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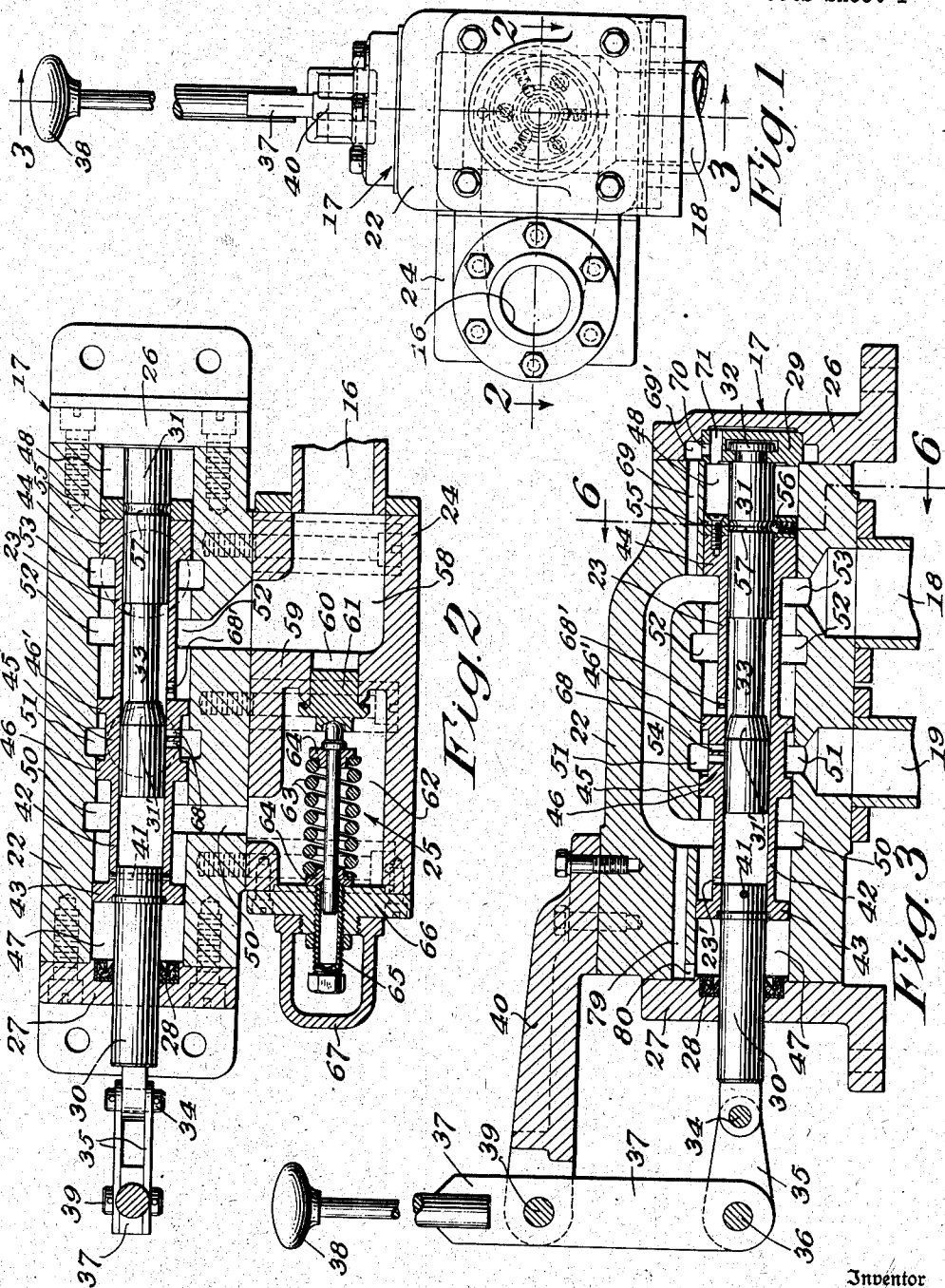
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2,295,948

VALVE

Filed Aug. 4, 1941

2 Sheets-Sheet 1



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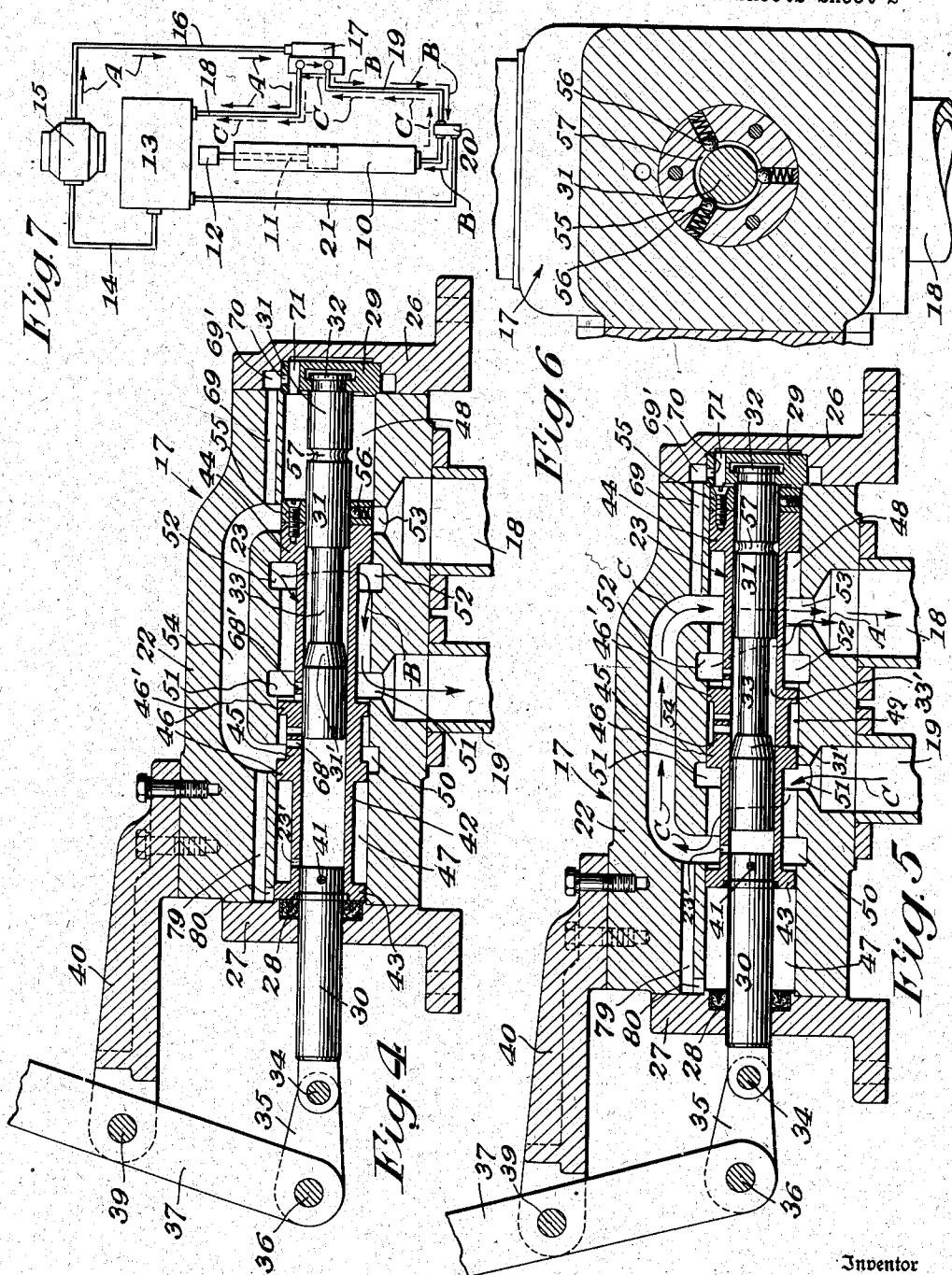
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,295,948

VALVE

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5 Claims. (Cl. 60—52)

This invention relates to control valves for hydraulic rams, and although useful in many industrial applications, is particularly advantageous when used in connection with a material loading and collecting machine, such as shown in the Andersen Patents Nos. 2,182,781, dated December 12, 1939, and No. 2,233,237, dated February 25, 1941, but equipped, however, with a hydraulic ram instead of a winch to raise and lower the receptacle.

Where such a machine is equipped with a hydraulic ram, the problem is to so control the application of the hydraulic pressure that when the movement of the receptacle is arrested at a stop or "hold" position, the stopping effect will be cushioned so as to avoid undue shock. Where the receptacle is abruptly stopped in its movement, the weight and momentum of the receptacle not only tends to tip up one end of the tractor, but exerts severe stresses on the parts.

Accordingly, the general object of my invention is to provide a control valve for a hydraulic ram which will cushion the stopping effect upon the load and thereby avoid undue shocks to the parts.

Another object is to provide a control valve of simple, inexpensive construction which will be positive in action under all conditions of service.

These objects, and other advantages which will appear as the description proceeds, are attained by the control valve illustrated in the accompanying drawings, wherein—

Fig. 1 is an end elevation of a control valve in accordance with my present invention.

Figs. 2 and 3 are sections on the lines 2—2 and 3—3, respectively, of Fig. 1, the valve being shown in its neutral or "hold" position.

Figs. 4 and 5 are partial longitudinal sections through the valve, showing in Fig. 4 the parts in load-raising position, and in Fig. 5 in load-lowering position.

Fig. 6 is a section on the line 6—6, of Fig. 3, and Fig. 7 is a diagram of the fluid-pressure circuit.

When my novel control valve is used in connection with a loading machine of the type disclosed in said patents aforesaid but equipped with a hydraulic ram, the valve is adjusted to the raising position of Fig. 4 to send the pressure-fluid from the pump to the ram so as to swing the receptacle upwardly in an overhead path from the rear end towards the front end of the tractor, or vice versa.

This raising action is discontinued substantially at the moment that the receptacle reaches approximately vertical position in its travel so

that the receptacle may descend by gravity and momentum, but under the control, however, of the valve which at substantially this moment is shifted to the lowering position of Fig. 5. In the lowering position of Fig. 5, the flow of the pressure-fluid returning from the ram to the reserve tank through the valve is so controlled by the valve as to decelerate the speed of descent of the receptacle and to cushion its drop.

As the receptacle approaches its final lowered position, or if it should be desired to stop and hold the receptacle at any point in its travel, the valve is shifted to the neutral or stop or "hold" position of Figs. 2 and 3 and in this position likewise the flow of the pressure fluid is so controlled by the valve as to cushion the shock of the stopping action.

Referring first to Fig. 7, wherein I have diagrammed the fluid-circulating system, the cylinder and piston of a hydraulic ram of conventional type are designated at 10 and 11, respectively, and the load to be moved by said piston is designated at 12. Such load may be the receptacle of said patented machine aforesaid.

The oil or other fluid under pressure for actuating the piston 11 is supplied from a reserve tank 13 communicating as at 14 with the inlet side of a power-driven pump 15. When applied to the patented machine aforesaid, the pump 15 may be driven from the motor of the tractor or other propulsion vehicle of said machine.

Connected as at 16 to the outlet side of the pump is my novel control valve, indicated generally at 17, and detailed in Figs. 1-6, inclusive.

When said valve is adjusted to the "hold" position of Figs. 2 and 3, the pressure fluid is passed through said valve to the reserve tank by means of conduit 18, as indicated by the arrows A.

When the valve is adjusted to the load-raising position of Fig. 4, the pressure fluid travels through the valve and along conduit 19 in the direction of the arrows B to the cylinder 10 and impinges upon the piston head to slide the piston in the load-raising direction.

When the valve is adjusted to the load-lowering position (Fig. 5) the weight of the load against the piston forces the fluid along the same conduit 19 by which it entered the cylinder, but in reverse direction as indicated by the arrows C, to the control valve 17 and thence by way of conduit 18 back to the reserve tank.

In reaching the ram, the fluid is preferably passed through a conventional safety valve 20, which is interposed in the circuit between the

control valve 17 and the ram and connected by conduit 21 with the reserve tank. The purpose of this safety valve is to permit the fluid to return direct to the tank if an overload is applied to the load end of the ram.

Referring now to Figs. 1 to 6, inclusive, wherein I have detailed the structure of my novel control valve 17, I have designated at 22 the main valve casing or head which defines the main valve chamber within which slides the manually operable slide valve 23. Extending from the main valve casing 22 is a supplemental valve casing 24 within which is mounted a safety valve 25 (Fig. 2).

The main valve casing 22 is a cored block or casting closed at its front and rear end by flanged plates 26 and 27, which provide aligned supports 28 and 29 for a slidable valve actuator 30 and a fixed valve guide 31, respectively, and also furnish attaching means for mounting the entire valve unit upon the machine with which it is to be used.

The valve guide is a solid rod spaced from but self-aligning with the slidable valve actuator 30. Its forward end is reduced and headed as at 32 within an annular recess formed in the forward support 29 so as to provide a floating action permitting the guide to automatically align itself with the actuator 30.

Between its ends the guide 31 is reduced as at 33 to permit flow of the fluid from openings 68 to openings 68' to establish a cushioning effect as the valve approaches its "hold" position, as will be hereinafter explained.

The actuator 30 projects beyond the end plate 27 and is there connected to any suitable operating lever. As shown, the outer end of member 30 is pivoted at 34 between a pair of links 35 which in turn are pivoted at 36 to the bifurcated lower end of an operating lever 37 having a hand grasping knob 38 at its upper end. The lever 37 is pivoted between its ends at 39 within a suitable bracket 40 projecting from the valve casing 22.

Pinned at 41 to the forward end of the valve actuator 30 so as to slide therewith is the tubular slide valve 23. Said valve is sleeved over and guided upon the fixed guide member 31, and has a valve portion 43 near its rear end, a valve portion 44 near its forward end, and a third valve portion 45 intermediate of its ends. The valve portion 45 is formed to present a pair of spaced flanges 46 and 46' at its ends.

The main valve casing 22 is bored from end to end to provide a snug fit between the casing and the slidable valve 23. This bore is intercepted at spaced intervals by four annular ports 50, 51, 52 and 53, respectively, the endmost pair of which, 50 and 53, are connected with each other by a by-pass 54 cored in the casing 22.

Attached to the outer face of the valve portion 44 is a collar 55 within which is reciprocally mounted a plurality of radially spaced spring-pressed detents in the form of balls 56 (see Fig. 6) which are adapted to enter within an annular groove 57 milled in the adjacent portion of the valve guide 31 and frictionally lock the slide valve 23 in the neutral or "hold" position shown in Figs. 2 and 3.

At one end, the extension valve casing 24 is internally cored to provide an inlet chamber 58 into which the conduit 16 from the pump directly discharges (see Fig. 2). The chamber 58 connects with the port 52 in the main valve casing 22 in all operating positions of the valve 23 so as

to admit fluid from the pump to the main valve casing at all times.

One of the walls 59 which define the inlet chamber 58 has a port 60 to receive the head 61 of the safety valve 25 which is mounted within a valve chamber 62 cored in the extension casing 24 behind the wall 59 and connecting with the port 50 in the main valve casing 22 in all operating positions of the main valve 23.

Coiled about the stem of the safety valve 25 is a spring 63 which reacts between collars 64 fast on said stem adjacent its ends. The stem itself is guided within an adjustable tubular guide 65 which is threaded through the rear wall 66 of the extension 24 and concealed by a removable cap 67.

In all operating positions of the main valve 23, the fluid under pressure from pump 15 is delivered by pipe 16 into the inlet chamber 58 of the supplemental valve casing 24 and from said chamber passes into port 52 to the main valve casing 22.

When the parts are in the neutral or "hold" position illustrated in Figs. 2 and 3, the fluid is returned from valve casing 22 to reserve tank 13 by means of port 53 and return pipe 18. In this position of the valve 23 the fluid is blocked from the port 51 however, by the flange 46 of the intermediate valve portion 45 of the slide valve 23 and consequently cannot pass through pipe 19 to the hydraulic ram.

When the hand lever 37 is shifted to move the parts to the load-raising position shown in Fig. 4, the fluid from the pump pipe 16 enters main valve casing 22 at port 52, and as indicated by the arrows B in said figure discharges through port 51 into the pipe 19 leading to the hydraulic ram.

In this position of the parts, the valve portion 44 blocks port 53 and consequently the pressure fluid cannot pass through pipe 18 to the reserve tank.

If while the valve 23 is in the raising position, however, the load on the ram should be greater per square inch than the limit at which the safety valve 25 is set, the pressure will unseat the safety valve from port 60 and the fluid will pass through said port into chamber 62 and thence back to the reserve tank by way of port 50, by-pass 54, port 53 and pipe 18.

When the lever 37 is shifted to move the parts to the load-lowering position shown in Fig. 5, fluid from the pump pipe 16 entering main valve casing 22 through port 52 discharges through port 53 into pipe 18, as shown by the arrows A. The fluid returning from the hydraulic ram along pipe 19 enters main valve casing 22 through port 51 and as indicated by the arrows C, passes through port 50 into by-pass 54 and discharges through port 53 into pipe 18 leading to the reserve tank.

Where the valve 23 is used to control the receptacle shown in said patented machine, it is essential, however, that the receptacle be brought to a cushioned stop at any time in its downward travel. To accomplish this the valve 23 is slowly adjusted from its lowering position (Fig. 5) towards its holding position (Figs. 2 and 3). As the port 51 becomes blocked by flange 46 of said valve, chamber 49 which lies between flanges 46 and 46' is gradually brought into communication with port 51, permitting a portion of the fluid which is returning from the ram to flow through holes 68 into and along the chamber 33' which surrounds the reduced portion 33 of the valve

guide 31 and out through holes 68' which now connect directly with outlet port 53.

By thus gradually shutting off the flow of the fluid from the ram, the ram is brought to a cushioned stop. This cushioning action is continued until in the further movement of the valve to the left in Figs. 2 and 3, the holes 68 are gradually closed by the enlarged part 31' of the guide 31. When these holes are entirely closed the flow of oil from the ram stops and the receptacle is at rest and stays at rest until the valve is shifted to either its raising or lowering position.

In all operating positions of the valve, portions of the fluid from main valve casing 22 may "bleed" through passages 69 and 79 cored in the main valve casing 22 adjacent its ends. Passage 69 connects by-pass 54 with an annular recess 69' in the front bracket 26' and recess 69' communicates as at 70 with a passage 71 within the front support 29 leading into a chamber 48 between the head 44 of the valve and the bracket 26. Passage 79 communicates through opening 80 with a chamber 47 between the portion 43 of the valve and the rear bracket 27.

Hence it results that if any fluid leaks past portions 43 or 44 and partially fills chambers 47 and 48, such fluid may be automatically discharged through port 53 into pipe 18 leading to the reserve tank. This avoids creating any built-up pressures which would resist movement of the valve in either direction. The space separating the forward end of actuator 30 and the rear end of guide 31 is likewise vented back to port 53 by means of opening 23' in slide valve 23.

Various modifications in construction, design and operation of my device may be resorted to without departing from the spirit and scope of my invention if within the limits of the appended claims.

What I therefore claim and desire to secure by Letters Patent is:

1. A control valve for controlling the flow of fluid in a system including a pump controlled source and a hydraulic ram, comprising a valve casing having a first port for admitting fluid under pressure from said source, a second port for sending fluid under pressure to said source, and a third port for admitting fluid under pressure to said ram, a fixed guide in said casing having a reduced portion between its ends, a valve slidable longitudinally over said guide and having spaced valve portions to control certain of said ports, said valve having three operative positions, the valve in the first of said operative positions connecting said first and second ports and blocking said third port to thereby hold said ram against movement, the valve in the second of said operative positions connecting said first and third ports and blocking said second port to thereby raise said ram, and the valve in the third of said positions connecting all of said ports to thereby lower said ram, and bleeder means adjacent said valve portions and coacting with the reduced portion of said valve guide for effecting communication between said third and second ports on movement of said valve from said third position to said first position to thereby retard said ram before it is stopped.

2. The control valve of claim 1, said guide and said slide valve having locking portions which when the valve reaches its load-stopping and holding position automatically inter-engage to frictionally lock the valve against accidental movement.

3. A control valve for use in a fluid circulating system of the type wherein fluid under pressure is pumped by a pump from a reserve tank to a hydraulic ram which raises, lowers, and stops and holds a load, comprising a valve casing having a first port for admitting pressure fluid from the pump to the valve casing, a second port for sending pressure fluid from the valve casing to the reserve tank, and a third port for sending pressure fluid from the valve casing to the hydraulic ram, a fixed guide in said casing having a reduced portion between its ends, a valve slidable longitudinally over said guide and having a first valve portion to control said second port and a second valve portion to control said third port, said second valve portion having a bleeder opening therein, and said valve between said valve portions having a second bleeder opening, means for moving said valve from load-raising to load-lowering position and from either of said positions to load-stopping and holding position, the relationship of said valve portions and said bleeder openings to said ports and to said reduced portion of the valve guide being such that in all operating positions of the valve said first port is unblocked, in the load-raising position said second port is unblocked by said second valve portion, in load-lowering position all of said ports are unblocked, and in the movement of said valve from load-raising towards load-stopping and holding position a portion of the fluid pressure from said third port passes through the bleeder opening in said second valve portion and along said reduced portion of the valve guide and out of said second-named bleeder opening to thereby establish a cushion effect which reduces the shock in stopping the loaded ram.

4. A control valve for use in a fluid circulating system of the type wherein fluid under pressure is pumped by a pump from a reserve tank to a hydraulic ram which raises, lowers, and stops and holds a load, comprising a main valve casing having a by-pass and having a first port for admitting pressure fluid from the pump to the valve casing, a second port for sending pressure fluid from the valve casing to the reserve tank, a third port for sending pressure fluid from the valve casing to the hydraulic ram, and a fourth port connecting with said second port through said by-pass, a fixed guide in said main casing having a reduced portion between its ends, a main valve slidable longitudinally over said guide and having a first valve portion to control said second port and a second valve portion to control said third port, said second valve portion having a bleeder opening therein, and said valve between said valve portions having a second bleeder opening, a valve casing extension communicating with said main valve casing through said fourth port and having a normally closed port for communication with said first port, a safety valve normally blocking said port of the valve casing extension but yieldable under excessive pressure load on the ram to unblock the same and permit the pressure fluid to pass therethrough and out of the main valve casing by way of said fourth port, said by-pass, and said second port, means for moving said main valve from load-raising to load-lowering position and from either of said positions to load stopping and holding position, the relationship of said valve portions and said relief openings to said ports and to said reduced portion of the valve guide being such that in all operating positions of the main valve said first

port is unblocked, in the load-raising position said second port is blocked by said first valve portion and said third port is unblocked by said second valve portion, in the load-lowering position all of said ports are unblocked, and in the movement of said valve from load-raising towards load-stopping and holding position a portion of the fluid pressure from said third port passes through the bleeder opening in said second valve portion and along said reduced portion of

the valve guide and out of said second-named bleeder opening to thereby establish a cushion effect which reduces the shock in stopping the loaded ram.

5 5. The valve of claim 4, there being passages connecting with the by-pass in said main valve casing and with the ends of the main valve for relieving any pressures built up by the main valve as it approaches either end of its stroke.

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