

June 3, 1969

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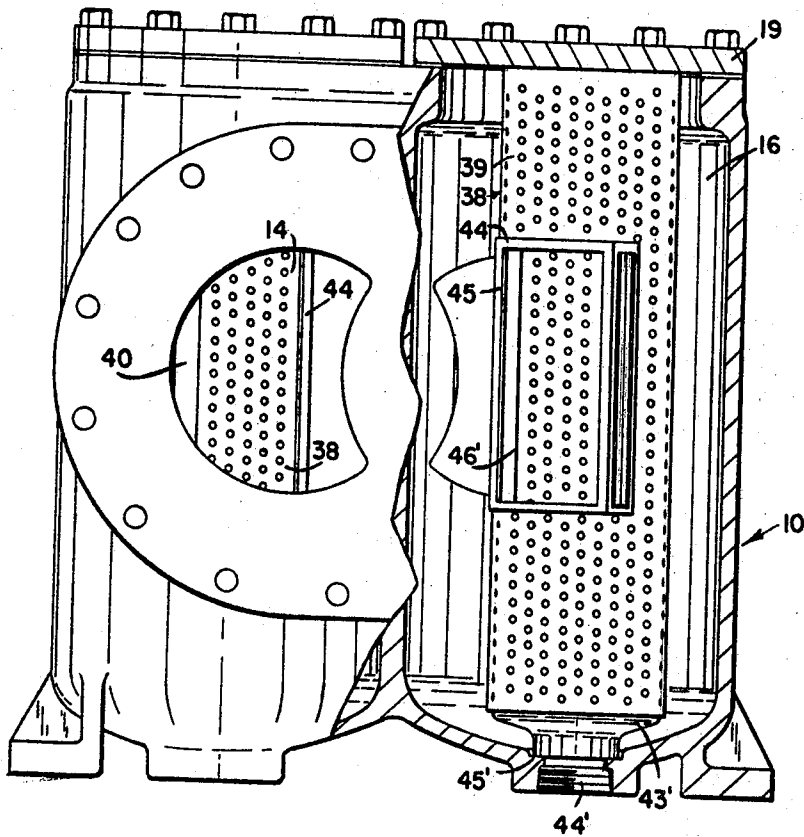
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FLUID STRAINER

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Sheet 1 of 3

FIG. 1



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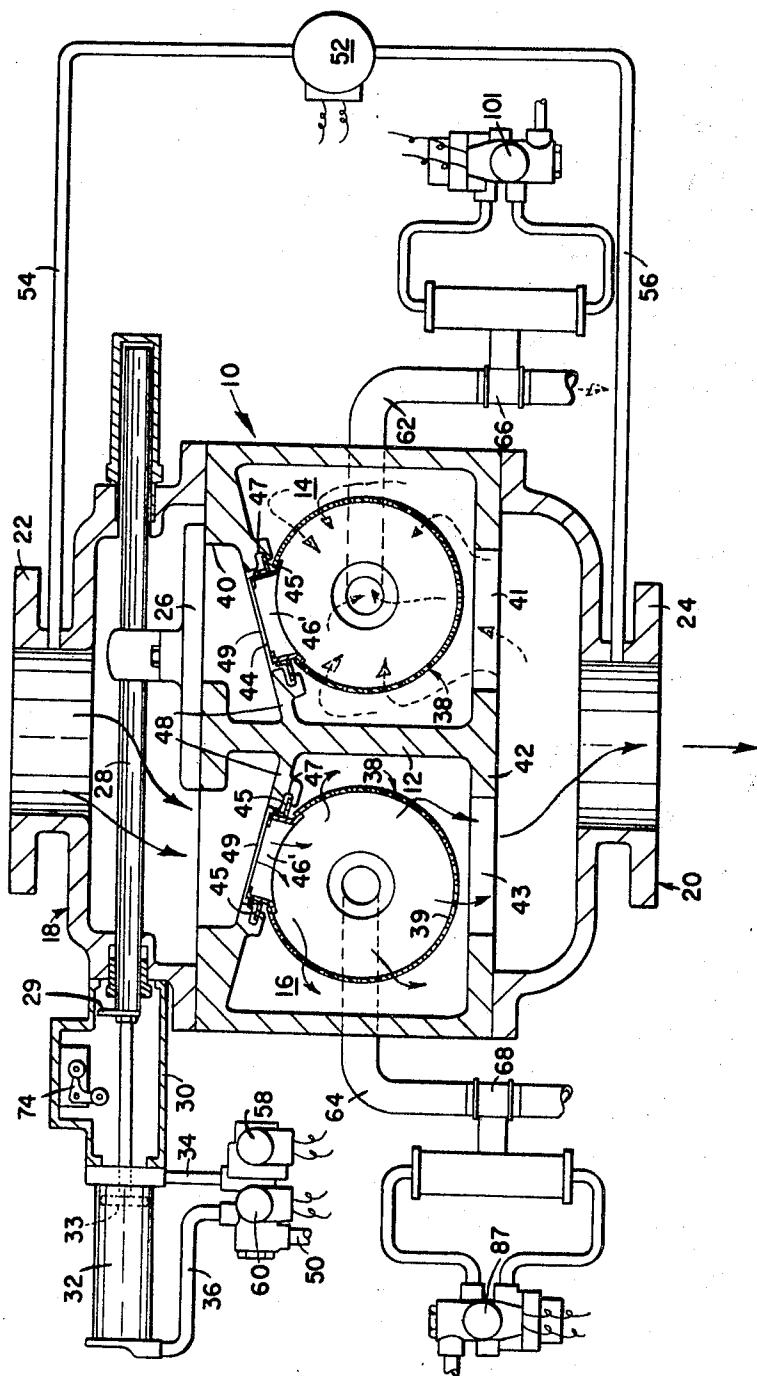
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Sheet 2 of 3

FIG. 2



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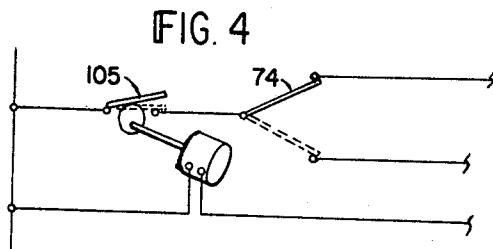
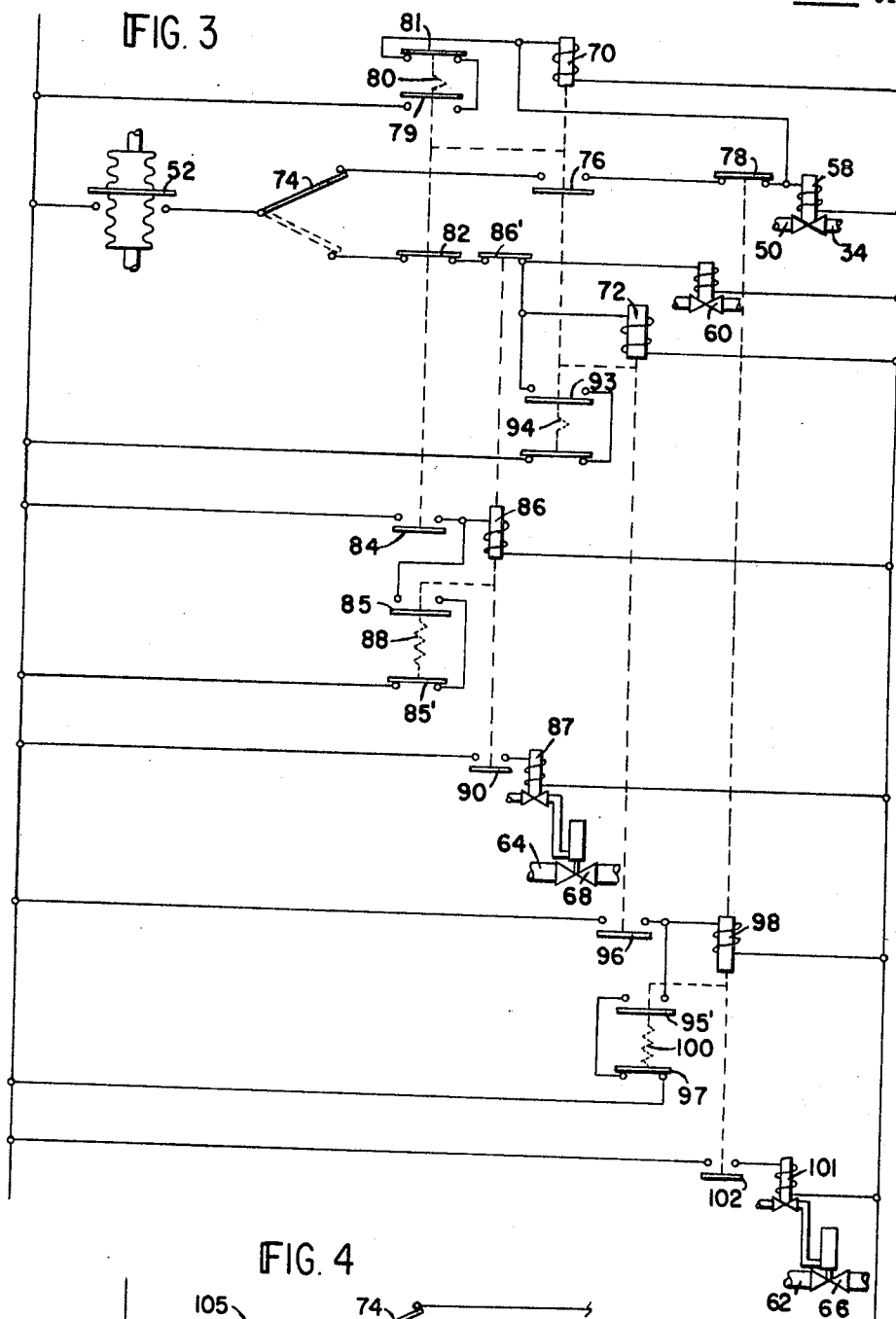
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Sheet 3 of 3



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1

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FLUID STRAINER

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4 Claims

ABSTRACT OF THE DISCLOSURE

A liquid filtering system including a strainer having two baskets through which a stream of fluid to be filtered selectively flows wherein a control circuit automatically cycles the stream through a clean basket while making provision for cleaning by backflushing the dirty basket.

This invention relates broadly to apparatus for removing material in particle form from a fluid stream. More particularly, this invention pertains to an arrangement for removing by filtration, particles of material from a stream of fluid. Still more particularly, this invention relates to apparatus wherein two perforated baskets are selectively interposed in a fluid stream for the purpose of removing foreign matter from the stream by offering surfaces for the accumulation of the material.

Apparatus of the kind contemplated is usually referred to as a fluid strainer and includes a casing or housing arranged in a conduit through which fluid passes. The casing contains separate chambers each equipped with a perforated basket positioned so that fluid entering the casing passes through the basket prior to flow from the casing. There is also included a valve member together with mechanism arranged for imparting sliding movement to the valve member so as to selectively place each of the chambers in series with the inlet and outlet of the casing. Apparatus of the kind described may be equipped with means permitting flushing of the basket disposed in the chamber opposite that subject to the flow of the stream by reverse or back flow of a portion of the fluid stream. With the flushing action described a clean basket is provided for use when the basket in the chamber subject to the main stream flow becomes clogged due to an excessive accumulation of foreign material on the surfaces thereof.

This invention has for its chief object the provision of an improved strainer construction wherein a relatively simple valve means together with actuating mechanism therefor is provided for the purpose of selectively communicating each of the two chambers in the casing with the fluid flow stream in a manner to ensure completely automatic operation of the strainer.

Another object of the invention is the provision of a novel control circuit for continuously accomplishing the automatic actuation of the valve member so that the liquid strainer will cycle to present a clean basket to the fluid stream when the companion basket becomes excessively clogged through a progressive accumulation of material on the surface of the perforated basket.

A still further object of the invention is the provision of an improved control circuit including cycle control relays regulating a series of time delay switches for the purpose of assuring proper positioning of the valve member in advance of the operation of the flushing means so that loss of fluid flow within the system is maintained at an absolute minimum.

An additional object of the invention is the provision of a control circuit as described that automatically senses an excessive accumulation of solid material on one of two perforated basket members and is effective to direct the

2

fluid stream through the other basket, while providing for the removal of the accumulated material from the surface of the first basket and to switch the fluid stream to its original path through the first basket while removing the accumulated material from the surface of the second basket.

These and other objects of the invention will be apparent upon a consideration of the ensuing specification and drawings in which:

FIGURE 1 is an end view partly in section of a strainer construction illustrating the invention;

FIGURE 2 is a sectional plan view illustrating the housing and the particular parts comprising the novel strainer;

FIGURE 3 is a schematic diagram of a control circuit illustrating in detail certain features of the invention; and FIGURE 4 is part of the control circuit shown in FIGURE 3, illustrating a modification of the invention.

Referring more particularly to the drawings for a description of a preferred embodiment of the invention, a body member 10 is shown provided with a partition wall 12 separating the body into compartments 14 and 16. End covers 18 and 20 are shown having passageways communicating with chambers 14 and 16. Top cover 19 is removably attached to body member 10 to form with the end covers an enclosure. End cover 18 is provided with a flange 22 that may be bolted to a conduit, not shown, through which the fluid to be processed is directed. End cover 20 is likewise provided with a flange 24 for connection to a conduit accommodating fluid that has passed through the strainer.

End cover 18 is provided with a valve member 26 attached to a rod 28 mounted in opposite sides of the end cover in appropriate bearing members, as shown in FIGURE 2. Forming an extension of end cover 18 is a bracket 30 through which rod 28 with switch actuating flange 29 moves. Disposed in a cylinder 32, attached to bracket 30, is a piston 33 connected to rod 28. Connected to the cylinder 32 at opposite ends thereof are conduits 34 and 36 for selectively supplying to and exhausting from the cylinder a source of compressed air or any other suitable fluid for the purpose of moving the piston 33 to the opposite ends of the cylinder. It will be appreciated that under the circumstances, when the piston 33 is disposed to the right end of the cylinder, rod 28 which is connected to the piston will be positioned so that valve 26 will cover an opening 40 located in the front wall of casing member 10. With the arrangement shown in FIGURE 2, fluid entering the strainer through the inlet in end cover 18 will pass to chamber 16. From chamber 16 fluid passes through opening 43 in rear wall 42, through end cover 20 to the discharge conduit, not shown. An opening 41, provided in the rear wall 42 of casing 10, permits communication between chamber 14 and the fluid stream for the purpose of flushing, by reverse flow of the stream (note dotted arrows), accumulated material deposited on the surface of perforated basket 38 as a result of flow through chamber 14 during an earlier cycle of operation of the strainer.

Located in each of the chambers 14 and 16 is a perforated basket member 38 as illustrated in FIGURE 1. The basket is preferably formed of perforated sheet material 39, rolled into the shape of a hollow cylinder, open at opposite ends. Appropriate stiffening rings, not shown, are mounted at the upper end and at spaced locations intermediate the ends of the basket. An adapter ring 43' is provided at the lower end of the basket in communication with an opening 44' in the body 10. The adapter ring rests on a relieved portion 45' of the base of body 10. A substantially central opening 46' is formed intermediate the ends of the basket in the area between the intermedi-

ate stiffening rings. A frame 44 formed of structural members connected to one another, to the intermediate stiffening rings and to the member 39 adjacent the opening supports mounting flanges 45 for engagement with recesses 47 formed about opening 49 in wall 48 of body 10. The perforated basket 38 is constructed so as to be introduced into the chamber with which it is disposed through the top of the body member 10.

Once the basket is arranged within the chamber the frame 44 fits about opening 49 so as to assure passage of the flow, entering the chamber, directly into the interior of the basket from which it flows outwardly to opening 43 communicating with the discharge line, not shown, connected to flange 24 of cover 20.

One of the main features of the invention is the provision of an arrangement for automatically sensing an accumulation of foreign matter, which is deposited as fluid flows through the basket, of a magnitude such that the flow of fluid should be routed through the other basket and the basket having the clogged surfaces be cleansed through removal of the accumulated material therefrom. To this end, there is provided a differential pressure responsive switch 52 together with lines 54 and 56 communicating with the inlet and outlet of the strainer. As will be explained in detail later, switch 52 is part of a control circuit for automatically shifting valve member 26 for the purpose of placing in communication with the fluid stream the basket in the chamber of the body that has been previously flushed. As indicated above, valve 26 moves under the influence of piston 33 disposed in cylinder 32. Controlling the movement of the piston 33 are the three-way air valves 58 and 60. Also, as indicated above, in order to have a completely automatic strainer, it is necessary that the basket that has become clogged should have the material removed from its surfaces so as to be ready when the control system indicates the companion basket has been clogged. Each of the chambers 14 and 16 is provided with a conduit 62 and 64 in communication with the interior of the basket so that when reverse flow occurs through the basket these conduits enable the reverse flow to pass to waste flushing with it the material that has previously been deposited upon the surfaces of the basket. Valves 66 and 68 control flow in lines 62 and 64, respectively, and the operation of these valves will be apparent upon explanation of the control system.

Considering the operation of the improved fluid strainer construction and its novel control circuit, it will be apparent that valve member 26 will assume a position in which flow through either chamber 14 or 16 is blocked while flow through the other chamber ensues. If we assume the parts are in the position shown in FIGURE 2, the fluid flow will occur through the strainer construction via chamber 16. As the flow of fluid continues through chamber 16 foreign material carried by the fluid will be deposited upon the surfaces of the basket member 38 disposed in chamber 16. Eventually, the deposition of foreign material on the surfaces of basket 38 will be great enough so that a predetermined pressure difference will be detected by pressure differential responsive switch 52. Switch 52 will then close and complete a circuit through a cycle relay 70 or 72 depending upon the position of the valve position switch 74 shown as a single pole double throw switch. Cycle control relays of the kind employed are manufactured by the Allen Bradley Co. and marketed as Style AXX Timing Relays. Assuming the valve position switch 74 to be in the position shown in FIGURE 3, a circuit will be completed through a normally closed switch 76, a normally closed switch 78 and the solenoid controlling valve 58 which will cause compressed air or any other suitable fluid to be delivered through line 50 to conduit 34 moving piston member 33 to the left in cylinder 32, it being understood that fluid trapped to the left of piston 32 may exhaust to the atmosphere through line 36 and valve 60.

At the same time, a circuit is completed through cycle control relay 70. Energization of cycle control relay 70 causes contacts 79 of time delay switch 80 to close and provide a holding circuit through the relay 70. At the same time, normally closed switch 82 is opened so as to prevent companion cycle control relay 72 from being energized. Also at the same time, cycle control relay 70 pulls in normally open switch 84 to complete a circuit through a relay 86 similar to relay 70, closing contacts 85 of a second time delay switch 88. Relay 86 also opens normally closed switch 86, and closes switch 90 which energizes coil 87 controlling flow of compressed air in a direction to open valve 68 to permit a flushing action described above to take place in chamber 16. It has been found that the time delay switch 80 will have an active cycle of about ten seconds while the time delay relay switch 88 as an active cycle of about sixty seconds.

Thus, air is supplied to the cylinder 32 so that valve member 26 is moved to its second operating position where flow through chamber 16 is prevented and flow through chamber 14 permitted. It will be appreciated that the movement of valve 26 will cause flange member 29 to change the position of switch 74 to the dotted position shown in FIGURE 3. However, as pointed out above, the flow of compressed air to cylinder 32 is continued by the action of the time delay switch 80 maintaining a circuit through the electrically controlled valve 58. This assures complete movement of the valve member despite the change of position of switch 74. At the same time, because of the holding circuit through cycle control relay 70, the movement of switch 74 is ineffectual as far as energizing cycle control relay 72 is concerned for as long as cycle control relay 70 is energized switch 82 in series with relay 72 remains open. Also, because of the holding circuit through cycle control relay 70, switch 84 remains closed and assures energization of relay 86 which controls the action of the flushing valve serving chamber 16 and prevents energization of cycle control relay 72 by holding switch 86' open. Under these circumstances, a part of the flow of fluid through chamber 14 is used to pass in a reverse direction through the basket 38 located in chamber 16 so as to flush the dirt deposited on these surfaces through the opening in the bottom of the chamber and into conduit 64, as described above.

Eventually, contacts 81 of time delay switch 80 will open and de-energize cycle control relay 70. Relay 86, however, is still energized because of the longer time interval designed in time delay switch 88. Thus, despite opening of switch 84, as cycle control relay 70 is de-energized, relay 86 remains energized and the flushing valve remains open for a period of sixty seconds to assure complete removal of the material deposited upon the surfaces of the basket in chamber 16.

After the sixty second interval has been completed, contacts 85' of switch 88 open and relay 86 is de-energized causing switch 90 to open and thus close valve 68 and terminate flow through conduit 64. At this time, the pressure difference across the strainer will have been reduced so that switch 52 controlling the entire operation of the control system is open.

After flow has continued for a time through chamber 14, the surfaces of the perforated basket 38 in the chamber will become clogged as material is continually being deposited thereon by the filtering action of the basket. The switch 74 is now in the dotted position so that when pressure switch 52 senses a predetermined pressure difference indicating a need for change of the path of fluid flow through the strainer, a circuit will be made through cycle control relay 72. De-energization of relay 86 as described above closes switch 86' and de-energization of relay 70 closes switch 82 to permit the energization of cycle control relay 72. At the same time, a solenoid associated with valve 60 is energized so that compressed air is permitted to flow into the cylinder 32 from the left-hand side and vent from the cylinder 32 through valve 58. Under the

circumstances, piston 33 is moved to the right and carries with it rod 28 mounting valve member 26 with the result that valve 26 assumes the position shown in FIGURE 2. Energization of this cycle control relay 72 causes a holding circuit to be made through contacts 93 of time delay switch 94 and a switch 96 to be closed, as well as a switch 76 to open and prevent premature energization of cycle control switch 70. Thus, a holding circuit is established via time delay switch 94 through second cycle control relay 72 and movement of switch 74 will not de-energize relay 72. The energization of relay 72, as pointed out above, closes switch 96 which in turn energizes relay 98, which in turn pulls in contacts 95' of time delay switch 100. A holding circuit is thus completed through relay 98 via time delay switch 100 so that the subsequent opening of the circuit through cycle control relay 72 will not affect the operation of relay 98 despite opening of switch 96. Energization of relay 98 also closes switch 106 in a circuit energizing a coil 101 permitting compressed air to open flushing valve 66.

Thus, the valve 26 has been moved to permit communication between the fluid stream and chamber 14, containing the recently cleaned basket 38. The opening of flushing valve 66 permits a portion of the fluid flow stream to reverse itself and flow inwardly through the basket 38 disposed in chamber 14. Eventually contacts 97 on relay 98 will open and terminate the flushing action in the same manner as described in conjunction with switch 88. As pointed out above, this action results in a flushing of the surfaces sufficient to remove the deposited foreign material therefrom. Foreign material flows from conduit 62 to waste.

With the construction illustrated and described it will be appreciated that once the improved strainer together with its control circuit has been assembled in a fluid flow conduit having particles of solid material carried therein, automatic attendant-free continuous filtering of the fluid flowing in the conduit will obtain. When the strainer is assembled and a manually controlled main control switch, not shown, is closed, flow will ensue through the chamber in communication with the strainer inlet and outlet. Flow through the chamber will continue until the pressure differential switch 52 indicates the presence of an undesirable accumulation of material on the perforated basket in the chamber by sensing an increased pressure drop through the strainer. The control circuit will then energize the cycle control relay associated with the contact of the valve position switch in engagement with the actuating arm of the switch initiating movement of the valve as long as the control switches in series therewith are closed. As will be apparent from the above description control switch 76 will be closed as long as companion cycle control relay 72 is de-energized, and the control switch 78 will be closed as long as relay 98 is de-energized indicating completion of a previous flushing operation. Thus the control circuit will not energize a cycle control relay if the companion cycle control relay is energized or if the flushing action initiated by the companion cycle control relay has not terminated.

Shifting of the valve 26 occurs as a circuit through the air valve associated with the energized cycle control relay is completed. This action opens the circuit by shifting switch 74, however, the holding circuit, described above, through cycle control relay maintains the latter energized and the flushing action also described above occurs.

Flow continues through the chamber uncovered by movement of the valve 26 until the pressure differential switch 52 detects an undesirable accumulation of material on the surface of the perforated basket in that chamber. The action of the control circuit is then repeated so that the other chamber with its clean basket is in communication with the fluid flow.

The invention has been described as it applies to a control arrangement employing a pressure differential switch. FIGURE 4 illustrates a portion of a modification

of the control circuit wherein a timer controlled switch is substituted for the pressure differential switch. The operation of the modified circuit is substantially the same as that described except that the timer controlled switch 105 replaces the pressure differential switch. The time interval between periodic closing of the switch 105 may be chosen so as to eliminate the switches 78 and 86' in the circuit illustrated in FIGURE 3. To this end the time interval could be such that the flushing action, also controlled by time responsive means, would have been completed before the succeeding closing of the timer controlled switch.

While I have described a preferred embodiment of my invention, it will be understood the invention is not limited thereto since it may be otherwise embodied within the scope of the following claims.

I claim:

1. Apparatus for removing foreign matter from a continuously flowing stream of fluid comprising a body member having:

- an inlet for receiving said stream of fluid, an outlet through which said stream is discharged and two chambers positioned in parallel between the inlet and outlet to provide separate flow paths from said inlet to said outlet through said body member;
- a perforate element located in each chamber, said perforate element presenting a plurality of spaced connected surfaces upon which foreign matter may collect as fluid flowing through said body passes through said element;
- valve means for selectively directing fluid flow from said inlet through a first of said chambers while restricting communication between the second chamber and the fluid flow;
- drain means located in each chamber; and
- control means for automatically shifting the valve means so that a perforated member substantially free of foreign matter is periodically presented to the stream of fluid, wherein said control means includes an electric circuit regulating movement of said valve means, said circuit comprising a first switch operable to periodically energize the control circuit to initiate movement of said valve means, a second switch in series with said first switch, said second switch having a first position for completing a circuit to move the valve means to a position wherein said first chamber is in communication with the inlet of the body member so that fluid entering the body member will flow directly to said first chamber, while preventing communication between the inlet and the second chamber and thus limit flow of fluid in said second chamber to a part of the stream passing through said first chamber, said second switch also being effective to actuate the drain means serving said second chamber to enable flow of fluid entering said chamber to drain therefrom for a predetermined time.

2. A control circuit for the automatic operation of a fluid strainer having two chambers arranged in parallel and in each of which is positioned a perforate member for filtering said material from a fluid stream, said strainer having valve means for selectively communicating each chamber directly with the strainer inlet and drain means enabling selective cleansing of the perforate members comprising:

- a single pole, double throw switch, having first and second operating positions, responsive to the position of the valve means;
- a first cycle control relay in series with the single pole double throw switch when the switch is in one of its operating positions;
- a second cycle control relay in series with the single pole double throw switch when the switch is in the other of its operating positions;
- time delay switches associated with each of said cycle control relays, said time delay switches being effective upon energization

7

of its associated cycle control relay to (i) establish a holding circuit through the cycle control relay, (ii) actuate valve shifting means, (iii) prevent energization of the other cycle relay, (iv) actuate the drain means associated with the chamber which receives the valve in blocking position;
 a second switch in series with said single pole double throw switch, said second switch being periodically actuated to energize either said first or said second cycle control relays.

3. The circuit set forth in claim 2 wherein said second switch is responsive to a predetermined difference in pressure drop through said strainer.

4. The circuit set forth in claim 2 wherein said second switch is responsive to a timer arranged to periodically close said switch.

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