ABSTRACT: An operator's control lever which is shifted to actuate a hydraulic motor is returned to the initial position to stop the motor after a preselected amount of travel of the element driven by the motor. A fluidic circuit has means producing digital signals indicative of successive increments of travel of the element and a counter for storing any preselected number of such signals. When the selected count is reached, a kickout means manipulates the operator's control lever to stop further operation of the motor. The count required to stop the motor, and thus the amount of travel of the element, may be changed by turning of a control knob. The system is applicable, for example, to limiting movement of the lift arms of a loader vehicle.
FLUIDIC MOTION-LIMITING SYSTEM FOR MOTOR-DRIVEN APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to systems for limiting the amount of movement of a motor-driven apparatus and more particularly to a system for stopping the movement of a motor-driven element at a preselected point in the travel of the element.

Many forms of motor-operated apparatus are equipped with motion-limiting means which automatically stops the motor after a predetermined amount of travel of a driven element. In certain equipment of this kind, it is necessary that the operator be able to adjust the system to change the amount of permitted travel of the element. In the absence of cumbersome linkage or complex electrical components, prior motion-limiting means of this kind have not been readily adjustable in this manner. In most cases, the operator must shut down the apparatus and leave his normal station and make the necessary adjustments in the area of the moving element. Many such prior systems require that motion-sensing means be situated at a location where the possibility of damage is high. Still further, such prior systems tend to be undesirably bulky, costly, prone to jamming and are not readily adaptable to different forms of powered mechanism.

The kickouts or positioners used to stop raising and lowering of the bucket on a loader vehicle are typical of the motion-limiting mechanisms discussed above and the invention will be herein described with reference to a loader, it being apparent that the invention is also applicable to other powered apparatus.

The bucket of a loader is carried by lift arms which are pivoted to a tractor vehicle and one or more hydraulic jacks, responsive to shifting of an operator's lever, provide for raising and lowering of the arms and the bucket. Detents are usually provided to hold the control lever in either of the raise or lower settings so that the operator need only initially position the control lever and may then remove his hand from the lever and turn his attention to other tasks while the bucket rises or drops. Kickouts of the kind referred to above are mechanisms which sense when the bucket has been lowered or raised to a predetermined desired position and then automatically release the detents so that the control lever returns to the hold position to stop further bucket movement without requiring any action on the part of the operator.

As such kickout systems are subject to the disadvantages of motion-limiting means in general as discussed above. Notably, any adjustment of the point of bucket travel at which the kickouts operate is difficult in that the operator must stop the loader, dismount from his station, and make time-consuming and intricate manipulations. When working under conditions where such adjustments are required frequently, operators tend to disregard the kickout system and to perform all bucket control movements manually thereby diverting their attention from other necessary operations. This is not only a source of inefficiency but may also constitute a safety hazard in that the operator must focus his attention on the bucket at a time when the vehicle is moving.

Further, the conventional kickouts require complex moving mechanisms, includingvalving and mechanical linkages, which are often damaged by impact from rocks or other material being handled and which frequently jam or otherwise malfunction.

SUMMARY OF THE INVENTION

This invention is a compact, inexpensive and highly reliable motion-limiting system for motor-driven apparatus which may be readily adjusted to change the limit of motion of an element 23 with such adjustment being made by simply changing the setting of an adjustable control which may be located at any convenient point.

The invention provides means for sensing movement of the motor-driven element to produce digital signals in a fluidic logic circuit wherein the accumulated total of such signals is indicative of the distance traveled by the moving element. After a predetermined number of such signals have been generated and counted, the motor control is automatically operated to stop the motor to limit further travel of the moving element. The number of counts needed to effect such action is variable as desired by changing the setting of a control which may be located at a position convenient to the operator.

Accordingly, it is an object of this invention to provide a motion-limiting system for motor-driven apparatus which may be readily adjusted to effect changes in the limit of motion of a moving element.

It is a further object of the invention to provide a compact, sensitive and versatile motion-limiting system for powered mechanisms which system has few moving parts and does not require the disposition of fragile elements at points where the potential for damage is high.

It is still another object of the invention to provide a more convenient and reliable kickout system for use in conjunction with the operator's controls of load manipulating elements in loader vehicles and the like.

The invention, together with further objects and advantages thereof, will best be understood by reference to the following description of a preferred embodiment in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. 1 is a side elevation view of a front-end loader, with portions thereof broken out, in which the present invention is utilized for automatic stopping of the raising and lowering of the loader bucket.

FIG. 2 is a side elevation view of the operator's control lever of the loader of FIG. 1 with certain hydraulic elements, operated by the lever, being shown in schematic form.

FIG. 3 is a section view of the operator's control mechanism of FIG. 2 taken along a line III--III thereof; and

FIG. 4 is a fluidic circuit diagram showing elements of the limit arm motion-limiting system of the loader of FIGS. 1 to 3.

Referring initially to FIG. 1 of the drawing, salient elements of a loader 11 include a tractor 12 having a bucket 13 pivoted to the front end of a forwardly directed lift arms 14. To provide for vertical travel of the bucket 13, the rearward end of the lift arms 14 is coupled to the tractor body by pivot connections 17 and fluid motors 16, generally a pair of hydraulic jacks, are coupled between the lift arms and the tractor body. Tilt linkage 18 is coupled between the bucket 13 and tractor body to maintain the bucket at a substantially constant inclination as the lift arms 14 are raised or lowered, with the linkage being formed in part of additional hydraulic jacks 19 which provide for pivoting of the bucket relative to the lift arms to perform rack back, dumping and other operations.

The lift motor 16 is controlled by manipulating a control lever 21, situated at the operator's station 22, which connects with a spool valve 23 through linkage 24. As shown schematically in FIG. 2, spool valve 23 may be a three-position valve with a RAISE setting at which a pump 26 delivers fluid from a supply reservoir 27 to the head end of lift motor 16 while venting the rod end of the motor to the reservoir. Valve 23 has a LOWER setting at which the output of the pump is transmitted to the rod end of lift motor 16 while the head end is vented and further has an intermediate HOLD setting at which the ports at both ends of the motor are closed while the output of pump 26 is diverted directly back to the reservoir 27. Control lever 21 is pivoted at its base to a support housing 28 for movement between the RAISE, HOLD, and LOWER settings and acts to shift the valve 23 between the above-described positions thereof through linkage 24.

Referring now to FIG. 3 in conjunction with FIG. 2, the lower end of control lever 21 extends into a slot 29 in support housing 28 and is transperenced by a pivot shaft 31 to provide for the fore and aft movement of the lever. To provide a hydraulically actuated detent mechanism 32 for temporarily
holding lever 21 at a selected position, shaft 31 is formed as an axial projection on a piston 33 which is slidable within a circular chamber 34 in the support housing 28 in a direction normal to the plane of movement of lever 21 whereby the piston may be caused to contact the piston of a selected position. To actuate the piston 33 for this purpose, the outer side of chamber 34 is defined by a circular closure 36 having a port 37 into which high-pressure fluid may be admitted and released. Shaft 31 extends through the base of lever 21 into a bore 38 in the opposite side of the support housing 28 and a compression spring 39, held by a fixed retainer pin 41, acts against the end of the shaft 31 at the position lever 21 so that the lever is not clamped in a fixed position except when fluid pressure in the chamber 34 overcomes the force of spring.

To urge lever 21 toward the center or HOLD setting, a table 42 extends downwardly from the lower end of the lever between spaced-apart downwardly directed legs 43 of the support housing 28 and one of a pair of compression springs 44 is disposed between the tab and each leg 43.

The structure of FIGS. 1 to 3 as described to this point provides a means for manually controlling the raising and lowering of the loader lift arms 14 and bucket 13 by manipulating control lever 21. However, the above described mechanism by itself would require that the operator hold lever 21 in either the RAISE or LOWER settings for the full time period required to raise or lower the lever to the selected position. To avoid this requirement, the invention provides fluidic circuitry which actuates the detent mechanism 32 to hold the control lever 21 at each of the RAISE and LOWER positions of the lever until the lift arms and bucket have risen or lowered to predetermined levels at which point the detent mechanism is automatically released enabling springs 44 to return the control lever to the HOLD position and stop further movement of the lift arms.

Referring now to FIG. 4 in conjunction with FIG. 3, the detent mechanism 32 is operated and released by shifting of a two-position spool valve 46. Valve 46 has a spool 47 which may be shifted, by application of air under pressure to a first control port 48, to couple the hydraulic fluid pump 26 to a conduit 37' connected to the previously described detent mechanism port 37 whereby actuating the detent to hold the control lever 21 at a selected setting. Application of air under pressure to an opposite port 49 of spool valve 46 shifts spool 47 conduit 37' with the drain reservoir 27 thereby releasing the detent mechanism 32 whereby the control lever 21 is spring returned to the HOLD setting.

Fluidic circuit elements which control the spool valve 46 are shown in FIG. 4 wherein standard symbols for fluidic elements are used with the letter S designating connections to a source of air under pressure and the letter E designating Exhaust or Vent ports of the several fluidic components. While the circuit will be described as utilizing pneumatic components, it will be apparent that the same circuit is adaptable to hydraulic fluidic elements.

In order to actuate the detent mechanism, movement of the control lever 21 into the LOWER or RAISE setting is detected by fluidic Schmitt triggers 51 and 52 respectively. Schmitt trigger 51 has control channels 53 and 53' connected to the air supply S through reservoirs (flow constructions) 54 and 54' with control channel 53 also being connected to a conduit 56 to the control lever assembly. Referring now again to FIGS 2 and 3 in conjunction, conduit 56 connects with a passage 57 in lever housing 28, a fluid port 87 passing through the cylinder 79 is connected to the inside of the fluid port 87 with the cover 88 in series and to the control lever 21, and port 87 is connected to the inside of the control lever 21 which is connected to the air supply S through reservoirs 54 and 54' (flow constructions) 55 and 55' with control channel 55 also being connected to a conduit 58 to the control lever assembly. Referring now again to FIG. 4, this release of pressure from conduit 56 and control channel 53 enables the air flowing into the opposite control channel 53' to shift the fluid spool 47 conduit 37' of air supply S through droplet detector 60 to output control channel 62. Output channel 62 then transmits air to one input 63 of an OR-gate 64 which responds by transmitting air through output channel 66 to one input 67 of an OR-gate 68 causing pressure to be switched form a first output channel 69 of OR-gate 68 to the second output channel 60' thereof. Output channel 69 connects with port 49 of spool valve 46 while output channel 69' connects with port 48 of spool valve 46. The above described action of OR-gate 68 causes spool 47 to shift to couple pump 26 with conduit 37' thereby actuating the detent mechanism 32 of FIG. 3 to clamp the lever 21 at the LOWER setting. Thus, anytime that the operator shifts the lever 21 into the LOWER setting, it is immediately held thereat by the actuation of the detent mechanism 32 as described above.

A similar action is shifts the lever 21 in the other direction to the RAISE setting. Referring again to FIGS. 2 and 3, a second passage 71 in support housing 28 has an end 72 situated to be blocked by lever 21 when the lever is in the HOLD or LOWER settings but which is uncovered when the lever is moved into the RAISE setting, thereby venting a conduit 73. Referring now again to FIG. 4, conduit 73 connects with the signal input channel 74 of Schmitt trigger 52, the input channel 74 and the opposite control channel 74' being connected to air supply S through resistors 76. As in the previous instance, the release of pressure from conduit 73 enables the airflow into control channel 74' to switch the flow through the Schmitt trigger from the vent channel E to output channel 78. Channel 78 connects with the other input 63' of OR-gate 64. Consequently, through the previously described action of OR-gate 64 and 68, the movement of the control lever into the RAISE setting also operates spool valve 46 to actuate the detent mechanism 32, thereby holding the control lever at the RAISE setting.

Thus, the control lever is immediately held at either the RAISE or LOWER positions once it is moved to such positions and the operator may remove his hand and direct attention to controlling other aspects of the vehicle during the period that the lift arms rise or fall. This desirable mode of operation further requires that means be provided for determining when the lift arms have risen or lowered the desired amount and further requires means which then releases the detent automatically so that the control lever springs back to the HOLD position and stops further lift arm movement.

Referring to FIGS. 1 and 4 in combination, a portion of the control lever 21 is connected between the body of tractor 12 and lift arms 14, by pivot connections 81, to generate fluidic digital signals indicative of movement of the lift arms.

Referring again to FIG. 4 in particular, digitizer cylinder 79 includes a cylinder 82 and a rod 83 which is slidable therein in an axial direction whereby lowering of the lift arms contracts the rod into the cylinder and raising of the lift arms expands the rod further out of the cylinder. A passage 84 within the rod 83 is coupled to air supply S through a resistor 86 and connects with a port 87 in the side of the rod. Port 87 is normally blocked by the adjacent inner wall of cylinder 82 but passes across a port 88 in the side of the cylinder, as the lift arms approach the lower portion of the downward travel.

Momentary venting of rod port 87 in the cylinder generates a fluidic signal which conditions a binary counter 89, comprised of a series of fluidic binary counting elements 91, to begin a count indicative of the amount of further downward travel of the lift arms. In particular, the signal input control channel 92 of another fluidic Schmitt trigger 93 is connected to rod passage 84 with the other control channel 92' being connected to air supply S through a resistor 94 whereby the passage of port 87 past port 88 diverts the airflow through the flip-flop from an outlet channel 101, which connects with the reset channel 102 of each of the binary counting elements 91, to a vent channel E of the flip-flop. This condition depressurizes all of the binary counting elements 91 to condition the counter 89 to begin a counting sequence.

Signals indicative of further movement of the rod 83 into cylinder 82 are generated by momentary exhausting of a
passage 103 rod 83 as an end port 104 thereof passes along a series of ports 106 in the wall of cylinder 82. Passage 103 is connected with the air supply S through a resistor 107 and also connects with the signal input channel 108 of another Schmitt trigger 109. The other control channel 108' of Schmitt trigger 109 connected to the air supply through a resistor 111 and thus passage of port 104 past each of the cylinder ports 106 acts to momentarily divert the airflow through Schmitt trigger 109 from vent E to an output channel 112. Output channel 112 is connected with the signal input A of the first of the series of binary counting devices 91.

Binary counter 89 is comprised of four of the counting devices 91, here identified as 91a, 91b, 91c, and 91d, each having an input A and outputs F1 and F2 in addition to the common reset input 102. The input A of each device 91, other then the first, is coupled to the F2 output of the preceding device so that the sequence operates as a binary counter in a manner understood in the data processing art. In particular, the first device 91a changes state with each incoming signal while the second device 91b changes state with every other incoming signal and the cice 91c changes state with every fourth signal while the final device 91d changes state only upon the eighth signal of the sequence. Thus, the devices 91 jointly assume a condition after each incoming signal which is unique and indicative of the number of such signals that has been received at that time.

To monitor the count stored in counter 89, to initiate stopping of the down apparently movement of the loader lift arms at a preselected time, a sequence of four AND-gates 118a to 118d are connected between the counting devices 91 and a sequence of eight distinct fluid signal channels 122—1 to 122—8. AND-gates 118 function to pressurize the particular one of the channels 122 which corresponds to the number of counts which has been received by counter 89 at any given time. For this purpose, the F1 output of device 91a is coupled to one input A of AND-gate 118a and is also coupled directly to channel 122—1. Thus, channel 122—1 is energized when the first count is received by counter 89 inasmuch as device 91a changes state at that time to pressurize its output F1. Output F1 of device 91b is connected with channel 122—2 and also to one input A of AND-gate 118b. Thus, channel 122—2 is pressurized after the second incoming signal as 91b changes state at this time to pressurize its output F1. Output F1 of device 91c is coupled with channel 122—3 and also to one input B of AND-gate 118c while the output F of gate 118a is coupled to the third channel 122—3. Thus, the above described connections provide for pressurization of channel 122—3 after the third signal is received, inasmuch as both inputs A and B of AND-gate 118a are pressurized at that time and therefore the AND gate transmits pressure to its output F and thus to line 122—3. The output F1 of device 91c is coupled directly to channel 122—4 and device 91c first changes state upon the fourth signal. Channel 122—5 is pressurized upon the fifth signal in that it is coupled to the output F of AND-gate 118b which has one input A coupled to output F of device 91a and the other input B coupled to output F of AND-gate 118a so that the condition existing after the fifth pulse enables gate 118b to transmit pressure to its output F1. Output F1 of AND-gate 118c employed after the sixth pulse, the output F of AND-gate 118c is coupled to channel 122—6 with the inputs of gate 118c being coupled respectively to the output of AND-gate 1180 and the F1 output of device 91a. Channel 122—7 is pressurized after the seventh incoming signal through a connection to the output F of AND-gate 118a, the two inputs of gate 118c being connected respectively to the output F of AND-gate 118a and the output F1 of counting device 91c. Channel 122—8 is pressurized after the eighth pulse through a direct connection to output F1 of the final counting device 91d which does not change state until the last signal of the sequence y is received.

Considering now an important aspect of the invention, the operator is provided with a manually adjustable multiposition fluidic switch 119 for selecting the point at which motion of the lift arm and buckets is to be automatically stopped. As shown in FIG. 1, the switch 119 may include a rotatable knob 119a positioned within easy reach of the operator's hand at operator's station 22, the switch being located on the console at the front of the operator's station in this instance. Referring now again to FIG. 4, switch 119 has a series of settings including an off or zero position and a number of additional positions equal to the number of channels 122, there being eight such additional positions in this example. Rotation of knob 119a to any of the positions thereof connects an output line 121 with a corresponding one of the channels 122. Thus, output line 121 will be pressurized when the particular channel 122 associated with the selected setting of dial 119 is pressurized as described above. Thus, the point in the travel of rod 83 into cylinder 82 at which switch output line 121 is pressurized is determined by the selected setting of switch 119 and may be varied as desired by adjusting the knob 119a.

Pressurizing of the switch output line 121 in this manner transmits air to one input channel of an AND-gate 124 which has the other input channel already pressurized through a connection 126 to the previously described output channel 62 of Schmitt trigger 51 which was pressurized by the original manipulation of the control lever. Accordingly, the airflow through AND-gate 124 is switched to the output channel 127 of the gate. Output terminal 127 is coupled to the second control channel 67 of the previously described OR-gate 68 that controls spool valve 46. Receipt of a signal at the second control channel 67 of gate 68 returns the airflow therethrough from port 48 of spool valve 46 back to port 49 thereof thereby shifting spool 47 to vent conduit 37.

Referring now again to FIGS. 2 and 3 in conjunction, venting of conduit 37 releases the detent mechanism 32 enabling springs 44 to return the control lever 21 to the on or HOLD position. This shifts the lift motor control valve 23 to stop further travel of the lift arms.

Referring now again to FIG. 4, the circuit operates in an essentially similar manner to stop raising of the lift arms at any preselected one of a number of points. As rising of the lift arms extends rod 83 from cylinder 82, an additional port 88' in the cylinder is positioned to momentarily vent port 87 as the lift arms approach the final portion of upward travel. As previously described, the momentary exhausting of rod passage 84, acting through Schmitt trigger 93 and flip-flop 98 conditions the binary counter 89 for a counting sequence. As the rod 83 extends further, fluidic signals are generated periodically by momentary venting of rod passage 103 by an additional series of ports 106 which are similar to ports 106 but situated near the opposite end of cylinder 82.

Such signals are counted as previously described with respect to lowering of the lift arms. The number of counts required to stop raising of the lift arms is determined by the setting of a second multiposition fluidic switch 128 which is also situated at 128's station 22 of the loader as shown in FIG. 1. Referring again to FIG. 4, setting of a knob 128' of switch 128 at any of the positions thereof other than the initial or OFF position connects an output line 121' with one of the previously described channels 122 each of which is pressurized after a corresponding number of signals have been received at counter 89. Pressurizing of output line 121' because of the accumulation of the requisite number of counts applies air pressure to one of the control channels of an ANDgate 124'. The other control channel of gate 124' is coupled to output channel 78 of Schmitt trigger 52. AND-gate 124' then transmits air pressure through output channel 129 to control channel 67 of OR-gate 68. Gate 68 responds by shifting spool valve 46 to deenergize the detent mechanism 32 of FIGS. 3 and 4 thereby releasing the control lever 21 and stopping further extension of lift motor 16.

Referring now again to FIG. 1, while the motion-limiting system has been herein described with reference to the action of the lift motors 16 in raising and lowering the lift arms 14 and buckets 13, it will be apparent that such a system may also be utilized to automatically limit the action of lift motors 19 in pivoting the bucket 13 about the end of the lift arms.
Similarly, it will be apparent that the system is not confined to crawler tractor loaders of the kind herein described for purposes of example, but has diverse uses where motor-driven elements are to be automatically stopped at a predetermined and adjustable point in the travel thereof.

What is claimed is:

1. A system for stopping movement of a motor-driven element at any selected one of a plurality of points in the travel of said element comprising a motor a control element having a first position at which said motor is actuated and a second position at which said motor is stopped, a fluidic signal generator coupled to said element and responding to movement of said element by producing a fluidic signal as said element reaches each of a plurality of points in said travel thereof, fluidic signal-counting means coupled to said signal generator for counting the number of said signals produced thereby, and fluid circuit means coupled between said signal-counting means and said motor control for shifting said motor control to said second position thereof after receipt of a fluidic signal indicating the occurrence of a respective one of said fluidic signals at said counting means, said fluid circuit means having an adjustable component for selecting the number of said signals required to shift said motor control to said second position thereof.

2. The combination defined in claim 1 wherein said motor control is manually operable and further comprising means urging said control toward said first position thereof and further comprising a fluidic-operated detent holding said control at said second position thereof after being manually moved to said second position, said fluid circuit means being coupled to said detent to release said detent after receipt of a fluid signal of preselected number of fluidic signals at said counting means.

3. The combination defined in claim 2 wherein said control is a lever and said detent has a fluid pressure-controlled member movable against said lever to clamp said lever at said first position thereof and wherein a valve is coupled between said member and a source of fluid under pressure to operate said detent and wherein said fluid circuit means is comprised of an element defining a fluid passage with a port which is vented and closed by movement of said lever between said positions thereof to generate a fluidic signal upon movement of said lever to said first position thereof, and fluid circuit means coupled between said passage and said valve for operating said valve to apply said detent to said lever in response to said signal in said passage.

4. The combination defined in claim 2 further comprising a source of fluid under pressure, a detent control valve coupled between said fluid-operated detent and said source and having one position transmitting fluid from said source to said detent and having another position exhausting said detent, said detent control valve being shifted between said positions thereof in response to fluidic signals, means shifting said detent control valve in response to movement of said motor control to said first position thereof whereby said detent is actuated to hold said motor control lever thereat, and means generating a fluidic signal to shift said detent control valve back to the other position thereof after receipt of said preselected number of fluidic signals at said counting means whereby said detent is released.

5. The combinations defined in claim 1 wherein said fluidic counting means is comprised of a series of fluidic binary counting devices each having a signal input and a pair of outputs with the input of a first device being coupled to said signal generator whereby said devices are independent of the total number of signals received at that time, said control circuit means being comprised of a plurality of fluidic channels, logic circuit means coupled between said binary-counting devices and said channels for transmitting a signal to the one of said channels corresponding to the number of counts registered by said counting means, a manually adjustable multiposition valve having a plurality of inputs each connected to a separate one of said channels and having an output signal channel selectively connectable with any one of said inputs, and means for shifting said motor control to said second position thereof in response to a signal in said output channel of said multiposition valve.

6. The combination defined in claim 1 wherein said fluidic signal generator is comprised of a cylinder having a plurality of openings spaced apart along the length of the wall thereof, a rod extending within said cylinder in coaxial relationship therewith and being slidable in an axial direction relative thereto, said rod having a first passage with a port which passes successive ones of said openings of said cylinder as the rod is moved axially relative thereto, coupling means providing for relative movement between said rod and said cylinder in response to movement of said motor-driven element, a source of fluid under pressure coupled to said rod passageway and said rod, and a flow restriction connected between said source of fluid and said passageway of said rod whereby the pressure within said passageway is momentarily reduced to produce a fluidic digital signal as said passageway each of said openings of said rod.

7. The combination defined in claim 6 further comprising a fluidic Schmitt trigger having a signal input control channel coupled to said passageway of said rod and having a second control channel coupled to said air supply through a flow construction and having an output channel coupled to said fluidic signal counting means whereby venting of said passageway of said rod as said port thereof passes each of said openings of said rod cylinder actuates said Schmitt trigger to deliver a signal to said fluidic signal counting means.

8. The combination defined in claim 6 wherein said rod has an additional passageway and port, said additional port being situated to be vented by an opening in the wall of said cylinder during movement of said rod relative to said cylinder prior to the juxtaposition of said port of said first passageway with the first of said openings, said additional passageway of said rod being coupled to said air supply through a second fluid construction whereby the pressure in said additional passageway is momentarily reduced as said additional port is vented to produce a start of count signal in said second passageway, and means transmitting said start of count signal to the reset line of said fluidic signal counting means.

9. The combination defined in claim 6 wherein said system stops movement of said motor-driven element in each of two directions of travel thereof, said cylinder having a first portion of said plurality of openings near one end section of the cylinder and having the other portion of said plurality of openings near the opposite end section of the cylinder whereby a sequence of fluidic digital signals is generated in said rod passageway as said rod approaches maximum contraction into said cylinder and as said rod approaches maximum extension from said cylinder.

10. The combination defined in claim 9 wherein the fluid circuit means coupled between said signal-counting means and said motor control has a pair of said adjustable components for selecting the number of said signals required to shift said motor control to said second position whereby the position at which said motor-driven element is stopped at one extreme of travel thereof may be changed independently of the position at which said element is stopped at the other extreme of travel thereof.