United States Patent

[11] **3,552,501**

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[45] Patented **Jan. 5, 1971**

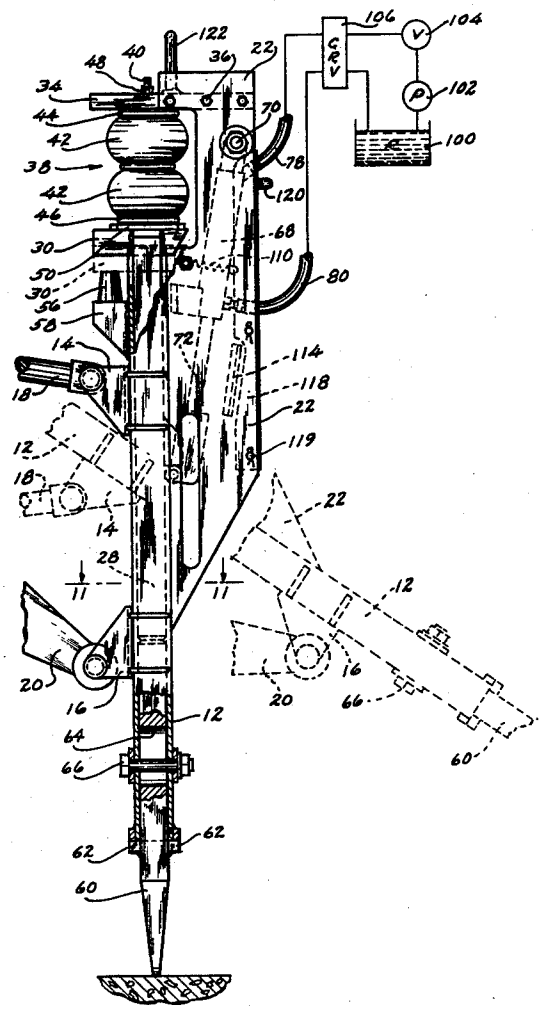
[54] **DEVICE FOR BREAKING PAVEMENT AND THE LIKE**
4 Claims, 12 Drawing Figs.

[52] **U.S. Cl.** **173/119,** 173/124, 173/139, 299/37
[51] **Int. Cl.** **E01c 23/09**
[50] **Field of Search** 173/119, 120, 124; 94/49; 299/37

[56] **References Cited**
UNITED STATES PATENTS
3,358,779 12/1967 Cunningham 173/119

Primary Examiner—Ernest R. Purser
Attorney—Axel H. Johnson

ABSTRACT: An impact tool to be mounted upon an implement, for breaking pavements and similar material. It comprises a hammer that is retracted against an "air spring" or similar means by a hydraulic cylinder to store energy in the spring. Means is provided to release the hammer so retracted, and permitting it to make impact with a chisel or point resting on the material to be broken. This tool can be positioned for operation in a horizontal, as well as in a vertical position.



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SHEET 1 OF 3

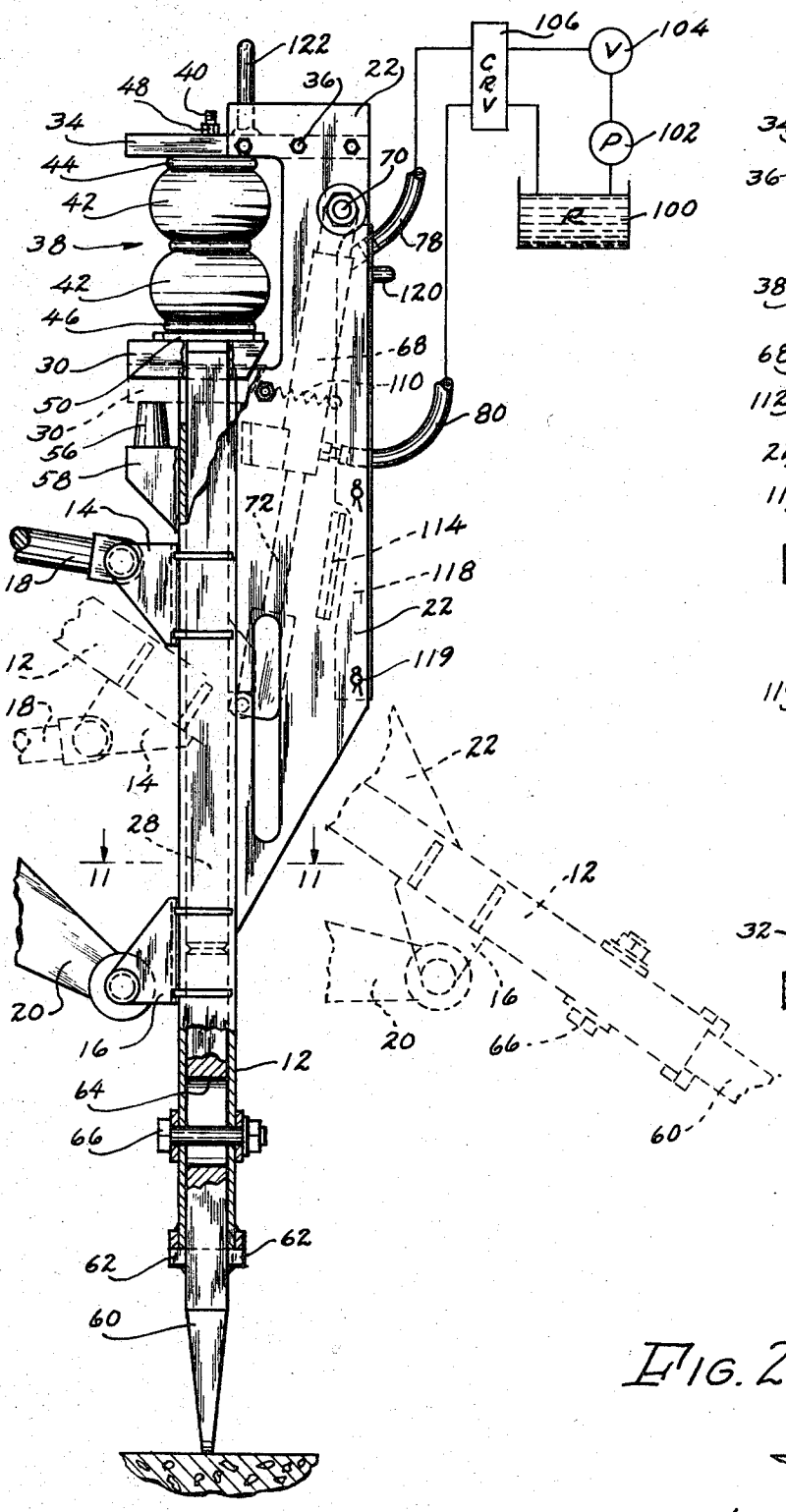


FIG. 1

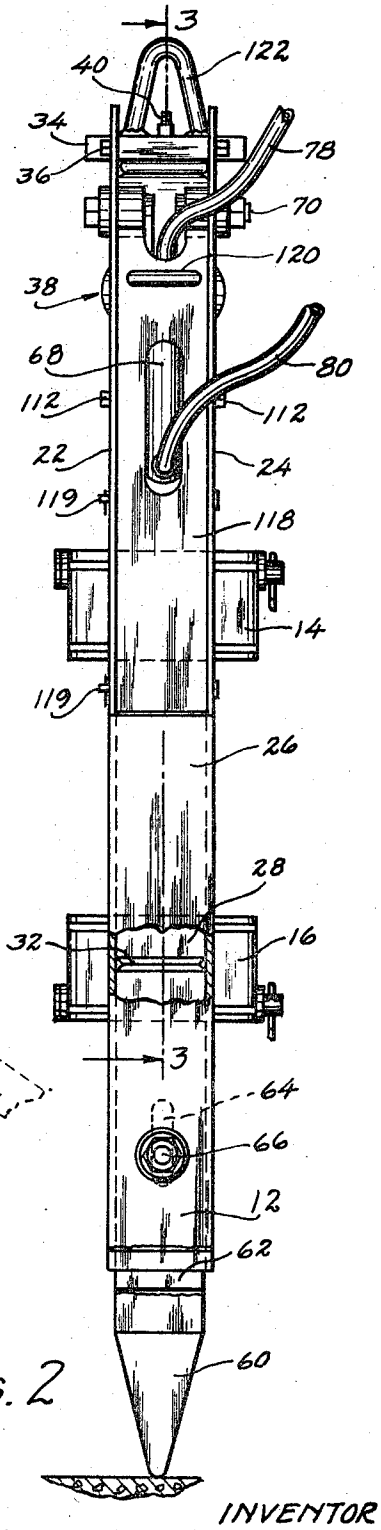


FIG. 2

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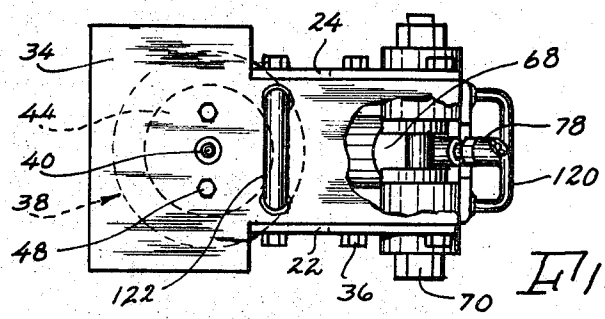


FIG. 4

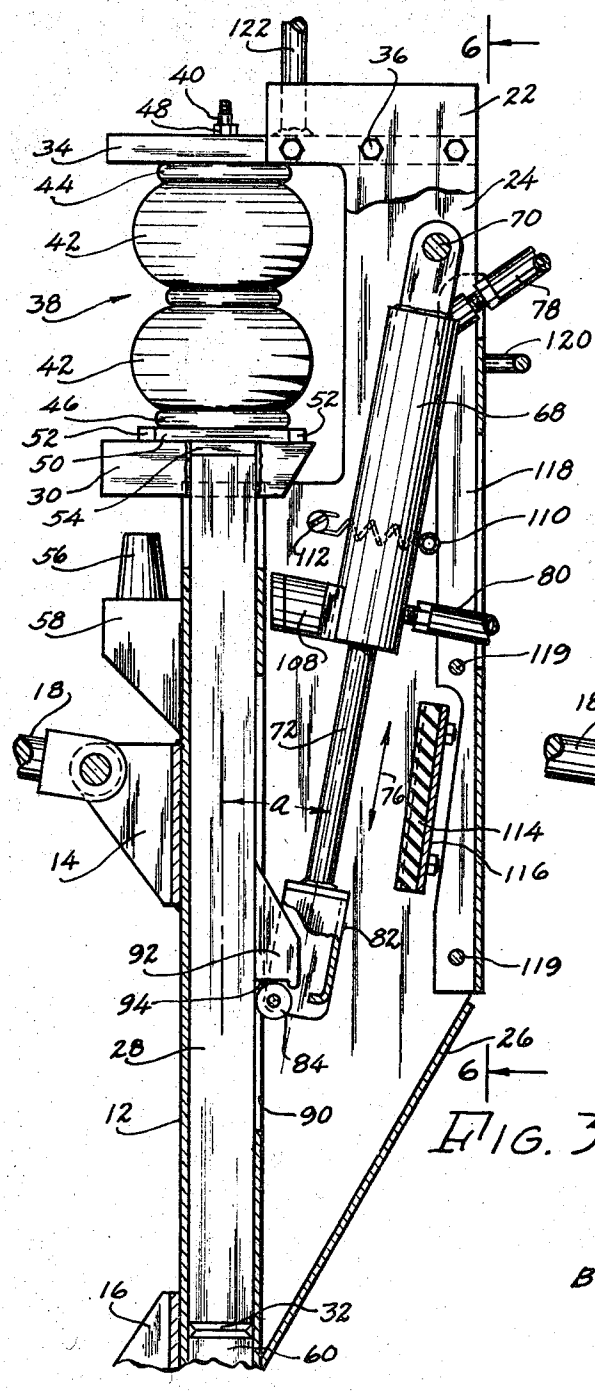


FIG. 3

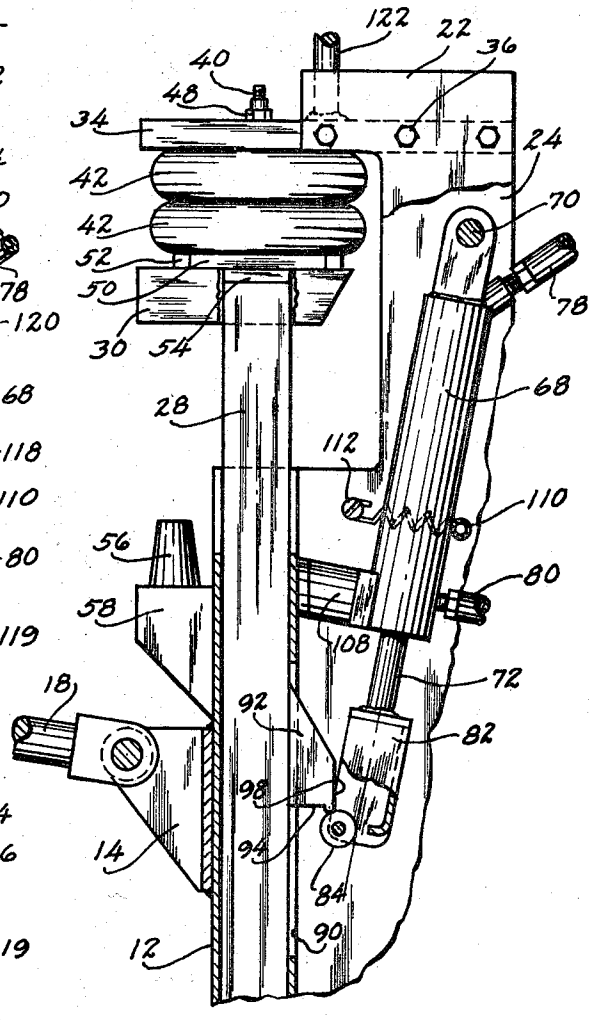


FIG. 5

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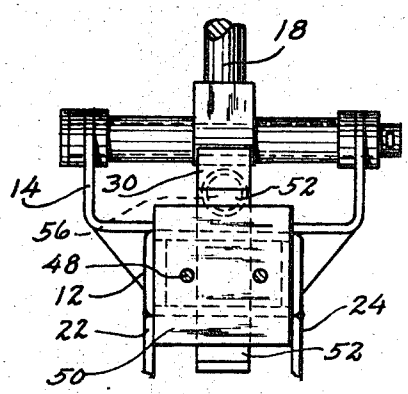


FIG. 7

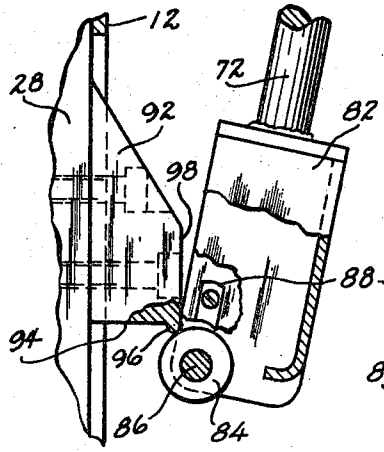


FIG. 8

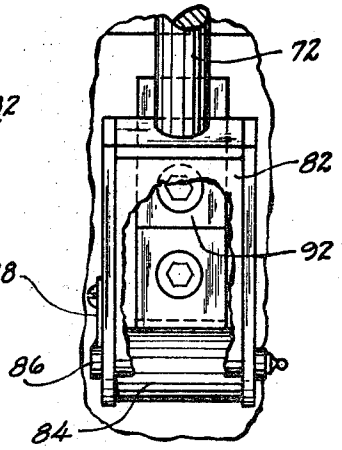


FIG. 9

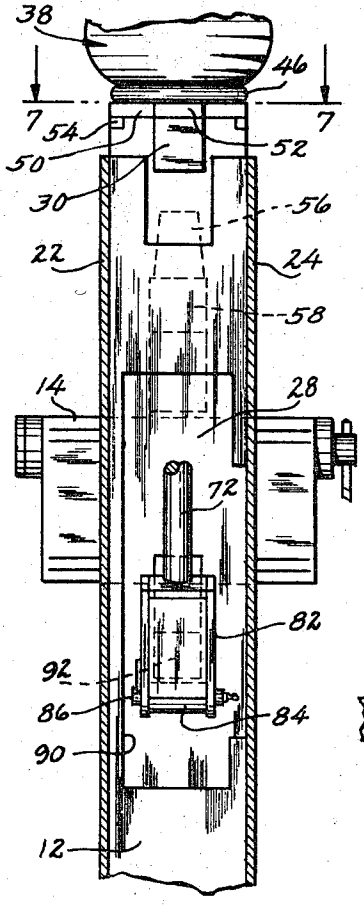


FIG. 6

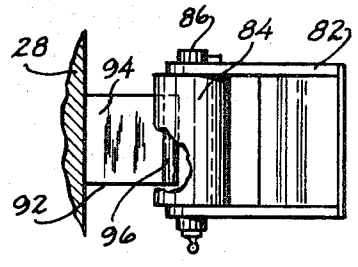


FIG. 10

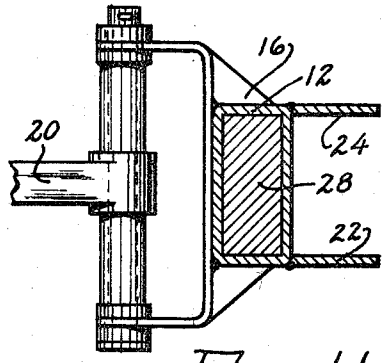


FIG. 11

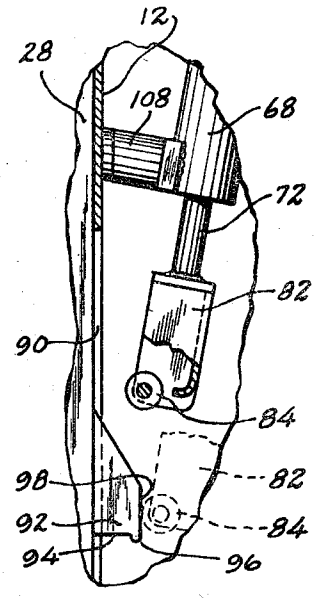


FIG. 12

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DEVICE FOR BREAKING PAVEMENT AND THE LIKE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to devices employed for breaking pavements, stone, concrete walls and similar materials, and to reduce such materials to a size for convenient disposal.

2. Description of the Prior Art

The prior art embrace devices such as are disclosed in the U.S. Pat. Nos. listed below: Otto et al. 2,107,495 Lutz et al. 2,844,006 McGonigal, 3,369,616.

The customary device of this nature employs a "freely-falling" hammer which precludes positioning it for operation in any other position than in the vertical, such as, for example, when breaking vertical structures such as concrete walls.

SUMMARY OF THE INVENTION

This invention comprises a hammer slidable in a tubular frame which is supported on an implement. A point or chisel is also slidable in the tubular frame and rests in contact with the material to be broken. A hydraulic cylinder retracts the hammer to store up energy in a device called an "air spring." Means is provided to release the energy so stored up, to cause the hammer to strike the point and fracture the material. The frequency of the operating cycle may be upwardly of 60 strokes per minute. An object, therefor, of this invention is to provide an impact tool that can be employed in a horizontal as well as in the customary vertical position.

Another object is to provide an impact tool employing the existing hydraulic system of the implement upon which it is mounted.

Referring to the drawings:

FIG. 1 is an elevational side view of the device, showing an alternate position thereof in dotted lines.

FIG. 2 is an elevational front view of the device.

FIG. 3 is an enlarged fragmentary sectional view taken at 3–3 of FIG. 2, and showing the hammer after the impact stroke, and in position to be retracted in preparation for another stroke of impact.

FIG. 4 is a top view of FIG. 3.

FIG. 5 is a fragmentary sectional view, similar to FIG. 3, but showing the "air spring" compressed, and at the moment of release of the hammer for its impact with the point.

FIG. 6 is a fragmentary sectional view taken in the direction of 6–6 of FIG. 3, and with parts broken away.

FIG. 7 is a section taken at 7–7 of FIG. 6.

FIG. 8 is an enlarged view of a portion of FIG. 5.

FIG. 9 is a front view of FIG. 8.

FIG. 10 is a projected view of FIG. 8.

FIG. 11 is a section taken at 11–11 of FIG. 1.

FIG. 12 is a fragmentary view of the device with the hammer released for the impact stroke.

The preferred form of the device is shown in FIGS. 1 and 2, and comprises a frame having a longitudinal tubular member 12 of a rectangular cross section. Longitudinally-spaced brackets 14 and 16 are secured rearwardly to member 12 as by welding, and provide the means to support the device on an implement. The customary means provided on the usual implement to engage the brackets 14 and 16, are the piston rod 18 and the arm 20, respectively.

A pair of spaced walls 22 and 24 are welded, in this instance, to tubular member 12, and define an enclosure, as shown in FIG. 11. A connecting panel 26 is welded between walls 22 and 24 as shown in FIGS. 2 and 3.

A hammer 28, which is a sliding fit in tubular member 12, terminates upwardly in a cap 30. The lower end of hammer 28 is chamfered as shown at 32, to prevent "peening."

A support member 34 positioned normal to the axis of hammer 28 and between walls 22 and 24. Cap screws 36 secure member 34 integrally with walls 22 and 24.

A pneumatic device 38 popularly known as an "air spring" provides the impact force that is applied to the hammer. "Air spring" 38 comprises, in this instance, a resilient chamber of

rubber which is inflatable by means of a tire valve 40, and has a pair of annular convolutions 42 which when compressed, appear as in FIG. 5. When expanded, as when released for impact, the convolutions appear as in FIGS. 1, 3 and 6. Metal end plates 44 and 46 are secured integrally with the resilient portions of the "air spring" 38. Cap screws 48 secure the plate 44 to member 34. A locating plate 50 is secured to end plate 46 by similar means to that employed with respect to member 44. Plate 50 is keyed against lateral displacement relative to cap 30 by means of keys 52 and 54. Keys 52 are secured to cap 30 as by welding, and embrace plate 50. Keys 54 are likewise secured to plate 50 and engage notches in the edges of hammer 28.

A resilient bumper 56 is supported on tubular member 12 by means of a bracket 58. The purpose of bumper 56 is to limit the lowest position of cap 30 when the tool is raised for transport. This position of cap 30 is shown by dotted lines in FIG. 1.

A point or chisel 60 is slidable in tubular member 12 coextensively with hammer 28. Stops 62 are secured to point 60 and abut the end of tubular member 12 when chisel 60 rests upon the material to be fractured, thereby limiting the upward position of the chisel. A longitudinal slot 64 is provided in chisel 60. A bolt 66 is passed through member 12 and slot 64 to retain the chisel in the tubular member, and to permit limited travel of the chisel to the length of the slot, when the tool is out of contact with the material to be fractured.

A hydraulic cylinder 68 is positioned between walls 22 and 24, and is pivoted on a pin 70 which is suitably supported by walls 22 and 24. Cylinder 68 is directed axially and convergently toward hammer 28 at an angle *a*, and downwardly from the pin 70, and has a ram 72. Cylinder 68 operates in two directions as indicated by arrow 76 of FIG. 3. The fluid connections are indicated as 78 and 80.

Ram 72 terminates in a roller cage 82 which embraces a cam roller 84. Roller 84 is journaled on a pin 86 which is secured in cage 82 against turning and axial displacement by means of a member 88 welded to pin 86, and secured to the cage by a screw.

An opening 90 is provided in the front wall of tubular member 12 to expose the front face of hammer 28, as shown in FIGS. 3 and 6.

A cam block 92 is secured to hammer 28 within opening 90 by suitable screws. Cage 82 receives cam block 92 therein, and permits roller 84 to engage the surface of hammer 28 as shown in FIG. 3. Cam block 92 has a face 94 normal to the surface of Hammer 28 and which face terminates in a bead 96. The purpose of bead 96 is to "delay" the release of hammer 28 and eliminate unnecessary sensitivity. Cam block 92 has a "land" surface 98 upon which roller 84 rides during periods when the ram 72 is advancing to repeat an impact stroke, and when the tool is suspended freely, and the hammer 28 and point or chisel 60 assume an extended position. In the extended position cam 92 is in the extreme lower position, and actuation of the controls would limit roller 84 to travel between the position shown in FIG. 12 by solid lines and that shown by dotted lines. This arrangement provides what is known as a "dead-man" control, and prevents unintentional actuation of the hammer 28.

The hydraulic circuit is shown in FIG. 1, diagrammatically and comprises a reservoir 100, a pump 102, and operator-controlled valve 104; all of which are part of the equipment of the implement on which the tool is mounted. A continuous reciprocating valve 106 is added to provide operation of the ram 72 at strokes up to 150 per minute; the usual number of strokes being about 60 to 90 per minute.

A stop 108 is secured to cylinder 68 and is provided with a rubber face which contacts the surface of tubular member 12 when the cylinder 68 is in the position shown in FIGS. 5 and 12.

A spring 110 partially surrounds cylinder 68 and the ends of the spring are anchored in walls 22 and 24 by bolts such as 112. Spring 110 assures that roller 84 will be constantly urged toward hammer 28 or cam block 92.

A bumper pad **114** is positioned as shown in FIG. **3**, being secured between walls **22** and **24**. The resilient portion of pad **114** is bolted to a plate **116** by suitable bolts. The purpose of pad **114** is to provide a bumper for cage **82** when the latter is suddenly released from cam block **92** at the time of impact.

A cover **118** closes the opening between walls **22** and **24** to prevent damage to the elements enclosed therebetween. Bolts or preferably pins **119** extend through cover **118** and walls **22** and **24**. Cotter pins secure the pins against accidental removal. A handle **120** is provided for convenience in removing or replacing the cover.

A lifting ring **122** is welded to support member **34** to provide a means to conveniently handle the tool when mounting it or preparing it for transport.

When preparing this impact tool for operation, an initial pressure of approximately 20 to 40 pounds of air is supplied to the air spring **38** by means of the valve **40**. The point or chisel **60** is then pressed upon the surface to be broken, as shown in FIG. **1**. Valve **104** is then actuated manually by the operator to retract hammer **28**. As ram **72** is being retracted, roller **84** moves outwardly normal to the face of hammer **28** and along face **94** of cam block **92**. As the retraction continues, air spring **38** is being compressed. Roller **84** finally reaches bead **96** and is forced over the bead by reason of stop **108** in its engagement with the wall of tubular member **12** as shown in FIG. **5**, thus suddenly releasing hammer **28** to make impact with point **60** in response to the energy stored in air spring **38**. The valve **106**, owing to its continuous and repeating operation, will then extend ram **72** to again assume the position shown in FIG. **3**, in preparation for another cycle. The cycle will then be automatically repeated and will continue to do so during the time the operator maintains the valve **104** in the operating position.

A novel feature of this invention is the positioning of cylinder **68** on an axis converging downwardly relative to the axis of hammer **28**. This relationship results in transporting roller **84** along face **94** of cam block **92** during the retracting of ram **72**, compelled by engagement of stop **108** with the wall of tubular member **12**, until roller **84** passes over bead **96** and is released from cam **92**.

Other objects and advantages of this invention will become apparent from a consideration of the detailed description taken in connection with the accompanying drawings wherein an embodiment of the invention is shown. It is, however, to be understood that the invention is not limited to the details disclosed, but includes all such variations as fall within the spirit of the invention: For example, it is within the purview of the invention to make the hammer **28** of other cross sections as a substitution for the rectangular shape. Also it is intended that the brackets **14** and **16** may be otherwise positioned if so dictated by convenience.

The above being a complete description of an illustrative embodiment of the invention, what is claimed as new and desired to be secured by Letters Patent of the United States is:

I claim:

1. A device for breaking pavement material and the like, comprising, in combination a frame having an upright portion comprising a tubular passageway defined by a front wall, said wall having an opening therein, a hammer having an upper and a lower end, and slidable in said passageway, a point slidable in said passageway and engaged by said lower end of said hammer, means to limit the travel of said point in said passageway, spaced upright members secured to said frame, a support member secured to said frame and normal to said passageway and spaced upwardly from said upper end, an impact energy-producing means intermediate said upper end and said support member, a hydraulic cylinder intermediate said spaced upright members, and having fluid connections, a pivot means in said members and normal thereto, for the upper end of said cylinder and spaced forwardly from said front wall, means to urge said cylinder pivotally toward said front wall, a cam block secured to said hammer and positioned in said opening and having a downwardly-directed face extending forwardly relative with respect to said hammer, said cylinder having a ram, the axis of which is directed convergently downward toward said hammer, said ram terminating in a roller cage embracing said cam block, a cam roller positioned in said cage to engage said lower face adjacent said hammer when said ram is extended downwardly, means associated with said cylinder and said front wall to effect translation of said roller forwardly along said lower face during retraction of said ram into said cylinder thereby raising said hammer and storing energy in said energy-producing means, continued retraction of said ram resulting in disengagement of said roller from said cam block, permitting release of said energy-producing means to expend said energy and force said hammer into engagement with said point, and a hydraulic system connected to said fluid connections.

2. A device as set forth in claim **1**, in which said downwardly-directed face of said cam block terminates forwardly in a raised bead portion directed parallel to the axis of said roller.

3. A device as set forth in claim **1**, in which said passageway is of a rectangular cross section.

4. A device as set forth in claim **1**, in which said impact energy-producing means comprises a pneumatic spring.