

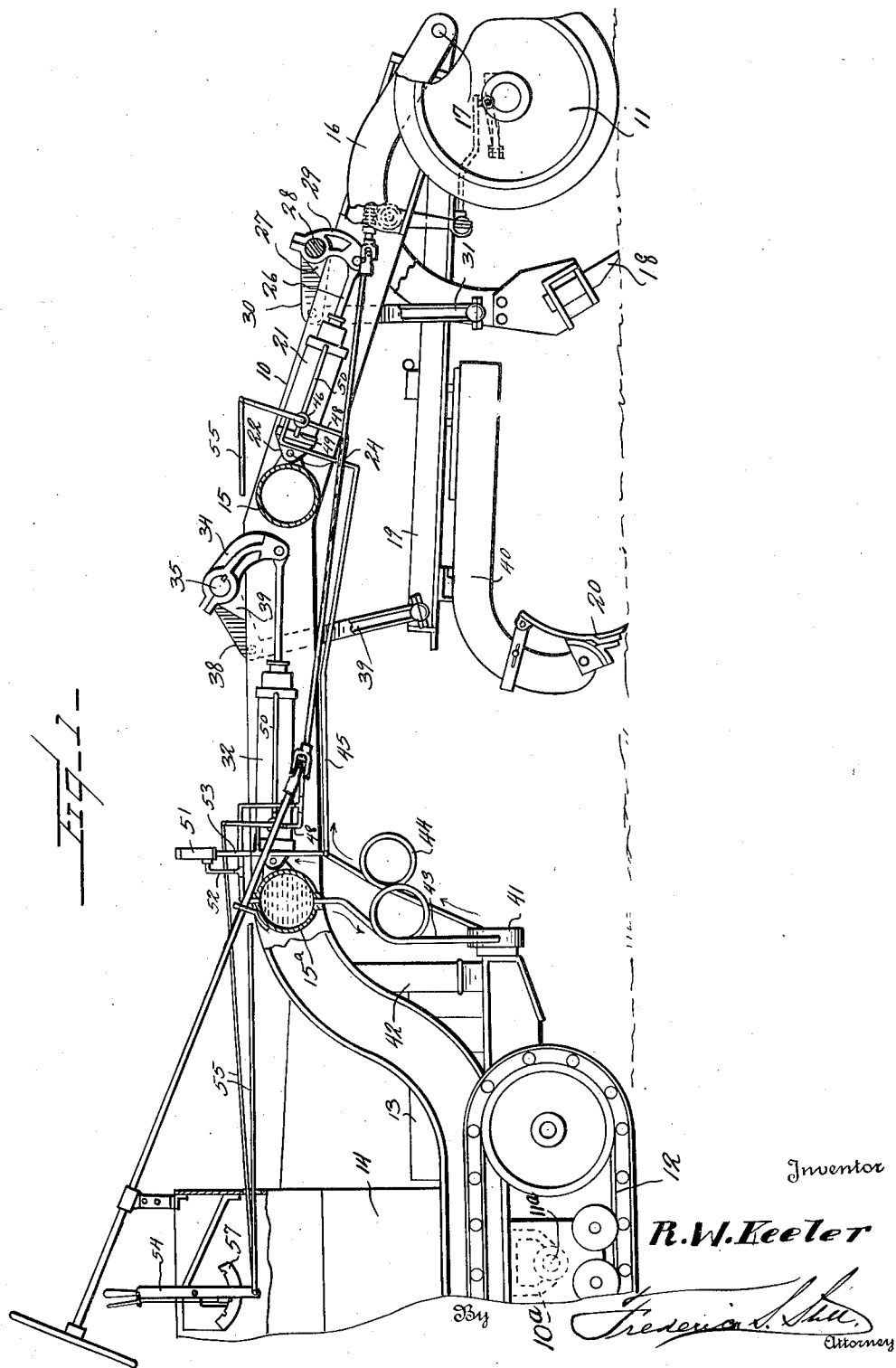
March 2, 1937.

R. W. KEELER

2,072,306

HYDRAULIC LIFTING MECHANISM FOR ROAD GRADERS

Original Filed Jan. 2, 1932 3 Sheets-Sheet 1



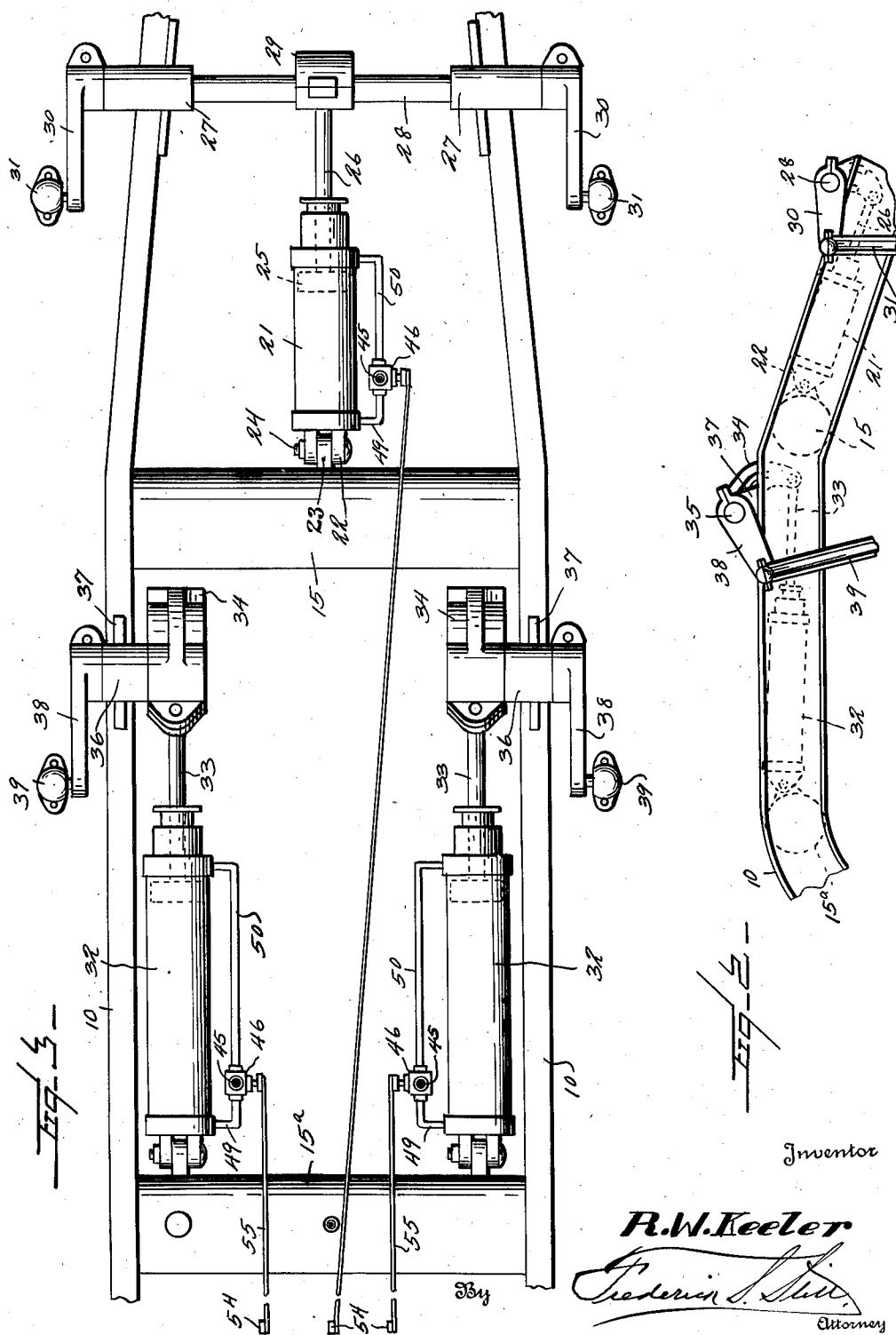
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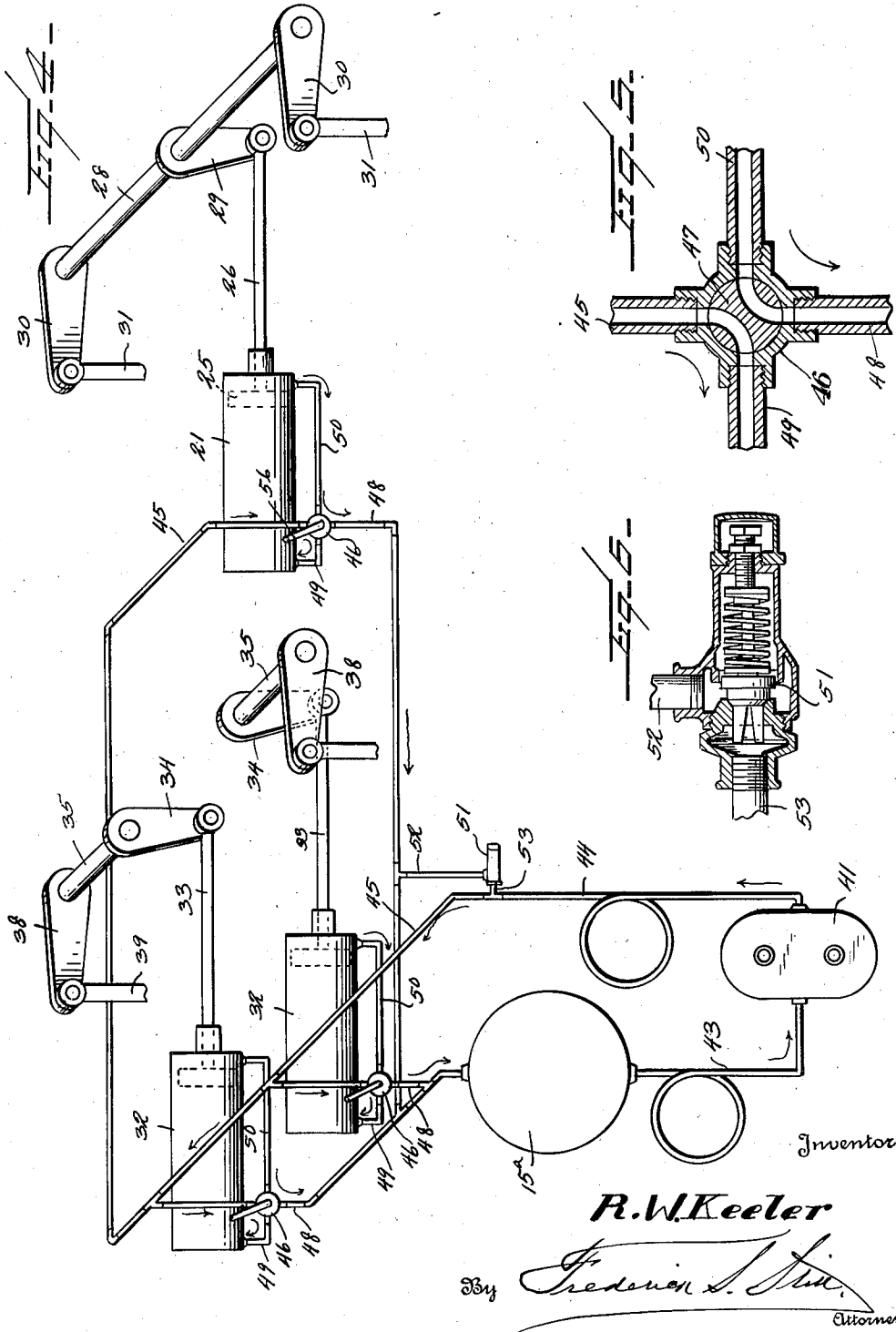
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UNITED STATES PATENT OFFICE

2,072,306

HYDRAULIC LIFTING MECHANISM FOR
ROAD GRADERS

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Renewed May 24, 1934

19 Claims. (Cl. 37—145)

This invention relates to road graders and particularly road graders in which hydraulic means comprising cylinders with their accompanying pistons are used to elevate the mold board circle of the grader and elevate the scarifier in case the grader is equipped with a scarifier.

In graders of this character, it is common practice to form the frame of two longitudinally extending channel irons and to cross brace this frame by a series of tubular members welded to the channel iron frames. It is also common to provide a mold board circle which is pivotally connected to the front axle and which is vertically adjustable by means of manually operable mechanism controlled from the operator's station at the rear of the grader and to raise or lower the scarifier by means of manually operated mechanism, operated from the operator's station.

The general object of the present invention is to provide hydraulic means for the purpose of raising or lowering the mold board circle and independent hydraulic means for raising or lowering the scarifier and to so mount said hydraulic means that the application of power to the parts to be elevated is greatly aided, and a further object is to place the cylinders between the longitudinal frame members and connect the cylinders to the transverse cross braces to thus secure compactness and simplicity of design and to further secure a very rigid connection for the cylinders.

Another object is to provide a hydraulic pump which is connected directly to the crank shaft of the tractor, means being provided whereby the liquid circulating through this pump may be directed into either end of the cylinder of said hydraulic means or by-passed to thus secure a very quick and flexible control of the mold board circle elevating means or depressing means and a like easy and ready control of the scarifier means, doing away with the necessity of the operator manually raising or lowering one or the other or both sides of the mold board circle or raising or lowering the scarifier so that the operator may confine his attention to the road being graded and to the proper steering of the machine and only having to bestow a minimum amount of attention upon the elevating or lowering mechanism.

A further object is to utilize one of the tubular cross braces not only as the means for supporting two of the cylinders, but a tank to hold the liquid circulated through the cylinders and the pump.

My invention is illustrated in the accompanying drawings, wherein:—

Figure 1 is a longitudinal sectional view through a road grader constructed in accordance with my invention;

Figure 2 is a fragmentary side elevation of the supporting beams and the cranks mounted thereon;

Figure 3 is a fragmentary top plan view of the structure shown in Figure 1;

Figure 4 is a diagrammatic view of the operating cranks, the cylinders, and the means for controlling the flow of liquid to or from the cylinders;

Figure 5 is a sectional view through one of the valves for controlling the action of the cylinders;

Figure 6 is a longitudinal sectional view through a relief valve used with my mechanism.

In the drawings I have illustrated so much of a grader as is necessary to understand my mechanism. The frame of the grader includes two longitudinally extending, upwardly curved or bowed frame beams 10 which are channel-shaped in cross section and operatively supported at their forward ends upon the front steering wheel or wheels 11. The rear ends of these beams are supported in any suitable manner upon either rear wheels or rear endless tractors. I have illustrated the rear ends of the frame beams as being pivoted at 11a to the frame of a crawler designated generally 12 but as this crawler may be of well known construction, I have not attempted to illustrate the same in detail. The frame of the crawler carries upon it the engine designated generally 13 and also supports the platform 14 upon which the operator rides. The usual controls for the engine and for the steering wheels extend to the operator's platform or station.

The frame beams 10 are connected at intervals to each other, as for instance at two points, by transversely extending cylindrical cross braces 15 and 15a which are relatively large and rigid and which are welded to the beams 10. Connected to the forward end of the frame formed of the beams 10 are the two rearwardly extending scarifier arms 16 which are pivoted to the forward end of the frame as at 17 so that the rear ends of these arms may be raised or lowered. These arms carry the usual scarifier teeth 18.

The draw bar yoke 19 which supports the mold board 20 is of any usual or suitable character and is pivotally supported at its forward end so that the rear end of this draw bar together with the mold board may be raised or lowered. Preferably the mounting of this draw bar is such that either end of the mold board may be raised or lowered independently of the other end so that the mold

board may be disposed at an inclination to the horizontal transversely of the machine. Inasmuch as this is also a common construction in graders, I have not attempted to illustrate this construction in detail.

My invention, as before stated, relates principally to the means whereby the scarifier may be raised and lowered or the mold board raised or lowered either bodily or at one side or the other. For the purpose of raising or lowering the scarifier, I dispose between the beams 10 and in a position approximately parallel thereto a hydraulic cylinder 21. The rear end of this cylinder is provided with ears 22 and the corresponding cylindrical cross brace 15 is likewise provided with an ear 23 interdigitating with the ears 22 and the ears 22 are pivoted to the ear 23 by means of the pivot pin 24. The cylinder 21 carries within it the piston 25 and the usual piston rod 26. Mounted upon bearing brackets 27 attached to the beams 10 is a rock shaft 28 having a downwardly extending arm 29 to which the forward end of the piston is pivotally connected.

This arm 29 is preferably curved downward and rearward and bifurcated for the reception of the forward end of the piston rod, the extremities of the shaft 28 carrying upon them the arms 30 and to each of these arms 30 is pivotally connected a depending link 31. The lower end of each link 31 is in turn pivotally connected to one of the arms 16 of the scarifier. Preferably the pivotal connection between the arm 16 and the link 31 will be in the form of a ball and socket joint. It will be obvious now that when liquid is admitted to the rearward end of the cylinder 21 the piston will be forced forward and this will cause the arms 30 to be swung downward, thus depressing the scarifier into engagement with the road to be worked and upon the admission of the liquid to the forward end of the cylinder, the arms 30 will be raised, lifting the scarifier. The means whereby liquid may be admitted to the forward and rear ends of the cylinder will be later stated.

Only one cylinder and corresponding piston is necessary for raising and lowering the scarifier because the scarifier does not have to be raised or lowered independently at its opposite ends, but is raised or lowered bodily. For the purpose of raising or lowering the mold board circle, however, it is necessary to provide two cylinders. Each of these cylinders is designated 32 and each of these cylinders is pivotally connected in the manner heretofore described to the corresponding transverse cylindrical tubular cross brace 15a. Each cylinder 32 has in it a piston and a piston rod designated 33, the piston rod being pivotally connected to an arm 34 extending downward from a short shaft 35. These shafts are mounted in bearings 36 carried by brackets 37 welded to or otherwise carried by the beams 10.

Each short shaft 35 has clamped upon its outer end which projects beyond the frame beam the arm 38 to which is pivotally connected the link 39 which in turn is operatively connected to the mold board circle 40 and more specifically to the rear end of the draw bar yoke 19 which operatively supports this circle. It is to be understood, of course, that, as is usual in graders, the mold board circle is rotatable with relation to the yoke in a horizontal plane so that the blade or mold board 20 may be inclined in one direction or the other relative to the line of draft. This is a common and usual construction in graders and the means whereby this is accomplished needs

no description nor is it necessary to illustrate the means whereby the mold board is tilted forward or rearward relative to the ground.

It will be seen that inasmuch as there are two cylinders 32 each operatively connected to one side of the rear end of the drawbar 19 the mold board may be lifted either bodily by forcing liquid into both cylinders or lowered bodily by allowing the escape of liquid from both cylinders and that by operating either one cylinder or the other, the mold board may be tilted transversely of the line of draft.

For the purpose of forcing liquid into the cylinders or circulating this liquid through the cylinders, I have provided a gear pump, the casing of which is designated generally 41. Inasmuch as gear pumps of this character are well known, I have not considered it necessary to show the details of the gear pump and it is only necessary to state that the driving shaft of the gear pump may be connected to or is constituted by the crank shaft of the engine, though obviously I do not wish to be limited to this construction as the pump might be driven from any other shaft of the power unit. This gear pump is illustrated as being located just below the radiator 42 and, therefore, just forward of the rear supporting and tractor unit.

The pump is supplied by a tank constituted by the tubular cross brace 15a as shown in Figure 1, this hollow brace serving as a supply tank connected to the pump by a pipe 43. From the outlet side of the gear pump a hose 44 leads to a supply line 45 which has three branches, each leading to a four-way valve casing 46 having, as shown in Figure 5, a valve 47. These valves 47 are disposed each in conjunction with their respective cylinders and these three valves are controlled from the operator's station. A return pipe 48 is connected to each one of the four-way valves and discharges into the tank 15a.

From opposite points of each valve 47, a supply pipe 49 and a supply pipe 50 lead to the respective cylinders 32 and 21. It will be seen from Figure 5 that when the four-way valve is turned to the position shown in this figure, connection is made from the supply pipe 45 to the pipe 49 whereby the liquid may be caused to pass into one end of the cylinder while connection is made from the pipe 50 to the pipe 48 which leads back to the tank 15a and that when the valve is turned through a quarter of a revolution in a clockwise direction as viewed in Figure 5, the pipe 49 will be connected with the return pipe 48 while the supply pipe 45 will be connected with the pipe 50 leading to the other end of the cylinder. Thus hydraulic pressure may be applied to either side of the piston and the liquid withdrawn from the opposite end of the cylinder. It is obvious that if the valve be given an eighth of a revolution in either direction, liquid will be held locked in one or the other of the cylinders and the piston held in this position and the element, as for instance, the scarifier or mold board, held elevated at any desired point.

Preferably a relief by-pass valve 51 is provided as shown in Figure 6. This has pipe connections 52 and 53 leading respectively to the supply pipe 45 and the return pipe 48. Thus if the valves 47 are turned to the position locking the pistons against movement, the pressure will cause the opening of the valve 51 and fluid will be by-passed through pipe 52 back to the tank 15a. Preferably, the operating means for these valves comprises a plurality of levers 54 mounted at the op-

erator's station, each lever being connected by a link 55 to an arm 56 on the corresponding valve 47.

There will be three of these levers 54 and three of the links 55, each connected to one of the valves 47. The levers 54 will operate over sectors 57, each lever being provided with a releasable latch for holding it in its adjusted position. I have found that by placing the control valves immediately adjacent the cylinders with which they are associated, a very quick response is secured, whereas if the valves are disposed, as they might be, at the operator's station, it takes some little time to build up pressure in the relatively long pipe lines requisite before movement is accomplished. I wish it to be understood, however, that it is within the purview of my invention to place each of these controlling valves in any position with relation to the station.

It will be seen that with this mechanism, the operator does not have to operate worm gearing for the purpose of raising or lowering either end of the mold board or raising or lowering the scarifier and, therefore, does not have to take his attention away momentarily from the proper steering of the machine or the proper control of the machine as is the case where the mold board and scarifier are raised by mechanical means. The control of the valves requires but a minimum of exertion on the part of the operator and, therefore, becomes very quickly automatic with the operator so that his entire attention may be given to the character of the road he is operating on, the irregularities to be scraped away or filled. Furthermore muscular exertion on his part is very largely done away with. While hydraulic cylinders have been heretofore used for the purpose of raising or lowering elements such as mold boards or scarifiers, yet in all constructions known to me, the cylinders have not been disposed between the frame beams and connected to the very rigid tubular cross bracing of these frame beams.

By placing the cylinders in an approximately horizontal position and between the longitudinal frame members, compactness and simplicity of design is secured and the cylinders are very rigidly supported. It is also to be noted in this connection (see particularly Fig. 3) that the cylinders 32 forming parts of the mold board raising and lowering mechanism are mounted close to the inner faces of the frame bars or members 10 which also serves to protect the cylinders and assists in securing compactness and simplicity of design. With this arrangement, also a more powerful lifting effect can be obtained than from vertically arranged hydraulic cylinders. By mounting the hydraulic cylinders at their rear ends upon the rigid transverse tubular cross braces and connecting the pistons to arms mounted upon transverse shafts which are rigidly mounted upon the longitudinal beams, the cylinders, pistons and arms are held rigidly in alignment with each other against the inevitable shocks, jars and twisting strains to which machines of this character are exposed. The stresses and strains to which the supporting frames of machines of this character are exposed, tend to get these operating members out of line and, therefore, cause wear and render operation difficult. This is entirely avoided in my construction.

It should be particularly noted that the tubular cross braces 15 and 15a co-operate with the fluid pressure motors comprising the cylinders 21 and

32 and the adjusting mechanism operated by these motors, to enable the road working implements to be adjusted and locked in adjusted positions for much more efficient operation than would be possible with solid cross-braces having the same weight of material. That is to say, by using the same weight of material in the cross-braces and making them tubular, large areas of welded connections at the ends of the cross-braces to the beams of the frame are provided thereby making the frame structure very rigid for supporting the bearings 27 and 36 and the shafts journaled therein. Furthermore, the tubular cross-braces resist bending strains much more efficiently than solid cross-braces having the same weight of material. The tubular cross-braces therefore afford very strong abutments permitting powerful hydraulic motors to be used during adjustments of the road working implements, and when the latter are locked in adjusted positions the tubular cross-braces afford very strong abutments to resist rearward movements of the road working implements relatively to the supporting frame during operation of the machine. Consequently, the greater rigidity of the supporting framework due to the tubular cross-braces enables the adjustable supporting mechanism for the road working implements to be mounted and operated without tendency of the pistons or piston rods to bind relative to the cylinders with which they are associated.

It should also be noted that the power tractor unit is pivotally connected at 11a to a bracket 10a secured to the rear horizontal end portion of the frame 10, for tilting movement of the tractor unit relatively to the frame 10 on a horizontal transverse axis. Although the hydraulic pump 41 is connected to the power plant of the tractor unit for operation thereby, such tilting movement of the tractor unit relatively to the frame 10 does not interfere with the hydraulic control system because flexible conduit connections are provided as shown at 43 and 44 in Fig. 1, between the pump 41 and the fluid pressure connections mounted on the intermediate portion of the frame 10. When the valves 47 are moved to such positions as to effect locking of the road working implements in their adjusted positions, as explained above, the pump 41 may be continued in its operation so long as the power plant is operating, irrespective of whether the machine is traveling along a roadway or not, because the relief valve shown in detail in Fig. 6 is connected in a by-pass around the pump as shown in Fig. 1.

Obviously those skilled in the art may make various changes in the details and arrangement of parts without departing from the spirit and scope of the invention as defined by the claims hereto appended, and I therefore wish not to be restricted to the precise construction herein disclosed.

Having thus described and shown an embodiment of my invention, what I desire to secure by Letters Patent of the United States is:

1. In a road machine, a frame including two approximately parallel beams, a cross brace rigidly connected to and disposed between said beams, a road working element operatively connected to the frame for swinging movement in a vertical plane, means for raising or lowering the element including a hydraulic cylinder disposed between the beams and extending longitudinally thereof, one end of the cylinder being pivoted to the cross brace, a piston and piston rod coacting with the cylinder, a transverse shaft having an arm, a

link operatively connecting the arm to the road working element, an arm on the shaft connected to said piston, and manually controlled means for controlling the passage of liquid into or from the cylinder.

2. In a road machine, a frame including two approximately parallel beams, a cylindrical cross brace rigidly engaged with and disposed between said beams, a road working element operatively connected to the frame for swinging movement in a vertical plane, means for raising or lowering the element including a hydraulic cylinder disposed between the beams and extending longitudinally thereof and having a piston and piston rod, the cylinder at one end being pivoted to the cross brace, a transverse shaft mounted upon the frame, an arm connected to said shaft and having linked connection to the road working element, an arm connected to the piston rod, and manually controllable means for directing liquid under pressure into either end of the cylinder and conducting liquid from either end of the cylinder.

3. In a road machine, a frame including two approximately parallel beams, a cross brace rigidly connected to and disposed between said beams, a road working implement operatively connected to the frame for swinging movement in a vertical plane, the road working implement having independent vertical motion at each end, and means for raising or lowering either end of the element including two hydraulic cylinders disposed between and extending longitudinally of the beams, one end of each cylinder being pivoted to the said cross brace, a piston and piston rod in each cylinder, a pair of transverse shafts mounted upon the beams of the frame, the inner end of each shaft having an arm operatively connected to the piston rod of a cylinder, the outer end of each shaft having an arm linked to the corresponding end of the road working implement, and manually controllable means for directing liquid under pressure into either end of either cylinder and conducting liquid from the opposite end of the cylinder.

4. In a road machine, a frame including two approximately parallel beams, cross braces rigidly connected to and disposed between said beams, a mold board and a circle therefor operatively connected to the frame for vertical swinging movement, a scarifier operatively connected to the frame for vertical swinging movement, a single hydraulic cylinder disposed between said beams and pivotally connected to the adjacent cross brace and having a piston and piston rod, a shaft mounted at its ends upon the beams and having an arm connected to the piston rod and an arm having linked connection to the scarifier, a pair of cylinders disposed between said frame beams and each pivotally connected to the adjacent cross brace, and each having a piston and piston rod, a pair of shafts mounted in bearings each upon one of said beams, each shaft at its inner end having an arm connected to the piston rod of the corresponding cylinder, each shaft at its outer end having an arm having linked operative connection to the circle, a motor operated pump, a supply tank mounted on the frame, and means for directing liquid from said pump into either end of the first named cylinder and conducting liquid from the other end to the supply tank and for directing liquid from the pump into either end of the second named cylinders and conducting liquid from the other ends of said cylinders to the said supply tank.

5. In a road machine, a supporting frame in-

cluding a tubular cross brace, a road working implement operatively connected to the frame for swinging movement in a vertical plane, means for raising or lowering the element including a hydraulic cylinder, one end of the cylinder being pivoted to said tubular brace, a piston and piston rod coacting with the cylinder, a shaft having an arm, a link operatively connecting the arm to the road working element, means on the shaft connected to said piston rod, and manually controlled means for controlling the passage of liquid into or from the cylinder.

6. In a road machine, a frame including two approximately parallel beams, a hollow cross brace, disposed between and rigidly engaged with said beams, a road working element operatively connected to the frame for swinging movement in a vertical plane, means for raising or lowering the element including a hydraulic cylinder disposed between the beams and extending longitudinally thereof and having a piston and piston rod, the cylinder at one end being pivoted to the cross brace, a transverse shaft mounted upon the frame, operative connections between the piston rod and said shaft to oscillate the shaft as the piston rod is shifted in one direction or the other, a motor operated pump, the hollow cross brace constituting a supply tank for the pump, a pipe leading from this cross brace to the pump, and manually controllable means for directing liquid under pressure from the pump into either end of the cylinder and conducting the liquid from either end of the cylinder back to said supply tank.

7. In a road machine, a frame including two approximately parallel beams, a hollow cross brace disposed between and rigidly engaged with said beams, a road working element operatively connected to the frame for swinging movement in a vertical plane, means for raising or lowering the element including a hydraulic cylinder disposed between the beams and extending longitudinally thereof and having a piston and piston rod, the cylinder at one end being pivoted to the cross brace, a transverse shaft mounted upon the frame, operative connections between the piston rod and said shaft to oscillate the shaft as the piston rod is shifted in one direction or the other, a motor operated pump, the hollow cross brace constituting a supply tank for the pump, a pipe leading from this cross brace to the pump, and manually controllable means for directing liquid under pressure from the pump into either end of the cylinder and conducting the liquid from either end of the cylinder back to said supply tank including a four-way valve having opposed pipe connections leading to the supply tank and to the pump, opposed pipe connections leading to opposite ends of the cylinder, and means whereby said valve may be operated from the operator's station.

8. In a road machine, a frame including two approximately parallel beams, a hollow cross brace disposed between and rigidly engaged with said beams, a road working element operatively connected to the frame for swinging movement in a vertical plane, means for raising or lowering the element including a hydraulic cylinder disposed between the beams and extending longitudinally thereof and having a piston and piston rod, the cylinder at one end being pivoted to the cross brace, a transverse shaft mounted upon the frame, operative connections between the piston rod and said shaft to oscillate the shaft as the piston rod is shifted in one direction or the other, a motor operated pump, the hollow cross brace

constituting a supply tank for the pump, a pipe leading from this cross brace to the pump, and manually controllable means for directing liquid under pressure from the pump into either end of the cylinder and conducting the liquid from either end of the cylinder back to said supply tank including a four-way valve having opposed pipe connections leading to the supply tank and to the pump, opposed pipe connections leading to opposite ends of the cylinder, and means whereby said valve may be operated from the operator's station including a lever at the operator's station, means for latching the lever in a plurality of positions, and a reach rod connected to the lever and operatively connected to said valve.

9. In a road machine, a frame including laterally spaced beams, cross braces rigidly connected to and disposed between said beams, a road working element operatively connected to the frame for movement in a vertical plane, means for raising or lowering the element including hydraulic cylinders disposed between the beams and lying close to the inner faces of the latter and extending longitudinally thereof, said cylinders being pivoted at one end to one of the cross braces, piston and piston rods co-acting with the respective cylinders, transverse shafts mounted on said beams and each provided with an arm, operative connections between said arms and the road working element, arms on the shafts connected to said piston rods, and means for controlling the passage of liquid into and from said cylinders.

10. In a road machine, a frame including laterally spaced beams, cross braces rigidly connected to and disposed between said beams in longitudinally spaced relation to each other, a road working element operatively connected to the frame for movement in a vertical plane, and means for raising and lowering the road working element including hydraulic cylinders disposed horizontally between the beams and extending longitudinally thereof close to the inner faces of the beams, between said cross braces, said cylinders being pivoted at one end to one of the cross braces, piston and piston rods co-acting with the respective cylinders, transverse shafts mounted on said beams and each provided with an arm, links operatively connecting the respective arms to the road working element, arms on the shafts connected to said piston rods, and means for controlling the passage of liquid into and from the cylinders.

11. In a road working machine, a supporting frame including a tubular cross brace, a road working element operatively connected to the frame for movement in a vertical plane, and means for raising and lowering said element including a hydraulic cylinder, one end of which is pivoted to said tubular cross brace, a piston and piston rod co-acting with the cylinder, operative connections between the piston rod and the road working element arranged to raise and lower the latter upon the movement of the piston rod out of and into the cylinder, a motor driven liquid pump operatively connected to the cylinder on opposite sides of the piston, and means for controlling the passage of liquid into or from the cylinder, the said tubular cross brace constituting a supply tank for the pump.

12. In a road machine, a frame including laterally spaced beams, front and rear cross braces connected to said beams, a scarifier operatively supported forwardly of the front cross brace for bodily vertical movement, a hydraulic cylinder

pivotaly connected to the front cross brace and extending substantially horizontally and forwardly from the latter between the frame beams, a piston movable in said cylinder and provided with a piston rod operatively connected to the scarifier, a mold board and circle suspended from and below the frame beams in the rear of the scarifier, independently operable shafts carried by the respective frame beams and operatively connected to the mold board and circle whereby the latter may be raised bodily or one side higher than the other, two hydraulic cylinders pivotaly connected at their rear ends to the rear cross brace and extending forwardly therefrom close to and between the frame beams in substantially the same horizontal planes as the latter, each of said last named cylinders being provided with a piston and piston rod and the piston rods being operatively connected to the independent shafts of the mold board and circle, and means for admitting fluid into the ends of the respective cylinders on opposite sides of their pistons, said means including selector valves mounted close to the respective cylinders, operating rods connected to the respective valves and extending rearwardly therefrom for manual manipulation by the operator, and a motor operated pump for forcing liquid into all of said cylinders according to the positions of the valves on the latter.

13. A road-working machine comprising the combination with a supporting frame having spaced-apart longitudinal beams connected rigidly together by a transverse tubular cross-brace, of a road-working implement, mechanism for adjustably supporting said road-working implement on said longitudinal beams, and a fluid pressure motor connected pivotaly at one end to said tubular cross-brace and at its other end to said adjusting mechanism to operate the latter to secure adjustment of said road-working implement.

14. In a road working machine, the combination with a vehicle frame comprising spaced-apart longitudinal beams, of a cross-brace rigidly connected at its ends to said beams, a fluid-pressure motor having one end pivotaly connected to said cross-brace while occupying a position between said beams and extending longitudinally thereof, an adjustable member in the machine, and operating mechanism between the other end of said fluid-pressure motor and said member for adjusting the latter by the power of said fluid-pressure motor.

15. A road-working machine comprising the combination with a supporting frame having a hollow cross-brace rigidly connected at its ends to spaced-apart longitudinal beams, of a road-working implement adjustably supported by said frame, means comprising a fluid-pressure motor connected between said hollow cross-brace and said road-working implement for adjusting the latter relative to said frame, a motor-operated pump, said hollow cross-brace serving as a supply tank for said pump, and means connected between said pump and said fluid pressure motor for operating the latter while said tubular cross-piece acts as an abutment therefor.

16. A one-man grader comprising a frame formed of longitudinally extending spaced frame beams which are upwardly arched intermediate their ends, a tractor unit pivotaly connected to the rear end of said frame for supporting the said rear end, said tractor unit being stable as a unit without regard to its connection to said frame, supporting and steering wheels adjacent the front of said frame, a scarifier pivotaly at-

tached to said frame and positioned rearwardly of said steering wheels and forwardly of said tractor unit, a mold-board pivotally attached to said frame and positioned rearwardly of said scarifier and forwardly of said tractor unit, a hydraulic motor for adjusting the position of said scarifier, said hydraulic motor being positioned between said frame beams and extending longitudinally of said frame, a pair of hydraulic motors for adjusting said mold-board, said last-named hydraulic motors also being positioned between said frame beams and extending longitudinally of said frame, and control means for said steering wheels and said hydraulic motors positioned adjacent the rear of said grader where they may be operated by one man.

17. In a road working machine, the combination with a tractor power plant, of a frame comprising spaced-apart beams having a tubular cross-brace between the same intermediate the ends thereof, the rear end portions of said beams being connected to the sides of said power plant, front steering wheels, a road-working implement, mechanism disposed between said tubular cross-brace and said road-working implement and mounted on said beams in position to adjust the elevation of said road-working implement, said member being operatively connected to the cross-brace whereby to transmit the road working thrust to said tubular cross-brace, means for operating the front steering wheels, and means for effecting the operation of said adjusting mechanism.

18. In a road-working machine, the combination with a tractor power plant, of a frame comprising spaced-apart beams connected to the sides of said power plant and extending forwardly therefrom, said frame comprising also a tubular cross-brace abutment between said beams and in-

intermediate the ends thereof, front steering wheels and means for operating the same, a road-working implement, means comprising a fluid pressure motor disposed between said tubular cross-brace abutment and said road-working implement for adjusting the latter, said adjusting means being mounted on said beams to enable said fluid pressure motor to occupy a position between said beams approximately parallel thereto and operatively connected to the cross-brace abutment whereby back-pressure due to operation of said road-working implement will be transmitted longitudinally of said fluid-pressure motor onto said abutment, and means for controlling the operation of said fluid adjusting means.

19. In a self-propelled road grader, the combination with a tractor power plant, of a frame comprising spaced-apart beams having a tubular cross-brace between the same intermediate the ends thereof, the rear end portions of said beams being connected to the side of said power plant, front steering wheels and means for operating the same, a mold-board, a drawbar for carrying said mold-board, adjusting mechanism disposed between said tubular cross-brace and said drawbar and comprising a pair of spaced apart hydraulic motors, said adjusting mechanism being mounted on said beams to enable said hydraulic motors to occupy positions between said beams and substantially parallel thereto and the motors being operatively connected to the cross-brace whereby the working thrust from the operation of said mold-board will be transmitted longitudinally of said hydraulic motors to said tubular cross brace, and means for controlling said hydraulic motors to effect locking thereof rigidly in position during operation of said mold-board.

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