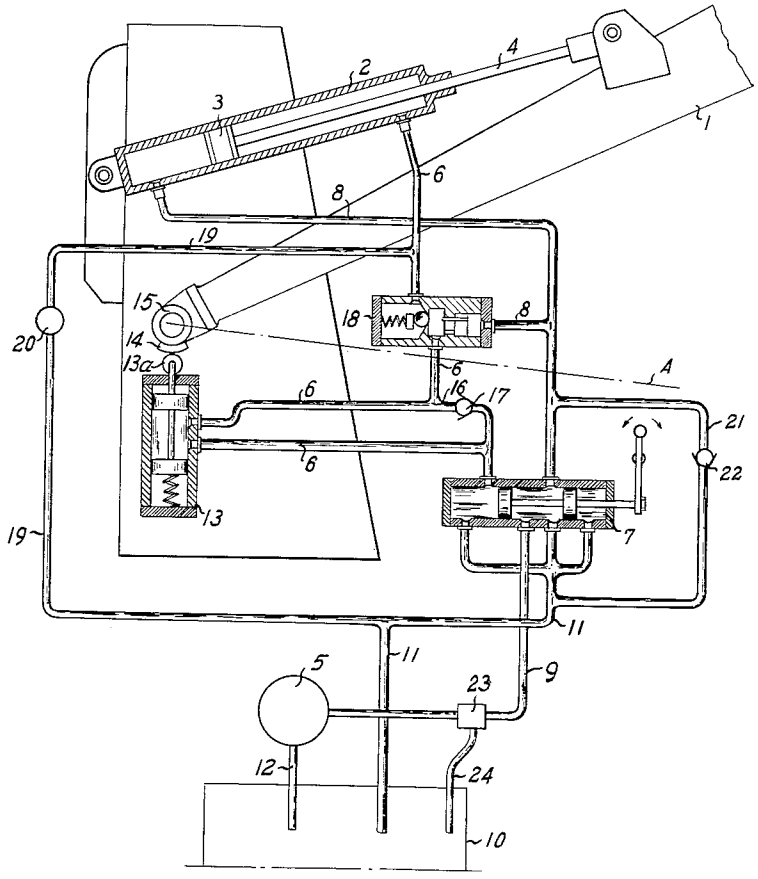
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HYDRAULIC WHIP DRIVE FOR THE OVERHANG BEAM OF A CRANE

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HYDRAULIC WHIP DRIVE FOR THE OVERHANG BEAM OF A CRANE

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The present invention relates to an overhang crane with hydraulic whip drive for the overhang beam.

It is the primary object of the present invention to secure the overhang beam against overload by further lowering the overhang beam under load when said overhang beam occupies its maximum working position.

It is also an object of the present invention so to design a crane of the type set forth in the preceding paragraph that the means for preventing an overload under the conditions set forth in the preceding paragraph can be made ineffective whenever the overhang beam is to be lowered into a resting position as is customary with ship cranes.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawing diagrammatically illustrating a safety control circuit for the crane in conformity with the present invention.

The hydraulic whip drive for the overhang beam of a whipping crane is characterized in conformity with the present invention in that a shut-off valve adapted to block the hydraulic drive system for the whipping cylinder of the overhang beam in maximum working condition of the latter, and which is controlled by the whipping movement of the overhang beam, is arranged in the lifting conduit of the whipping cylinder, while a conduit bypassing the shut-off valve is provided with a check valve shutting off said conduit during the lowering of the overhang beam.

Referring now to the drawing in detail, the hydraulic whip drive according to the invention for an overhang beam **1** comprises a tiltably journalled cylinder **2** having reciprocably mounted therein a piston **3** with connecting rod **4** the free end of which is pivotally connected to the overhang beam **1**. For purposes of elevating the overhang beam **1**, pressure fluid is conveyed by a pump **5** through conduit **6** and a control valve **7** to cylinder **2**. Correspondingly, when the overhang beam **1** is to be lowered, pressure fluid from pump **5** is conveyed through the control valve **7** and conduit **8** to the cylinder **2**. The control valve **7**, which is operable by hand for controlling the elevating or lowering of the overhang beam **1**, communicates with the pressure side of pump **5** through a conduit **9** and also communicates through a conduit **11** with a fluid reservoir **10** for the working fluid. The suction side of pump **5** communicates through a suction conduit **12** likewise with the reservoir **10**. Control valve **7** in one shifted position connects pressure conduit **9** with conduit **8** while connecting exhaust conduit **11** with conduit **6** and in another shifted position of control valve **7**, these connections are reversed.

Interposed in conduit **6** is a shut-off valve **13** the control element **13***a* of which is adapted to be actuated by a cam **14** which is connected to the overhang beam **1**. More specifically, the cam **14** may form a part of the bearing eye **15** of the overhang beam **1** and is so arranged that it will close the shut-off valve **13** as soon as the overhang beam during its lowering movement, brought about by the supply of pressure fluid through conduit **8** into cylinder **2**, approaches the position of its maximum overhang. As a result of the closing of shut-off valve **13**, the path of the liquid flowing from cylinder **2** through conduit **6** to control valve **7** will be closed off. As a result

thereof, the pressure developing in conduit **6** prevents the piston **3** from moving upwardly with regard to the drawing, i.e. in the direction for lowering the beam **1** further.

If the overhang beam **1** is now to be elevated from this position, the control valve **7** is adjusted accordingly so that pressure fluid is conveyed through conduit **6** to cylinder **2** while fluid below piston **3** may escape through conduit **8** and control valve **7** into the reservoir **10**. This supply of pressure fluid through conduit **6** to cylinder **2** is made possible, even though the shut-off valve **13** is held in its closing position by cam **14**, in view of the fact that a conduit **16** is automatically made effective which by-passes that portion of conduit **6** which leads to the shut-off valve **13**. Moreover, that portion of conduit **6** which is located between a check valve **18** and control valve **7** is provided with a check valve **17** which will open by the feeding pressure in line **9**. As soon as the overhang beam **1** has been lifted to such an extent that cam **14** no longer closes shut-off valve **13**, pressure fluid will then pass through valve **13** and conduit **6** to cylinder **2**. The check valve **18** above referred to is located in conduit **6** and normally permits free flow of fluid upwardly therethrough toward the right end of cylinder **2**, but does not normally permit fluid to flow downwardly through conduit **6** away from cylinder **2**. Fluid can thus freely be supplied to cylinder **2** to elevate beam **1** but the fluid in the right end of cylinder **2** is normally entrapped therein by check valve **18** to prevent beam **1** from dropping accidentally.

Check valve **18** is adapted for being pilot operated into open position to release fluid from the right end of cylinder **2** to permit lowering of beam **1** and this is accomplished by a conduit connected from the pilot of check valve **18** to conduit **8** so that whenever actuating pressure is developed in conduit **8** to drive piston **3** rightwardly in cylinder **2** to lower the beam, check valve **18** will be piloted open to release fluid from the right end of cylinder **2**. It will be evident that the beam **1** is prevented from dropping because whenever the beam moves fast enough to reduce the pressure on the left side of piston **3**, the pressure will drop in conduit **8**, thus releasing the pilot pressure from check valve **18** permitting this valve to close and to interrupt the downwardly movement of the beam.

A résumé of the operation is as follows:

OPERATION

I. Elevation of the Overhang Beam

For elevating the overhang beam, pump **5** conveys pressure fluid through pressure-relief valve **23**, conduit **9**, control valve **7**, conduit **6**, shut-off valve **13**, and control valve **18** to cylinder **2**, while fluid is discharged from the cylinder through conduit **8**, control valve **7**, and conduit **11** back to reservoir **10**.

II. Lowering the Overhang Beam

For lowering the overhang beam, pump **5** conveys pressure fluid through pressure relief valve **23**, conduit **9**, control valve **7**, conduit **8** to cylinder **2**.

(A) Cam **14** is part of the bearing **15** of the overhang beam and, as the overhang beam reaches its maximum overhang position it actuates control-tip **13***a* of shut-off valve **13** which, in turn, will close the fluid path from the right end of cylinder **2**. The pressure developed in blocked off conduit **6** will prevent the piston **3** from further movement and thus prevent further lowering of the overhang beam.

For elevating the beam from its maximum overhang position the control valve **7** is shifted so that pressure fluid flows through conduit **6** to cylinder **2**. The fluid under piston **3** may escape through return conduit **8** and

control valve 7 and conduit 11 into fluid reservoir 10. Since shut-off valve 13 is closed, in order to allow the supply of pressure fluid to cylinder 2, valve 13 is made ineffective by by-pass conduit 16 incorporating check valve 17 which will open under slightly raised pressure conditions in conduit 9 allowing a flow of fluid to cylinder 2. When the beam raises so that cam 14 no longer closes shut-off valve 13, the pressure fluid can pass through valve 13 and conduit 6 to cylinder 2, and check valve 17 may close.

If it is desired to move the overhang beam 1 downwardly into its rest position indicated by the dot-dash line A, beyond its position of maximum overhang, a discharge conduit 19 communicating with the conduit 6 and also with the exhaust line 11 is opened by a manually adjustable valve 20. This bypasses control valve 18 and control valve 7. When the overhang beam 1 is lowered in this manner without any supply of pressure fluid from pump 5, piston 3 will take in fluid from reservoir 10 through conduit 11 and through conduit 21 which bypasses the closed control valve 7 and communicates with conduit 8. Conduit 21 comprises a check valve 22 adapted to open in response to a suction effect in conduit 8 and closes in response to a pressure in conduit 8.

For purposes of safeguarding against any overload, the feeding conduit 9 of pump 5 has interposed therein a relief valve 23 adapted in response to a predetermined pressure at the pressure side of pump 5 to establish communication with conduit 24 leading to the reservoir 10.

It is, of course, to be understood that the present invention is, by no means, limited to the particular construction shown in the drawing but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. In a hydraulic circuit for a whipping crane comprising a tiltable overhang beam: a hydraulically operable cylinder piston system pivotally connected to said overhang beam for lifting and lowering the same, a pressure fluid delivery pump, control valve means movable selectively into a first position or into a second position, first conduit means leading from the pressure side of said pump to said control valve means, a fluid reservoir connected to the suction side of said pump, second conduit means leading from said fluid reservoir to said control valve means, third conduit means leading from said control valve means to one side of said cylinder piston system and being adapted in response to the movement of said control valve means into said first position to convey pressure fluid from said pump to said cylinder piston system for elevating said overhang beam, said third conduit means also being adapted in response to the movement of said control valve means into said second position to release fluid from said cylinder piston system to lower said overhang beam, fourth conduit means leading from said control valve means to said cylinder piston system and adapted in response to the movement of said control valve means into said first position to release fluid therefrom during the elevating operation of said overhang beam, said fourth conduit means also being adapted in response to the movement of said control valve means to said second position to convey pressure fluid to said cylinder piston system to positively lower said overhang beam, shut-off valve means interposed in said third conduit means and occupying its closing position in response to said overhang beam occupying its maximum overhang position thereby interrupting the discharge of fluid from said cylinder piston system through said third conduit means, by-pass conduit means by-passing said shut-off valve means, and check valve means interposed in said by-pass conduit means and adapted to open in response to pressure fluid being conveyed from said pump to said third conduit means, said check valve means closing in response to fluid released from said cylinder piston system through said third conduit means and said control valve means while the latter occupies its second position.

2. An arrangement according to claim 1, in which said overhang beam has connected thereto means for engagement with said shut-off valve means to close the same in maximum overhang position of said overhang beam.

3. An arrangement according to claim 1, in which said overhang beam is provided with a bearing eye having cam means connected thereto for engaging said shut-off valve means and moving the same into closing position when said overhang beam moves into its maximum overhang position.

4. In a hydraulic circuit for a whipping crane comprising a titltable overhanging beam: a hydraulically operable cylinder piston system pivotally connected to said overhang beam for lifting and lowering the same, a pressure fluid delivery pump, control valve means movable selectively into a first position or into a second position, first conduit means leading from the pressure side of said pump to said control valve means, a fluid reservoir connected to the suction side of said pump, second conduit means leading from said fluid reservoir to said control valve means, third conduit means leading from said control valve means to one side of said cylinder piston system and being adapted in response to the movement of said control valve means into said first position to convey pressure fluid from said pump to said cylinder piston system for elevating said overhanging beam, said third conduit means also being adapted in response to the movement of said control valve means into said second position to release fluid from said cylinder piston system to lower said overhang beam, fourth conduit means leading from said control valve means to said cylinder piston system and adapted in response to the movement of said control valve means into said first position to release fluid therefrom during the elevating operation of said overhang beam, said fourth conduit means also being adapted in response to the movement of said control valve means to said second position to convey pressure fluid to said cylinder piston system to positively lower said overhang beam, shut-off valve means interposed in said third conduit means and occupying its closing position in response to said overhang beam occupying its maximum overhang position thereby interrupting the discharge of fluid from said cylinder piston system through said third conduit means, by-pass conduit means by-passing said shut-off valve means, check valve means interposed in said by-pass conduit means and adapted to open in response to pressure fluid being conveyed from said pump to said third conduit means, said check valve means closing in response to fluid released from said cylinder piston system through said third conduit means and said control valve means while the latter occupies its second position, and additional check valve means arranged in said third conduit means and communicating with said fourth conduit means, said additional check valve means being responsive to the pressure in said fourth conduit means so as to move into open position thereby permitting the discharge of fluid from said cylinder piston system through said third conduit means to said fluid reservoir.

5. In a hydraulic circuit for a whipping crane comprising a tiltable overhang beam: a hydraulically operable cylinder piston system pivotally connected to said overhang beam for lifting and lowering the same, a pressure fluid delivery pump, control valve means movable selectively into a first position or into a second position, first conduit means leading from the pressure side of said pump to said control valve means, a fluid reservoir connected to the suction side of said pump, second conduit means leading from said fluid reservoir to said control valve means, third conduit means leading from said control valve means to one side of said cylinder piston system and being adapted in response to the movement of said control valve means into said first position to convey pressure fluid from said pump to said cylinder piston system for elevating said overhang beam, said third conduit means also being adapted in response to the move-

ment of said control valve means into said second position to release fluid from said cylinder piston system to lower said overhang beam, fourth conduit means leading from said control valve means to said cylinder piston system and adapted in response to the movement of said control valve means into said first position to release fluid therefrom during the elevating operation of said overhang beam, said fourth conduit means also being adapted in response to the movement of said control valve means to said second position to convey pressure fluid to said cylinder piston system to positively lower said overhang beam, shut-off valve means interposed in said third conduit means and occupying its closing position in response to said overhang beam occupying its maximum overhang position thereby interrupting the discharge of fluid from said cylinder piston system through said third conduit means, first by-pass conduit means bypassing said shut-off valve means and adapted to establish communication between said third conduit means and said reservoir, manually operable valve means interposed in said first by-pass conduit means and normally interrupting said first by-pass conduit means, said manually operable means being movable into an open position to make said first by-pass conduit means effective for

lowering said overhang beam beyond its maximum overhang position, second by-pass conduit means by-passing said shut-off valve means, and check valve means interposed in said second by-pass means and adapted to open in response to pressure fluid being conveyed from said pump to said third conduit means, said check valve means closing in response to fluid released from said cylinder piston system through said third conduit means and said control valve means while the latter occupies its second position.

6. A hydraulic circuit according to claim 1, which includes a by-pass line interconnecting said second and fourth conduit means while by-passing said control valve means, and additional check valve means interposed in said by-pass conduit means and adapted to move into open position in response to a suction effect in said fourth conduit means.

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