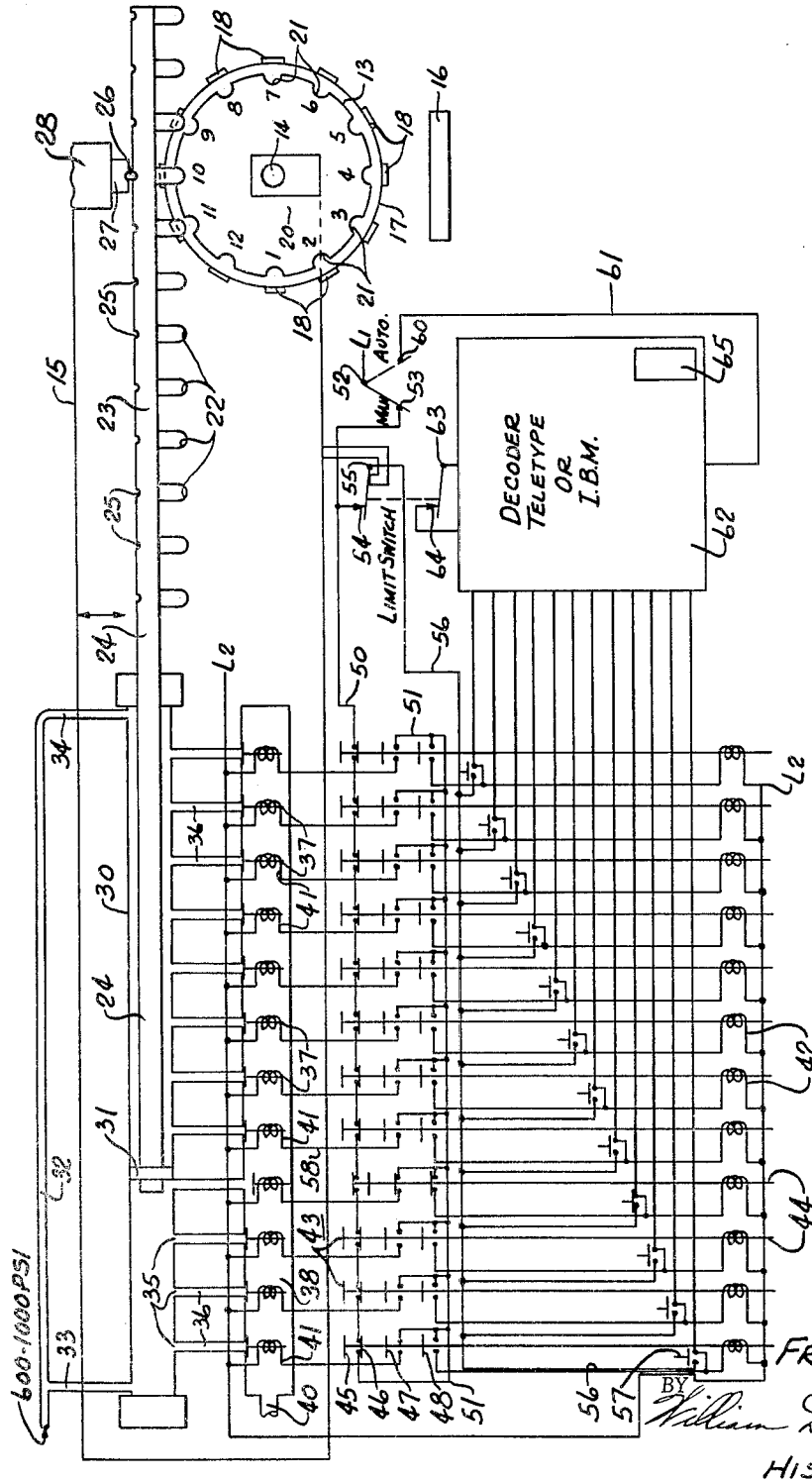
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FLUID ACTUATED SERVO INDEX

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FLUID ACTUATED SERVO INDEX

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This invention relates generally to fluid actuated servo index motors and more particularly to the operation and control of such motors.

In controlling the operation of production machines it is frequently necessary to index the machine so as to provide the proper setting thereof. The item being indexed may require a multiplicity of index positions. These positions will frequently change depending upon the use to which the index device is applied. When operating with numbers, ordinarily each index wheel will have ten positions and if it is desired to employ a blank 11 then twelve positions are provided, two positions being blank, so that no indicia will occur under such situation, particularly when small and large numbers are employed at different times and it is undesirable to provide zeros in front of the numbers. Again it is sometimes desirable to have a twelve index to indicate the months of the year or a seven index to indicate the days of the week.

The present invention illustrates a circuit in combination with a fluid actuated mechanism for indexing one character wheel. In practice this character wheel may multiply in many fold, which of course would require duplication of each of the control circuits as illustrated in conjunction with one character wheel.

Another object of this invention is the provision of a fluid actuated servo motor which employs the principle of the differential areas on the other side of the fluid actuated piston for causing the piston if given a sufficient length of time to pass to the extremity of the cylinder and return to a predetermined position, accurately locating the specific index by reason of providing a leakage path on the large area side of the differential piston. This immediately properly indexes the character wheel and when locked in position will remain there until it is required to further index the character wheel.

Another object is the provision of a circuit for operating in conjunction with the fluid actuated index machine which will hold the index position while the head carrying the character wheel is moved out of contact with the indexing mechanism and functions to perform its work before being returned to the indexing mechanism.

Another object is the provision of an automatic control system for automatically adjusting the indexing mechanism through a pre-set memory device and for retaining the setting during the period of the operation of the member being indexed.

Another object is the provision of a fluid biased piston in a cylinder having a series of control ports which when opened balance out the piston at a predetermined position in the cylinder.

Another object is the provision of an electric control circuit to actuate controlled ports in a fluid cylinder to move the piston to pre-determined selected positions and change a device such as a marking head either manually or automatically through.

Another object is the provision of a fluid actuated mark changing control for each indicia wheel that may be manually or automatically controlled and which rides with the character wheels when they are marking an ingot or other article.

Other objects and advantages appear hereinafter in the following description and claims.

The accompanying drawing shows for the purpose of exemplification without limiting the invention or claims

thereto, certain practical embodiments illustrating the principles of this invention where a diagrammatic view shows one of a series of character wheels together with the controls and circuitry therefor.

Referring to the drawing the character wheel **13** is rotatably mounted on the shaft **14** carried by the ram or hammer mechanism **15** which in this particular instance is designed to move downwardly to stamp the article **16**. However, the structure could be arranged to move horizontally or any other direction desired. The character wheel **17** is provided with the character numbers indicated at **18** and is secured to an indexing wheel **20** which has the same number of positions and is provided with the pockets **21** of which there are twelve in number. These pockets are in the form of a gear which is engaged by the teeth **22** of the rack member **23** that is mounted on the end of the piston rod **24**. There are the same number of teeth **22** in the rack **23** as there are pockets **21** and thus each tooth and each pocket represents a definite character on the character wheel. As illustrated in the drawings, the character **1** is shown at approximately 9 o'clock and if the rack **23** were moved to the left in the drawing to the last position the character **1** of the character numbers **18** would of course be opposite the printing position for printing the same on the article **16**. As shown in the drawing, the fourth character is in printing position and the corresponding fourth tooth **22** is in the uppermost socket **21**. Thus any position that the rack **23** is moved will present the proper character **18** in printing position over the article **16**.

In order to insure the centered position of each of the characters a series of detent sockets **25** is placed in the top of the rack **23** for receiving the detent member **26** which is resiliently held in position by the piston **27** operating in the cylinder **28**. This detent may be of any suitable character and it merely offers slight resistance after the rack has been located but is readily overcome by the fluid pressure when it is desired to change the character.

The piston rod **24** extends into the cylinder **30** and is provided with a piston indicated at **31**. The cylinder **30** has a fluid pressure such as 600 to 1000 p.s.i. supplied to the pipeline **32** which has one branch **33** extending into the left end of the cylinder **30** and one branch **34** extending into the right end of the cylinder beyond which the piston **31** cannot travel.

Intermediate of the right and left ends of the cylinder a series of ports **35** are open into the cylinder and these ports are valved by the operation of the piston through the cylinder. Each port **35** has a pipeline **36** connected thereto and this pipe is controlled by the valve member **37** that controls the flow of fluid pressure into the manifold **38** and thence to discharge through the line **40**. Each of the valves **37** are electromagnetically operated as indicated by the coil **41**. There is the same number of ports **35** and valves **37** together with their operating coils **41** as there are positions in the character wheel and on the rack **23**. One side of each of the coils **41** is connected to the line L2 which may be one side of the source of supply of 110 volts alternating current or any other suitable electrical supply. The same line L2 is likewise connected to one side of each of the electromagnetic coils **42** which operate the relay contacts indicated generally at **43** for each of a series of relays, there being the same in number as there are valves and operating coils therefor. Each of the relay coils **42** actuate the armature as indicated at **44** which has attached thereto a series of four contact members generally indicated at **45**, **46**, **47** and **48**. The contact members **45** and **46** close a continuous circuit through each of the relays **42** from the line **50** to the line **51** and when the relays **42** are de-energized as indicated in the drawing except for the fourth

of such relays their contact members 46 bridge the terminals between the lines 50 and 51 to provide continuously closed circuit. When the relay is energized such as indicated in the fourth relay position of the relay 42 the contactor 45 closes the contacts in the circuit between the lines 50 and 51. Thus the only time that the circuit between the lines 50 and 51 is interrupted by the contactors 45 and 46 is in the transfer by one of the relays 42 from its normally deenergized position to its normally energized position which may be a relatively short period but when one relay is selected for operation and is operating it is desirable to prevent any of the other relays in the bank to operate at this time and its function must be delayed.

When the relay such as the relay in the fourth position indicated at 42 is energized as shown the valve operating coil 41 is energized from line L1 to the manual control switch 52, the contact 53, to the line 50 and thence through the contact 54 to the contactor 55 representing the hammer limit switch to the line 56 which supplies energy to one side of each of the push buttons 57, the other side of which energizes the coil 42 and supplies current to the contacts normally bridged by the contact member 48 of each of the relays 42 when they are energized. Since the switch 52 has been thrown to the manual position and 15 is in its retracted position the hammer limit switch 55 is closed and the push button in the fourth position which is also shown to be closed supplies current from the line 56 to its relay 42 and also through the lower contact bar 48 to the line 51. This provides a holding circuit for the relay 42 to maintain it in this position and also supplies current through the contact bar 47 and the line 58 to its corresponding valve actuating coil 41 and thence to line L2 thereby completing the circuit for both the relay 42 and the corresponding valve operating coil 41. The opening of the valve 37 at the fourth position allows the fluid under pressure to leak through the pipe 36 to the manifold 38 and thence to discharge or return system 40. This reduction in the pressure permits the piston 31 to move to the left until it just about closes the port 35 at the fourth position. The piston allows a sufficient leakage through the port at the fourth position to just balance the forces on opposite sides of the piston 31 in the cylinder 30. These forces are unbalanced owing to the fact that the piston rod is connected to one face of the piston and when none of the valves 37 are opened the piston will of course be at its fully extended position owing to the fact that there is a greater pressure area on the left side of the piston than there is on the right due to the piston rod. Thus the piston will seek its own level and control its own leakage through the port 35 to properly position the rack 23 and thereby properly locate the indicia 18 in a printing position which in this case was obtained by the fourth pushbutton 57 when the switch 52 was in its manual position.

When the ram or hammer mechanism 15 has moved down to its printing position the contacts 54 and 55 are opened. However, the stick circuit through the contact bars 46 and the contact bar 45 in the fourth position maintain the relays 42 and the valve operating coil 41 energized and they maintain this energization until the circuit between lines 50 and 51 is again broken by the resetting of the piston to another position. However, this cannot take place until the hammer is back in its withdrawn position and the switches 54 and 55 are closed. In other words, the circuit provides a lock out for changing the character wheel when the ram or hammer 15 is not retracted.

When the ram or hammer is retracted and it is desired again to change the characters on the character wheel the depression of any one other button for this particular character wheel will immediately break the holding circuit of the fourth position and thus deenergize the relays 42 and the valve operating coil 41 in the fourth position which causes the valve to immediately close and the piston will again move to the right until the next consecutive button is pushed and regardless of the location of this button the piston 31 will immediately adjust to this new position.

The push buttons 57 will remain closed for a sufficient length of time to permit the relay 42 to become closed. However, as soon as this time has elapsed these push buttons will then become open. The schematic showing in the drawing illustrates that period during which time the push button is held closed until after the energization of the relay 42. Shortly after such time the push button 57 in the fourth position will of course become released.

If the marking device is not to be manually operated the switch 52 is thrown in the opposite position so as to energize from line 1 the contact 60 to the decoder teletype or IBM memory device which operates either on a punch card or a punch tape or a magnetic memory drum. By energizing the decoder 62 it will be provided with a series of operating relays usually five for each position or for each relay 42 and if the proper combination of relays in the series of five closes the circuit to a selected one of the relays 42, then same will be energized in the same manner and function to produce the same result. A similar limit switch 63 with its contact 64 is provided for the decoder in the same manner as that of the limit switch 54, 55. This limit switch determines whether or not the selection can be made through the decoder but the decoder will retain its impulse until after it has been removed. However, the line 50, 51 still functions as the stick circuit for the relay 42 in the same manner as that previously described.

The decoder is provided with a card or other initiating mechanism such as indicated at 65 which card or tape would be punched so as to provide a series of predetermined selection of numbers or other indicia when the particular commodity is being fed through the mill or other product requiring a marking throughout its production.

I claim:

1. A control for a fluid actuated piston comprising a fluid cylinder having a piston therein, a piston rod attached to said piston to provide a differential area and extending from one end of said cylinder to operate a member at fixed lineal positions, a series of spaced discharge ports in said cylinder at predetermined spaced relation to each other and commensurate with positions of operating said member, a fluid supply line connected to each end of said cylinder to supply fluid under the same pressure on both ends of said piston to move said piston to the piston rod end of the cylinder, valves closing said discharge ports, and operating means to open a valve controlling a selected port causing said piston to move and partially block said port to balance the forces on both sides thereof and thus actuate said piston rod to a predetermined position.

2. A control for a fluid actuated piston comprising a fluid cylinder having a piston therein, a piston rod attached to said piston to provide a differential area and extending from one end of said cylinder to operate a member at fixed lineal positions, a series of spaced discharge ports in said cylinder at predetermined spaced relation to each other and commensurate with positions of operating said member, a fluid supply line connected to each end of said cylinder to supply fluid under the same pressure on both ends of said piston to move said piston to the piston rod end of the cylinder, valves closing said discharge ports, and operating means to open a valve controlling a selected port causing said piston to move and partially block said port to balance the forces on both sides thereof and thus actuate said piston rod to a predetermined position, said operating means including an electromagnetic valve actuator means having contacts to create a holding circuit check through each of the operating means for every other valve control discharge port.

3. The control structure of claim 2 characterized in that said operating means includes an electromagnetic operator for said valve and a relay which relay provides said holding circuit for said relay and said electromagnetic valve actuator together with a front and back contact check circuit to supply said holding circuit.

4. The control circuit of claim 2 which also includes push button means for energizing the selected of said operating means, said push button means which must remain closed until said holding circuit is completed.

5. The control structure of claim 4 which also includes a check circuit closed by said operating means in either position to supply the current for said operating means through said push button means.

6. A control circuit of claim 2 which also includes a decoder means for selectively supplying current to said operating means to actuate the same to retain said holding circuit and the piston at a predetermined position until the circuit is again interrupted.

7. The control circuit of claim 2 which also includes push buttons for manually actuating each of said operating means and closing said holding circuit, and a decoder means for each operating means, and switch means to change the control from the manual position of each of said push buttons to the automatic position of each of said decoder means.

8. The structure of claim 7 which also includes a limit switch actuated by the member to be controlled to interrupt the supply of current to said push button means when the member to be operated is in position for operation while said holding circuit is maintained.

9. A control circuit for a fluid actuated marking wheel changer in a marking machine comprising a marking wheel with characters and having an indexing wheel connected therewith, said indexing wheel having the same number of sockets as character positions on said marking wheel, a double acting fluid cylinder having a piston therein with a piston rod extending from one end of the cylinder forming a differential piston area, a rack actuated by said piston rod and having a series of projections which mate consecutively with each of the sockets in said indexing wheel, a series of uniformly spaced discharge ports in said cylinder which are equal in number to the projections in said rack, a fluid supply line to each end of said cylinder to supply fluid under the same pressure on both ends of said piston to move said piston to the piston rod end of the cylinder, valves closing said discharge ports, and operating means to open the valve controlling a selected port causing said piston to move and partially

block said port to balance the forces on both sides thereof to actuate said rack and marking wheel, said operating means including an electromagnetic valve actuator means having contacts to create a holding circuit check through each of the operating means for every other valve control discharge port.

10. The control structure of claim 9 characterized in that said operating means includes an electromagnetic operator for said valve and a relay which relay provides a holding circuit for said relay and said electromagnetic valve actuator together with a front and back contact check circuit to supply said holding circuit.

11. The control circuit of claim 9 which also includes push button means for energizing the selected of said operating means, said push button means which must remain closed until said holding circuit is completed.

12. The control structure of claim 11 which also includes a check circuit colsed by said operating means in either position to supply the current for said operating means through said push button means.

13. A control circuit of claim 9 which also includes a decoder means for selectively supplying current to said operating means to actuate the same to retain the piston at a predetermined position until the circuit is again interrupted.

14. The control circuit of claim 9 which also includes push buttons for manually actuating each of said operating means, and a decoder means for each operating means and switch means to change the control from the manual position of each of said push buttons to the automatic position of each of said decoder means.

15. The structure of claim 14 which also includes a limit switch actuated by the member to be controlled to interrupt the supply of current to said push button means when the member to be operated is in position for operation.

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