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E. S. PRICHARD

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MOBILE CRANE AND CARRIER ASSEMBLY

Filed Feb. 23, 1954

4 Sheets-Sheet 1

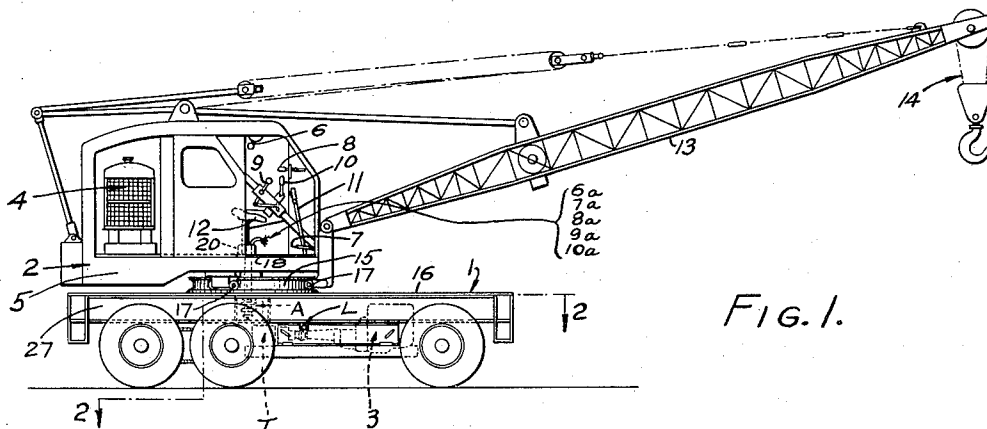


FIG. 1.

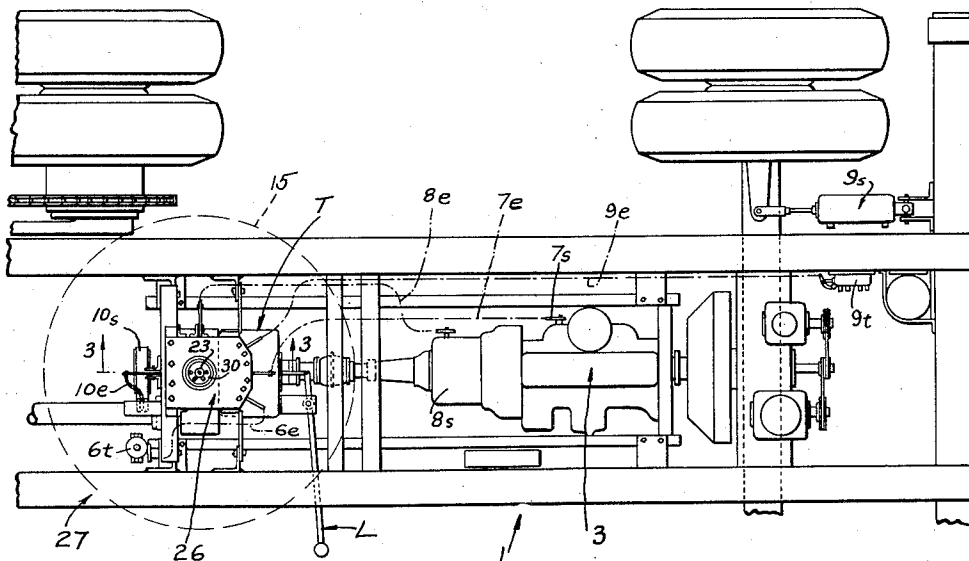


FIG. 2.

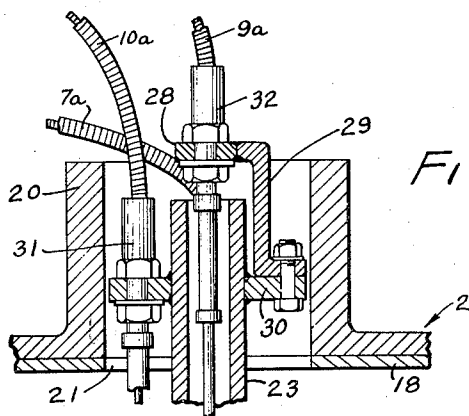


FIG. 6.

INVENTOR.
EVAN S. PRICHARD.
BY *Carvin D. Jones*
ATTORNEY.

Oct. 7, 1958

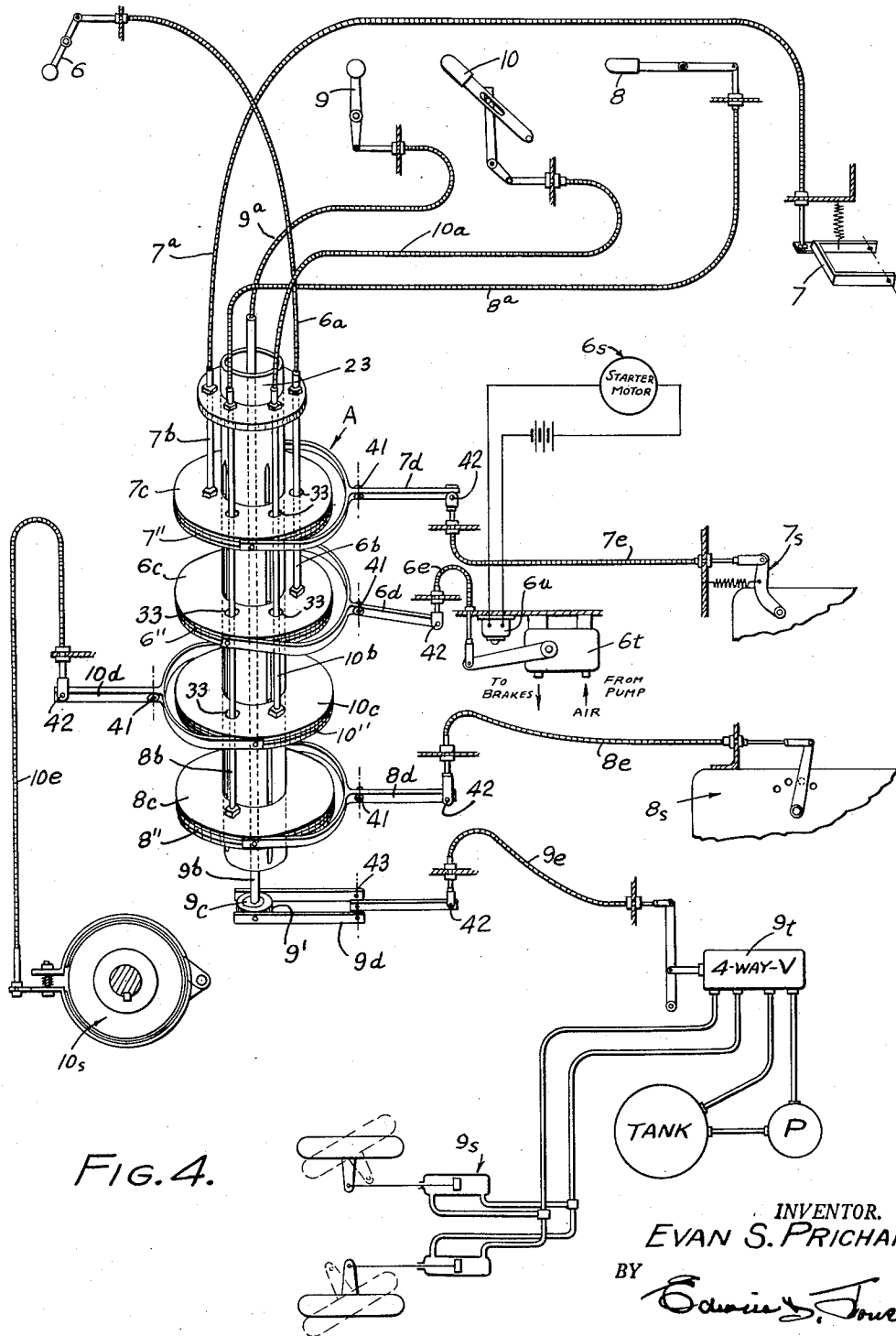
E. S. PRICHARD

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MOBILE CRANE AND CARRIER ASSEMBLY

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4 Sheets-Sheet 2



INVENTOR.
EVAN S. PRICHARD.
BY *Edwin S. Towell.*
ATTORNEY.

Oct. 7, 1958

E. S. PRICHARD

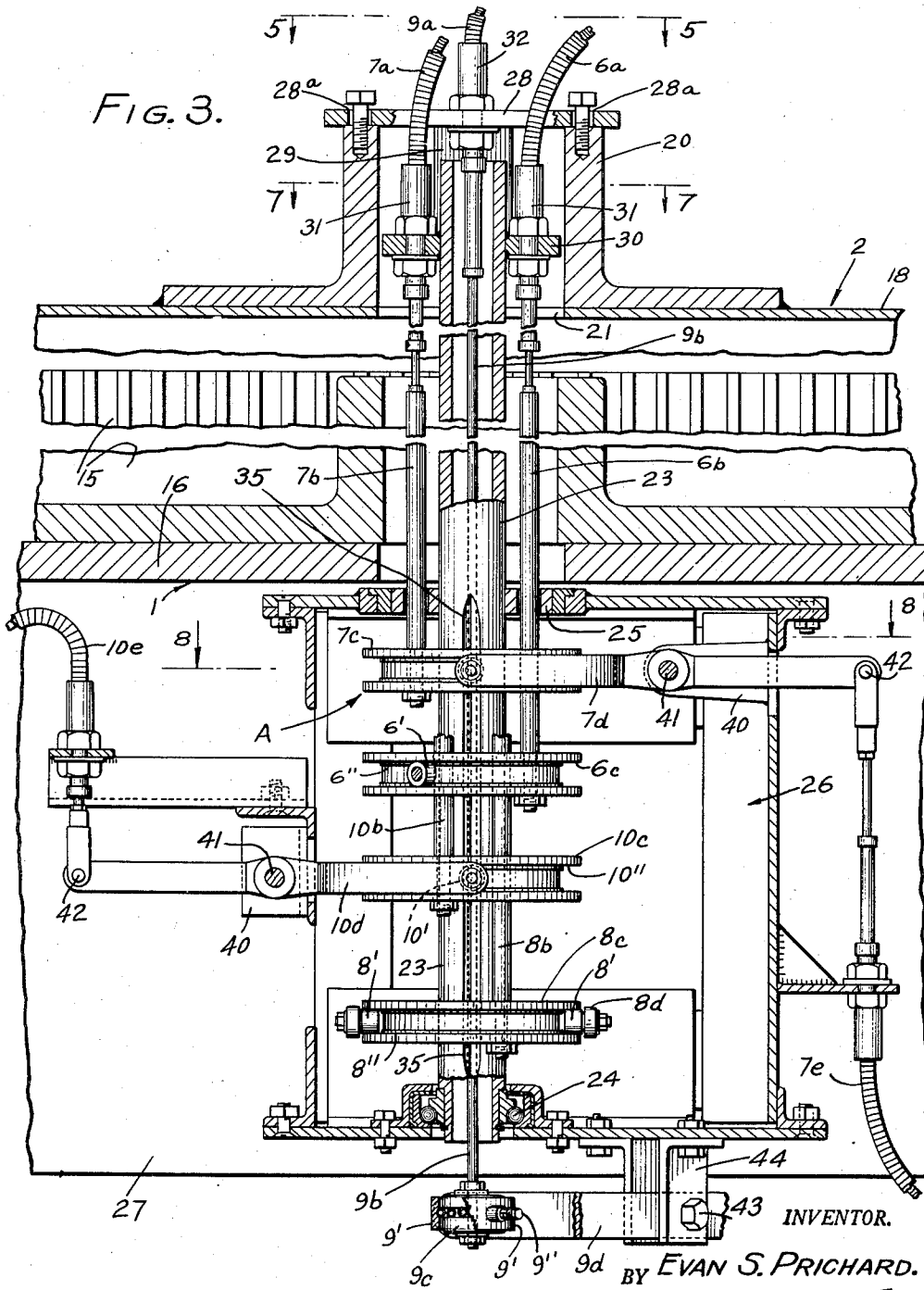
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MOBILE CRANE AND CARRIER ASSEMBLY

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FIG. 3.



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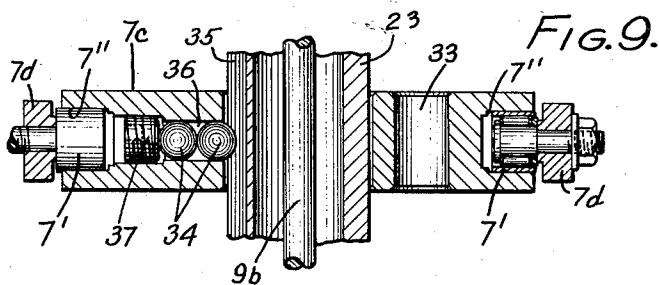
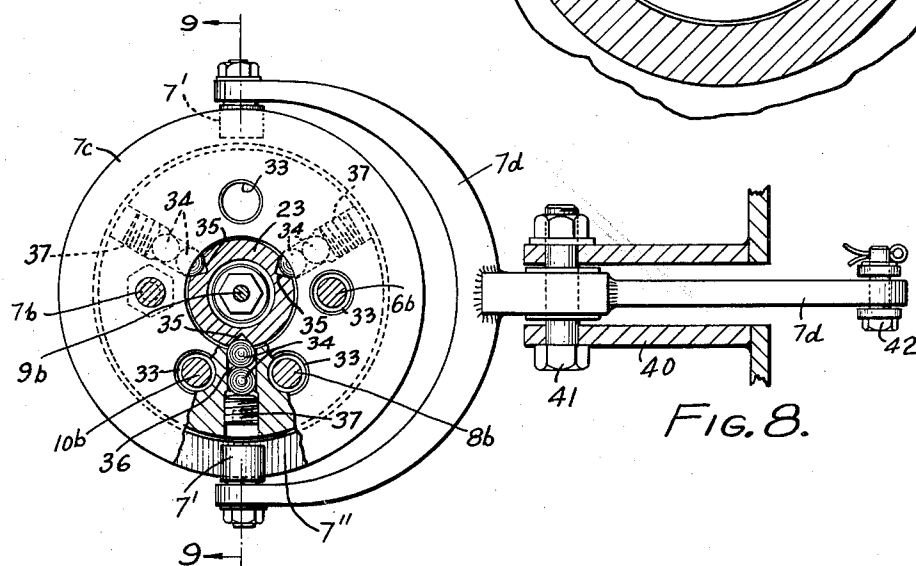
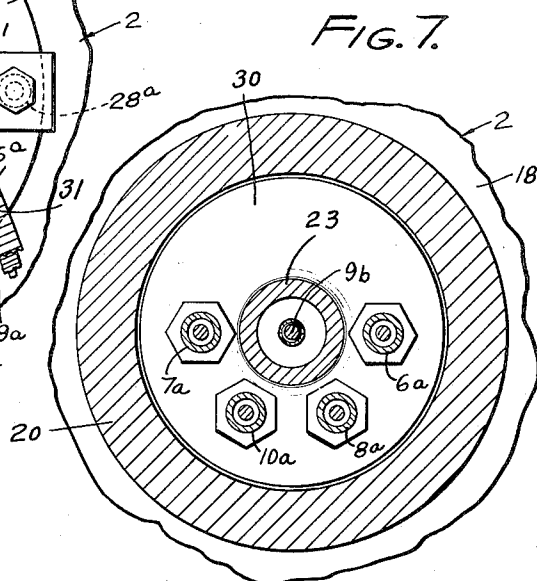
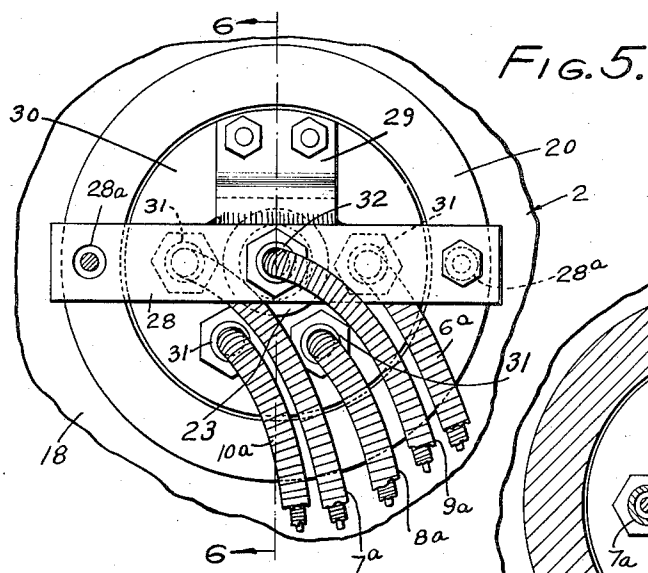
E. S. PRICHARD

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MOBILE CRANE AND CARRIER ASSEMBLY

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2,855,110

MOBILE CRANE AND CARRIER ASSEMBLY

Evan S. Prichard, La Canada, Calif., assignor to Cook Bros. Equipment Co., Los Angeles, Calif., a corporation of California

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8 Claims. (Cl. 212—38)

This invention relates to cranes of the type revolvably supported on power-driven, wheeled and dirigible carriers. Cranes of this character have a power plant for revolving the cab and operating the windlass for the boom, which is mounted to revolve with the cab, and the control means therefor is located within the cab. A second power plant is mounted on the carrier for driving the latter. The control means to vary the speed at which the carrier may be driven, as well as the control means for braking and steering the carrier, are manually operated from points within the driver's cab on the carrier.

Accordingly, two separate control stations are required, one for the crane and the other for the carrier, and this arrangement, of necessity, requires an operator for each control station.

It is an object of this invention to provide a crane and carrier assembly of this character which embodies novel means whereby a single operator at the control station in the crane cab, may conveniently and accurately control movement of the carrier as well as the operation of the crane.

Another object of this invention is to provide a crane and carrier assembly which embodies improved means making it unnecessary to transmit power from the crane cab for propelling the carrier.

It is another object of this invention to provide a crane and carrier assembly wherein novel carrier control connections between the crane cab and the power driven propulsion means on the carrier as well as the transmission means, fluid brakes and steering means for the carrier, make it unnecessary to employ fluid lines such as hydraulic and pneumatic conduits between the crane cab and the carrier.

Further, it is an important object of this invention to provide novel and highly efficient mechanical linkage between carrier controls in the revolvable crane cab and the means on the carrier for effecting and controlling the movement of the carrier.

It is another object of this invention to provide an improved crane and carrier assembly wherein the novel mechanical carrier-control connections between the crane cab and the carrier, and the elimination of carrier propulsion transmission means between the crane cab and the carrier, make it unnecessary to ship the crane unit and the carrier unit to or from a central point for assembly and testing before delivery to or from the job site, as the two units readily may be assembled on the job and as readily disassembled.

Additionally, it is an object of this invention to provide a crane and carrier assembly such as described wherein the novel mechanical carrier-control means are installed on the carrier with simple flexible, manually operable, elements thereof extending therefrom so as to be subject to ready connection with the crane cab, as well as subject to selective and detachable mounting on the cab in positions readily accessible from the operator's station in the cab.

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Only one form of crane and carrier embodying the invention, will be described herein, and the novel features thereof pointed out in claims.

In the accompanying drawings:

Fig. 1 is a side elevation of a crane and carrier assembly embodying the present invention;

Fig. 2 is an enlarged fragmentary sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a greatly enlarged fragmentary sectional view partly in elevation and taken on the plane of 3—3 of Fig. 2 showing the carrier control means embodying this invention, and the manner of connecting the same with elements of the crane cab and the carrier;

Fig. 4 is a schematic view of the control means embodying this invention, showing the connection of the several control units thereof with the various carrier-carried elements for effecting and controlling the movement of the carrier;

Fig. 5 is a fragmentary top plane of the portion of the apparatus embraced by the line 5—5 of Fig. 3;

Fig. 6 is a sectional view taken on the line 6—6 of Fig. 5;

Fig. 7 is a cross sectional view taken on the line 7—7 of Fig. 3;

Fig. 8 is a fragmentary, enlarged cross sectional view taken on the plane of line 8—8 of Fig. 3; and

Fig. 9 is an enlarged fragmentary sectional view taken on the plane of line 9—9 of Fig. 8.

As shown in Fig. 1, a crane and carrier assembly embodying this invention comprises a wheeled carrier 1 on which a crane unit 2 is revolvably mounted. The carrier mounts an engine 3 for driving the same, whereas an engine 4 is provided in the cab 5 of the crane unit 2 for the sole purpose of operating the crane unit.

In accordance with this invention a single control station is provided in the crane cab 5, from which an operator may control the movement of the carrier 1, as well as the operation of the crane unit 2. This control of the carrier from the crane cab 5 is made possible by mechanical linkage means A which, as best shown in Figs. 3 and 4, operatively connects carrier control elements in the crane cab with the elements on the carrier 1 for effecting and controlling the movements of the carrier.

With reference to Figs. 1 and 4, particularly the latter, it will be seen that the carrier-control elements in the crane cab 5, include a lever 6 for controlling the engine starting motor 6s as well as the air brake system 6t on the carrier; an accelerator 7 for controlling the engine throttle 7s on the carrier; a lever 8 for controlling an automatic transmission unit 8s associated with the engine 3 to drive the carrier at different speeds; a lever 9 for controlling a hydraulic power steering unit 9s on the carrier; and a lever 10 for controlling emergency or parking brakes 10s on the carrier. The crane cab is also provided with the usual controls for the crane elements including the lever 11 as shown in Fig. 1. These controls are well known and are not shown except the lever 11. They are accessible from the operator's slot 12, and provide for control of the turning of the cab as well as for operation of the boom 13 and the tackle 14 associated therewith in a manner well known in this art.

The crane cab 5 is revolvable about the axis of an internal bull gear 15 fixed as by welding to the deck 16 of the carrier 2, as indicated in Figs. 1 and 3. Rollers 17 (Fig. 1) mounted on the cab deck 18 ride on the gear 15 so as to maintain the cab in centered relation to this gear, in the turning of the cab. A drive pinion, not shown, driven by the power plant 4 in the cab 5 in the usual manner for turning the cab, is carried by the deck 18 so as to mesh with and travel around the internal teeth of the bull gear 15.

The control levers 6, 7, 8, 9 and 10 operable in the

cab 5 for controlling the carrier movements, are connected with Bowden wire elements 6a, 7a, 8a, 9a and 10a respectively, which constitute parts of the linkage means A. These Bowden wire elements extend into a tubular member 20 welded to the cab deck 18 over an opening 21 in line with the axis of the bull gear 15, as best shown in Fig. 3, whereby they are positioned for connection with remainder of the linkage means A which will now be described.

With reference to Fig. 3, it will be seen that a vertically disposed tubular shaft 23 coaxial with and extending through the hub of the bull gear 15, is mounted for rotation in bearings 24 and 25 on a frame 26 fixed to a carrier frame 26 below the deck 16. The shaft 23 is rotated with the crane cab 5, being detachably and drivingly connected with the fixed member 20 on the cab deck 18, as best shown in Figs. 5 and 6. This detachable drive connection is effected by means of a torque bar 28 bolted on the member 20, and connected by means of a rigid angular link bar 29 with a ring 30 welded on the upper end of the shaft 23. As the crane cab tilts about its axis during the operation of the crane, the bolt holes 28a accommodating the bolts which fasten the bars 28 and 29, are enlarged to permit of such rocking movement without damaging the connection between the member 20 and the shaft 23.

Means, as best shown in Figs. 3 and 4, is mounted on the shaft 23 and associated therewith, for mechanically linking the control units 6s, 6t, 7s, 8s, 9s and 10s on the carrier, with the Bowden wire elements 6a, 7a, 8a, 9a and 10a in the cab 5. This means includes extensions 6b, 7b, 8b, 9b and 10b of the Bowden wire units 6a, 7a, 8a, 9a and 10a, respectively. The extensions 6b, 7b, 8b and 10b are detachably joined to the associated elements 6a, 7a, 8a and 10a through the ring 30, by means of like coupling members 31. The extension 9b extends through the tubular shaft 23, and is detachably joined through the torque bar 28 to the element 9a by coupling means 32.

It will now be apparent that as the shaft 23 and the Bowden wire elements and extensions thereof are in effect, parts of the carrier which are subject to detachable connection with the crane cab 5 by means of the torque bar 28, link 29, ring 30 and the coupling means 31 and 32, it is possible for a mechanic readily to connect these controls between the carrier and the crane cab, as well as to disconnect such controls.

Continuing with the description of the linkage means A on the carrier, it is seen with reference to Figs. 3 and 4, that the Bowden wire extensions 6b, 7b, 8b and 10b are slidable through openings in the rotary part of the bearing 25 and secured as at their lower ends to peripherally grooved circular disks 6c, 7c, 8c and 10c respectively, mounted on the shaft 23 for rotation therewith and axial movement relative to the shaft. Those of the extensions which extend past certain of the disks are movable freely through openings 33 in such disks.

As best shown in Figs. 8 and 9, the disks 6c, 7c, etc. are splined on the shaft 23 for rotation therewith as well as independent vertical movement thereon, through the provision of non-friction splines 34 engaging in V-shaped grooves 35 in the shaft. Each spline 34 comprises a pair of steel balls mounted in a radial bore 36 in the disk, with the inner ball rotatable in the groove 35 and the outer ball rotatable with the inner ball and having rotatable contact with the inner cupped end of a plug 37 screwthreaded in the disk.

It will now be apparent that the shaft 23, disks 6c, 7c, 8c and 10c, as well as all of the Bowden wire elements 6a, 7a, 8a, 9a and 10, with their extensions 6b, 7b, 8b, 9b and 10b, will rotate with the turning of the crane cab 5, relative to the carrier 1.

The control elements 9, 9a and 9b in being operable for controlling the power steering unit 9s of the carrier, are of different arrangement than the other control

elements in that the extension 9b of the Bowden wire element 9a is extended axially through the shaft 23, and has a circular disk 9c fixed to the lower end thereof below the shaft 23. A ring 9' surrounds the disk 9c, the ring and disk being constructed and arranged so that the disk will rotate relative to the ring while both are subject to bodily movement responsive to axial movement of the Bowden extension 9b.

Means are provided in cooperation with the rotary disks 6c, 7c, 8c and 10c as well as with the rotary disk 9c, for operatively connecting these disks respectively with the controls 6s, 6t, 7s, 8s, 9s and 10s on the carrier 1. These means include levers 6d, 7d, 8d, 9d and 10d arranged to actuate associated Bowden wire elements 6e, 7e, 8e, 9e and 10e, respectively, which latter are connected with and operate the control elements 6s, 6t, 7s, 8s, 9s and 10s, respectively. The Bowden wire element 6e, as shown in Fig. 4, serves the dual purpose of operating the switch 6u for engine starting motor 6s, as well as operating the air brake unit 6t.

With reference to Fig. 3, it will be seen that the levers 6d, 7d, 8d and 10d are fulcrumed on the frame 26 so as to extend radially toward the shaft 23, there being brackets 40 on the frame 26, on which the levers are fulcrumed as at 41. The outer ends of these levers are pivoted as at 42 to the Bowden wire elements 6e, 7e, 8e and 10e. The inner ends of these levers are forked and carry rollers 6', 7', 8' and 10' which ride in grooves 6'', 7'', 8'' and 10'' in the rotary disks 6c, 7c, 8c and 10c, respectively, thereby operatively connecting these disks with the levers.

The lever 9d is fulcrumed as at 43 on a bracket 44 depending from the frame 26, and one end of this lever is pivoted as at 9'' to the ring 9'. The other end of the lever 9d is connected with the Bowden wire element 9e (see Fig. 4) which operates a 4-way control valve 9t for the power steering hydraulic unit 9s on carrier 1.

With reference to the foregoing description in consideration of the accompanying drawings, particularly the schematic showing in Fig. 4, it will be apparent that the mechanical linkage between the crane cab 5 and the carrier 1 will provide the objects and advantages appearing herein in a particularly efficacious manner. Operation of any one of the levers 6, 7, 8, 9 and 10 in the crane cab 5 will transmit through the Bowden wire control associated therewith, a force for moving the associated splined disk axially on the rotary shaft 23 whereby, the lever connected with the disk will be rocked to operate the Bowden wire element connected therewith, thereby actuating the selected unit on the carrier 1 for effecting movement and/or controlling movement thereof as required.

Thus it becomes manifest that by means of this invention complete and remote control of the carrier to maneuver the crane unit from place to place, is attained by a single operator stationed in the crane cab, and that mechanical linkage is provided, as distinguished from fluid linkage, such as oil and air lines running from carrier to crane, for operation of the fluid and mechanical controls for carrier movement, steering and braking.

As shown in Fig. 2, an auxiliary transmission T is provided between the transmission 8s and the rear axle of the carrier. This transmission T is of the low-speed selective gear type, and is operable manually by a lever L which projects from the side of the carrier 1 so as to be actuated by an operator standing on the ground. The transmission 8s is designed for high-speed operation of the carrier, and is used in working in open areas, or for moving from one job site to another. The auxiliary transmission T is for slow-speed operation of the carrier, and permits easy operation and maneuvering in cramped quarters. Thus there is provided extreme maneuverability and large working radius of the carrier and crane.

Although only one form of mobile crane and carrier assembly embodying the invention is herein shown and

described it is to be understood that various changes and modifications may be made herein without departing from the spirit of the invention and the spirit and scope of the appended claims.

I claim:

1. Mechanical linkage means for controlling the movement of a mobile crane carrier from the revolvable cab of a crane unit mounted on the carrier, wherein the carrier is provided with a power plant as well as means for controlling the operation of such plant and the movement of the carrier, comprising: a tubular shaft; bearing means on said carrier rotatably mounting said shaft in a vertical position in line with the axis of rotation of said cab; a plurality of circular members independently splined on said shaft; an elongated axially movable member extending through said shaft; means connecting said shaft with said cab for rotation with the cab; flexible actuating elements connected with said axially movable circular members for operation from said cab to reciprocate said members; a plurality of said circular members having openings therein through which said elements are extended; levers fulcrumed on said carrier; said circular members having peripheral grooves; rollers on said levers disposed in said grooves; another lever fulcrumed on said carrier; means connecting said last named lever with said elongated member and means operatively connecting said first named and said last named levers with said control means on said carrier.

2. Mechanical linkage means for controlling the movement of a mobile crane carrier from the revolvable cab of a crane unit mounted on the carrier, wherein the carrier is provided with a power plant as well as means for controlling the operation of such plant and the movement of the carrier, including: a shaft supported on the carrier for rotation about a vertical axis and extending through the deck of said cab; means connecting the shaft with the deck of said cab for rotation therewith; peripherally grooved disks splined on said shaft for rotation therewith and for independent axial movement thereon; flexible actuating elements one for each of said disks secured thereto and extending through the cab deck for operation from the cab to reciprocate the respective disks; those of said elements for operating those disks below the uppermost disk extending through and slidable in those disks above the lowermost disk so as to allow said elements to individually actuate all of said disks; forked levers fulcrumed on said carrier, one for each of said disks and having parts engaging within the groove thereof; and means connecting said levers with said control means on said carrier.

3. Mechanical linkage means for controlling the movement of a mobile crane carrier from the revolvable cab of a crane unit mounted on the carrier, wherein the carrier is provided with a power plant as well as means for controlling the operation of such plant and the movement of the carrier, including: a shaft supported on the carrier for rotation about a vertical axis and extending through the deck of said cab; means connecting the shaft with the cab deck for rotation therewith; said means having parts allowing controlled rocking movement of the shaft relative to the cab deck while maintaining an operative connection between the two; peripherally grooved disks splined on said shaft for rotation therewith and for independent axial movement thereon; flexible actuating elements one for each of said disks secured thereto and extending through the cab deck for operation from the cab to reciprocate the respective disks; those of said elements for operating those disks below the uppermost disk extending through and slidable in those disks above the lowermost disk so as to allow said elements to individually actuate all of said disks; forked levers fulcrumed on said carrier one for each of said disks having parts engaging within the groove thereof; and means connecting said levers with said control means on said carrier.

4. Mechanical linkage means as embodied in claim 3, 75

wherein said parts comprise a tubular member fixed to the cab deck and into which the upper end of said shaft extends, a link bar fixed to the upper end of said shaft, and a torque bar fixed to the link bar above the upper end of said shaft and loosely bolted to the tubular member.

5. Mechanical linkage means for controlling the movement of a mobile crane carrier from the revolvable cab of a crane unit mounted on the carrier, wherein the carrier is provided with a power plant as well as means for controlling the operation of such plant and the movement of the carrier, including: a shaft supported on the carrier for rotation about a vertical axis and extending through the deck of said cab; means connecting the shaft with the cab deck for rotation therewith; peripherally grooved disks arranged one above the other on said shaft; means for individually splining said disks on said shaft, comprising grooves longitudinally in said shaft and circumferentially spaced about the latter; radial bores in each of said disks, screw plugs in said bores, and balls in said bores between said plugs and said shaft and engaging within the shaft grooves; flexible actuating elements one for each of said disks secured thereto and extending through the cab deck for operation from the cab to reciprocate the respective disks; those of said elements for operating those disks below the uppermost disk extending through and slidable in those disks above the lowermost disk so as to allow said elements to individually actuate all of said disks; forked levers fulcrumed on said carrier, one for each of said disks having parts engaging within the grooves thereof; and means connecting said levers with said control means on said carrier.

6. Mechanical linkage means for controlling the movement of a mobile crane carrier from the revolvable cab of a crane unit mounted on the carrier, wherein the carrier is provided with a power plant as well as means for controlling the operation of such plant and the movement of the carrier, including: a shaft supported on the carrier for rotation about a vertical axis and extending through the deck of said cab; means connecting the shaft with the cab deck for rotation therewith; said means having parts allowing controlled rocking movement of the shaft relative to the cab deck while maintaining an operative connection between the two; peripherally grooved disks arranged one above the other on said shaft; means for individually splining said disks on said shaft comprising grooves longitudinally in said shaft and circumferentially spaced about the latter; radial bores in each of said disks, screw plugs in said bores, and balls in said bores between said plugs and said shaft and engaging within the shaft grooves; flexible actuating elements one for each of said disks secured thereto and extending through the cab deck for operation from the cab to reciprocate the respective disks; those of said elements for operating those disks below the uppermost disk extending through and slidable in those disks above the lowermost disk so as to allow said elements to individually actuate all of said disks; forked levers fulcrumed on said carrier one for each of said disks having parts engaging within the grooves thereof; and means connecting said levers with said control means on said carrier.

7. Mechanical linkage means for controlling the movement of a mobile crane carrier from the revolvable cab of a crane unit mounted on the carrier, wherein the carrier is provided with a power plant as well as means for controlling the operation of such plant and the movement of the carrier, including: a frame fixed on said carrier directly beneath said cab; a shaft; upper and lower bearings in said frame for supporting said shaft for rotation about a vertical axis and in vertical alignment with the axis of rotation of said cab; means connecting said shaft with the deck of said cab for rotation therewith; peripherally grooved disks splined on said shaft for rotation therewith and for independent axial movement thereon; flexible actuating elements having rigid terminal extensions secured to said disks, with said elements extending

through the cab deck for operation from the cab to actuate said extensions to individually reciprocate said disks; said extensions slidable longitudinally in and rotatable with the upper bearing, with those extensions for operating those disks below the uppermost disk extending through and slidable in those disks above the lowermost disk so as to allow said elements to individually actuate all of said disks; forked levers fulcrumed on said frame, one for each of said disks, and having parts engaging within the groove thereof; and means connecting said levers with said control means on said carrier.

8. Mechanical linkage means as embodied in claim 7, wherein said shaft is tubular; a rod-like member extending downwardly through said shaft; a flexible actuating element connected to the upper end of said member for operation from said cab to reciprocate said member; a disk fixed to the lower end of said member; a ring ro-

tatably mounted on said disk but fixed against axial movement thereon; a forked lever secured to said ring and fulcrumed on said frame; and means connecting the last-mentioned lever with one of said control means on said carrier.

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