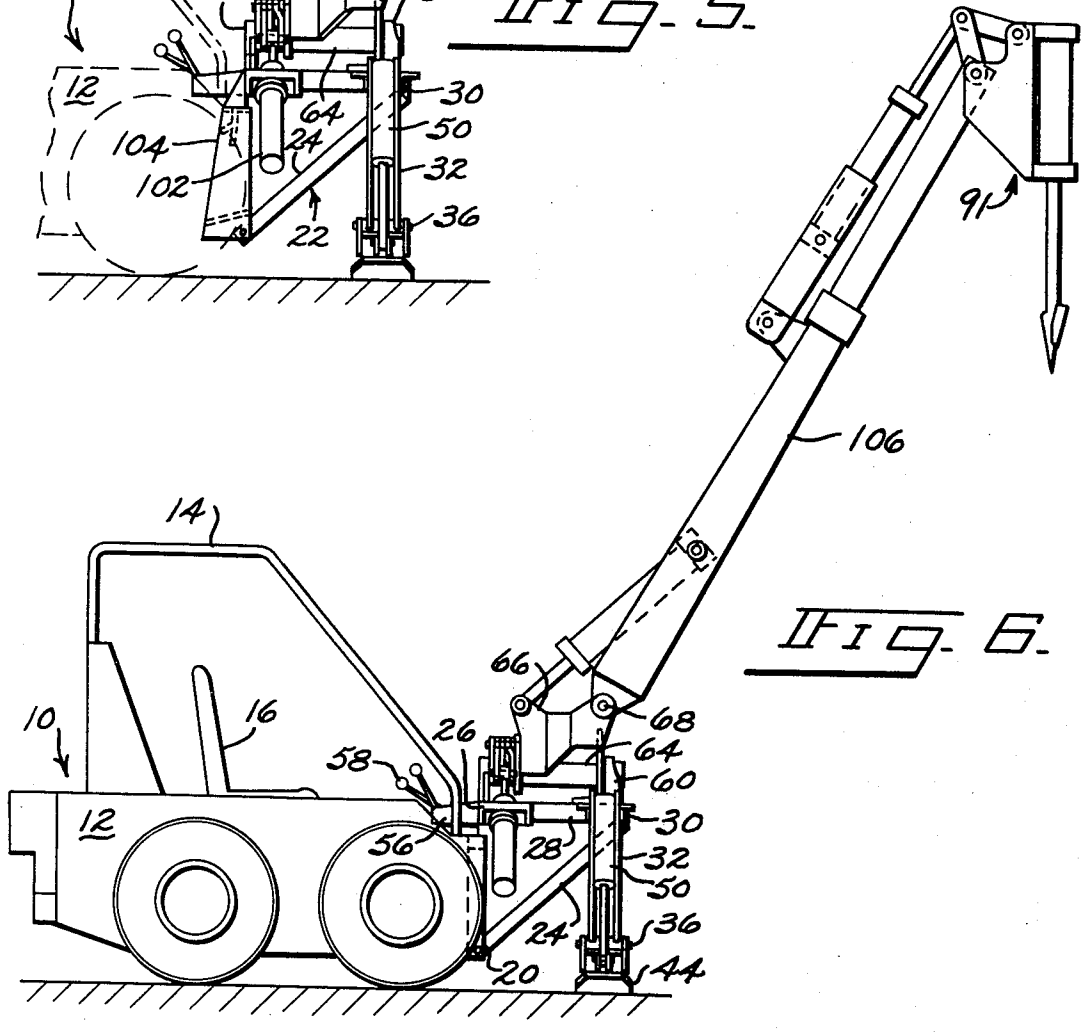

91
106
14
66
68
10
16
26
64
58
60
12
30
56
28
32
50
24
36
20
44

FIG. 6.

UTILITY DEVICE

BACKGROUND OF THE INVENTION

In certain circumstances, it is desirable to locate a pneumatic hammer in difficult to reach areas. An example of such a circumstance is when the refractory lining of a cement kiln or furnace must be removed. A kiln or other type of furnace lining is usually composed of refractory brick. The present practice of removing old, or worn, refractory brick from a kiln or other furnace is to send a man into the kiln with an air hammer to remove the refractory brick from the inner wall of the kiln. This has disadvantages both in terms of safety and economy as the man is subject to falling bricks from overhead, the dust level within the kiln is high, and the man's output is limited by his physical endurance.

THE PRIOR ART

It would be advantageous to have a device which operates with substantially total mechanical means rather than relying on human physical endurance. The type of vehicle generally adapted for this activity in the prior practice has been a tractor-like vehicle having an extendable boom and an air hammer at the outer extremity of the boom. The shortcomings of the present vehicles are that they can only operate in two dimensions, i.e., in a plane generally longitudinal to the forward movement of the vehicle. Movement from side to side is very limited and is only possible to the extent that the front of the vehicle may be turned. Vehicles of this type, by necessity, are only practical in extremely large furnaces, where the vehicle can enter and have sufficient room for mobility. It would be advantageous to have such a vehicle whose extension means could operate in a multidirectional three dimensional pattern.

It is, therefore, an object of this invention to provide a vehicle having a pneumatic or hydraulic device that can be universally positioned in a widespread working zone.

It is a further object of this invention to provide a mechanism for supporting and positioning an air hammer in a three dimensional manner.

It is still another object of this invention to provide extension means which can be attached to a vehicle with said means having a high degree of mobility.

It has been found that these and other objects may be achieved by the articulated boom having a pair of axes which are at right angles to one another. This and other features are described in the balance of this specification and in the drawings, wherein:

FIG. 1 is a side elevational view of a vehicle incorporating the concepts of the present invention;

FIG. 2 is a cross-sectional view of the support assembly taken along lines 2—2 of FIG. 1;

FIG. 3 is an elevational view of the support assembly taken from line 3—3 of FIG. 1;

FIG. 4 is a partial view of the boom and arm assembly wherein the actuating cylinder and link arms are arranged on the under side of the arm;

FIG. 5 is a view of a detachable boom and arm assembly; and

FIG. 6 is a view of a telescoping boom assembly which is mounted to the tractor in the improved manner of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, a tractor-like vehicle **10** comprises heavy chassis **12**, a cage-like top **14** secured to and above the body, a seat **16** to accommodate an operator and wheels **18** driven by selectively operable means (not shown). The front of the chassis **12** has a frame member **20** fixedly secured thereto.

Secured to frame member **20** is a support assembly **22**, which includes a pair of opposed diagonally extending arms **24**, which are secured to the frame member **20** by being bolted or welded thereto. Mounted upon frame member **20** is a brace **26**. Supported at the outer ends of the diagonal arms **24** and brace **26**, are a pair of opposed horizontal brace members **28,28** which, in cooperation with the diagonal arms **24**, support a transverse brace **30** at the outer ends thereof. Depending from transverse brace **30** are a pair of U-channeled leg members **32,32** which have a cross-brace **34** transversely extending therebetween. Offering rigidity to the support assembly **22** is a pair of diagonal struts **35** which extend from the lower portions of leg members **32** to transverse brace **30**. A connecting member **40** is pivotally attached at **36** to each leg member **32**. Fixedly secured to the lower end of each connecting member **40** is a second pair of leg members **42**. Attached to the end of each leg member **42** is a pad **44**. Intermediate the ends of each of the leg members **42** is a pair of spaced ears **46** having opposed openings **48** therein.

Each of the leg members **32** has an opening **49** at its upper end, which opening is pinned to a pair of trunnions **51** secured to the upper end of an actuating cylinder **50** having a slideable piston arm **52**. Each of the piston arms **52** is connected to the pad **44** by a pin **54** which is received within the ear opening **48**. The combination formed by the actuating cylinder **50**, trunnions **51**, piston arm **52** and pin **54** provides pivotable movement between the first leg member **32** and the second leg member **42**.

Located above support assembly **22** and attached thereto is an air compressor or hydraulic pump **56** operated by control unit **58** located in vehicle **10**, there being control lines (not shown) extending from the control unit to the compressor or pump. The apparatus may be either hydraulic or pneumatic, but a pneumatically operated system will be described, it being understood that a pneumatic system may be directly connected to the engine of the vehicle or have its power generated independently. A hydraulic system may be powered by a take-off system connected to the drive train of the vehicle. Pneumatic lines (not shown) extend from the compressor **56** to the control unit and to the actuating cylinders thereby providing power for operating the pistons of the cylinders.

Attached intermediate the transverse brace **30** and the brace **26** are a pair of trunnions **60**, each having an opening **62** therein. Journalled within the openings **62** is a longitudinally extending shaft **64**. Located immediately above the support assembly **22** is a support member **66** secured to shaft **64** by flange **65**. Thus the support member **66** rotates with shaft **64**.

Boom **72** is pivotally attached at **68** to support member **66**. Arm **74** is pivotally mounted at **76** to boom **72**. Pivotally mounted at **73** to boom **72** is an actuating cylinder **75** having a piston arm **77** pivotally secured to the support member **66** at **79**. Pivotally attached at **81** near

one end of arm 74 is an actuating cylinder 78 having a piston arm extending therefrom and connected to a pair of line arms 82,82 at a common pivot 84. Actuating cylinder 86 is pivotally mounted on boom 72 at 87 and the actuating cylinder has a piston arm 88 which is pivotally connected at 90 to arm 74. The jackhammer assembly 91 has a mounting flange 92 pivotally mounted at 94 near the far end of arm 74. One of the link arms 82 is pivotally secured to arm 74 at 96 and the other link arm 82 is pivotally attached to mounting flange 92 at 98. The jackhammer assembly comprises an actuating cylinder 95 and a piston arm 97 having a replaceable tool 98 located at the extreme end thereof.

If desirable, the actuating cylinder and link arms of the arm 74 can be mounted so that they are positioned under the arm as shown in FIG. 4. This arrangement affords protection for the actuating cylinder 83 and linkage 85 from falling bricks or other debris while the hammer is being operated within a furnace or tank. It also allows greater force to be applied to the work surface.

Attached to shaft 64 is support member 66 that in turn supports the boom 72. Also secured to the shaft 64 is a pair of spaced-apart lever arms 99,99. The lever arms are moved by actuating cylinders 102,102 through suitable linkage arms 100,100 to cause the shaft 64 to rotate within trunnions 60,60.

The advantage of the structure, as shown in the drawing and described above, lies in the high degree of freedom of movement of the jackhammer assembly 91. The support member 66, whose axis of rotation about the longitudinally extending shaft 64 is horizontal and the swinging boom 72, whose axis of movement about pivot 68, have axes of rotation which are perpendicular to each other but both lie in a horizontal plane. The axis upon which arm 74 pivots is parallel to the axis upon which boom 72 pivots. In this way, the support member 66 is able to rotate in a clockwise or counterclockwise manner in front of the vehicle; whereas, the other members 72, 74, and jackhammer 91 are able to extend longitudinally away from and toward the vehicle 10. As can be readily ascertained, by having this motion the tool 98 can be placed in virtually any three dimensional position since the mounting flange 92 is able to pivot at the end of the second arm 74.

Although the combination is useful for a variety of purposes, it has particular utility in the removal of used and worn brick in a furnace, as the assembly 91 can be extended within the furnace by control and movement of the several actuating cylinder 95. In order to move from side to side relative to the vehicle, the support member 66 may be rotated through movement of the piston arms 102 and the linkage arms 100. Any other suitable means of rotating the shaft 64 and thus the support member 66, can be used.

Although in the described embodiment, the angle of rotation of the boom 72 about axis 64 would be limited, it is obvious that the rotation of the same may be extended through the use of appropriate mechanical linkage intermediate piston 102 and the support member 66.

The principal embodiment has been shown in use for removing brick from a kiln or other furnace; however, other uses are contemplated. As examples, this described invention would have utility in the mining field, could be adapted for cleaning operations, the handling of radioactive materials, and other applications which require a combination of strength and dexterity. A clam bucket, rotating saw, or other utility device can be attached to the boom instead of a jack-hammer.

A further modification (FIG. 5) involves the utilization of a quick-release adapter bracket 104 which makes it possible to remove the support assembly 22 and boom and hammer from the vehicle 10 so that the vehicle can be used for other jobs.

A telescoping boom 106 universally mounted for multiple plane manipulation may be used, see FIG. 6.

Other modifications may be used within the scope of the invention as claimed.

What is claimed is:

1. A boom assembly for a vehicle, said boom assembly comprising supporting means adapted to be affixed to the vehicle, a generally horizontally-extending shaft carried by said supporting means and positioned relative to said supporting means so as to be parallel to the normal forward and rearward movement of the vehicle, a support member on said shaft and pivotable in a vertical plane which is transverse to the normal forward and rearward movement of the vehicle, a boom having one end thereof pivotally connected to said support member with a pivot axis of the boom positioned perpendicular to the axis of said shaft to enable the boom to rotate in a plane perpendicular to the vertical plane of movement of said support member, means for pivoting said boom in its plane about its pivot axis, a fluid-operated cylinder having an end pivotally connected to said supporting means and having a piston rod connected to move said support member in its vertical plane perpendicular to said shaft, an arm pivotally connected to the other end of said boom, means for pivoting said arm relative to said boom, and a work tool carried by an end portion of said arm.

2. A boom assembly according to claim 1 characterized by the pivot connection of said boom and said arm is perpendicular to the axis of said shaft.

3. A boom assembly according to claim 1 characterized by a second fluid-operated cylinder located on the side of said shaft opposite the first fluid-operated cylinder and connected in opposition to the first fluid-operated cylinder so that an extension of a piston rod of the first fluid-operated cylinder must be accompanied by a retraction of a piston rod of the second fluid-operated cylinder, and vice versa.

4. A boom assembly according to claim 1 characterized by said means for pivoting said boom in its plane about its pivot axis comprises a fluid-operated cylinder having a piston rod, with the piston rod connected to one of said boom and said support member and having an end pivotally connected to the other of said support member and said boom.

5. A utility vehicle comprising a mobile unit, a base supporting member removably secured to said mobile unit, a generally horizontally-extending shaft journaled upon said base supporting member, a support member carried by said horizontal shaft and pivotable in a vertical plane which is transverse to the normal forward and rearward movement of the vehicle, a boom having one end thereof pivotally connected to said support member with a pivot axis of the boom positioned perpendicular to the axis of said shaft to enable the boom to rotate in a plane perpendicular to the vertical plane of movement of said support member, a fluid-operated cylinder having an end pivotally connected to said supporting member and having a piston rod connected to

move said support member in its vertical plane, a tool, and means for pivotally connecting said tool to the other end of said boom.

6. A boom assembly according to claim 5 characterized by a second fluid-operated cylinder located on the side of said shaft opposite the first fluid-operated cylinder and having an end pivotally connected to said supporting member and having a piston rod connected to move said support member in its vertical plane perpendicular to the axis of said shaft, said first and second cylinders being in opposition such that an extension of a piston rod of the first fluid-operated cylinder must be accompanied by retraction of a piston rod of the second fluid-operated cylinder, and vice versa.

7. A boom assembly according to claim 5 characterized by said means for pivoting said boom comprises a fluid-operated cylinder having a piston rod, with the piston rod connected to one of said booms and said support member, and having an end pivotally connected to the other of said support member and said boom.

8. A boom assembly for a vehicle, said boom assembly comprising supporting means adapted to be affixed to the vehicle, a generally horizontally-extending shaft carried by said supporting means and positioned relative to said supporting means so as to be parallel to the normal forward and rearward movement of the vehicle, a support member on said shaft and pivotable in a vertical plane which is transverse to the normal forward and rearward movement of the vehicle, a boom having one end thereof pivotally connected to said support member with a pivot axis of the boom positioned perpendicular to the axis of said shaft to enable the boom to rotate in a plane perpendicular to the vertical plane of movement of said support member, means for pivoting said boom in its plane about its pivot axis comprising a fluid-operated cylinder having a piston rod with the piston rod connected to one of said boom and said support member, and having an end pivotally supported by the other of said support member and said boom, a second fluid-operated cylinder having a piston rod, with the piston rod connected to one of said support means and said supporting member, and having an end connected to the other of said support member and said supporting means, a third fluid-operated cylinder located on the side of said shaft opposite said second fluid-operated cylinder, with a piston rod of said third fluid-operated cylinder being connected to one of said supporting means and said support member and with an end of said third fluid-operated cylinder being pivotally connected to the other of said supporting member and said supporting means, said second fluid-operated cylinder and said third fluid-operated cylinder being connected in opposition so that an extension of the piston rod of said second fluid-operated cylinder must be accompanied by a retraction of the piston rod of said third fluid-operated cylinder, and vice versa.

* * * * *