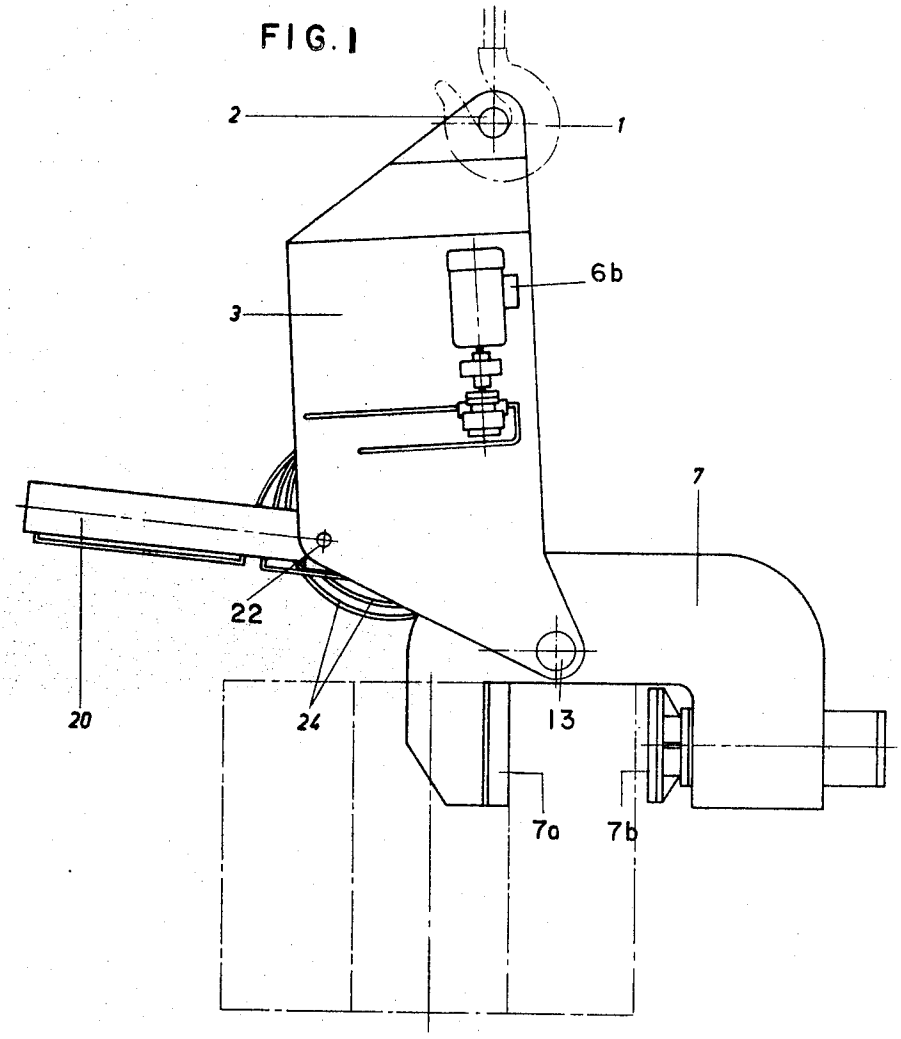
Aug. 2, 1966 F. BELLMANN 3,264,029

CLAMPING DEVICES FOR CRANES FOR ROLLING MILL SERVICE

Filed Sept. 14, 1964 5 Sheets-Sheet 1

FIG. 1



Inventor

Friedhelm Bellmann

By Irwin Dalgin

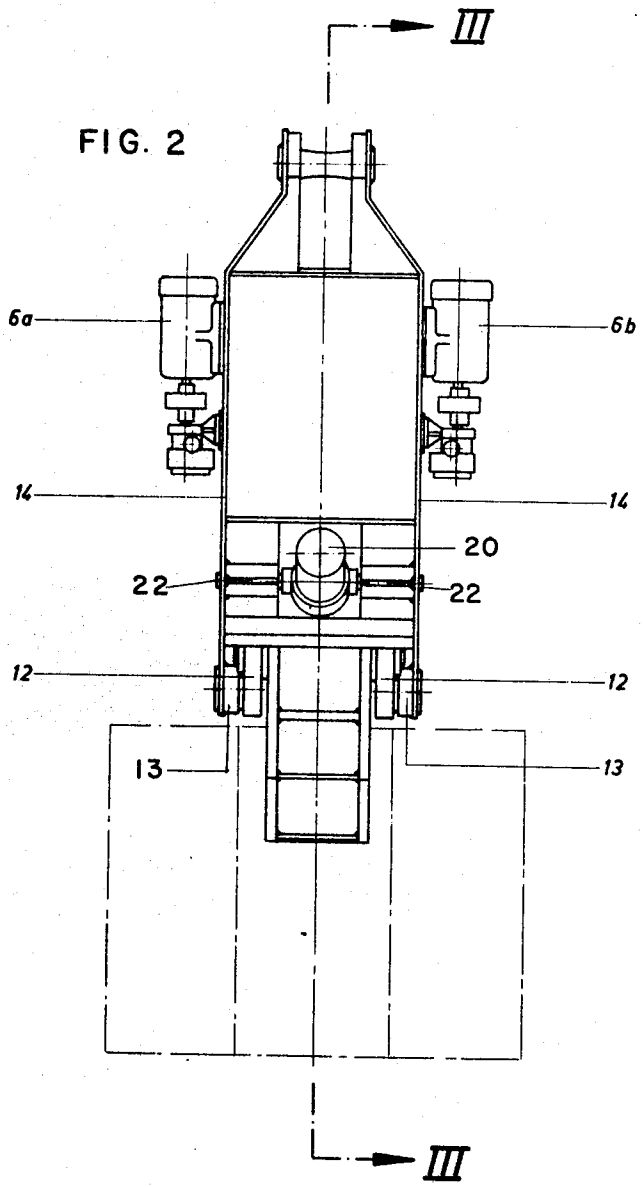
Attorney

Aug. 2, 1966 F. BELLMANN 3,264,029

CLAMPING DEVICES FOR CRANES FOR ROLLING MILL SERVICE

Filed Sept. 14, 1964 5 Sheets-Sheet 2

FIG. 2



Inventor
Friedhelm Bellmann
By Erwin Salpe
Attorney

Aug. 2, 1966 F. BELLMANN 3,264,029

CLAMPING DEVICES FOR CRANES FOR ROLLING MILL SERVICE

Filed Sept. 14, 1964

5 Sheets-Sheet 3

FIG. 3

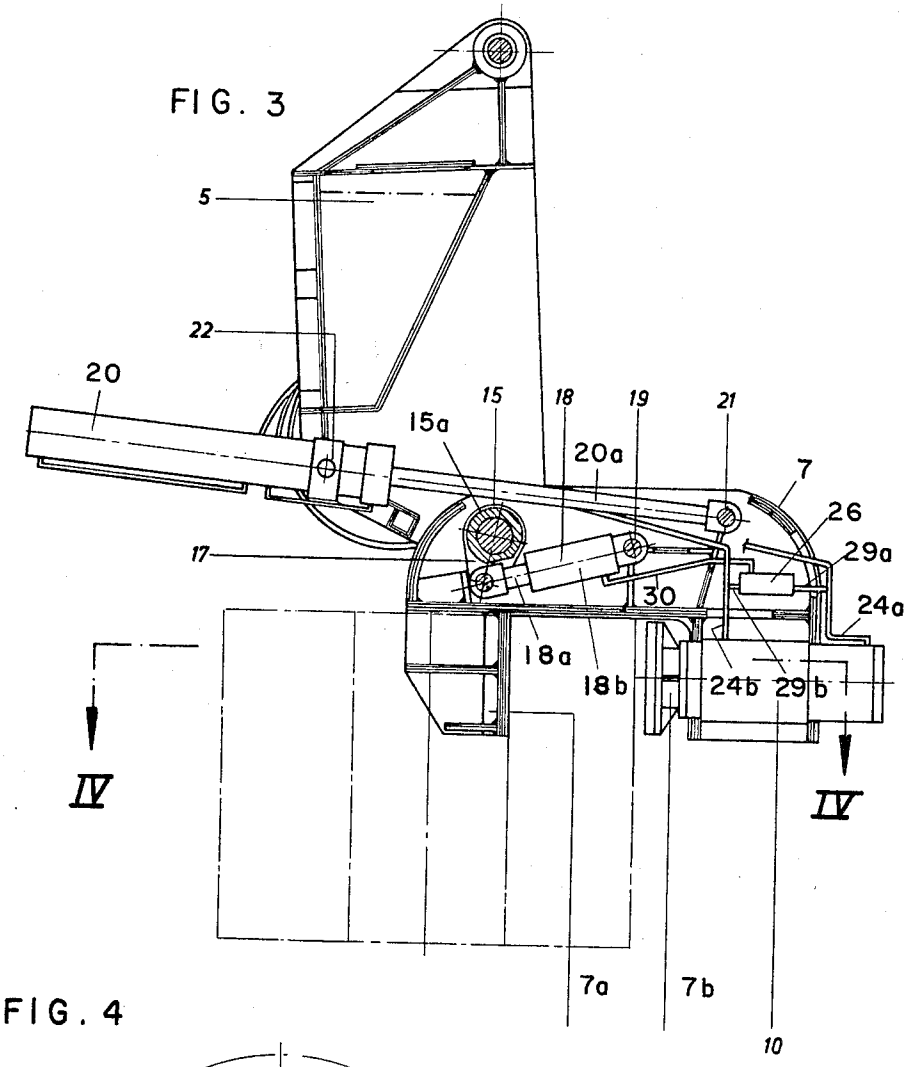
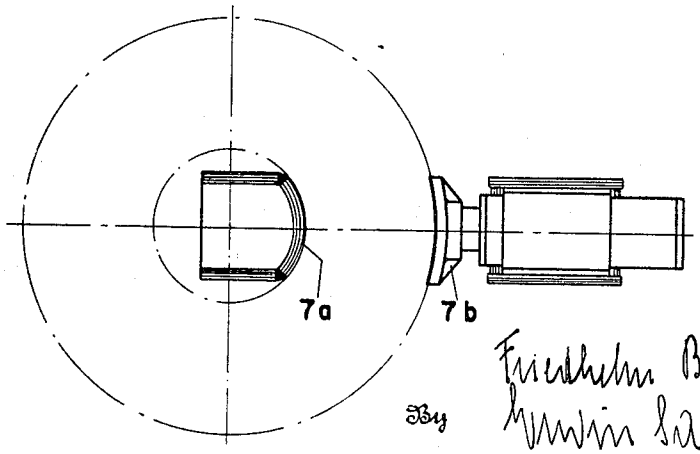


FIG. 4



Inventor

Friedhelm Bellmann

By Irwin Sahn

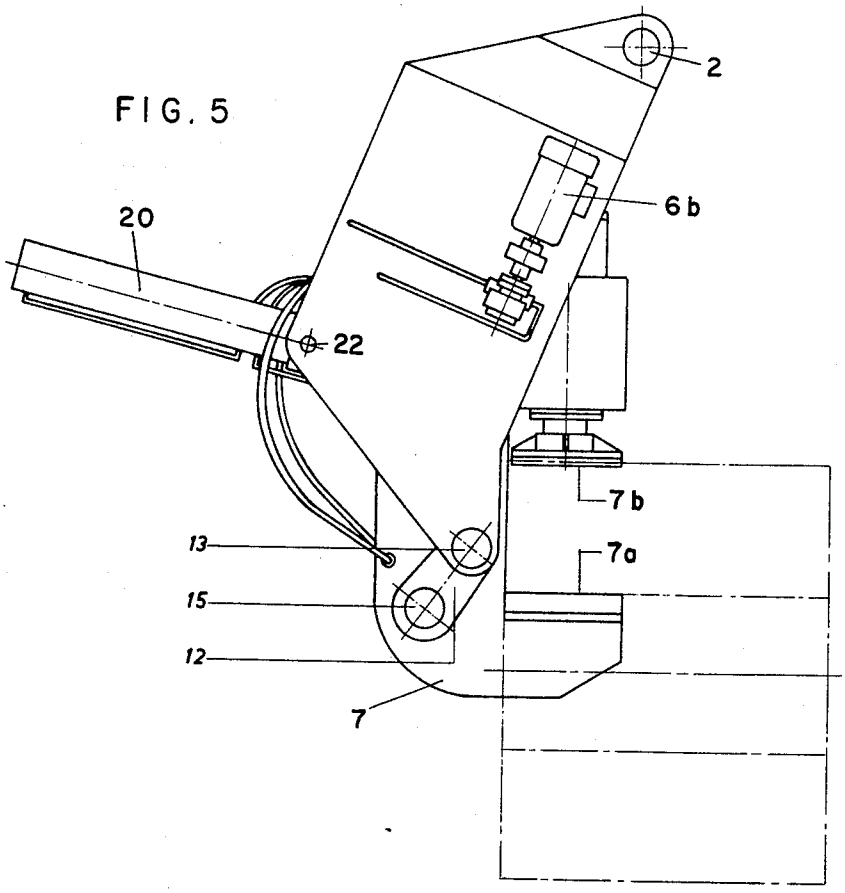
Attorney

Aug. 2, 1966 F. BELLMANN 3,264,029

CLAMPING DEVICES FOR CRANES FOR ROLLING MILL SERVICE

Filed Sept. 14, 1964 5 Sheets-Sheet 4

FIG. 5



Inventor

Friedhelm Bellmann

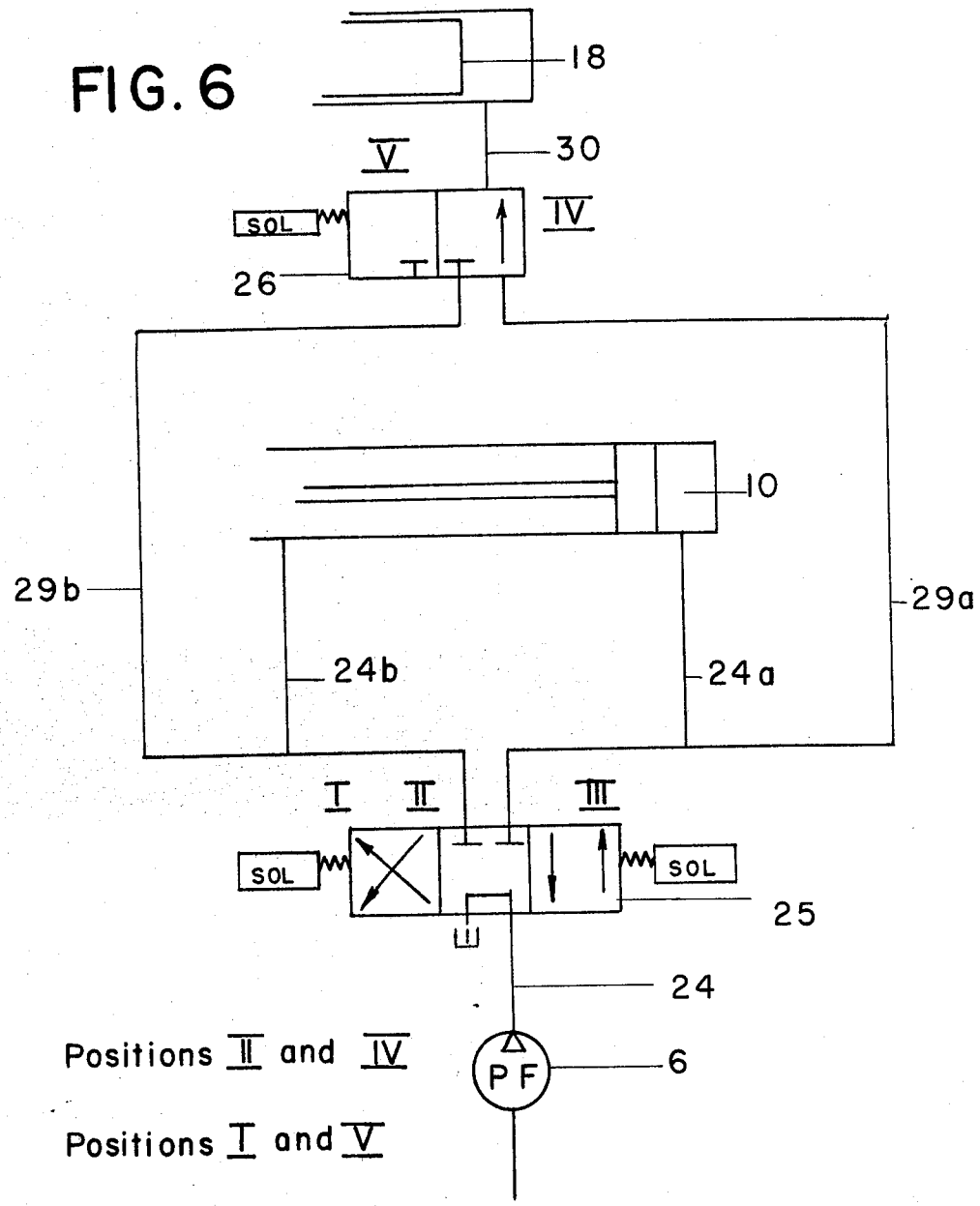
By Irwin Lahn

Attorney

CLAMPING DEVICES FOR CRANES FOR ROLLING MILL SERVICE

Filed Sept. 14, 1964 5 Sheets-Sheet 5

FIG. 6



Positions II and IV

Positions I and V

Positions III and IV

ASA Standard Symbols

United States Patent Office 3,264,029 Patented August 2, 1966

3,264,029

CLAMPING DEVICES FOR CRANES FOR ROLLING MILL SERVICE

Friedhelm Bellmann, Hagen, Westphalia, Germany, assignor to Maschinenfabrik Eugen Bellmann G.m.b.H., Hagen-Haspe, Germany

Filed Sept. 14, 1964, Ser. No. 396,429
Claims priority, application Germany, Sept. 26, 1963, M 58,340
10 Claims. (Cl. 294—88)

This invention relates to devices for clamping rolled stock to be lifted by cranes.

It is one object of this invention to provide a clamping device of the aforementioned description including hydraulic means for exerting a clamping action and additional hydraulic means for boosting the clamping action in proportion to the weight of the load to be clamped and lifted.

It is another object of this invention to provide clamping devices of the aforementioned description which are more rugged and more compact than comparable prior art clamping devices.

It is another object of this invention to provide clamping devices of the aforementioned description which are adapted to be tilted about a horizontal axis 90 degrees by compact hydraulic means, thus dispensing with chain-drives for effecting such tilting operation.

It is anothr object of the invention to provide clamping devices of the aforementioned description which make it possible for the operator of a crane to effect a smoother and more precise transfer of the goods intended to be transferred.

It is another object of the invention to provide clamping devices of the aforementioned description which can, if desired, readily be adapted to perform a pivotal motion about a vertical axis.

This invention is more particularly concerned with clamping devices to be used in conjunction with cranes in rolling mills for tilting and transferring rolled products.

Further objects and advantages of my invention will become apparent as the following description proceeds, and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to, and forming part of, this specification.

For a better understanding of the invention reference may be had to the accompanying drawings in which

FIG. 1 is a side elevation of a clamping device embodying my invention shown as being suspended from the hook of a crane;

FIG. 2 is a rear elevation of the structure of FIG. 1 projected upon a plane at right angles to that of FIG. 1;

FIG. 3 is substantially a section taken along III—III of FIG. 2;

FIG. 4 is substantially a section taken along IV—IV of FIG. 3;

FIG. 5 is a side elevation of the structure of FIG. 1 in a different operating position, i.e. upon tilting one of its constituent parts about a horizontal axis; and

FIG. 6 is a diagrammatic representation of a hydraulic system which may be used for operating and for controlling the operation of the clamping device shown in FIGS. 1 to 5.

Referring now to the drawings, reference numeral 3 has been applied to generally indicate a frame structure substantially in the shape of a box having a horizontal stud 2 intended to be engaged by the hook 1 of a crane. As shown in the drawings the hook 1 of a crane cooperatively engages the horizontal stud or rod 2. Frame structure 3 comprises two vertical walls 14, and an oil tank 5 is arranged in the space bounded by the aforementioned lateral walls 14. Oil tank 5 supplies the oil required for

the hydraulic control and operating mechanism of the clamping device. Each of the lateral walls 14 supports on the outer side thereof a hydraulic unit 6*a* and 6*b*, respectively. Each of units 6*a*, 6*b* comprises an electric motor drive and a pump driven by it. The symmetrical arrangement of two hydraulic units 6*a*, 6*b* establishes equilibrium conditions for the clamping devices. Each of the hydraulic units 6*a*, 6*b* is readily accessible for maintenance and/or repair. If one of the two units 6*a*, 6*b* should become defective or inoperative, the clamping device will still continue to be operative with but one of the hydraulic units 6*a*, 6*b* in operation.

Reference character 7 has been applied to generally indicate the clamping device proper which is substantially in the shape of a C-clamp. Part 7 is a substantially box-shaped frame structure including a fixed clamping jaw 7*a*. Movable clamping jaw 7*b* is normally spaced from fixed clamping jaw 7*a* and movable relative to the latter, thus increasing or decreasing at will the spacing between the two clamping jaws 7*a*, 7*b*. Fixed clamping jaw 7*a* has preferably some freedom of pivotal motion relative to frame structure 7 proper. One of a pair of links 12 is arranged to each side of the stationary portion of the clamping device, i.e. the portion thereof including the fixed jaw 7*a*. Links 12 form an integral part of a crank mechanism—as will be more apparent as this specification proceeds—one of the ends thereof being pivotally connected at 13 to projections of the upper frame structure 3 integral with the lateral walls 14 thereof. Each link 12 is fixedly connected to a shaft 15 extending transversely across the lower frame structure 7 of the clamping device and being journalled therein by means of suitable bearings 15*a*, as clearly shown in FIG. 3. In the position of the structure shown in FIG. 1 the end of shaft 15 and the link 12 which is mounted upon it cannot be seen because of the relative positions of frame structures 3 and 7. In other words, in the position shown in FIG. 1 one end of shaft 15 and one of the links 12 are overlapped, or covered, by one of the lateral walls 14 of frame structure 3.

The frame structure 7 houses a hydraulic pressure converter 18 which includes a cylinder housing a piston. One end of the piston rod 18*a* of the aforementioned piston is pivotally connected to an eccentric arm 17 fixedly mounted upon shaft 15. The cylinder 18*b* of the aforementioned pressure converter 18 is pivotally supported at 19 by the frame structure 7.

Movable jaw 7*b* is adapted to be operated by a hydraulic motor 10 including a piston and a cylinder supplied with oil under pressure by pipe lines or conduits 24*a* and 24*b* from hydraulic units 6*a* and 6*b*. Movable jaw 7*b* clamps goods intended to be lifted against fixed jaw 7*a*. Whenever it is intended to use the clamping device in the operation of a rolling mill, it is moved to the position shown in FIG. 3. The fixed jaw 7*a* is then inside of the product to be lifted and the movable jaw 7*b* is on its outside. Oil stored in tank 5 is being put under pressure by hydraulic units 6*a*, 6*b* and supplied through conduit 24*a* to fluid motor 10, resulting in a movement of movable jaw 7*b* from right to left, as seen in FIG. 3. The reverse movement may be achieved by admitting oil under pressure through conduit 24*b* to the other side of the piston forming part of fluid motor 10.

When hook 1 engaging horizontal stud 2 is being raised, the upper frame structure 3 transmits the lifting force upon the lower frame structure 7 by the intermediary of links 12. As a result, links 12 tend to pivot shaft 15 in counterclockwise direction, as seen in FIG. 3. Hence the piston rod 18*a* of pressure converter 18 is moved from left to right, as seen in that figure. Consequently oil under higher pressure than that produced by hydraulic pump and motor units 6*a* and 6*b* is injected into conduit 30.

Conduit 30 connects pressure converter 18 with valve 26 from where it may be admitted to fluid motor 10. Since the torque to which shaft 15 is subjected increases in proportion to the load, the pressure produced by pressure converter or booster 18 and the clamping pressure exerted by jaw 7*b* increase likewise in proportion to the load. It will be noted that the pressure converter or booster 18 has a relatively small diameter in comparison to that of hydraulic motor 10, resulting in generation of relatively high pressures in the former.

The structure of FIGS. 1–5 includes several control valves, including valve means for controlling the flow of liquid between hydraulic units 6*a*, 6*b* and hydraulic motor 10. In one position of these valve means oil is admitted to one and drained from the other side of motor 10. In another position of these valve means oil is admitted to the reverse side of the piston of fluid motor 10 and simultaneously oil is drained from the other side of said piston.

Reference numeral 20 has been applied to indicate another fluid motor or hydraulic motor including a piston and a cylinder provided to tilt the frame structure 7 relative to the frame structure 3. The piston rod of fluid motor 20 is pivotally connected at 22 to the frame structure 7 and the cylinder body of fluid motor 20 is pivotally connected at 22 to frame structure 3. When the piston rod of fluid motor 20 is retracted, i.e. moved from the position shown in FIG. 3 to the left, frame structure 7 is pivoted about fulcrum 13 in counterclockwise direction from the position shown in FIGS. 1 and 3 to the position shown in FIG. 5. It will be noted from FIG. 3 that the front of oil tank 5 is slanted so as not to interfere with the above tilting motion of frame structure 7.

It will be apparent from the foregoing that the structure of FIGS. 1–5 lends itself readily to be adapted in such a way that the upper frame structure 3 and the lower frame structure 7 can be jointly rotated about a vertical axis. All that is required to this end is interposition between suspension rod 2 and upper frame structure 3 of a mechanical coupling having two parts which may be rotated relative to each other about a common vertical axis suspending frame structure 7 from rod 2.

FIG. 6 is a diagrammatic illustration of the hydraulic operating and control system for the structure of FIGS. 1–5. Reference numeral 6 has been applied in FIG. 6 to indicate a compressor and motor unit. Unit 6 is supplied with oil from tank 5 (shown in FIG. 3) and supplies oil under pressure to a three way valve 25. Valve 25 is adapted to supply selectively either side of the cylinder of fluid motor 10 with oil under pressure by the intermediary of conduits 24*a* and 24*b*. When the cylinder of fluid motor 10 is supplied with fluid under pressure through conduit 24*a*, oil is dumped from the other side of fluid motor 10 through conduit 24*b*, and vice versa. Valve 25 is connected by conduits 29*a* and 29*b* to a three way valve 26. In one position of valve 26 oil under pressure is admitted from valve 25 through conduit 30 to pressure booster 18. In another position of valve 26 oil is admitted from pressure booster 18 to motor 10. The positions of valves 25, 26 have been indicated by roman numerals. When valve 25 is in position II valve 26 is in position V; when valve 25 is in position I valve 26 is in position V; and when valve 25 is in position III valve 26 is in position IV.

It will be understood that although but one embodiment of this invention has been shown and described in detail, the invention is not limited thereto, and that the illustrated embodiment may be modified or other embodiments made without departing from the spirit and scope of the invention as set forth in the accompanying claims.

I claim as my invention:

1. A clamping device adapted to be suspended from a hook of a crane comprising in combination:
(a) a first frame structure adapted to be cooperatively engaged and supported by the hook of a crane;

(b) a second frame structure having substantially the shape of a C-clamp including a pair of clamping jaws, said pair including at least one movable jaw;
(c) a hydraulic motor for operating said movable jaw supported by said second frame structure;
(d) a pressure booster comprising a piston and a cylinder hydraulically connected to said hydraulic motor;
(e) a crank mechanism to operate said pressure booster to supply said hydraulic motor with an operating liquid under high pressure, said crank mechanism including a crank-shaft; and
(f) a pair of links each having one end fixedly mounted on said crank-shaft and another end pivotally supported on said first frame structure.

2. A clamping device adapted to be suspended from a hook of a crane comprising in combination:
(a) a first frame structure including a pair of spaced vertical lateral walls and a transverse rod extending across said lateral walls;
(b) a second frame structure pivotally supported by said first frame structure and having substantially the shape of a C-clamp including at least one movable clamping jaw;
(c) a hydraulic motor for operating said movable clamping jaw supported by said second frame structure;
(d) a pair of links suspending said second frame structure from said first frame structure, said pair of links having ends pivotally secured to said first frame structure;
(e) a crank-shaft pivotally journalled in said second frame structure, said pair of links having ends remote from said first frame structure fixedly mounted on said crank-shaft;
(f) a pressure booster comprising a piston and a cylinder hydraulically connected to said hydraulic motor; and
(g) means for operating said pressure booster by said crankshaft in response to a pivotal motion of said crank-shaft relative to said second frame structure.

3. A clamping device adapted to be suspended from a hook of a crane comprising in combination:
(a) a first frame structure including a pair of spaced lateral walls and a transverse supporting rod extending across said lateral walls;
(b) an oil tank arranged in the space bounded by said pair of lateral walls;
(c) a pair of motor pump units each arranged on the outside of one of said pair of lateral walls and supported by said first frame structure;
(d) conduit means for supplying oil from said tank to said pair of motor pump units;
(e) a pair of links arranged in planes parallel to said pair of walls and pivotally supported by said first frame structure;
(f) a second frame structure having substantially the shape of a C-clamp and including at least one movable clamping jaw;
(g) a hydraulic motor supplied with oil under pressure from said pair of motor pump units and operating said movable jaw;
(h) a crank-shaft journalled in said second frame structure, the ends of said pairs of links remote from said first frame structure being fixedly mounted on said crank-shaft;
(i) a pressure booster comprising a piston and a cylinder hydraulically connected to said hydraulic motor; and
(j) power transmission means for operating said pressure booster in response to pivotal motion of said crank-shaft relative to said second frame structure.

4. A clamping device adapted to be suspended from a crane comprising in combination:
(a) an upper frame structure;
(b) a lower frame structure being substantially in the

shape of a C-clamp and including a fixed portion and at least one clamping jaw movable relative to said fixed portion;

(c) a hydraulic motor operatively connected to said one clamping jaw supported by said lower frame structure, said hydraulic motor including a piston operable within a cylinder;

(d) link means having one end pivotally supported on said upper frame structure adjacent the lower end of said upper frame structure;

(e) a shaft journalled in said lower frame structure, said link means having another end fixedly mounted on and jointly pivotable with said shaft; and

(f) a pressure booster including a relatively movable piston and cylinder operable by said shaft discharging liquid under pressure to said hydraulic motor.

5. A clamping device as specified in claim 4 including oil tank means, motor pump means supplied with oil from said oil tank means and supplying oil under pressure to said hydraulic motor and to said pressure booster, and valve means for controlling the flow of oil to and from said hydraulic motor and for controlling the flow of oil to and from said pressure booster, some of said means being integral with said upper frame structure and other of said means being integral with said lower frame structure.

6. A clamping device as specified in claim 4 including a supporting means adapted to be engaged by a hook of a crane, and a coupling supported by said supporting means and connecting said supporting means to said upper frame structure and allowing said upper frame structure to turn relative to said supporting means about a vertical axis.

7. A clamping device as specified in claim 4 including a second clamping jaw opposite said clamping jaw operated by said hydraulic motor and having some freedom of pivotal movement relative to said fixed portion.

8. A clamping device adapted to be suspended from a crane comprising in combination:

(a) an upper frame structure;

(b) a lower frame structure being substantially in the shape of a C-clamp and including a fixed portion and at least one clamping jaw movable relative to said first portion;

(c) a hydraulic motor for operating said one clamping jaw supported by said lower frame structure, said hydraulic motor including a piston operable within a cylinder;

(d) means for suspending said lower frame structure from said upper frame structure, said suspending means including a pair of links each having one end pivotally supported by said upper frame structure;

(e) a shaft journalled in said lower frame structure, each of said pair of links having another end fixedly mounted on said shaft to subject said shaft to a torque;

(f) a pressure booster comprising a piston operable within a cylinder hydraulically connected to said cylinder of said hydraulic motor, said cylinder of said pressure booster having one end supported by said lower frame structure; and

(g) an eccentric arm mounted on said shaft operating said piston of said pressure booster.

9. A clamping device adapted to be suspended from a crane comprising in combination:

(a) an upper frame structure;

(b) a lower frame structure being substantially in the shape of a C-clamp and including a fixed portion and at least one clamping jaw movable relative to said fixed portion;

(c) a hydraulic motor for operating said one clamping jaw supported by said lower frame structure, said hydraulic motor including a piston operable within a cylinder;

(d) link means having one end pivotally supported on said upper frame structure adjacent the lower end of said upper frame structure;

(e) a shaft journalled in said lower frame structure, said link means having another end fixedly mounted on and jointly pivotable with said shaft;

(f) a pressure booster including a relatively movable piston and cylinder operable by said shaft discharging liquid under pressure to said hydraulic motor; and

(g) an additional hydraulic motor for pivoting said lower frame structure relative to said upper frame structure about the point thereof pivotally supporting said one end of said link means.

10. A clamping device adapted to be suspended from a crane comprising in combination:

(a) an upper frame structure;

(b) a lower frame structure being substantially in the shape of a C-clamp and including a fixed portion and at least one clamping jaw movable relative to said first portion;

(c) a hydraulic motor for operating said one clamping jaw supported by said lower frame structure, said hydraulic motor including a piston operable within a cylinder;

(d) means for suspending said lower frame structure from said upper frame structure, said suspending means including a pair of links each having one end pivotally supported by said upper frame structure;

(e) a shaft journalled in said lower frame structure, each of said pair of links having another end fixedly mounted on said shaft to subject said shaft to a torque;

(f) a pressure booster comprising a piston operable within a cylinder hydraulically connected to said cylinder of said hydraulic motor, said cylinder of said pressure booster having one end supported by said lower frame structure;

(g) an eccentric arm mounted on said shaft operating said piston of said pressure booster; and

(h) an additional hydraulic motor for pivoting said lower frame structure and said upper frame structure relative to each other, said additional hydraulic motor including a cylinder and a piston movable therein, said additional hydraulic motor being pivotally supported at one point thereof by said upper frame structure and being pivotally supported at another point thereof by said lower frame structure.

References Cited by the Examiner

UNITED STATES PATENTS

2,770,380	11/1956	Anderson	294—67 X
2,817,450	12/1957	Ulinski	214—147 X

GERALD M. FORLENZA, *Primary Examiner.*

G. F. ABRAHAM, *Assistant Examiner.*