

Feb. 6, 1968

R. D. BENNETT ET AL

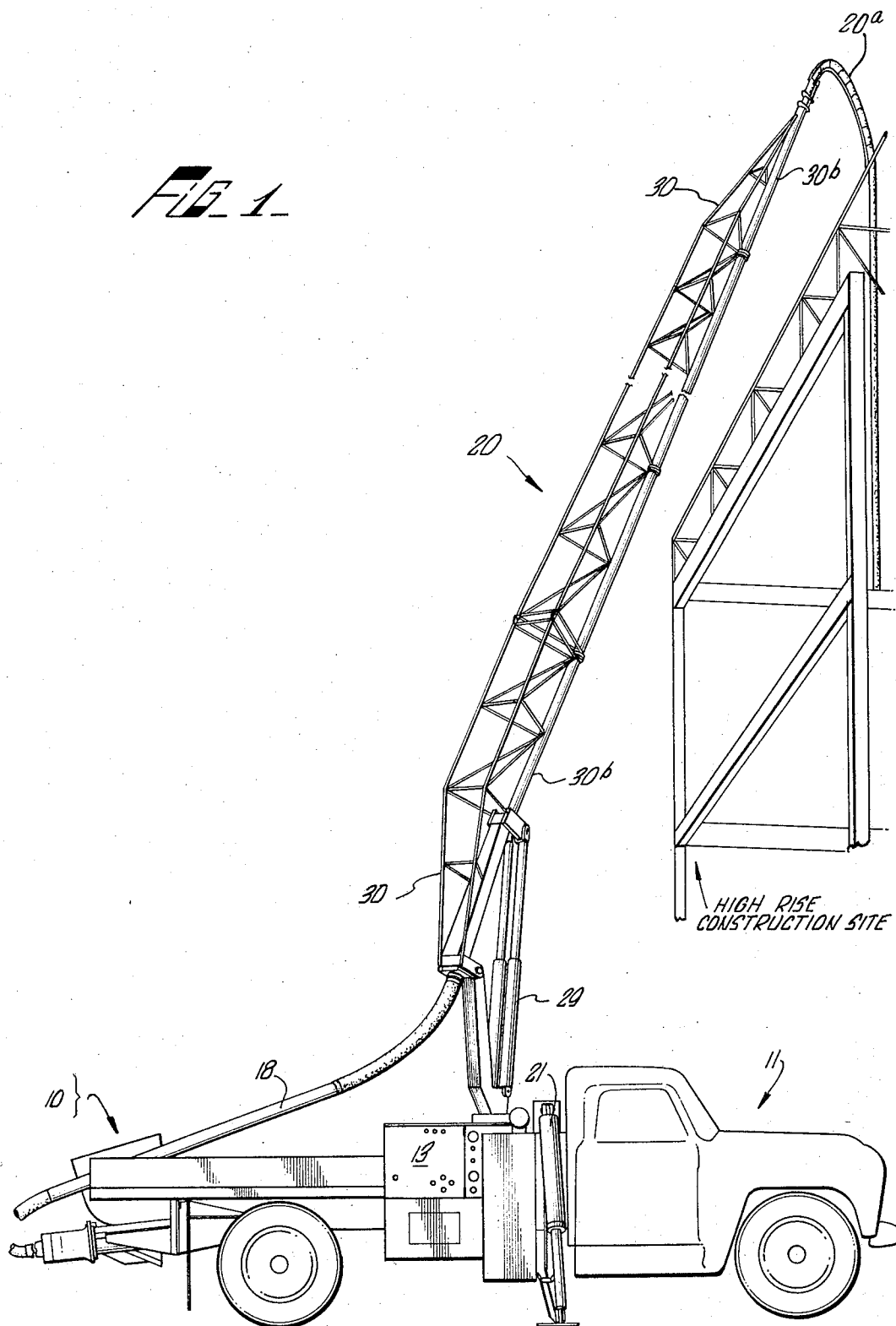
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Filed March 7, 1966

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*FIG 1*



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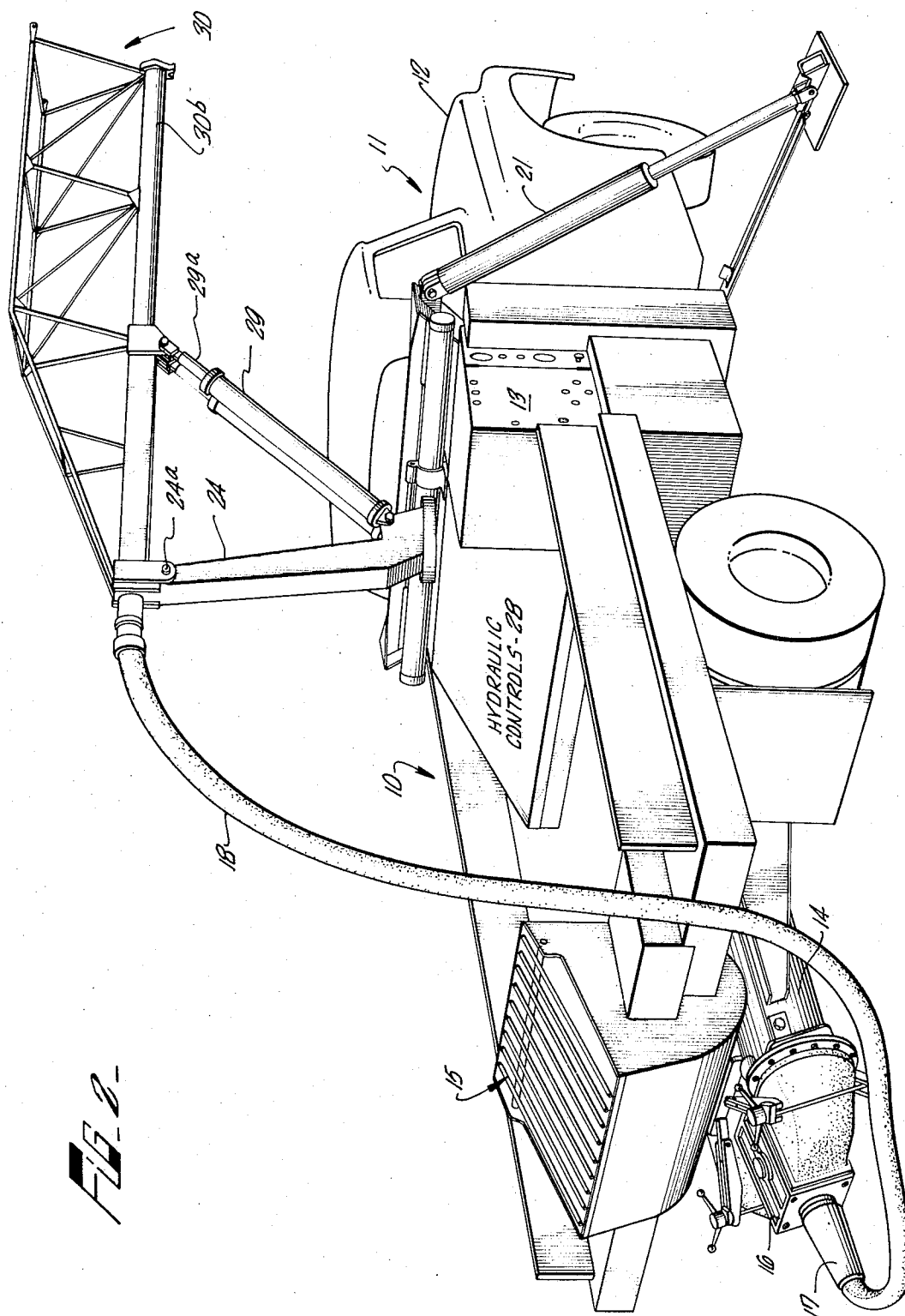
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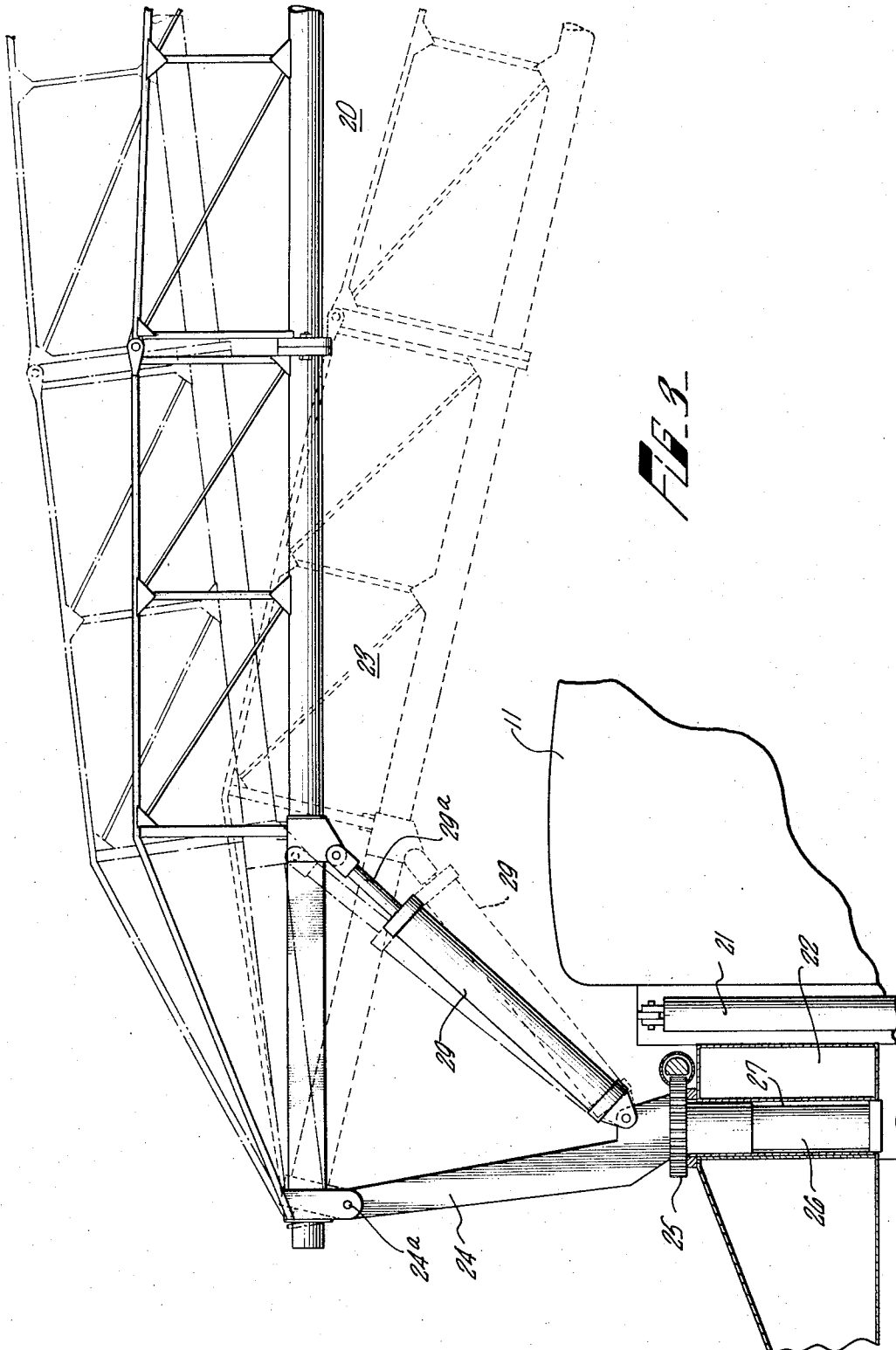
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Filed March 7, 1966

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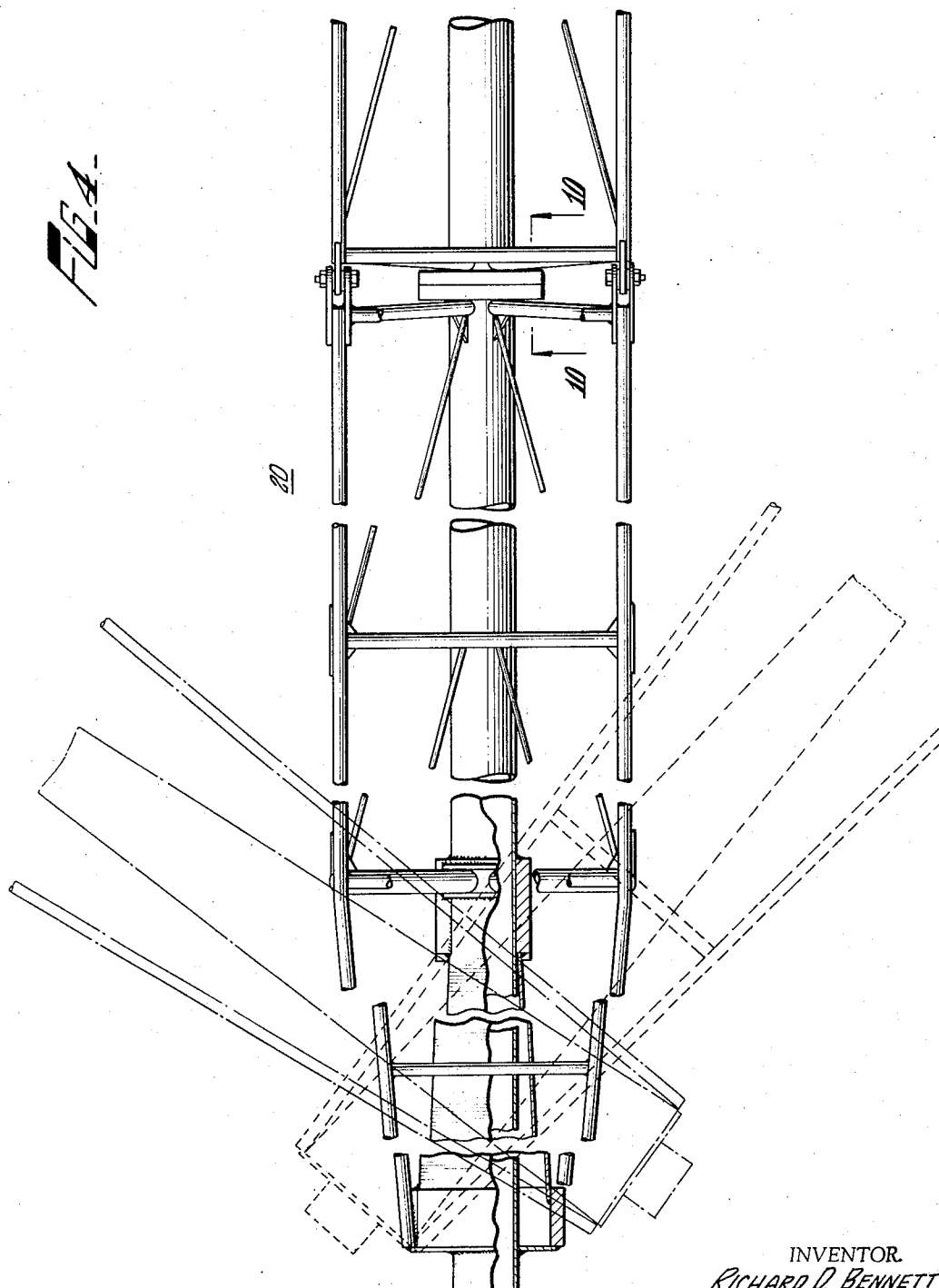
R. D. BENNETT ET AL

3,367,280

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Filed March 7, 1966

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INVENTOR  
RICHARD D. BENNETT  
MARVIN D. BENNETT  
BY  
*Christie, Parker & Hale*  
ATTORNEYS

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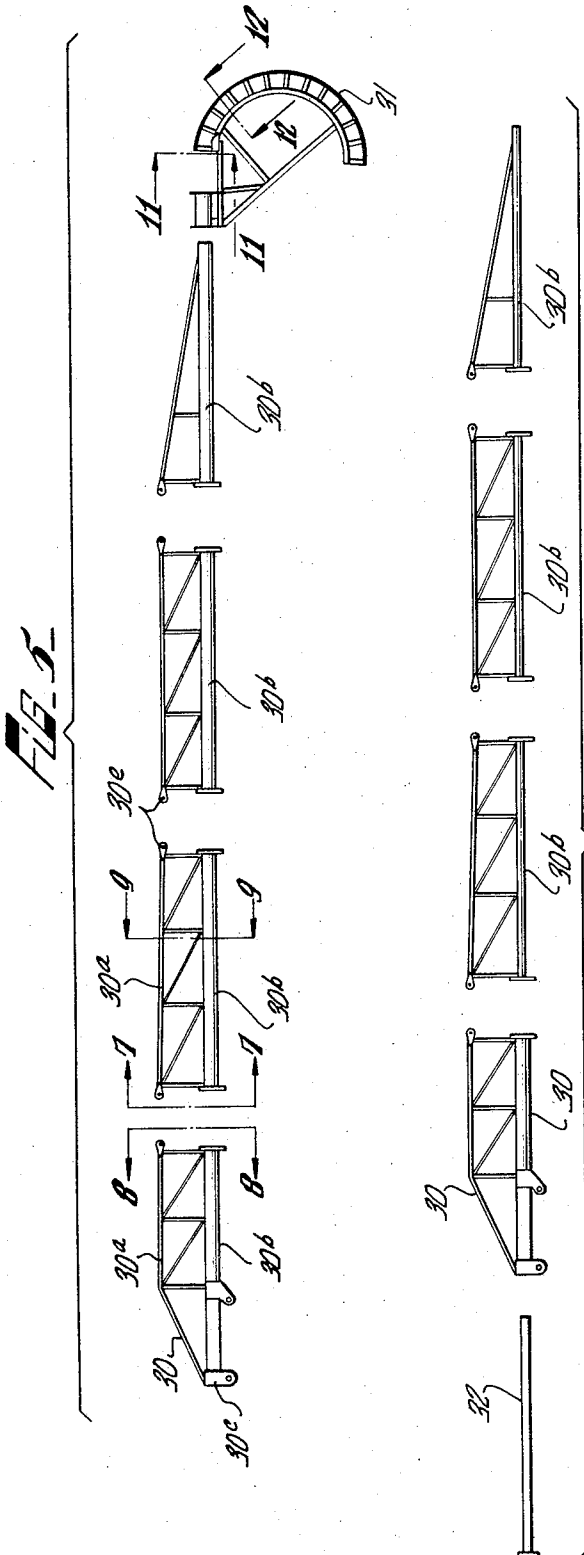
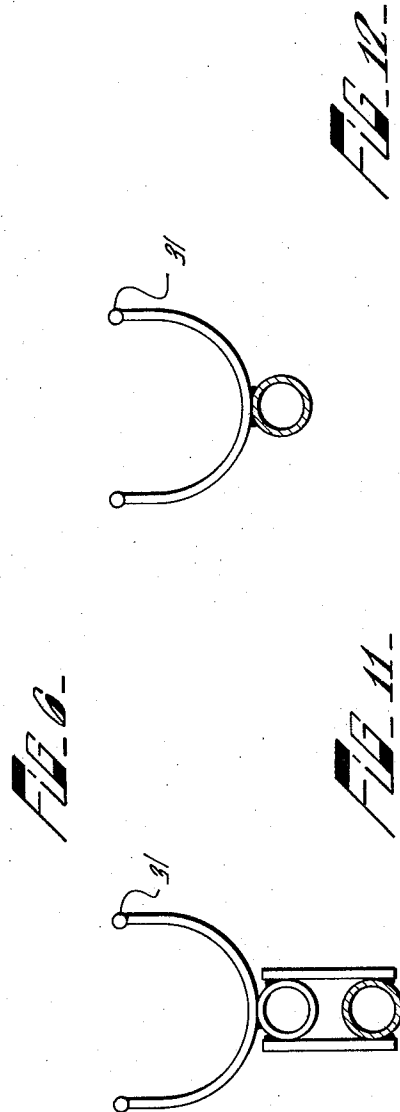
R. D. BENNETT ET AL

3,367,280

PUMP

Filed March 7, 1966

6 Sheets-Sheet 5



INVENTOR  
RICHARD D. BENNETT  
MARVIN D. BENNETT  
BY  
*Christie, Parker & Hall*  
ATTORNEYS

Feb. 6, 1968

R. D. BENNETT ET AL

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Filed March 7, 1966

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**FIG. 7**

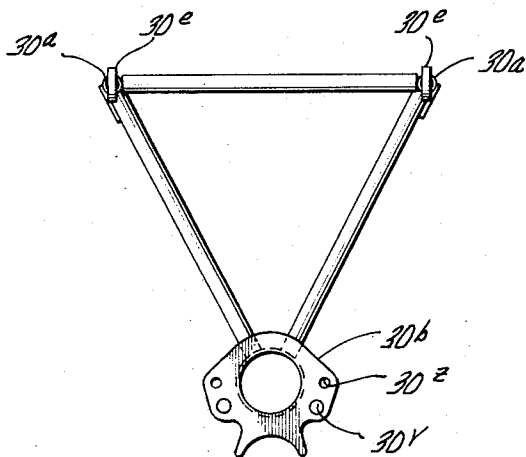


**FIG. 8**

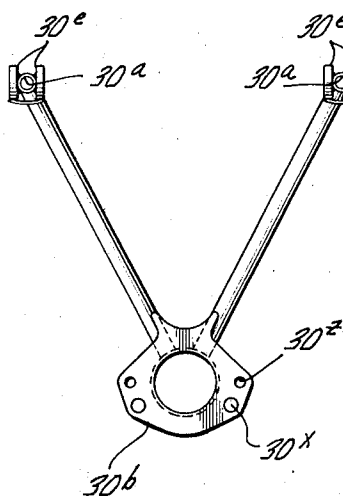


**FIG. 9**

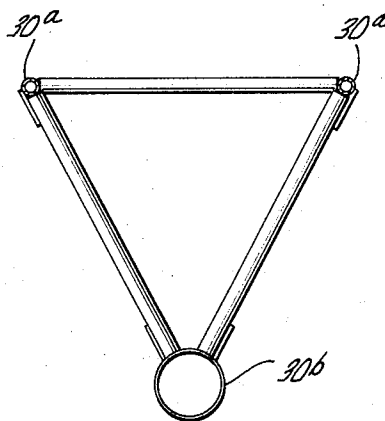
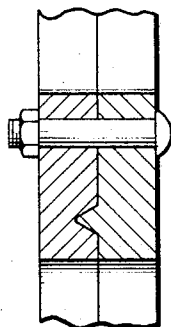


**FIG. 10**



INVENTOR.  
RICHARD D. BENNETT  
MARVIN D. BENNETT  
BY

*Christie, Parker & White*  
ATTORNEYS

1

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Richard D. Bennett, Pasadena, and Marvin D. Bennett, Wilmington, Calif., assignors to Royal Industries, Inc., Pasadena, Calif., a corporation of California  
Filed Mar. 7, 1966, Ser. No. 532,192  
8 Claims. (Cl. 103-218)

## ABSTRACT OF THE DISCLOSURE

A pump for pumping moist compressible materials such as plaster, concrete, mortar and the like and particularly a mobile concrete pump including a boom for conveying the pumped materials to work locations beyond the "local" work locations.

The pump when embodied with a motor vehicle includes a boom that may be constructed of detachable sections for transport purposes and is self-supporting when assembled. The boom is controllable, and rotatable in both a horizontal and vertical sense for conveying the pumped material through the boom sections. The pump includes means for stabilizing against lateral sway when the boom is in use.

This invention relates to a pump for pumping moist compressible materials such as plaster, concrete, mortar, and the like.

This application discloses an improvement over the pump disclosed in the copending patent application bearing Ser. No. 359,628, filed on Apr. 14, 1964 now Patent No. 3,279,382 and assigned to the same assignee as the present application. This copending application discloses a pump, particularly adapted for pumping concrete, that is mounted on a motor vehicle and is typical of mobile concrete pumps presently available.

The pump disclosed in the aforementioned copending application is typical of the pumps that have been developed for receiving construction materials, such as concrete, which are delivered to the job site and are pumped to the point of use. When concrete is the material required on the job site, it is customary to deliver the concrete in motor vehicles mounting the concrete mixer thereon. These mobile concrete mixers are commonly termed "ready-mix trucks." The pumps that have been developed to be employed with these "ready-mix trucks" are constructed for pumping or conveying building materials, such as concrete, to the point of use on the job site. A mobile pump has been found to have advantages over a stationary pump, or a pump that is portable but not self-propelled. A mobile pump can be moved from point to point on the job site along with the "ready-mix trucks" in a minimum amount of time and with a minimum amount of effort and personnel to allow the concrete to be immediately applied to different locations on the job site. The construction of the mobile pump in the form of a motor vehicle, however, limits the areas where the pump may be employed. In this light, the mobility of the pump is limited by obstructions, excavations, structures and the like on the job site which would prevent the vehicle from being driven from one job site to the other. In addition, in the remodeling of a structure wherein construction material is required at an elevated position within the building, the building may not be designed and constructed to allow a conventional pump to be elevated to the desired point in the building to effect the desired pumping operation. In addition, even when the mobile pump or otherwise may be located adjacent the job site, the very weight of the concrete conveyed through the material conduit presents problems in handling and properly positioning the material

2

conduit at the desired location on the job site. In many instances the concrete or other building materials must be conveyed to these elevated locations by elevators, cranes, or the like, and, then, transported manually within the building itself. There is a present need, then, for improvements to the pumps for pumping the moist compressible building materials to allow the material conduit to be employed in areas more remote to the pump and areas that are at presently inaccessible to a large extent to present day mobile pumps for the reasons mentioned hereinabove. In addition, there is a need for greater ease of handling the materials or hose that conveys the concrete to these more remote locations.

The present invention provides an improved pump including a mobile pump that includes controllable material handling means adapted to be coupled to the mobile pump for delivering or depositing the pumped building materials to areas or locations that were heretofore remote or inaccessible to present day mobile pumps and which means is capable of bypassing excavations, structures and similar obstructions characteristic of a construction site. The improved pump of the present invention also affords greater ease in handling the material conduit and locating same at the point of use. When the controllable material handling means is in the form of a material handling boom, essentially no material conduit need be manually handled while the pump is in use; the lifting of the material conduit being largely accomplished through the controllable boom. The pump incorporating a material handling boom has been found to double the quantity of pumped material when the material is required at an elevated or remote location. In addition, the time consumed in moving the pump from location to location on any one job site is reduced, allowing the pump to be operated for longer intervals and, thereby, providing a more efficient construction "tool" to the contractor.

Broadly, the present invention comprehends material handling apparatus having a pump with discharge means therefor and controllable material handling means adapted to be coupled to the discharge means of the pump for conveying the pumped material.

In a specific embodiment of the material handling apparatus the pump comprises a mobile pump for pumping moist compressible materials such as plaster, concrete, mortar, and the like and which pump is mounted on and powered from the motor vehicle. The pump may include discharge means having a detachable discharge conduit for conveying the pumped material. When the controllable material handling means is in the form of a material handling boom, it may be constructed of detachable boom sections each defined with a material conduit for conveying the pumped material therethrough when coupled to the discharge conduit.

The boom, per se, as comprehended by the present invention is a self-supporting boom constructed and defined of a plurality of detachable boom sections each adapted to be connected to at least one other boom section and including a pair of boom sections adapted to have the material conduit coupled thereto. The latter pair of boom sections may be considered the end boom sections. Each of the boom sections are constructed and defined to include a material conduit integral therewith for conveying the pumped material therethrough when interconnected. The boom sections are further constructed and defined with an upstanding frame extending longitudinally therewith whereby the assembled boom sections are self-supporting, without resorting to guy cables.

These and other features of the present invention may be more fully appreciated when considered in the light of the following specifications and drawings in which:

FIG. 1 is a side elevational view of the improved material handling apparatus in the form of a mobile pump,

illustrated in an operative relationship at a high rise construction site and embodying the invention;

FIG. 2 is a perspective view of the apparatus of FIG. 1 with the terminal end of the material handling boom sections detached;

FIG. 3 is a partial, side elevational view of the boom section of FIG. 2 with the vertical boom positions illustrated in dotted outline;

FIG. 4 is a top plan view, with portions broken away, of the boom section of FIG. 3 and illustrating the various horizontal positions of the boom in dotted outline;

FIG. 5 is an exploded, elevational view of the detached boom sections comprising the material handling boom for the apparatus of FIG. 1;

FIG. 6 is an exploded, elevational view of the detached boom sections of another embodiment of the boom;

FIG. 7 is a sectional view of the boom taken along the line 7—7 of FIG. 5;

FIG. 8 is a sectional view of the boom taken along the line 8—8 of FIG. 5;

FIG. 9 is a sectional view taken along the line 9—9 of FIG. 5;

FIG. 10 is a sectional view of the boom taken along the line 10—10 of FIG. 4;

FIG. 11 is a sectional view of the boom taken along the line 11—11 of FIG. 5; and

FIG. 12 is a sectional view of the boom taken along the line 12—12 of FIG. 5.

The present invention broadly comprehends material handling apparatus comprising a pump having discharge means therefor and controllable material handling means adapted to be coupled to the discharge means for conveying the pumped material to a location beyond the conventional "local" work locations of the pump with the pump in situ. The invention is best disclosed when it is embodied in a mobile pump provided with a material handling boom for conveying the pumped material to a remote location. For the purposes of facilitating the description of the invention, reference is directed to the aforementioned copending patent application bearing Ser. No. 359,628 and which patent disclosure is incorporated herein by reference.

Briefly, the mobile pump as disclosed in the aforementioned application for the purposes of the present invention comprises a pair of pumping units for pumping moist, compressible materials, such as the building materials plaster, concrete, mortar, and the like, and pumping them through discharge means for conveying the pumped material to the point of use. The pumping units receive the pumped material from a source of supply or hopper and pump it through a material conduit. The flow of the material to be pumped between the supply hopper and the material conduit is controlled whereby one of the pumping units draws the material to be pumped to it, while the other pumping unit is discharging the previously charged material through the material conduit.

The pump is rendered mobile in accordance with the teachings of the aforementioned application and the present application by mounting the pump on a motor vehicle so that the mobile pump may be self-propelled or driven from job to job and from site to site on any particular job. The motor vehicle is adapted to power the pump and for this purpose is provided with switchable power means interconnecting the power unit of the motor vehicle and the pump for selectively and alternately powering the vehicle or the pump from the vehicle power unit. In addition, means are coupled to the power unit of the motor vehicle to allow remote control of the power unit and, thereby, the pump including means for remotely controlling the speed of the control unit.

Now referring to the drawings wherein the above-described concrete pump 10 is illustrated mounted to the rear of the cab of a motor vehicle or truck 11. The motor vehicle 11 is provided with a conventional power unit located to the front of the cab of the motor vehicle and

beneath the hood 12 in the conventional fashion. The power unit for the motor vehicle 11 is also employed as the primary power source for the concrete pump 10 and, accordingly, is adapted with a drive member (not shown) coupled between the vehicle's power unit and the concrete pump 10. The power unit may be any unit such as a conventional internal combustion engine or any other convenient power unit may be employed when the pump is mounted on a base member other than the motor vehicle. In any case, the concrete pump 10 is adapted to be remotely controlled and an individual control panel 13 is illustrated as mounted on one side of the vehicle and behind the cab thereof.

From an operational standpoint, the concrete pump 10 includes the pumping units similar to the ones identified by the reference character 14 mounted on opposite sides of a building material hopper 15. The hopper 15 is utilized to receive and store the building material to be pumped, such as concrete. The concrete may be supplied to the hopper 15 by means of ready-mix trucks. The pumping units 14 are connected with a discharge chamber 16 defining a common material chamber for these units and arranged in communication thereof and with the hopper 15 to allow the pumping units to be directly charged with the building material or concrete and to be discharged in response to the pumping action of the pumping units 14 through a common discharge outlet 17 and a discharge conduit 18. The discharge conduit 18 is generally extended to the local point of use of the concrete as long as the point of usage or work area is within the local work area afforded by the conduit when the motor vehicle is in situ.

The above-described construction and operation is considered conventional. The material handling apparatus or pump for the purposes of the invention may be constructed in any form, however, stationary, portable or other mobile forms.

The pumped material delivered by the material conduit 18 is coupled to a controllable material handling means 20. The controllable material handling means 20 is embodied in the form of a material handling boom and is illustrated in FIG. 1 in its extended position for conveying the pumped building material to an elevated location such as the high rise construction site illustrated adjacent the motor vehicle 11. A close examination of FIG. 1 will reveal the advantages of the pump of the present invention in that an additional piece of construction equipment would heretofore be required to convey or transport the pumped building material to the elevated position on the construction site. With the integration of the controllable material handling means into the pump, these additional pieces of equipment are not necessary. It will also be noted that any floor on the building site may be provided with concrete by controlling the position of the material handling boom 20. To this end, the pump of the present invention will pump concrete, for example, six floors high. Stated differently, the "local" work area may be extended to include a horizontal distance seventy feet straight out to a vertical height of seventy feet, located forty feet from the motor vehicle 11 and allowing 270 degrees of rotation.

The material handling boom 20 is constructed so that a material conduit is integral therewith for conveying the pumped material therethrough. The material conduit 18 is coupled to the receiving boom section of the material handling boom 20 while the terminal boom section has another material conduit coupled thereto for conveying the pumped material to the desired location. The base member, in this instance the motor vehicle 11, mounting the controllable material handling means or apparatus 20 must be stabilized to prevent the overturning of the base member due to the weight of the material handling apparatus and pumped material. The means for stabilizing the motor vehicle 11 is illustrated as an outrigger 21 shown in FIGS. 1 and 2 in its extended position adjacent the side of the motor vehicle 11 immediately behind the

5

cab thereof. In view of the fact that the material handling apparatus is mounted on a motor vehicle, the stabilizing means with regard to stabilizing the base in the lengthwise direction is provided by the length of the vehicle and no special means, in this instance, is required for this purpose. However, the stabilizing means must include means for stabilizing against lateral sway and the hydraulic outrigger 21 is provided for this purpose.

The material handling boom 20 is mounted on the motor vehicle 11 immediately behind the cab and on the water tank 22, as best seen in FIG. 3. The material handling boom 20 is defined as a self-supporting boom comprised of detachable boom sections 30 that may be readily connected together for defining a boom of a preselected length. The initial or receiving boom section 30 is permanently installed on the motor vehicle 11 and when the vehicle is in transit is mounted on the vehicle to extend over the cab and the hood 12 without extending beyond the vehicle proper. For this purpose, the initial boom section 30 is mounted to an upstanding arm or boom mast 24 secured to a spur gear 25 to be rotatable therewith. The gear 26 is mounted on a spindle 26 depending therefrom and, in turn, mounted in a socket 27 defined in the water tank 22. The socket 27 is arranged substantially centrally of the water tank 22 and thereby locates the boom mast 24 on the vehicle 11. The gear 26 is, in this instance, arranged to rotate through 270 degrees. The free end on the boom mast 24 secures the receiving boom section 30 by means of a bolt 24<sup>a</sup> and thereby functions as a boom pivot.

Adjacent the water tank 22 there is provided a hydraulic controls compartment 28 for housing the hydraulic controls for the material handling boom 20. The hydraulic controls 28 are considered commercially available and, accordingly, are considered to be conventional and will not be described any further. It should be noted, however, that the hydraulic controls 28 may be readily integrated with the remote control apparatus for the pump 10 for remotely controlling the material handling boom 20, as well as the pump. From a functional standpoint, it will be appreciated from those skilled in the art that the hydraulic controls 28 are operated to rotate the spur gear 25 and, thereby, the boom 20. In addition, the controls 28 operate a hydraulic cylinder 29 secured between the boom mast 24, adjacent the gear 25 as illustrated and to the receiving boom section 30 at a point spaced from the boom pivot. The hydraulic cylinder 29 has its movable ram 29<sup>a</sup> secured to the boom section 30. The various vertical positions of the boom 20 are illustrated in dotted outline in FIG. 3 while the rotary positions are similarly illustrated in FIG. 4.

The boom 20 is defined for the purposes of the present invention as a self-supporting boom whereby it may be extended from the truck 11 without resorting to auxiliary supporting means such as guy wires and the like, extending outwardly of the boom proper. In order to render the improved pump more readily transitory, the boom 20 is constructed of the detachable boom sections 30 which may be readily coupled and uncoupled and allow the motor vehicle to be driven from job site to job site easily. The boom sections each comprise an upstanding frame 30<sup>a</sup>. The frame 30<sup>a</sup> for each boom section 30 includes a longitudinal member arranged to be in tension the entire length of the boom for supporting a material conduit 30<sup>b</sup> constructed integral with the frame 30<sup>a</sup>. The material conduit 30<sup>b</sup> defined as an integral part of the boom sections are each defined with a uniform bore for conveying the pumped material therethrough so that the material may easily flow therethrough. For this purpose, the material conduit 30<sup>b</sup> preferably has the same internal diameter as the material conduit 18.

The detachable boom sections 30 are constructed and defined with their outer ends of the material conduits 30<sup>b</sup> provided with means for coupling the sections together. The coacting portions of the boom sections 30 are

6

best illustrated in FIGS. 7 and 8. The boom section of FIG. 8 is provided with a coupling aperture 30<sup>\*</sup> for receiving a protrusion 30<sup>†</sup> provided on the outer end of the conduit 30<sup>b</sup> for the boom section illustrated in FIG. 7. The interengagement of the elements 30<sup>\*</sup> and 30<sup>†</sup> positions the two adjacent boom sections together and they may then be secured together by means of bolts, or the like, passed through the aperture 30<sup>\*</sup> provided for both of the boom sections. When the boom sections 30 are mounted and secured together in this fashion, the material conduits 30<sup>b</sup> are arranged in coaxial relationship.

In the same fashion, the upper end of the frames 30 are provided with eyelets 30<sup>e</sup> to allow a fastener to be accepted for securing the upper ends of the frames together. To afford the necessary structural rigidity to the boom sections, they may have a triangular configuration in cross-section, at least at a portion thereof, such as illustrated in FIG. 9. The terminal boom section or the section shown on the righthand end of FIG. 5 is further adapted to receive or have coupled thereto a material conduit basket 31. The basket 31 is constructed and defined to be slipped over the terminal end of the terminal boom section at the conduit 30<sup>b</sup> thereof and to cradle the material conduit 20<sup>a</sup> coupled to the terminal end so as to prevent the conduit from kinking or having any bends therein that would obstruct the uniformity of the material conduit and/or the passage of the concrete therethrough. The material conduit 20<sup>a</sup> attached to the terminal end of the boom receives the material conveyed through the boom conduit 30<sup>b</sup> for discharging the pumped material at the point of use on the construction site.

The material conduit basket or cradle 31 is defined to have a substantial U-shaped configuration and cross-section, such as illustrated in FIGS. 11 and 12, to receive the material conduit 20<sup>a</sup> coupled to the terminal end of the boom section. The construction of the cradle 31 is merely exemplary of the means to be mounted with the boom 30 for preventing the material conduit from flexing or bending to obstruct the flow of the material therethrough.

Now referring to FIG. 6, another embodiment of the boom will be described. The boom illustrated in FIG. 6 is essentially similar to that illustrated in FIG. 5 except that the material conduit 30<sup>b</sup> has a different internal diameter from the boom illustrated in FIG. 5. Assuming the internal diameter of the conduit provided for the boom of FIG. 5 is a four inch internal diameter, the boom sections 30 for the boom of FIG. 6 will be considered to be three inches. The receiving boom section 30, the section permanently installed on the vehicle 11, is used with the three inch boom sections and provisions must be for a uniform bore. This boom section may readily be modified through the provision of a liner 32 in the form of a tubular element to reduce the internal diameter to any desired size such as the three inch internal diameter. For this purpose, the initial boom section 30 has the liner 32 slipped into the conduit 30<sup>b</sup> therefor so as to reduce the internal diameter. The remaining sections shown to the right of the initial boom section 30, then, are substantially the same as those previously described except that the conduits 30<sup>b</sup> are defined with the reduced internal diameter for coaction with the initial section and the material conduits 18 and 20<sup>a</sup> having the desired internal diameter.

With the boom sections and material conduit assembled, the operator need only place the outrigger 21 in position in preparation for operation of the pump. The outrigger 21 is generally stored behind the cab of the motor vehicle adjacent the water tank 22. The outrigger 21 may be manually operated screws for stabilizing purposes but are illustrated as hydraulic cylinders. The hydraulic cylinders may be controlled from the hydraulic controls 28, once they are properly positioned, to actuate the rams for the cylinders.

The operation of the improved pump should now be

apparent with the above description in mind. When the ready-mix concrete truck delivers the concrete to the hopper 15, the controls 13 are operated to pump the concrete. The concrete is pumped, after the hydraulic controls have been operated to rotate the material handling boom to a correct location and vertically positioned it to the point of use. With the commencement of the pumping, the concrete is conveyed through the conduit 18, 30<sup>b</sup> and 20<sup>a</sup> to the point of use. When sufficient concrete is pumped, the boom 20 may be moved to another work location. When the location of the vehicle 11 is not within the range of the next work location, the outriggers 21 are moved and the vehicle 11 is driven to the correct location and the pumping repeated.

What is claimed is:

1. In a mobile concrete pump including a vehicle having a power unit for self-propulsion, a pump mounted on said vehicle for pumping moist compressible materials such as plaster, concrete, mortar and the like to a preselected "local" work location, controllable means mounted on the vehicle and connectable with the pump for extending the range of the pump beyond the preselected "local" work location with the pump in situ, said means being controllable to cause concrete to be conveyed in a horizontal and/or vertical direction relative to the "local" work location, said controllable means comprising a self-supporting rotatable boom constructed and defined by a plurality of detachable boom sections each having a portion defining a portion of the discharge conduit when the sections are interconnected for conveying the pumped concrete therethrough, and means for stabilizing and balancing the vehicle when the boom is in use.

2. In a mobile concrete pump as defined in claim 1 wherein the pump includes discharge conduit means for placing concrete at a "local" work location and connectable to said boom for conveying the concrete through the boom sections, said remote end of the boom including a detachable discharge conduit connectable thereto.

3. In a mobile concrete pump as defined in claim 1 wherein said stabilizing means comprises detachable, hy-

draulic means mountable on opposite sides of the motor vehicle for stabilizing the vehicle against lateral sway.

4. In a mobile concrete pump as defined in claim 1 wherein said detachable conduit, boom conduit and discharge conduit all are constructed and defined to have substantially the same internal diameters.

5. In a mobile concrete pump as defined in claim 1 wherein said boom conduit has a preselected internal diameter, and said pump includes detachable means for coupling to the boom conduit for modifying the internal diameter of the boom conduit.

6. A self-supporting boom for use with a concrete pump and the like comprising a plurality of detachable boom sections each adapted to be connected to at least one of the other boom sections, said plurality of boom sections including a pair of boom sections adapted to have a material conduit coupled thereto, each of said boom sections being constructed and defined to include a material conduit for conveying pumped concrete and the like therethrough when interconnected, said boom sections being further constructed and defined with an upstanding frame extending longitudinally thereof whereby the assembled boom sections are self-supporting.

7. A self-supporting boom as defined in claim 6 including detachable means for modifying the internal diameter of at least one of the boom sections.

8. A self-supporting boom as defined in claim 7 wherein said detachable means comprises a tubular element adapted to be slipped into the material conduit of the boom section.

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40 ROBERT M. WALKER, *Primary Examiner.*