

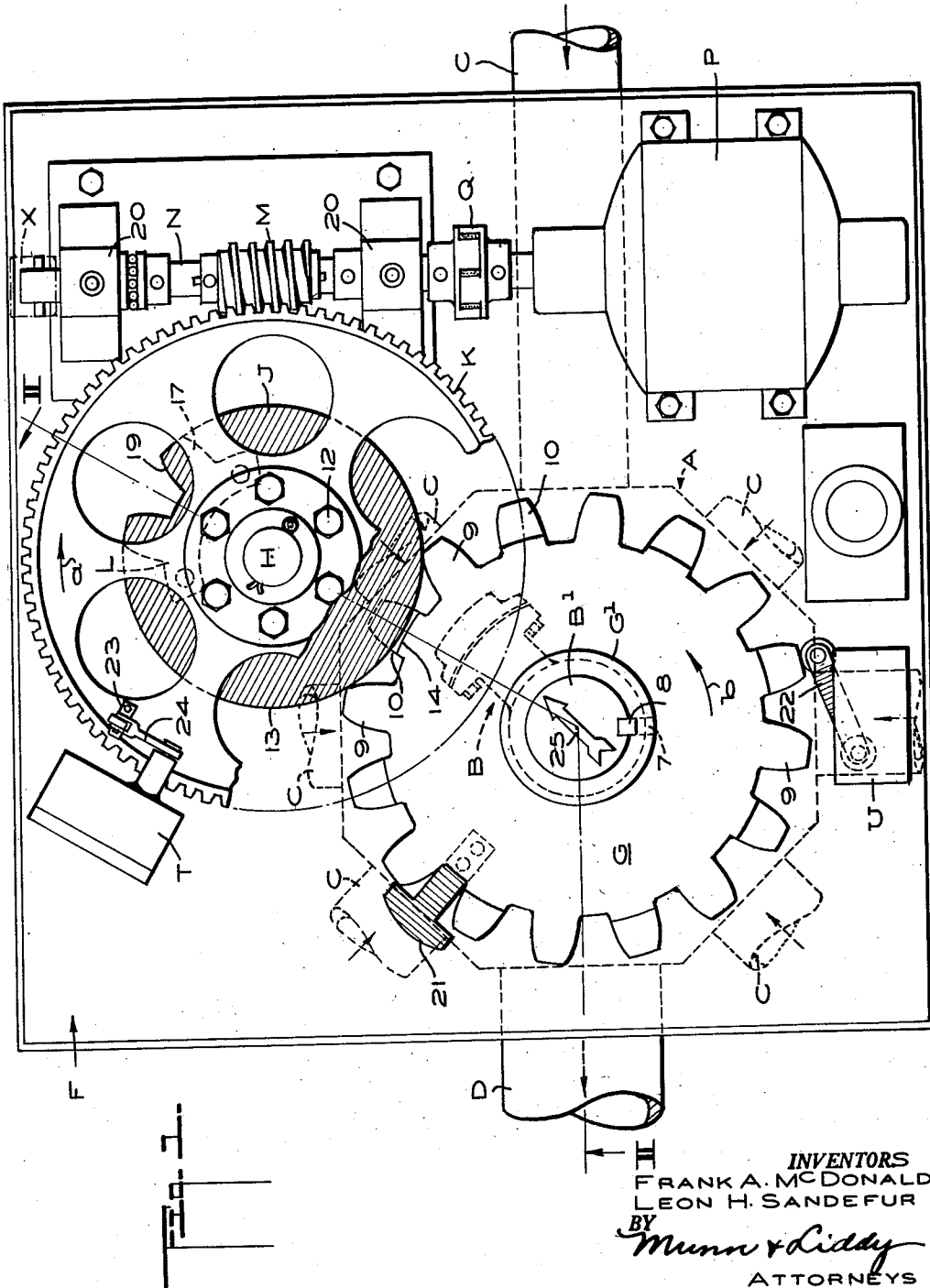
Sept 17, 1957

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AUTOMATIC CONTROL FOR MANIFOLD VALVE
WITH SELECTIVE BY-PASS ROTOR

2,806,486

Filed Dec. 22, 1953

4 Sheets-Sheet 1



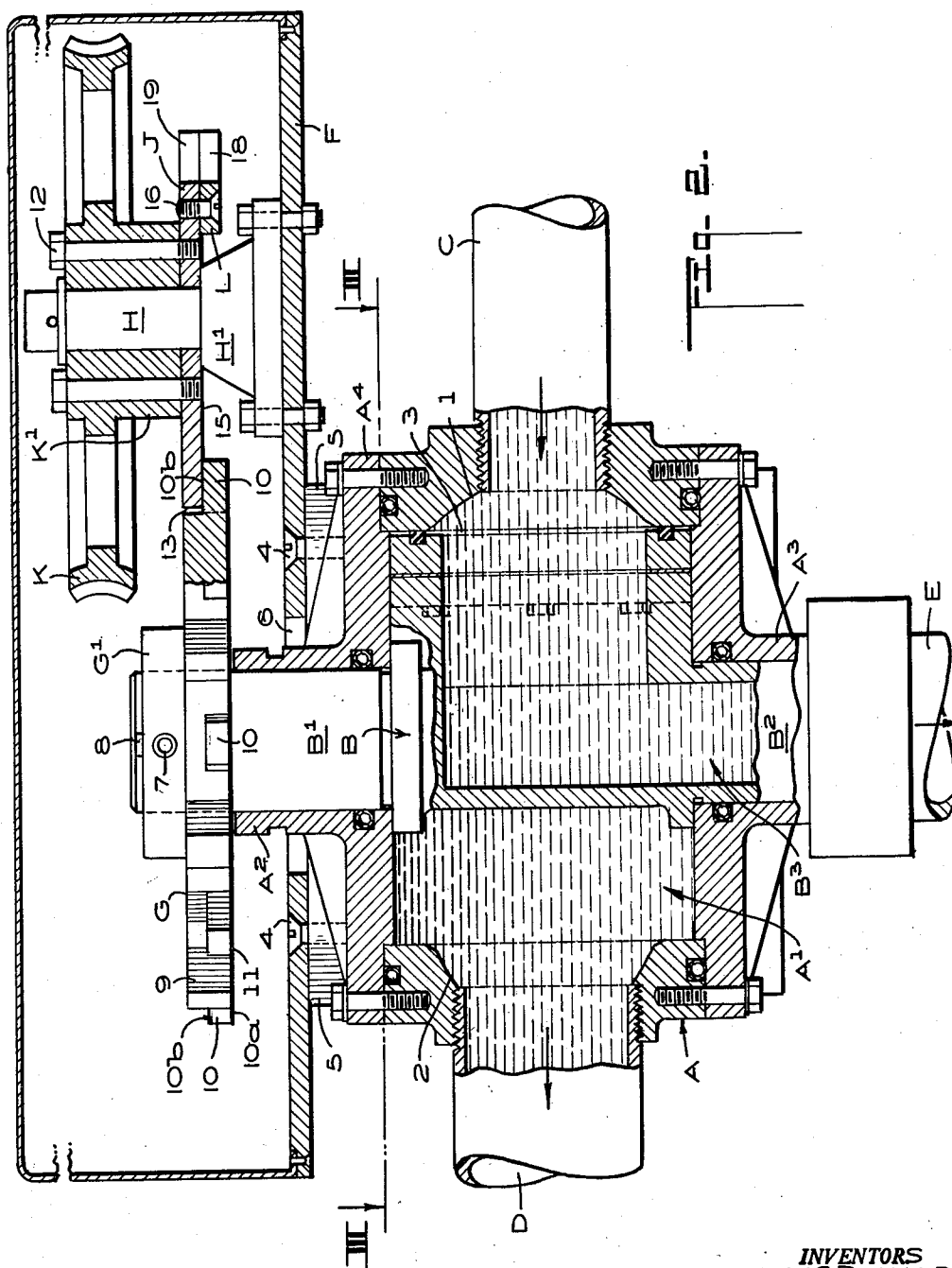
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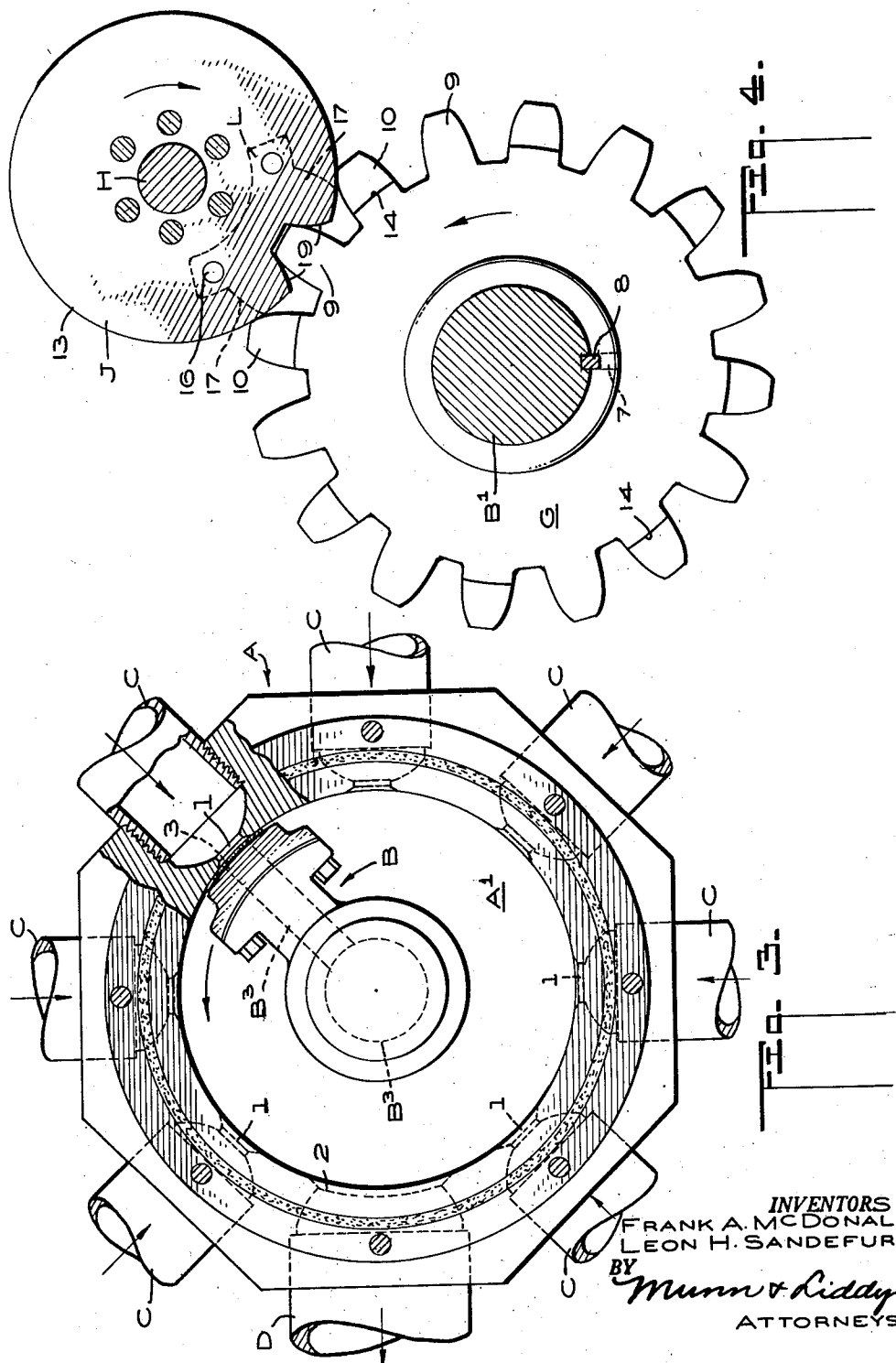
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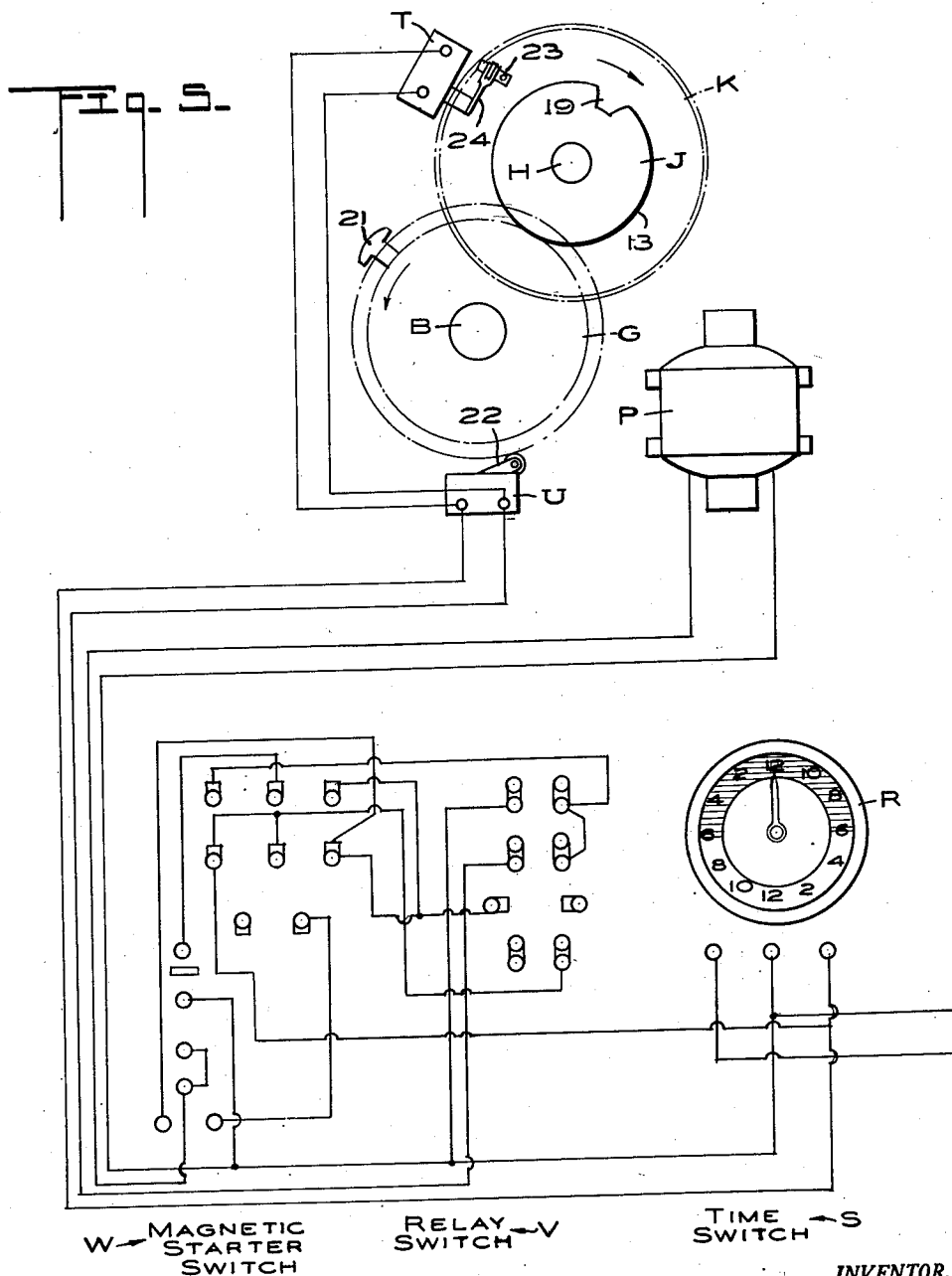
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AUTOMATIC CONTROL FOR MANIFOLD VALVE WITH SELECTIVE BY-PASS ROTOR

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Application December 22, 1953, Serial No. 399,672

2 Claims. (Cl. 137—633)

An object of our invention is to provide an automatic control for the manifold valve shown in an application of Frank A. McDonald, on a manifold valve with selective by-pass rotor, Serial No. 378,777, filed September 8, 1953. In the pending case, manual means is illustrated for moving the rotor to register with any desired one of a number of inlet ports in the stator and to hold the rotor from accidental movement.

The manifold valve in Serial No. 378,777 is designed to receive fluid simultaneously from a number of inlet pipes and to direct this fluid out through a common outlet pipe. The selective rotor is used to by-pass the fluid from any desired inlet pipe for permitting the quantity of this fluid to be measured before it is returned to the common outlet pipe at a point exterior of the stator. The manifold valve may be used in oil fields where a number of wells are being pumped at the same time and the oil delivered to a common storage tank. It is desirable to check periodically the quantity of oil being pumped from each well so that each well owner will be given proper credit for the volume of oil pumped from his well. The selective by-pass rotor permits successive checks of all of the wells. Usually the well is checked for a twenty-four hour period.

The present invention pertains to an automatic control for moving the selective by-pass rotor to another oil inlet pipe, every twenty-four hours or other designated period of time. The automatic control does away with the need of manually moving the rotor into registration with individual oil inlet pipes, successively. The automatic control has novel means for moving the rotor so that it will pass by the common outlet to the valve. Therefore, the rotor will successively register with each fluid inlet in the stator and remain in registration for a predetermined period of time, but the rotor will move past the common outlet opening without stopping. It is possible for the valve and automatic control to be used for purposes other than the checking of the quantity of oil flow and we do not wish to be confined to any specific fluid or gas being handled.

The automatic control is simple in construction and it will lock the rotor in the position into which it has been swung. It is possible to adjust the rotor manually if for any reason the source of power to the motor becomes disconnected therefrom.

Other objects and advantages will appear in the following specification, and the novel features of the device will be particularly pointed out in the appended claims.

Our invention is illustrated in the accompanying drawings forming a part of this application, in which:

Figure 1 is a top plan view of the device with the cover removed;

Figure 2 is a vertical section taken substantially along the line II—II of Figure 1;

Figure 3 is a horizontal section taken substantially along the line III—III of Figure 2;

Figure 4 is an enlarged view of the locking and drive disc shown meshing with the transfer and locking gear; and

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Figure 5 is a wiring diagram.

While we have shown only the preferred form of our invention, it should be understood that various changes or modifications may be made within the scope of the appended claims without departing from the spirit and scope of the invention.

In carrying out our invention, we make use of the manifold valve with selective by-pass rotor shown in the application of Frank A. McDonald, Serial Number 378,777, filed September 8, 1953. The manifold valve is illustrated in Figures 2 and 3, and comprises a stator indicated generally at A in Figure 2 and a rotor indicated generally at B. The stator has a plurality of inlet ports 1, see Figure 3, and these are in communication with inlet pipes indicated at C. Fluid flowing from the inlet pipes C enters the interior A1 of the stator by means of the inlet ports 1 and then this fluid passes on through an enlarged outlet port 2, see Figure 3, and on into an outlet pipe D.

The rotor B has an integral and upwardly-extending rotor shaft B1 rotatably received in an upper bearing A2 of the stator A. The rotor B also has an integral and downwardly-extending rotor shaft B2 that is axially aligned with the upwardly-extending rotor shaft B1 and is rotatably received in a lower bearing A3 of the stator, see Figure 2. In the above mentioned application, manual means is used for rotating the upwardly-extending rotor shaft B1 for swinging the inlet end 3 of a fluid passage B3 into registration with any one of a number of inlet ports 1. The fluid passageway B3 is L-shaped and has a downwardly-extending portion that is axially aligned with the axis of the rotor and communicates with a by-pass pipe E, see Figure 2. When the inlet end 3 communicates with an inlet pipe C, all of the fluid flowing through this pipe will be conveyed to the by-pass pipe E. All of the other inlet pipes will be delivering their fluid to the interior A1 of the stator and this fluid will flow out through the common outlet pipe D. It is possible to move the inlet end 3 of the passage B3 past the outlet port 2 in the stator A without interfering with the flow of fluid from the interior of the stator A1 through the outlet port 2 and into the outlet pipe D. In the application above referred to, the operator can manually rotate the rotor B to align the inlet end 3 of the fluid passage B3 with any desired inlet port 1 and hold the rotor in this position. It is further possible to move the inlet end 3 of the rotor past the outlet 2 of the stator and no provision is made in the application Serial Number 378,777 to hold the inlet end 3 in registration with the outlet port 2.

The present invention is designed to provide an automatic control for the rotor B so that this rotor will be moved and have its inlet end 3 successively brought into registration with the inlet ports 1, and to remain in registration with each inlet port for a predetermined period of time before being moved on to the next inlet port. The automatic control also causes the rotor to move past the outlet port 2 of the stator without stopping. In this way each inlet pipe C will take its turn in being placed in communication with the by-pass E and remain in communication with the by-pass for the given time period, while all of the other inlet pipes will be delivering their fluid to the interior A1 of the stator and from there the fluid will flow to the outlet pipe D. Inasmuch as the manifold valve with selective by-pass rotor is illustrated and described in detail in application Serial Number 378,777, further detailed description of the valve casing and rotor is not deemed necessary in this specification.

We will now describe the automatic control which cooperates with the valve for actuating the rotor in the manner described. A base plate F is mounted on the cover A4 of the stator and is secured in place by cap

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screws 4. Lugs 5 are integral with the cover A4 and project thereabove so as to provide a flat supporting surface for the base plate F. The cap screws 4 enter threaded bores in the lugs 5. The base plate F has an opening 6 through which the top of the upper bearing A2 projects.

A transfer and locking gear G is mounted on the portion of the upwardly-extending rotor shaft B1 that projects above the top of the bearing A2, see Figure 2. The transfer and locking gear G has a hub G1 and this hub has a set screw 7 that secures the transfer and locking gear G to the upwardly-extending rotor shaft B1. Figure 1 shows a dowel pin or key 8 for connecting the transfer and locking gear G to the upwardly-extending rotor shaft B1 so that the two will rotate as a unit.

In Figures 1, 2 and 4, we show the transfer and locking gear G provided with full teeth 9 and half teeth 10. The full teeth alternate with the half teeth about the circumference of the gear, as clearly shown in Figure 2, and it will be seen that the half teeth are arranged so that their under surfaces 10a will lie flush with the under surface 11 of the transfer and locking gear G. The purpose for this construction will be explained shortly.

On the base plate F, we mount a stud H, see Figure 2, for rotatably receiving a locking and drive disc J and a worm gear K. The stud H has a base H1 on which is rotatably mounted the locking and drive disc J. The worm gear K has a hub K1 that rests on the upper surface of the locking and drive disc J. Cap screws 12, or other suitable fastening means, secure the locking and drive disc J to the worm gear K so that the two will rotate as a unit. In Figure 2 we show the locking and drive disc J extending over the upper surface 10b of one of the half teeth 10. The circumference 13 of the locking and drive disc J is such as to clear the shoulder 14 on each of the half teeth 10.

The locking and drive disc J has a double tooth member L that is secured to the under surface 15 by cap screws 16 or other suitable fastening means. The double teeth 17 on the member L provide a tooth-receiving recess 18 that will receive a full tooth 9 on the transfer and locking gear G when the parts are arranged in the position shown in Figure 4. The locking and drive disc J has a recess 19 that registers with the recess 18 in the member L so that the full tooth can be received in the two recesses.

When the recesses 18 and 19 are out of registration with a full tooth, as clearly shown in Figure 1, the body portion of the locking and drive disc J will overlie the upper surface 10b of a half tooth 10 and the two full teeth 9 that are disposed on opposite sides of this half tooth, will contact with the periphery 13 of the locking and drive disc J and will be prevented from movement. The half teeth 10 are half as thick as the thickness of the full teeth 9. The drive disc J will intermittently rotate the transfer and locking gear G through a predetermined arc of 45° and then will hold this gear from further rotation until the locking and drive disc J completes another revolution.

The means for rotating the worm gear K is shown in Figure 1 and it comprises a worm M that is mounted on a shaft N and this shaft is mounted in bearings 20 that in turn are supported by the base plate F. The worm shaft N is connected to an electric motor P by a coupling Q.

In Figure 5 we show a wiring diagram by means of which the device is operated. A twenty-four hour clock is indicated generally at R and this clock will close a time switch indicated generally at S, every twenty-four hours. The time switch connects the source of power to the motor P at any time selected. Due to the time involved for the average time switch to open the circuit, it is necessary to mount a micro-switch T on the base plate F, this switch to be actuated by a trip 23 mounted on the worm gear K so as to break the electrical circuit

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to the motor and prevent over-travel of the worm gear and the consequent overtravel of the locking and drive disc J. The use of the micro-switch eliminates the use of various types of electronic control.

We have already stated that the stator A for the valve has one constant flow outlet port 2 and it is therefore necessary to install a second micro-switch U on the base plate F and place this adjacent to the transfer and locking gear G, see Figures 1 and 5. A transfer gear tripper plate 21 is secured to the gear G and it will come into contact with a roller actuated arm 22 when the inlet end 3 of the rotor passage B3, passes in front of the outlet opening 2. The wiring diagram shown in Figure 5 is such as to cause the motor P to continue operating even though the micro-switch T is momentarily opened by the worm gear tripper plate 23, acting on a roller-carrying arm 24 for the micro-switch T. The worm gear K will therefore make two complete revolutions as the inlet end 3 of the fluid passage B3 in the rotor, passes from an inlet pipe C disposed on one side of the outlet pipe D, to the inlet pipe C disposed on the opposite side of the same outlet pipe. The inlet end 3 of the rotor will therefore not remain in registration with the outlet 2, but will move by the outlet and be brought into registration with the next inlet port 1.

The wiring diagram shown in Figure 5 also discloses a time relay switch indicated generally at V, and a magnetic starter switch indicated generally at W. The time switch S, relay switch V, and magnetic starter W are of standard construction and are wired together in the manner indicated. These parts are also wired to the motor P and to the two micro-switches T and U so that the device will operate the valve rotor B, once every twenty-four hours, and then will bring the automatic control to a stop except for the twenty-four hour clock S. The rotor B will have its inlet end 3 brought into registration successively with each of the inlet ports 1 and the rotor will be held in each position for a predetermined time period, such as the twenty-four hour period already referred to. The automatic control will move the rotor intermittently around the interior of the stator so that it will register with each inlet port and then when it reaches the enlarged outlet port 2, the transfer gear tripper plate 21 will actuate the micro-switch U for causing the motor P to continue to operate and to move the inlet end 3 of the rotor past the outlet 2 and finally bring the inlet 3 into registration with the inlet port 1 that is disposed next to the outlet port 2. It is not necessary to trace the electric circuits set forth in the wiring diagram.

The novel rotor turning and rotor locking arrangement of the locking and drive disc J and the transfer and locking gear G, is clearly shown in Figures 1, 2 and 4. In Figure 1, the transfer and locking gear G is held against accidental rotation because one of the half teeth 10 underlies the disc J, while the two full teeth 9 disposed on each side of this half tooth 10, will contact with the periphery 13 of the disc J. It will therefore be seen that the transfer and locking gear G cannot rotate until the recess 19 on the disc J registers with one of the full teeth 9.

The arrow a on the worm gear K shown in Figure 1 indicates that the worm gear is rotated in a clockwise direction. Therefore, when the gear is rotated by the closing of the time switch S and the actuation of the motor P, worm M and worm gear K, the locking and drive disc J will be rotated for bringing the recess 19 into registration with the full tooth 9 that contacts with the periphery 13 of the disc J. Also, the double tooth member L will engage with the same full tooth 9 and will rotate the transfer and locking gear G in a counter-clockwise direction as indicated by the arrow b in Figure 1 on the gear G. The half tooth 10 that formerly was positioned under the disc J, will be moved away from the disc while the full tooth 9 is moved by the member L. The disc J will continue to rotate the gear G until the next

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half tooth 10 is brought into a position underlying the disc J. When this occurs, the two full teeth 9 disposed on both sides of the half tooth 10 will contact with the periphery 13 of the disc J and hold the gear G from further rotation. It will be seen that the transfer and locking gear G is moved into a predetermined position each time the gear G is rotated and this position causes the inlet 3 of the rotor to register with another inlet port 3 of the rotor. An arrow 25 is shown on the top of the rotor shaft B1 in Figure 1, and this arrow points in the direction of the inlet end 3 of the rotor. The operator can glance at the arrow and will know which inlet pipe C is in communication with the by-pass pipe E.

The automatic control will cause the rotor B to stop at all of the inlet ports in succession and for a desired time period, and to move past the outlet port 2 without stopping. The ratio between the worm M and the worm gear K is 100 to 1 although we do not wish to be held to any exact gear ratio. For each complete revolution of the worm gear K, the transfer and locking or holding gear will be rotated 45°, and then held from accidental rotation until the worm gear makes another complete revolution.

It is possible to actuate the rotor B, manually if desired and we therefore provide a hand lever X, shown by the dot dash line in Figure 1, for this purpose. The particular shape of the lever need not be set forth. Suffice it to say that the lever can be used for manually rotating the worm M. It is possible to position the selector rotor B, between two inlet ports 1 and then all seven inlet ports will deliver their fluid to the common outlet port and no fluid will flow through the rotor to the by-pass pipe E. The rotor B should be moved into registration with an inlet port 1 before the automatic control again takes over.

As already mentioned, one purpose of designing a nine port valve body, is to meet the request of the oil producing companies who desire to group their wells to a selector valve and operate on a seven day schedule. We provide means for centrally controlling the flow from one to seven wells so that the quantity of oil flowing from the well, can be checked. The control can be automatic so that all seven wells are periodically and successively checked.

In operation, the time clock R, closes the initial circuit through the magnetic motor switch W and the micro-switch T, located at the side of the worm gear K, see Figure 5, thereby completing the electric circuit to the motor P. The micro-switch T is actuated by the tripper plate 23, attached to the top of the worm gear K. When the tripper arm 24 breaks the circuit, it automatically breaks the circuit in the relay switch V, and at the same time holds the circuit open until such time as the time clock R again closes the circuit.

As already mentioned, the second micro-switch U is located at the side of the sixteen tooth transfer and holding gear G, and is actuated by the tripper 21. This tripper is located on the gear G, in relation to the outlet port 2. The tripper 21 is of sufficient length to close the micro-switch U and hold it closed for a sufficient length of time to prevent the micro-switch T from opening the circuit, thereby keeping the circuit closed for an extra revolution of the worm gear K. An additional 45° revolution is therefore imparted to the gear G and the rotor B is moved past the outlet port 2. This same performance may be repeated by extra trippers 21 being added to desired spots on the gear G to eliminate any of the seven inlet ports 1, desired. The outlet port 2 is preferably twice the area of

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the passage in the rotor B and therefore the flow of fluid through the outlet port is not restricted.

We claim:

1. The combination with a manifold valve having a stator with a cylindrical-shaped inner wall and a plurality of fluid inlet ports in the wall arranged in circumferential succession and communicating with the interior thereof; the stator having a fluid outlet port in the cylindrical wall and placed in the same circumferential row of inlet ports; the outlet port communicating with the stator interior; and a selective by-pass rotor mounted in the stator interior and being movable into registration with the inlet ports, one at a time, for by-passing fluid from the port with which the rotor is in registration and conveying the fluid away from the stator: of electrically controlled means for intermittently rotating the rotor for bringing the selective by-pass into registration successively with the inlet ports; said means including means for automatically rotating the rotor for moving the selective by-pass from registration with an inlet disposed on one side of the outlet, into registration with an inlet disposed on the other side of the outlet without stopping the continuous moving of the rotor as its selective by-pass moves past the outlet.

2. The combination with a manifold valve having a stator with a cylindrical-shaped inner wall and a plurality of fluid inlet ports in the wall arranged in circumferential succession and communicating with the interior thereof; the stator having a fluid outlet port in the cylindrical wall and placed in the same circumferential row of inlet ports; the outlet port communicating with the stator interior; and a selective by-pass rotor mounted in the stator interior and being movable into registration with the inlet ports, one at a time, for by-passing fluid from the port with which the rotor is in registration and conveying the fluid away from the stator: of a rotor revolving member operatively connected to the rotor for intermittently rotating it; a second revolving member operatively connected to the rotor revolving member for stepwise advancing the latter when the second member has been rotated a predetermined distance; an electric motor operatively connected to the second revolving member for rotating it when the motor is connected to a source of current by a switch; the second revolving member having a trip thereon for opening the switch and stopping further rotation of the second revolving member after the latter has moved the first member to bring the rotor passage into registration with the next inlet port; a second switch; and a second trip on the rotor revolving member for temporarily closing the second switch when the rotor registers with the outlet for continuing to connect the motor with the current source when the first switch is opened by the first trip; whereby the second revolving member will continue to move and cause the rotor to move the passage past the outlet and into registration with the next inlet port; whereupon the first and second trips will open both switches and will stop further movement of the rotor.

References Cited in the file of this patent

UNITED STATES PATENTS

1,432,494	Regen	Oct. 17, 1922
1,748,390	Otto	Feb. 25, 1930
1,811,624	Ford	June 23, 1931
1,910,004	De Ville	May 23, 1933
2,229,993	Weightman	Jan. 28, 1941
2,327,046	Hunter	Aug. 17, 1943