

Feb. 1, 1966

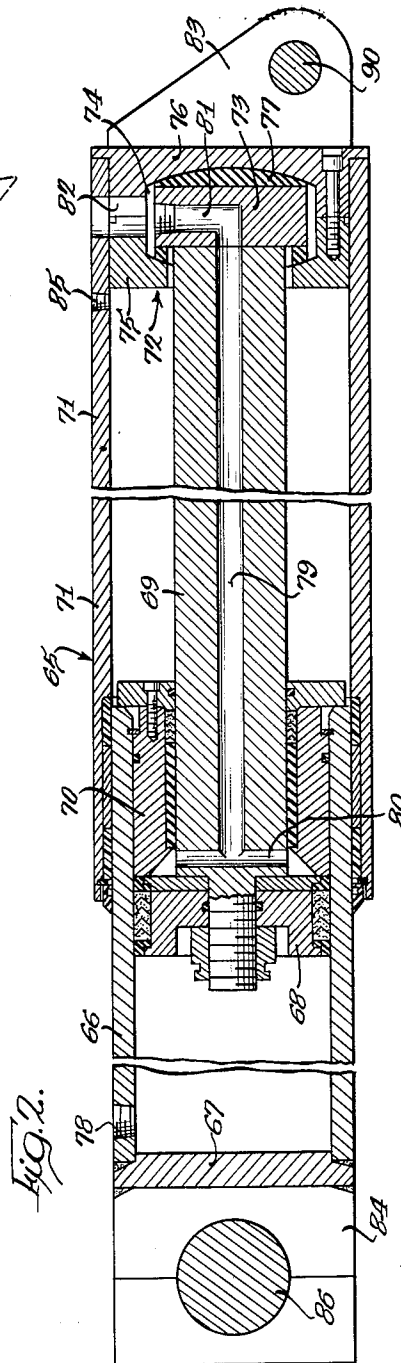
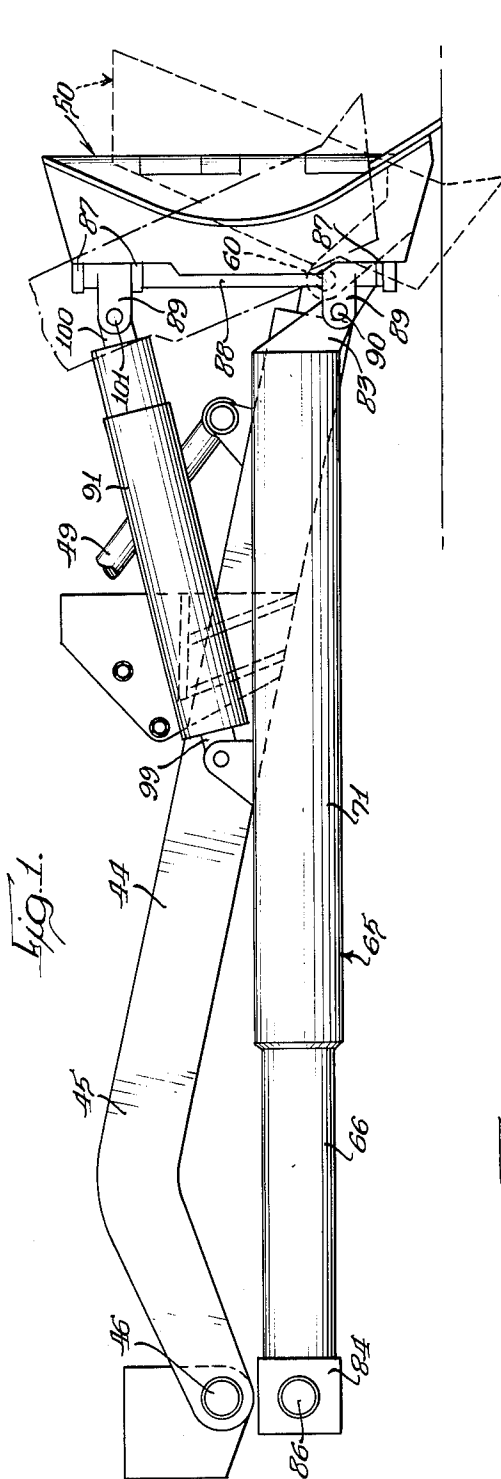
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3,232,184

HYDRAULIC PUSH BEAM

Filed Sept. 16, 1964

2 Sheets-Sheet 1



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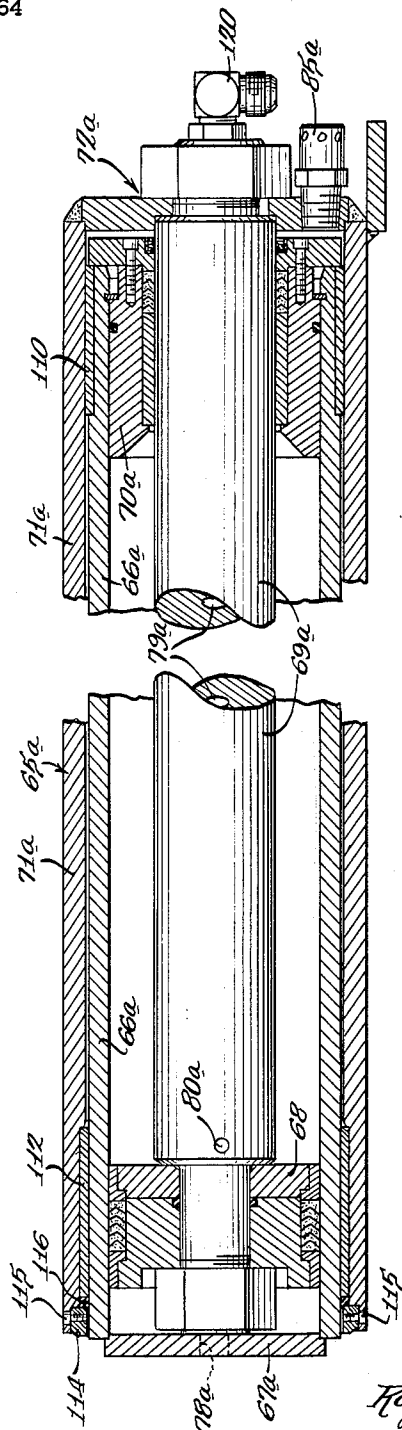
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FIG. 3.



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HYDRAULIC PUSH BEAM

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4 Claims. (Cl. 92-116)

This application is a continuation-in-part of my co-pending application, Serial No. 54,050, filed September 6, 1960, now Patent No. 3,157,099, issued November 17, 1964, and relates to earth materials handling equipment, particularly a new and novel materials handling blade structure applicable, for example, to bulldozers.

Bulldozers are, of course, well-known in the art, the same comprising by definition a tractor, a vertically movable transverse moldboard blade ahead of the tractor and push arms connected to the blade and movably mounted on the tractor. In the simplest form, the blade is rigidly secured to the push arms and is disposed at right angles to the longitudinal axis of the tractor. In an amplification, the push arms are pivoted to the blade and adjustable struts are provided for varying the "pitch" of the blade, i.e., the angle of the plane of the blade to horizontal, and for "tilting" the blade, i.e., raising or lowering one end of the blade relative to the other to dispose the lower or cutting edge of the blade at an angle to horizontal. Another form of bulldozer substitutes a "C-frame," a frame comprised of a pair of side arms like the aforesaid push arms and a transverse portion between the arms ahead of the tractor, for said push arms. One primary advantage of the C-frame is that the blade may be pivotally mounted on an upright axis at its center on the transverse forward portion of the frame and be connected at its ends to the side arms by selectively positionable struts, so that the blade may be disposed at an angle to said axis. Each of these several blade structures has its own particular advantages and uses, and the blades for the most part are purchased and installed on tractors on the basis of the use for which they are primarily intended.

In said copending application, I have disclosed an improved blade structure having all of the advantages and serving all of the uses of the prior blade structures, and at the same time providing further advantages and new uses, and facilitating broader application of bulldozers. As shown in said application, my improved blade structure, in its preferred embodiment, comprises a sectionalized blade comprising a plurality of blade sections hingedly connected to one another on generally upright axes, a universal mounting assembly on the blade substantially centrally of its length for mounting the blade for universal movement on a C-frame, a pair of selectively operable extensible and retractable push arms universally connected respectively to the outer end portions of the blade and the tractor for selectively swinging each outer section of the blade forward and backward, and a pair of selectively operable extensible and retractable struts pivotally mounted respectively on the push arms and universally connected to the respective outer end portions of the blade for tilting the blade, varying the pitch of the blade, or both tilting and varying the pitch of the blade.

In the described structure, the selectively operable, extensible and retractable push arms and struts are of prime importance in effecting manipulation of the sectionalized blade, and the object of the present invention is the provision of push arms and struts of improved structure especially adapted for the rugged service to which bulldozers are subjected.

More specifically, it is the object of the invention to provide an improved hydraulic beam structure adapted particularly for service as the push arm means and struts for the blade structure above described.

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Other objects and advantages of the invention will become apparent in the following detailed description.

Now, in order to acquaint those skilled in the art with the manner of making and using my improved extensible and retractable hydraulic beam means, I shall describe, in connection with the accompanying drawings, preferred embodiments of the beam and preferred manners of making and using the same.

In the drawings:

FIGURE 1 is a side elevation of a bulldozer blade structure incorporating my improved hydraulic beams;

FIGURE 2 is a vertical longitudinal section of my improved hydraulic push beam; and

FIGURE 3 is a vertical longitudinal section of a second embodiment of said beam.

Referring now to FIGURE 1, I have shown one embodiment of my new push beam as forming a part of the bulldozer blade structure of my said copending application, to which reference is made for a more detailed description thereof.

As shown, the blade structure includes a C-frame 44 having side arms 45 which are disposed adjacent the opposite sides of the tractor and are universally mounted on the tractor frame at their rearward ends by ball and socket connections 46 which pivotally mount the arms on a common transverse horizontal axis. The two side arms 45 are rigidly interconnected at their forward ends by a transverse portion extending between the arms forwardly of the tractor body; and a pair of hydraulically interconnected jacks 49 are pivotally connected to this portion for raising and lowering the forward part of the C-frame about the pivot axis defined by the ball and socket connections 46.

The blade per se is indicated generally at 50, the same comprising in its preferred embodiment an upright pintle pin and a pair of blade sections hingedly mounted on said pin and extending laterally outward in opposite directions therefrom. To mount the blade on the tractor, three mounting and/or adjusting means are provided. The first, indicated generally at 60, is located substantially centrally of the blade, preferably adjacent its lower edge. The object of this mounting is to mount the blade on the C-frame with freedom for pivotal movement about a first axis extending longitudinally of the tractor and a second axis extending transversely of the tractor. It is apparent, of course, that any known universal connection can be employed for this purpose.

The second mounting means for the blade is provided adjacent each end of the blade, i.e., the outer end portion of each blade section, and is comprised, in the preferred embodiment of the invention, of a pair of extensible and retractable push arms or beams 65. Each push arm comprises an extensible and retractable beam or ram comprised, as shown in one embodiment in FIGURE 2, of a hydraulic cylinder 66 having a closed rearward end 67, a piston 68 reciprocally mounted in the cylinder and sealing against the wall thereof, a piston rod 69 secured to the piston and extending axially through the forward end of the cylinder, an annular sealing collar 70 secured in the forward end of the cylinder and carrying sealing elements sealing against the cylinder wall and about the piston rod, a protective sleeve 71 substantially coextensive with the rod encircling the rod and the cylinder and slidably mounted on the cylinder, dry seals, such as nylon or Teflon annuluses, sealing between the cylinder and the sleeve, and connecting means, indicated generally at 72, between the forward end portions of the sleeve and the rod.

The purpose of the connection 72 is to couple the rod and sleeve for conjoint axial movement, and to accommodate relative lateral movement therebetween, whereby

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transverse stresses imposed upon the sleeve will not be transmitted to the piston and cylinder, so that the life of the hydraulic jack defined thereby will be prolonged. The connection is comprised of a radial flange 73 on the forward end of the piston rod, a complementary but radially enlarged socket 74 defined within the forward end of the sleeve by an annular member 75 and a disc 76, and a pair of washers 77 disposed to opposite sides of the flange 73 and having spherical forward and rearward surfaces cooperating with complementary surfaces on the members 75 and 76 to form therewith a spherical bearing. Thus, the rod is secured to the sleeve in the axial direction but is free to have relative radial and swiveling movement with respect to the sleeve.

To supply hydraulic fluid to the jack defined by the piston and cylinder, a radial bore 78 is provided in the cylinder 66 adjacent its rearward end 67, the piston rod 69 is provided with an axial bore 79, radial bores 80 adjacent its rearward end opening into the space between the piston and the collar 70, and a radial bore 81 adjacent its forward end; and the sleeve 71 and socket defining members 75 and 76 are provided with an enlarged radial bore 82 communicating with the bore 81. As illustrated in FIGURE 2, the portion of the flange 73 defining the bore 81 is tapped for reception of a pipe or other hydraulic conduit fitting so that the hydraulic line may be passed through the enlarged bore 82 in the sleeve and the socket defining members and be directly coupled to the piston rod.

At the forward and rearward ends thereof, each beam or ram is provided with conventional mounting blocks 83 and 84, respectively, by means of which it may be mounted on the blade and the tractor. The hydraulic fluid conduits thereby particularly facilitate supply of fluid to the jack or ram, even by pipes and only short lengths of flexible hose, since the beam has essentially only pivotal movement relative to the tractor and the blade as will presently be described. Also, a bleeder 85 is preferably provided in the forward end portion of the sleeve 71 to vent the space between the forward end of the sleeve and the forward end of the cylinder defining members.

At its rearward end, each beam or push arm 65 is movably mounted on the tractor in essentially the same manner as the side arms 45 are mounted, and on a transverse axis as close to coincident with the C-frame pivot axis as is conveniently practicable. As illustrated, I have provided mounting blocks 84 of a socket type mounted on complementary balls 86, which balls are secured to the tractor on a common transverse axis spaced a short distance below the axis of the C-frame mounting balls 46, whereby the beams or arms 65 are pivotally mounted on the tractor.

To accommodate attachment of each beam to the blade, the blade is provided on its back wall adjacent each of its ends with a plurality of vertically spaced rearwardly extending bars or brackets 87, preferably arranged in respective pairs adjacent the upper and lower edges of the blade. Each set of brackets is adapted for passage therethrough of an upright post or pin 88, which is suitably attached to the brackets by nuts at its upper and lower ends. Each pair of the brackets is adapted for reception therebetween of a clevis 89 which is pivotally mounted thereon by means of the post 88, each clevis having rearwardly extending transversely apertured ears. To the lower ones of the clevises 89 on each end of the blade I pivotally attach the forward mounting block 83 of the respective beam 65, a transverse horizontal pin 90 being employed for the purpose, whereby the beam is universally connected, in effect, to the blade. Preferably, these latter universals are disposed at substantially the same level as the transverse pivot axis of the first or central blade mounting means to define a transverse pivot axis for each blade section.

The third mounting and/or adjusting means for the blade comprises means for varying the pitch, or both the pitch and the tilt, of the blade, and in the preferred

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embodiment illustrated is comprised of a pair of extensible and retractable struts 91 pivotally connected respectively to the push beams or arms 65 and universally connected to the respective outer end portions of the blade in vertically spaced relation to the connection thereto of the respective push arm. Each strut comprises a double-acting hydraulic jack preferably of the same structure as the push beams 65.

At its rearward end, the strut carries a mounting block 99 by means of which it is pivotally mounted on a horizontal transverse axis between a pair of upstanding ears on the respective push arm 65. At its forward end, the strut carries a mounting block 100 by means of which it is pivotally connected, with a pin 101, to the upper clevis 89 at the respective end of the blade, whereby the strut, in effect, is universally connected to the blade. As will be appreciated by those skilled in the art, simultaneous extension or retraction of the struts 91 will cause the blade to pivot about the transverse axis of the central mount 60 and the pins 90, thereby to vary the pitch of the blade. If only one of the struts 91 is extended, or the one is extended while the other is being retracted, the blade will be caused to tilt about the longitudinal axis of the central mount to dispose one end of the blade lower than the other with the lower or cutting edge of the blade disposed at an angle to horizontal.

Each of the struts 91 and the push beams 65 is adapted for selective individual operation, the struts being operable for the purposes above stated and the beams being operable selectively to advance and retract the respective ends of the blade. The two jacks 49 are simultaneously operable to raise or lower the blade, or to force the blade downwardly; more specifically, to raise and lower and retain in a predetermined position the central mounting means 60 for the blade. This central mounting means may also be extended and retracted to shift the center portion of the blade forwardly and rearwardly, and this may if desired be effected hydraulically. The conventional hydraulic fluid supply system of the tractor is utilized to operate the several hydraulic units, and suitable control valves are provided at the operator's station to effect selective operation of the beams, struts and jacks at the will of the operator.

In my said copending application, I have shown exemplary ones of the almost unlimited range of positions that can be achieved with my blade structure, and reference is made to that application for detailed disclosure. It is also to be noted that my push beams and struts may be universally connected to a solid or one-piece blade to control the angle, pitch and tilt thereof. By virtue of the push beams 65, the sectionalized blade 50 may readily be disposed straight, or may be veed forward or back, or may be angled, or may be disposed with its two sections at diverse angles, or with one section straight and the other angled. Also, the blade may be tilted through an exceptionally great range due to the extensibility and retractability of the struts 91. In addition, the struts 91 by simultaneous adjustment serve to vary the pitch of the blade.

In use of the described blade structure the push beams and struts are subjected to exceptionally severe service conditions. The beams are forced into and travel through earth materials, are scraped against rocks, ties and the like, and yet must always be capable of instantaneous extension and retraction during travel of the tractor to facilitate adjustment of blade angle, V, tilt and pitch to meet the moment-to-moment requirements of the bulldozer operator. Also, in effecting adjustments during travel of the tractor, the beams are frequently required to serve as the earth-moving force applying means. Consequently, the beams must be of rugged construction and designed to operate at all times despite the impacts and blows to which the same are subjected, both longitudinally and laterally.

According to the present invention, the relatively movable parts of each hydraulic beam, arm and strut are comprised of (a) a cylinder 66, and (b) the combination of a piston 68 reciprocable in said cylinder, a coaxial piston rod 69 guided in the end block 70 of the cylinder and a circumscribing coaxial protective sleeve 71 secured to the free end of the piston rod and slidably guided on the exterior of the cylinder. By virtue of this construction, the cylinder is confined between the piston and the protective sleeve and thus is rigidly braced and protected against misalignment and also against lateral shock or impact; the piston, the hydraulic circuit and the guiding and sealing means 70 between the piston rod and the cylinder are fully enclosed and thus shielded from damage and entry of dirt; the seal 70 and the piston rod 69 are enclosed and shielded whereby the two may have and will retain accurately formed mutually guiding surfaces that are protected from wear, thereby to afford long service life in terms both of hydraulic longevity and bearing surface longevity; and the sleeve 71 serves as an overall protective shield for the operative components comprised of the piston, rod and cylinder.

In particular, it is to be observed that the sleeve 71 need not have especially accurate guidance on the cylinder 66 and that the sealing means between the sleeve and the cylinder need not withstand any hydraulic or other pressure, but need simply be such as to wipe the exterior surface of the cylinder and prevent entry of dirt into the interior of the sleeve. Thus, the mechanical conditions imposed on the sleeve are slight and there are no hydraulic conditions to be satisfied, whereby the sleeve is readily and economically provided. Yet, the sleeve attains and affords very substantial advantages as above noted.

A second embodiment of this highly advantageous push beam structure is illustrated in FIGURE 3, wherein parts corresponding to parts previously described are indicated by the same reference numerals with the suffix "a." As shown, the beam 65a like the beam 65 is comprised essentially of a hydraulic cylinder 66a having a fixed end wall 67a, a piston 68a reciprocable in the cylinder and sealing against the wall thereof, a piston rod 69a secured rigidly to the piston and extending axially through the forward end of the cylinder, an annular end seal and bearing assembly 70a sealingly secured in the forward end of the cylinder and accurately guiding and sealing against the piston rod, a protective sleeve 71a coextensive with the rod and encircling the rod and cylinder, and a connection 72a between the forward end portions of the rod and sleeve.

In contrast to the structure of FIGURE 2, and as a distinct improvement thereover, the beam of FIGURE 3 incorporates both bearing means and improved sealing means for the guidable mounting of the protective sleeve 71a on the cylinder 66a. Specifically, the cylinder 66a is provided on its exterior surface adjacent its forward end with a sleeve bearing 110 which slidably engages the interior surface of the sleeve 71a, the sleeve 71a is provided on its interior surface adjacent its rearward end with a similar sleeve bearing 112 which slidably engages the exterior surface of the cylinder 66a, whereby the sleeve is journaled on the cylinder with particular freedom for relative reciprocation. To prevent entry of dirt into the bearings, especially the bearing 112, an annular metallic scraper 114 is secured within the rearward end of the sleeve and a dirt resistant annular seal 116 is interposed between the scraper and the bearing. In use of the beam, when the beam is being retracted after having been extended, the scraper 114 positively removes from the exterior surface of the cylinder any dirt, mud or clay that has adhered thereto and the seal 116 then wipes the cylinder clean whereby the bearing 112 engages only clean surfaces and is afforded a long service life. Simultaneously, the bearing 110 is protected and thus also has long service life. Should the scraper 114 or the seal 116 be-

come worn, the same can quickly be replaced by removal of radial fasteners 115 which hold the scraper in the sleeve.

In this manner, the sleeve 71a is accurately guided and journaled on the cylinder at two spaced points, as contrasted to the single bearing surface in the FIGURE 2 embodiment. Also, while the tapered, outwardly extending sealing member of FIGURE 2 is fairly reliable, the combination of the wear resistant scraper 114 and seal 116 is much more effective and affords prolonged service life.

By virtue of experience in the field, and also the greater support imparted to the sleeve by the cylinder, the FIGURE 3 embodiment of the invention does not incorporate the movement accommodating connection 72 of FIGURE 2 but instead incorporates a simple bolted connection between the piston rod 69a and the rigid end wall of the sleeve 71a. Thus, the structure is greatly simplified, and assembly and disassembly of the same is facilitated.

In FIGURE 3, hydraulic fluid under pressure is supplied to and discharged from the rear face of the piston via an inlet 78a in the end wall 67a of the cylinder, and to and from the forward face of the piston via an axial bore 79a through the piston rod, radial bores 80a adjacent the rearward end of the rod and opening into the space between the piston and the sealing assembly 70a and a fitting 120 threaded axially into the forward end of the rod forwardly of the end wall of the sleeve 71a. Also, a bleeder 85a is provided in the end wall of the sleeve to vent the interior of the sleeve, i.e., the space of variable volume between the sleeve end wall and the assembly 70a.

In both embodiments of the invention, whether applied to a sectionalized bulldozer blade, a one-piece blade, or to any other of the variety of uses to which hydraulic rams may be put, the hydraulic beam of this invention affords an extremely rugged structure of exceptionally long service life despite the severity of the service and substantially irrespective of the environment in which it is used. The beam may be mounted at either or both of its ends or by suitable attachment to substantially any point on the cylinder 71-71a, and either end and/or said cylinder may carry other operative means, such as the struts 91.

In view of the foregoing, it is believed apparent that all of the objects of the invention have been shown to be attained in a convenient, economical and practical manner.

While I have shown and described what I regard to be the preferred embodiments of my invention, it is to be appreciated that various changes, rearrangements and modifications may be made therein without departing from the scope of the invention, as defined by the appended claims.

I claim:

1. A hydraulic push beam comprising a cylinder having a closed free end, port means in said cylinder adjacent said free end thereof, a piston reciprocably mounted in said cylinder, a piston rod secured to said piston and extending through the opposite end of said cylinder, an annular collar secured in said opposite end of said cylinder and sealing about said rod, said rod having passages therethrough communicating with the space between said collar and said piston, an encircling sleeve generally coextensive with said rod slidably mounted on said cylinder, and a connection between said rod and said sleeve at the ends thereof opposite said piston comprising a radial flange on one of said sleeve and said rod, a radial socket on the other of said sleeve and said rod receiving said flange with radial clearance therefrom and spherical bearing elements mounted on one and slidably engaging with radial clearance the other of said flange and said socket, said sleeve, socket, flange and bearing having passages therethrough communicating with the passages in said rod.

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2. A hydraulic beam comprising a cylinder having a closed end, a piston reciprocally mounted in said cylinder, a piston rod secured to said piston and extending through the opposite end of said cylinder, means closing said opposite end of said cylinder about said rod, an encircling sleeve generally coextensive with said rod slidably mounted on said cylinder, a connection between said rod and said sleeve at the ends thereof opposite said piston interconnecting the same for conjoint longitudinal movement, port means in said cylinder adjacent said closed end thereof communicating with the space between said closed end and said piston, passages through said rod communicating with the space between said means and said piston from the exterior of said sleeve, means for selectively supplying hydraulic fluid to said port means and said passages to reciprocate said piston, rod and sleeve relative to said cylinder, said connection closing the end of said sleeve opposite said piston whereby said sleeve encloses and shields said rod and said closing means, and means on said sleeve adjacent the end thereof that is adjacent said piston for wiping the surface of said cylinder and for preventing entry of dirt between said cylinder and said sleeve.

3. A hydraulic beam comprising a cylinder having a closed free end, port means in said cylinder adjacent said free end thereof, a piston reciprocally mounted in said cylinder, a piston rod secured to said piston and extending through the opposite end of said cylinder, an annular seal assembly sealingly secured in said opposite end of said cylinder and guidably sealing about said rod, said rod having passages therethrough communicating with the space between said assembly and said piston, an encircling sleeve generally coextensive with said rod slidably mounted on said cylinder, a connection between said rod and said sleeve at the ends thereof opposite said piston, said connection interconnecting said rod and sleeve for conjoint longitudinal movement and closing the end of said sleeve opposite said piston, breather valve means in said sleeve venting the space within said sleeve between said con-

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nection and said assembly, bearing means between said sleeve and said cylinder, and means on said sleeve at the end thereof adjacent said piston for wiping the surface of said cylinder and mitigating entry of contaminants into said bearing means and between said cylinder and said sleeve.

4. A hydraulic beam comprising a cylinder having a closed end, a piston reciprocally mounted in said cylinder, a piston rod secured to said piston and extending through the opposite end of said cylinder, an annular seal assembly sealingly secured in said opposite end of said cylinder and guidably sealing about said rod, an encircling sleeve generally coextensive with said rod slidably mounted on said cylinder, a connection between said rod and said sleeve at the ends thereof opposite said piston, said connection interconnecting said rod and sleeve for conjoint longitudinal movement and closing the end of said sleeve opposite said piston, a first sleeve bearing on said opposite end of said cylinder slidably mounting said sleeve thereon, a second sleeve bearing within the end of said sleeve adjacent said piston slidably mounting said end of said sleeve on said cylinder, a seal within said sleeve to the outer side of said second bearing sealing between said sleeve and said cylinder, and an annular scraper outwardly of said seal on the end of said sleeve adjacent said piston for scraping dirt and the like off of said cylinder upon relative contraction of said cylinder and said sleeve.

References Cited by the Examiner

UNITED STATES PATENTS

2,008,128	7/1935	Condon et al. -----	92—165 XR
2,163,959	6/1939	Nilson -----	92—117 XR
2,681,518	6/1954	Troop -----	37—144
2,813,515	11/1957	Curtis -----	92—51 XR

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