

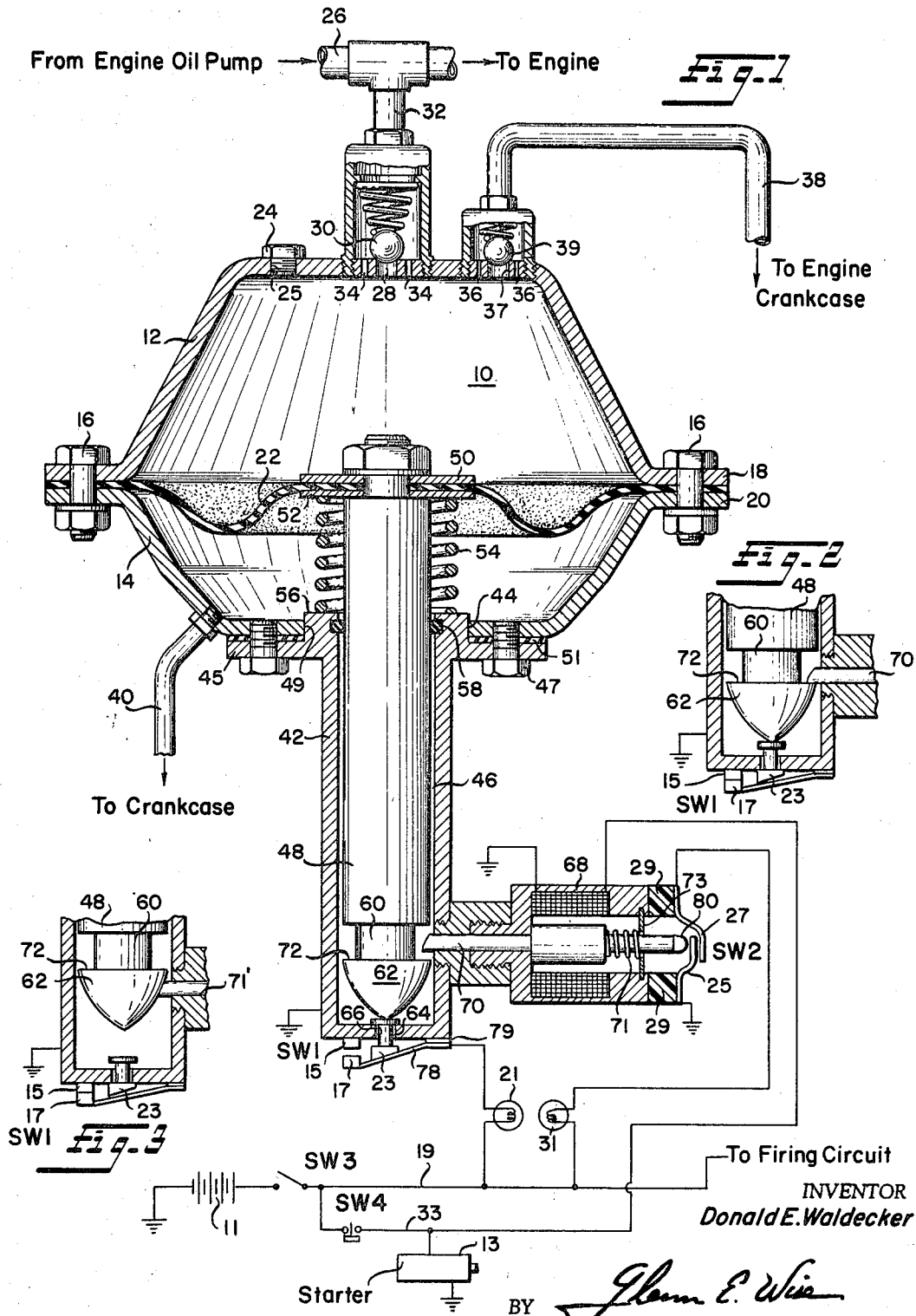
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PRELIMINARY LUBRICATION DEVICE

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PRELIMINARY LUBRICATION DEVICE

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ABSTRACT OF THE DISCLOSURE

A device for providing adequate lubrication to lubricant pump including pressure-lubricated equipment during start-up of the equipment or in case of temporary pump pressure decreases. Includes means to indicate to equipment operator whether or not device is in a lubricant-supply condition.

This invention relates to a preliminary lubrication device for pressure lubricated equipment such as internal combustion engines and machine tools and, more particularly, is directed to such a device having novel electrical control and warning features.

The construction and operation of my preliminary lubrication device will be set forth hereinbelow, for purposes of illustration, in conjunction with an internal combustion engine. However, it is to be understood that my preliminary lubrication device is also capable of being used with other pressure lubricated mechanisms.

An internal combustion engine normally has incorporated therewith an engine driven oil pump which is designed to supply lubricating oil under pressure to the engine so that a film of lubricant is maintained between relatively moving bearing and sealing surfaces to substantially decrease friction and lessen direct metal-to-metal wear. Once the engine is started and lubricating oil pressure has been achieved and is maintained by the engine driven oil pump, a flow of lubricant is carried to each surface which requires it.

After starting a cold internal combustion engine, several seconds normally elapse before oil pressure from the engine driven oil pump is sufficient to properly lubricate the parts which require lubrication. This lag is particularly critical in low temperature operation because the lack of a lubricant permits a dry metal-to-metal frictional contact resulting in excessive wear. My invention is directed to a device for reducing friction at engine start-up.

An object of my invention is to provide a preliminary lubricating device for an internal combustion engine which will provide lubrication to the engine before the engine driven oil pump achieves lubricating pressure.

Another object of my invention is to provide a preliminary lubricating device operatively associated with novel electrical control and warning apparatus.

Another object of my invention is to provide a preliminary lubrication device constructed in such fashion that the major components thereof are easily disassembled whereby maintenance problems are rendered relatively simple.

Other objects of my invention will become apparent upon consideration of the following description in conjunction with the drawings wherein:

FIGURE 1 is a vertical sectional view of my pre-lubricating device, with certain portions broken away.

FIGURE 2 is a sectional view of one portion of FIGURE 1 showing the parts in different relative positions than in FIGURE 1 during one phase of operation.

FIGURE 3 is another sectional view of the elements of FIGURE 1 at still another phase of operation.

In accordance with the invention, a chamber, generally designated by the numeral 10, is defined by a pair of cup-like casing halves 12 and 14. Each half is adapted to be

secured to the other as for example by a plurality of bolts 1 which extend through holes in annular flanges 18 and 20. Bolts 16 may also be utilized to mount my preliminary lubrication device on a fixed supporting bracket (not shown) adjacent an engine with which the device is used.

A flexible diaphragm 22 is secured between the flanges 18 and 20 and hermetically seals the casings 12 and 14 together at this juncture. That portion of chamber 10 formed between the diaphragm 22 and upper casing 12 is adapted to receive and, at the desired time, discharge lubricating oil to parts, such as cylinders and bearings, of an internal combustion engine. This operation will be more fully discussed hereinafter.

An existing lubricating oil discharge line, indicated by numeral 26, leads from the engine driven lubricating oil pump to bearings, cylinders and other parts requiring lubrication. A main oil discharge opening 28 is provided in casing 12 and a spring loaded one-way ball check valve 30 is seated at the top thereof to permit oil under pressure in chamber 10 to be discharged into tubing 32 which communicates with inlet line 26 of the engine's regular lubricating system.

In those engines where no line such as 26 is present or readily accessible external of the engine, my device may be connected into the engine's regular lubrication system by connecting line 32 directly to the engine's pressurized oil gallery (downstream of the engine driven oil pump). This latter method of connection can be accomplished, for example, by removing the engine's oil pressure sensing means, replacing same with a T-tubing fitting, and the coupling line 32 to one exposed branch of the T and replacing the oil pressure sensing means in the remaining exposed branch of the T.

Apertures 34 in FIGURE 1 form metering orifices which provide a passage around check valve 30 to permit oil to slowly return to and fill chamber 10 as a result of oil pressure being supplied through line 26 by the engine driven oil pump subsequent to oil discharge from the chamber 10 at engine start-up, as will be described further hereinbelow. Apertures 34 are intentionally made rather small so that a pressure surge from the engine driven oil pump will not transmit sufficient force against diaphragm 22 to rupture same.

It will be noted that several apertures, in addition to 28 and 34, are provided in the top of casing 12. Aperture 25 receives a plug 24 which may be removed to permit manual filling or flushing of the chamber 10 above diaphragm 22 is desired. Apertures 36, which are smaller in total cross-sectional area than apertures 34, for a reason to be more fully described later, serve to purge any air from the top of chamber 10 into a tube 38 which communicates with the engine's crankcase.

There will be a small flow of oil into the portion of chamber 10 which lies above diaphragm 22, by way of apertures 34, whenever the engine driven oil pump is operating properly. Apertures 34 must provide for more flow of oil into the top of chamber 10 than can flow out of apertures 36 in order that the pressure caused by the unequal flow can be utilized to compress spring 54 in order to charge or cock my device, as will be further described.

When my device is charged or cocked, the small oil flow which enters chamber 10 through apertures 34 will exit from chamber 10, along with unwanted air, through apertures 36 for return to the crankcase. Thus a full charge of oil, substantially unadulterated by air can be contained in the portion of chamber 10 which lies above diaphragm 22 when my device is in its charged or cocked condition.

An aperture 37 is also provided in the top of casing 12 and is in communication with tube 38. A second spring loaded one-way check valve 39 is seated in the top of

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aperture 37. Valve 39 is provided for the purpose of relieving excess pressure above diaphragm 22 in the event that the engine driven oil pump's pressure relief valve should malfunction. Thus, it will be seen that both the sizing of apertures 34 and provision of valve 39 are for the purpose of preventing the rupture of diaphragm 22.

Of course it is possible that, due to normal wear and tear, diaphragm 22 will rupture. Therefore, the lower portion of chamber 10 below diaphragm 22 communicates, through tubing 40, with the engine's crankcase in order to allow oil to return to the crankcase in the event of rupture of the diaphragm. This lower portion of chamber 10 is normally filled with air at substantially atmospheric pressure which allows the diaphragm to flex downwardly substantially unimpeded when required.

A housing 42 is adapted to be secured to the bottom of casing 14 as clearly shown in FIGURE 1. A tubular portion of the housing contains a bore 46 which is adapted to slidably receive therein shaft or plunger 48. The threaded top of plunger 48 is secured to diaphragm 22 by nut 49 and plates 50, 52 as clearly shown in the drawing. These plates, which are clamped on either side of the diaphragm, strengthen it and establish the desired connection.

The coil compression spring 54 surrounds shaft or plunger within lower casing 14 and seats against plate 52 at its top and against portion 56 at its bottom for urging the shaft and diaphragm upwardly from the position shown in FIGURE 1. In order for my device to operate as intended, the bias of spring 54 must be greater than the bias of the spring incorporated in valve 30 and less than the bias of the spring incorporated in valve 39.

The inside diameter of bore 46 is only slightly greater than the outside diameter of shaft 48 which is received therein for reciprocable movement. A seal such as O-ring 58 is located near the top of housing 42 for sliding contact with plunger 48 to prevent oil and other matter from reaching the lower part of the housing 42 which contains electrical apparatus.

Also located near the top of housing 42 is a radially extending flange 45 which adjoins an annular shoulder 44. Shoulder 44, as seen in FIGURE 1, is located in an aperture 49 in the lowermost portion of casing 14. Aperture 49, it will be noted, is larger in diameter than spring 54. Thus, spring 54 can easily be removed downwardly from chamber 10, in the event that replacement or inspection of this spring is necessary, without disassembling the upper elements of my device.

Bolts 47 are the means employed to attach housing 42 to casing 14, and these bolts, obviously, must be removed when spring 54 is to be replaced in the manner just discussed. A gasket 51 serves to seal the joint between housing 42 and casing 14 when my device is assembled for use.

The lower portion of plunger 48 has a radially reduced groove 60 which defines a shoulder 72. Plunger 48 terminates in a substantially conically-shaped portion 62 which is adapted to abut a movable pin 64. Pin 64 has a dielectric head 23 affixed to its lower end. When downward pressure is applied to pin 64, it moves downwardly through a hole 66 whereby head 23 actuates an electrical switch designated SW1. The operation of SW1 will be more fully discussed hereinafter in conjunction with the electrical circuit shown in FIGURE 1.

A solenoid 68, having a spring urged armature or plunger 70, is affixed to housing 42 as shown in FIGURE 1. As seen in FIGURE 1, the plunger is not in contact with shoulder 72. In FIGURES 2 and 3 are shown other stages in the operation of my device wherein plunger 48, and thus shoulder 72, are in different positions relative to plunger 70.

Oil pressure, as supplied from the engine driven oil pump once the engine is operating normally, provides a volume of oil in chamber 10 which forces diaphragm 22 and plunger 48 downwardly to the position shown in

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FIGURE 1. As long as engine driven pump oil pressure is maintained, plunger 48 and diaphragm 22 remain in this lower position with the tip of conical portion 42 bearing against pin 64 to maintain switch SW1 open. However, when the internal combustion engine is shut down, oil pressure will no longer be maintained in chamber 10 by the engine driven oil pump and spring 54 then urges plunger 48 and diaphragm 22 upwardly. This upward movement will be checked or stopped at the position shown in FIGURE 2 by reason of shoulder 72 coming in contact with plunger 70. It is plain from FIGURE 2 that contacts 15 and 17 of switch SW1 are closed by spring action of the leaf spring contact-carrying blade 78 when pressure is removed from pin 64. Blade 78 is electrically insulated from housing 42 by a dielectric spacer 79.

When it is desired to start the engine again switch SW3, which is the engine's ignition switch, is closed (conventionally by turning a key), whereupon switch SW4, which is the starter relay, is also closed, as is conventional. Once the engine is started, switch SW4 is opened as is also conventional. Upon initial closure of switches SW3 and SW4 solenoid 68 is energized and plunger 70 is moved to the right against spring 71 which is located between the plunger 70 and a spring back up element 73. This withdraws the plunger 70 from holding engagement with shoulder 72. The diaphragm 22 is then urged upwardly by reason of spring 54 to discharge lubricating oil into line 26 in sufficient quantity to temporarily lubricate the various parts of the engine which require lubrication. The volume of oil discharged by diaphragm 22 at engine start-up takes place before the engine driven oil pump is producing at a pressure sufficient to properly lubricate the aforesaid various engine parts. Therefore, the "slug" of oil provided by my device at this critical phase of engine operation greatly increases the life of vital engine parts such as the engine's piston rings.

The movement of plunger 70 to the right at engine start-up also causes switch SW2 to close thereby lighting an indicator lamp 31. Switch SW2 is composed of normally open spring contacts 25 and 27 which are electrically insulated from solenoid 68 by a dielectric spacer 29.

The tip of plunger 70 is provided with a dielectric head 80 to prevent plunger 70 from shorting switch SW2. Plunger 70, and the bore 71' in which it reciprocates, preferably are of non-circular cross-section so that plunger 70 cannot rotate about its longitudinal axis. Solenoid 68 is only energized (from battery 11, by means of conductors 19 and 33) while starter switch SW4 is closed in the circuit illustrated. Therefore lamp 31 is lighted for only a short time. However, lamp 31 is lighted long enough to indicate to an operator that plunger 70 has retracted and that a "slug" of oil has been discharged into the engine by upward movement of diaphragm 22.

Lamps 21 and 31 and switch SW3 are located where they are easily visible and accessible, respectively, to the engine's operator. In the case where my device is installed in a passenger automobile, elements 21, 31 and SW3 are preferably mounted on the dashboard.

In certain engine-associated installations, it may be desired to have a "slug" of oil available before, rather than after, cranking of the engine for starting takes place, as described above. My device can easily be modified to meet such a desire, as will be readily understood by a mechanic skilled in the art, for example, by replacing the circuit elements SW4 and starter 13 illustrated with either a conventional engine oil pressure-actuated switch or a conventional manifold pressure-actuated switch and by making the electrical circuit for my device an independent circuit not associated with the engine's ignition and firing circuit.

If elements SW4 and 13 are replaced by an engine oil pressure-actuated switch, such switch will be set to open, and solenoid 68 will be deactivated, when the engine

driven oil pump is producing lubrication pressure at some desired minimum after the engine is started. Thus, plunger 70 will be released once the engine driven oil pump is producing at lubricating pressures.

Similarly, if elements SW4 and 13 are replaced by a manifold pressure-operated switch, such switch will be set to open and solenoid 68 will be deactivated, when the engine is operating so as to produce a desired partial vacuum in the intake manifold at which time, if the engine is operating properly, the engine driven oil pump will be supplying adequate lubrication to the engine.

Once the oil in chamber 10 has been discharged to the engine and the engine has been started and oil pressure is maintained in line 26, the chamber 10 will once again be slowly filled with oil by reason of oil bypassing check valve 30 through orifices 34. This volume of oil will once again force the diaphragm 22 and plunger 48 downwardly. As conical part 62 passes the sloping end of plunger 70, the plunger will be urged to the right, against the action of spring 71 as clearly shown in FIGURE 3, thereby closing contacts 25 and 27 to light lamp 31. This indicates to the operator that my unit is recharged and ready to again discharge a "slug" of oil when same is required.

The circuit illustrated in FIGURE 1 has been described to some extent hereinabove. However, in order that the operation thereof, as related to the remainder of the structure, will be clearly understood, further description follows.

Apparatus constituting a part of the electrical system of an internal combustion engine is shown. This amounts to a battery 11, a starter 13, switches SW1, SW2, SW3 (the ignition switch), SW4 (the starter relay) and wiring for the foregoing and to the engine's ignition and firing circuit. My pre-lubricating device, thus, contains three circuits which are connected into an engine's existing ignition and firing circuit. These are the circuits completed through SW1 for lighting lamp 21, the circuit through SW2 for lighting lamp 31 and the circuit by which solenoid 68 is energized.

Contacts 15 and 17 of SW1 are adapted to be maintained in a closed position by reason of spring arm 78. As previously indicated, when the tip of plunger 48 is in contact with pin 64 as indicated in FIGURE 1, these contacts will be open. Whenever SW3 is closed and the plunger 48 has moved to the position as shown in FIGURE 2, contact will be made in SW1 thereby lighting lamp 21. Thus, whenever lamp 21 is lighted, an operator knows that plunger 48 is not in its FIGURE 1 position. The contacts of SW2 are normally open and are temporarily closed by reason of plunger 70 moving to the right to complete a circuit to lamp 31. This latter circuit is temporarily completed both when plunger 48 moves downwardly and pushes plunger 70 to the right as shown in FIGURE 3, and when SW3 is closed and solenoid 68 is energized at the time of engine start-up.

When the device is in the position of FIGURE 1 the engine is running normally and no lamps are lighted. After engine shutdown, the plunger will be in the position shown in FIGURE 2. Lamp 21 will not be lighted at this time because switch SW3 is open.

When the switches SW3 and SW4 are again closed at engine start-up the solenoid 68 is energized to withdraw the plunger 70 and complete the circuit of lamp 31. The lighting of this lamp indicates to the operator that the oil has been discharged. After starting of the internal combustion engine, engine driven pump oil pressure in line 26 forces plunger 48 downwardly as indicated in FIGURE 3 moving plunger 70 to the right once again temporarily lighting lamp 31. As the plunger 48 moves on to its lower limit, contact will be made with pin 64 to break the circuit at points 15 and 17 and, thereby, lamp 21 will be extinguished.

In the event of loss of oil pressure from the engine driven oil pump during operation of the engine, plunger

48 will move upwardly under the action of spring 54 and switch SW1 will close to light lamp 21 thus warning an operator that the engine is operating with insufficient lubrication. Lamp 21 can, thus, replace the engine's usual low oil pressure warning light if desired.

The position of plunger 48 and diaphragm 22 as shown in FIGURE 2 may be referred to as the cocked or charged position, as previously stated, whereby upon movement of plunger 70 to the right, elements 22 and 48 are permitted to respond to the action of coil spring 54. Thereby lubricating oil is discharged into conduit 26 for transmission to relatively moving parts of the engine.

While this specification and drawings have disclosed one embodiment of my invention, it is obvious that various modifications can be made without departing from the spirit of my disclosure. For example, tube 38 and tubing 40 can obviously be joined externally of my device since both of these conduits lead to the engine's oil storing reservoir or crankcase. I mean to be limited only by the scope of the following claims.

I claim:

1. A preliminary lubrication device for use with a machine which has incorporated therewith lubricating means including an oil pump driven by the machine for circulating oil under pressure from said pump through a conduit to relatively movable parts of the machine comprising: a substantially closed chamber divided by a diaphragm having opposite sides with one side in communication with said conduit, said chamber on said one side of said diaphragm adapted to be filled with oil under pressure from said conduit to move said diaphragm and compress resilient means; elongated first plunger means having one end attached to said diaphragm and having another end extending at all times that said device is in operating condition through an aperture in said chamber into a plunger housing which substantially encloses said another end of said first plunger means; said first plunger means being adapted for linear movement in one direction in response to oil pressure against said one side of said diaphragm and in the other direction in response to said resilient means; said resilient means being located within said chamber between the other side of said diaphragm and said housing and surrounding said first plunger means, said resilient means having one end seated on said housing and being adapted to expand and move said diaphragm to expel oil from said chamber to said conduit under control of an operator of said machine; said first plunger means having a groove defining a radially directed shoulder; second plunger means passing through an aperture in said plunger housing and adapted to operatively engage said shoulder for preventing movement of said first plunger means and said diaphragm in said other direction; means for releasing said second plunger means to allow said resilient means to urge said diaphragm so as to discharge oil from said chamber into said conduit for transmittal to said relatively movable parts; means removably attaching said housing to said chamber whereby said resilient means can be removed from said chamber after detachment of said housing from said chamber; and a tubing in communication with the other side of said diaphragm and an oil reservoir incorporated in said machine.

2. The combination of claim 1, said chamber having a tube in communication with said one side of said diaphragm and said oil reservoir incorporated in said engine.

3. The combination of claim 1, said conduit having incorporated therein means for metering oil flow into said chamber.

4. The combination of claim 1 including first indicating means adapted to be deactivated when said first plunger means is in a position wherein said chamber, on said one side of said diaphragm, is filled with oil and activated when said diaphragm and said first plunger means are moved by said resilient means to expel oil from said chamber upon release of said second plunger means.

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5. The combination of claim 1 including second indicating means adapted to be activated upon release of said second plunger means.

6. The combination of claim 2 including means between said chamber and said tube for purging air from said chamber and for allowing oil to return directly from said chamber to said reservoir without first flowing to said relatively movable parts in the event that said oil pump driven by said machine produces excessive oil pressures.

7. The combination of claim 4 wherein said machine is an internal combustion engine and wherein said first indicating means and said means for releasing said second plunger means are conductively interconnected with the ignition system of said engine.

8. The combination of claim 5 wherein said machine is an internal combustion engine and wherein said second

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indicating means is conductively interconnected with the ignition system of said engine.

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