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[31] **W 43624**

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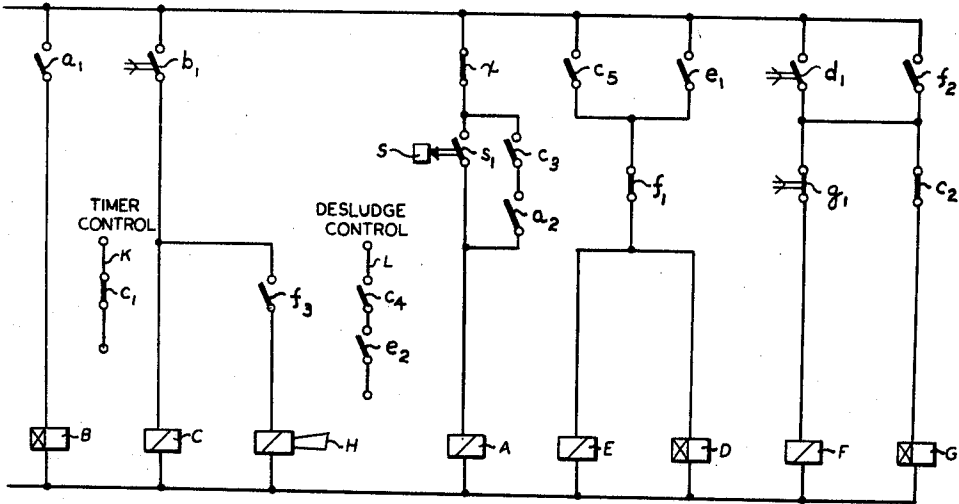
[54] **CONTROL DEVICE FOR CENTRIFUGAL SEPARATORS OR CLARIFIERS**
3 Claims, 1 Drawing Fig.

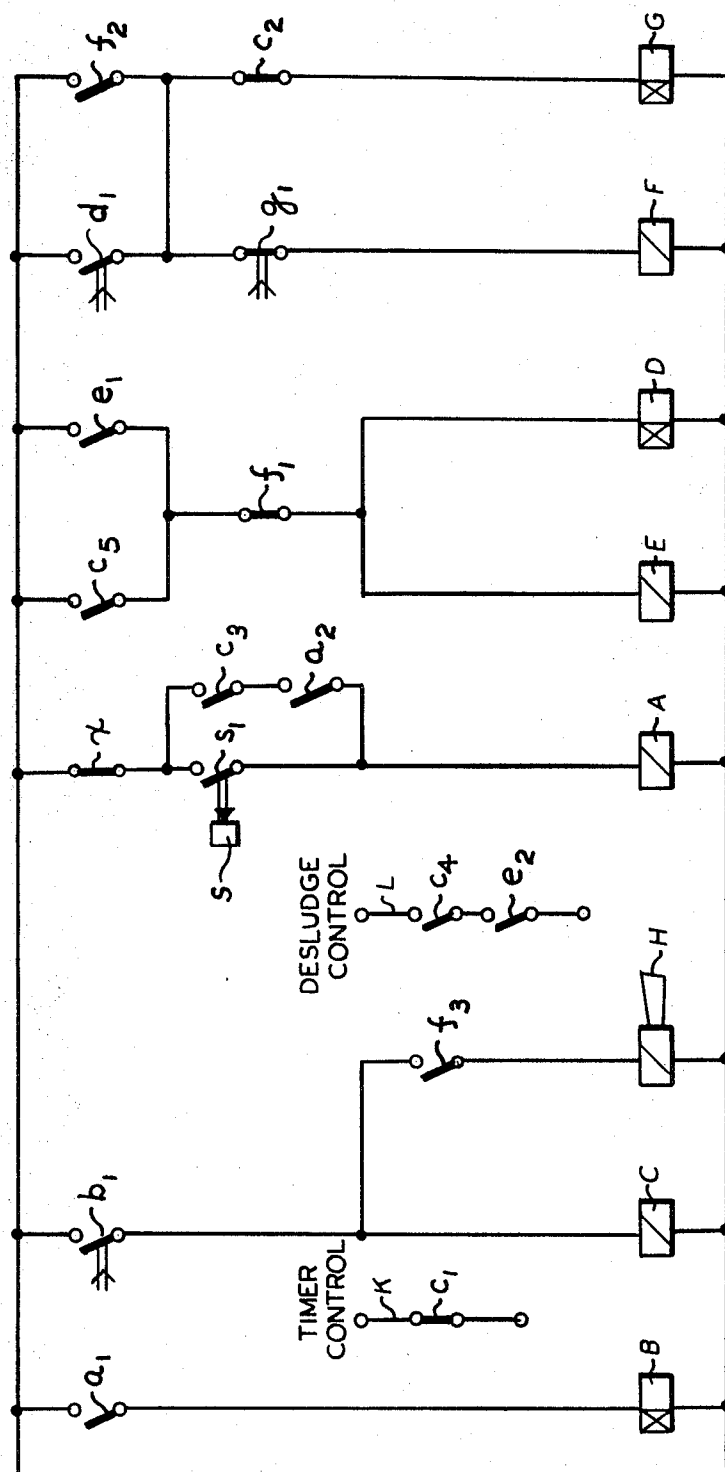
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ABSTRACT: Control device for centrifugal separators or clarifiers, which when excited by a trouble signal interrupts normal operating controls and initiates one or two desludging cycles to correct the malfunction. The device returns the separator to normal operation if the trouble is corrected by the first or second desludging cycle and, if not, activates an alarm.





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CONTROL DEVICE FOR CENTRIFUGAL SEPARATORS OR CLARIFIERS

This invention relates to a control device for automatically controlling separators or clarifiers of the self-cleaning type.

In the operation of such centrifugal separators or clarifiers, the specifically heavier solids deposited in the sludge space of the bowl must be ejected intermittently out of the bowl, in order to assure a continuous separating operation. The ejection of the solids is commonly called "desludging." Self-cleaning separators adaptable for this operation generally have valve-operated peripheral orifices which may be opened and closed by hydraulic or pneumatic power. By using a control device the desludging operation is automatically controlled according to a predetermined time cycle, that is at predetermined intervals, whereby a timer initiates the desludging cycle, which is carried out according to a set program. Such a control device is known, for example, in German Pat. No. 1,142,795.

Centrifugal separators of the character described are subject to various common trouble conditions. If, for example, the solid content in a crude liquid should increase for any reason, the sludge space of the drum will fill up prematurely. The solids then block the disc set causing the drum to overflow. Also, the drum can develop a leak. This may occur, when the main seal has become defective, when solids have lodged between the sealing surfaces or when the pressure in the closing chamber is no more sufficient to hold the sliding valve in the closed position. Failure of the valve to close may also be caused by loss of the valve-closing fluid. This often occurs through evaporation in high temperatures centrifuging operations.

Centrifugal separators for separating two liquid phases are equipped with a separating plate which projects beyond the zone of separation adjusting itself during operation between the two liquid components. This separating plate with the drum cover forms one or more outlet passages for the specifically heavier liquid. Occasionally, on the separation of a mixture of liquids, such as oil and water, the heavier liquid, that is the water, does not occur in sufficient quantity to maintain the separating zone at a proper radial distance during the separation process. Now, in such cases, if a mixture of liquids is being separated in which the specifically heavier liquid is contained only in small amounts, e.g., an oil-water mixture, the drum has to be filled with water before opening the crude mixture inlet, in order to produce this water seal for the oil.

Oil-water mixtures are usually separated at elevated temperatures of more than 80° C. so as to counteract the formation of emulsions. In order to compensate for evaporation losses and to assure that the waterlock ring is maintained in the drum, small amounts of water are metered into the incoming crude mixture. This measure is known, for example, from the published German Pat. application W 14,810 IVa/23a.

Now it can happen that the percentage of water in the oil may decrease or even drop to zero, so that the amount of water being metered in for the maintenance of the waterlock in the drum is too small. Also, the additional water infeed may fail. The waterlock ring in the drum then gradually recedes and the oil breaks through to the water outlet.

It is in the prior art to signal all of the above-mentioned troubles to the operating personnel by suitable warning devices. For example, a float can be disposed in the overflow receiver so as to indicate overflow by giving a signal as soon as liquid enters the catcher. To signal drum leaks, a warning signal can be mounted in the sludge receiver, and its control conductor can be interrupted during the desludging process, but if liquid emerges through the orifices in the drum periphery during the separating periods, an optical or acoustical signal is given.

To indicate the penetration of the specifically lighter component to the outlet for the specifically heavier component in liquid separators, a suitable trouble indicator, such as a level tester, can be provided in the receiver for the specifically heavier liquid. The receiver is then to be provided with an adjustable bottom drain which is to be adjusted so that the trou-

ble indicator will not respond in normal operation. If, however, the lighter component suddenly breaks through, the level tester will respond and call the attention of the personnel to the trouble.

For the same purpose, however, a trouble-warning device can be installed in the outlet for the specifically lighter component, which will respond whenever no liquid is passing through this outlet, which happens in the event of a breakthrough.

Hitherto the elimination of the above troubles has been performed by conducting one or two desludging operations by hand after the trouble signal. The emptying of the sludge chamber on the one hand remedies the overflowing of the drum, and on the other hand solids which may have been seized between sealing surfaces are removed. After the drum has been desludged, the closing chamber is again filled with closing liquid. This again forces the piston slide valve tightly against the main seal so that leaks due to insufficient closing pressure are eliminated.

In the case of liquid separators, the filling of the drum with specifically heavier liquid before opening the crude mixture inlet reestablishes a liquid locking in the drum, which prevents the breakthrough of the specifically lighter liquid.

In most cases, such additional desludging restores the normal state of operation of the drum.

Thus, regardless of the nature of the trouble, it can in most cases be cured by one or two additional desludging cycles.

It is an object of the present invention to provide automatic initiation of additional desludgings hitherto carried out by hand for the remedy of operational troubles.

The invention consists of a control device for centrifugal separators or clarifiers comprising at least one trouble indicator for starting a timing device when a trouble occurs, said timing device interrupting the operation of the centrifuge after the set delay time has expired, said timing device simultaneously energizing two switching elements the first of which initiates one or two additional desludgings and returns the centrifuge to normal operation if the trouble is corrected, and the second one actuates an alarm if the trouble is still indicated by the trouble indicator.

Referring to the drawing, one or more trouble indicators are connected parallel to the switching of mechanism S. Thus, upon the occurrence of trouble, the contacts₁ energizes a relay A. Relay A contact a₁, thereby energizing time-delay relay B. Simultaneously, relay A also closes contact a₂, although nothing occurs since contact c₃ is open.

The time-delay relay B can be set for any desired delay period, e.g., between 0 and 60 seconds. If, within this period, the trouble disappears by itself, then the trouble indicator S in the embodiment opens its contact s₁, relay A drops out again, and the opening of its contact a₁ also deenergizes relay B. In this case no countermeasures are initiated.

If the trouble continues to the end of the delay period set at B, the latter closes contact b₁ and thereby energizes another relay C. The latter opens contacts c₁ and c₂ and closes contacts c₃, c₄ and c₅.

Contact c₁ is in line K of the control apparatus, which supplies electric current to the timer on which the length of the centrifuging periods is set. The opening of this line shuts off the power from the timer, the timing indicator snaps back to the starting number, and the crude mixture inlet is shut off, thereby interrupting the separating action.

The significance of contact c₂ will be discussed further below.

The closing of contact c₃ causes relay A to hold in through its contact a₂ if the trouble indicator S drops out again after a desludging operation has started.

Contact c₄ is in line L of the control apparatus, which delivers to the latter the command for the desludging process. The desludging, however, still cannot be started upon the closing of contact c₄ because there is still a second contact to be closed in this line. These two contacts together replace the end switch of the timer.

Through contact c_5 a second time-delay relay D is energized, which holds in by cooperating with auxiliary relay E and its contact e_1 .

Auxiliary relay E has simultaneously closed contact e_2 in line L. The desludging operation is thereby initiated. When the desludging operation starts, the control apparatus in turn opens contact x in the power conductor running to the trouble indicator S and to relay A so that relays A, B and C drop out again. But since the desludging operation is in progress, the control apparatus cannot continue the separating operation in spite of the closed contact c_1 in conductor K.

The time delay to be set in the time-delay relay D must be greater than the duration of a desludging operation plus the delay time set in time-delay relay B, and shorter than twice the duration of a desludging plus twice the time set in time-delay relay B, if the desludging operation is to be repeated in case the trouble is not eliminated by a first desludging.

If, for example, relay B is set for 40 seconds and the desludging time amounts to 60 seconds, the time-delay relay D must be set for a time between 100 and 200 seconds. To this would have to be added the time required for the refilling of the drum, but this time is to be disregarded here.

In the operation of the apparatus according to the invention, there are four possibilities:

1. The trouble is eliminated after the first desludging.
2. The trouble is not eliminated by the first desludging so that desludging must be repeated.
3. The trouble is eliminated by the second desludging.
4. The trouble is not eliminated even by the second desludging.

As already described above, the control apparatus, which is not shown, opens contact x after the initiation of the desludging operation, thereby causing relays A, B and C to drop out. The desludging operation that has started is carried out in spite of the opening of contact c_4 . After the desludging has ended, contact x is reclosed by the control apparatus. If the trouble has been eliminated, the trouble indicator S does not make contact again.

Since contact c_1 in line K is closed and contact c_4 in line L is open, the centrifugal separating operation continues since the timer that determines the duration of the separating periods starts from time 0 again.

In the meantime, time-delay relay D runs on and energizes through contact d_1 the auxiliary relay F and the time-delay relay G.

Relay F, by the opening of its contact f_1 , deenergizes relays E and D. At the same time, through holding contact f_2 , it closes the circuit so that relays F and G hold in, if relay D reopens its contact d_1 . The closing of contact f_3 in this case has no effect because relay B has dropped out and contact b_1 is open.

The time-delay relay G deenergizes relay F by means of contact g_1 after the end of the preset time. By the opening of its contact f_2 , relay F thus deenergizes relay G, thereby restoring the starting condition.

The significance of the delay period to be set in relay G will be referred to later on.

If the trouble is not eliminated by the first additional desludging and another response of trouble indicator S takes place, the sequential action of relays A, B and C is again performed in the manner described above, and the desludging is repeated because relay E is still energized and its contact e_2 is closed.

After the initiation of the second desludging, time-delay relay D is soon about to end its cycle. As explained above, at the end of the preset time, it energizes relays F and G, relays E and D being deenergized by the opening of contact f_1 . The opening of contact e_2 has no influence on the desludging process that has been initiated.

If the trouble has been eliminated, the apparatus shuts off in the manner described above.

If the trouble still has not been eliminated after the second desludging, the trouble indicator S responds a third time.

During the second desludging process, however, time-delay relay D has completed its cycle and, by the closing of contact d_1 , it has energized relays F and G. Auxiliary relay F has deenergized relays E and D by the opening of contact f_1 . Contact e_2 in line L is therefore open again.

The third operation of trouble indicator S again energizes relay A, which in turn starts up time-delay relay B again. After the time-delay of B, contact b_1 is closed, thereby exciting relay C and operating the alarm signal H because the pulled-in relay F holds contact f_3 closed.

Relay C opens contact c_1 in line K and thereby interrupts the centrifugal separating process.

An additional desludging cannot be started by the closing of contact c_4 in line L because relay E has dropped out and contact e_2 is open. Since a desludging operation cannot be started, the control apparatus cannot open contact x so that relays A, B and C remain excited.

Relay C has furthermore opened contact c_2 so that the time-delay relay G cannot operate and auxiliary relay F cannot shut off. Therefore, the signal horn H sounds an alarm until the maintenance personnel intervenes. The trouble is then such that it cannot be dealt with automatically.

Time-delay relay G prevents a desludging from being performed during its operating cycle. Relay F, which is held in by contact f_2 , cannot then be shut off by G, and therefore it holds contact f_1 open, which prevents the operation of relays E and D. The open contact e_2 in line L prevents the initiation of the desludging operation. Now it may happen that the trouble is eliminated by the second desludging of the drum, but that the trouble indicator S momentarily responds again during the refilling of the drum and the normalization of operating conditions. If such a response should occur after the end of the delay time set in relay B, the system would be switched back to desludging if relay G has dropped out. It might then happen that the separator installation would continually perform desludgings.

Since desludgings cannot be performed during the operating cycle of time-delay relay G, its cycle time must be adjusted so as to span the time required for the stabilization of operating conditions. Its time cycle is governed by the time set in time-delay relay D because it commences when contact d_1 closes and continues through f_2 after relay D drops out.

If time-delay relay D is set for 120 seconds, for example, another 40 seconds will pass before the end of the second desludging. During this time, time-delay relay G is already running. Upon the response of the trouble indicator S, the end of the time delay set in time-delay relay B, which is to amount to 40 seconds, must again be awaited. To these, 80 seconds must also be added, in the setting of the time delay of time-delay relay G, the desired period of time in which any trouble that occurs is to sound an alarm instead of performing a desludging. In such cases the separator installation must be operated manually by the maintenance personnel until operating conditions have stabilized.

What I claim is:

1. In combination with a self-cleaning separator having means for automatically desludging the separator for desludging at preselected intervals:

- a. trouble detector means,
- b. an alarm circuit including an alarm means,
- c. a first and second switching means, said first switching means being operatively connected for response to operation of the trouble detector means and effective after a time delay, if the trouble persists, to operate the second switching means.
- d. said second switching means being effective to interrupt operation of the separator and to initiate a first trouble response desludging, by said desludging means, and
- e. a third switching means operatively connected to the second switching means and for controlling the number of trouble response desludgings by time setting and for operation of said alarm if the trouble is not removed after the preset number of trouble response desludgings has taken place.

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2. Apparatus according to claim 1, wherein that third switching means becomes effective after a time delay following said initiation of said first trouble response desludging to interrupt the desludging operations for limiting the number of desludgings.

3. Apparatus according to claim 2, wherein the time delay of said third switching means is longer than the time delay of said first switching means plus the desludging time of said

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desludging means plus the time for filling the separator, and is shorter than twice the time delay of the first-mentioned switching means plus twice the desludging time of said desludging means plus twice the time for refilling the separator, whereby the desludging following operation of the trouble detector means may be repeated once.

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