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(54) **FLUID-POWERED PRECISION OSCILLATOR.**

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Description

The invention relates to a fluid-powered precision oscillator having a cylindrical housing, a piston displaceable in the housing and being connected to a piston rod extended through a front end wall of the housing, and a control means for automatically reversing the direction of movement of the piston and of the piston rod, wherein the piston rod is hollow and a screw is rotatably journalled in a rear end wall of the housing, with a first end thereof extending into the hollow piston rod and engaging a nut fixed to the piston rod and at a second end thereof carrying a toothed code disk cooperating with a reading fork for feeding pulses corresponding to the movement of the piston and of the piston rod to a control circuit which in turn emits signals for operating the oscillator dependent upon the pulses fed into the circuit.

In its most general form an oscillator may simply be an automatically returning or reversing cylinder, and within the prior art such an automatically reversing cylinder is known being provided with a double-ended piston rod and a valve block attached directly to the rear end wall of the cylinder. Thereby, the rod extended through the rear end wall of the housing acts directly as a valve slide in the valve block, for reversing the direction of movement of the cylinder in its end position. The most serious limitation inherent in such an automatically reversing cylinder is that it, as has been mentioned above, returns or reverses at fixed end positions which means that the stroke length cannot be adjusted.

As a further development of the above indicated automatically reversing cylinder having a fixed stroke length, attempts have also been made to employ inductive sensors along the cylinder for detecting the position of the piston therein. By means of the inductive sensors, which may be adjustable along the cylinder, the actuating valves of the cylinder have been controlled for reversing the movement of the cylinder. Although the stroke length of the oscillating movement may be adjusted with this configuration, it is not possible to achieve any high accuracy in detecting the position of the piston and thus not in the adjustment of the stroke length either. Accordingly, it is not preferable to employ such a prior art structure in cases where the demands for accuracy are high.

Although the present invention may be used within many fields, one embodiment thereof is especially intended for solving the problems encountered in connection with oscillating spray pipes used at paper mills for cleaning the wire. The spray pipes are tubes provided with a sequence of bores along their length, through which bores water is sprayed onto the wire for cleaning the same. The spray pipes are extended transversely in relation to the wiew and are oscillated back and forth for cleaning the wire across its full width, and in that connection it is essential for the efficient cleaning, that the spray pipe is moved with a constant speed.

Presently electrical oscillator in the shape of reversible motors are primarily used for moving the spray pipes across the width of the wire. One of the most serious disadvantages of these presently used oscillators, is that when their direction of movement is reversed they will be at a standstill during a short period of time. However, since the spray pipe water is ejected having a very high pressure and in a thin jet from the bores of the spray pipes, a very short standstill, with a duration of one or a few seconds, may also lead to the fact that the water jets simply cut off threads of the wire. This means that the wire is worn comparatively quickly and that its effective life becomes unsatisfactorily short before it has to be replaced.

Moreover, JP-A-60-129409 describes a pneumatic cylinder having the general structure as described in the first paragraph of the specification. By means of said structure this prior art cylinder provides a solution to the problem of obtaining high positioning accuracy. However, the prior art cylinder employs conventional means for supplying and discharging high pressure air to and from respectively the cylinder chambers and is therefore not suitable for use as a precision oscillator which is required to operate smoothly and without jerks or stops.

A basic object of the present invention is therefore to provide a fluid-powered oscillator of the kind indicated in the introduction, which does not stop in the position where its direction of movement is reversed but reverses without any delay or standstill, and which simultaneously operates smoothly and without jerks.

This object is achieved by means of an apparatus having the features indicated in the characterizing portion of the enclosed claim 1.

Advantageous further developments and embodiments of the invention are claimed in the dependent subclaims.

A preferred embodiment of the invention is described more closely below with reference to the enclosed drawings, on which:

- Fig. 1 is a partially schematic plan view, partially in cross-section, of the fluid-powered oscillator according to the invention,
- Fig. 2 is an end view of the oscillator according to Fig. 1,
- Fig. 3 is a longitudinal section through the oscillator according to Figs. 1 and 2, along the line A-A in Fig. 2,

Fig. 4 is a schematic illustration of a pressure fluid circuit for manoeuvring the oscillator,

Fig. 5 is a perspective view of the means for detecting the position of the piston and piston rod of the oscillator according to Figs. 1-3, and

Fig. 6 is a schematic operational diagram illustrating the electronics of the control unit.

Although the invention in its preferred embodiment is especially intended for oscillating spray pipes, as stated above, it should be emphasized that the invention is in no way restricted to this specific use, but that the oscillator according to the invention with the same benefit may be employed in other situations where an oscillating movement is required.

With reference to Figs. 1-3, it is evident that the oscillator 1 according to the invention basically consists of a piston and cylinder assembly 2 having a cylindrical wall or jacket 3, a front end wall 4, a rear end wall 5 and a valve block 6 which is protected by means of a cover 6a and which is attached directly to the rear end wall 5. A piston rod 8 is extended through an aperture 7 in the front end wall 4, and this piston rod is at its rear end connected to a piston 9 displaceable in the cylinder 3 (see Fig. 3).

Moreover, as is clear from Fig. 3, the piston rod 8 is provided with a central bore 13 opening towards the piston 9 and being closed towards the free outer end of the piston rod. A central tube 14 is centrally mounted in the bore 13 and more specifically it is mounted with its forward end in connection with the bottom of the bore 13 so that it is supported in a cantilever manner. The central tube 14 is furthermore mounted such that its free rear end terminates substantially at a level with the rear surface of the piston 9 facing the rear end wall 5 of the cylinder assembly. Thus, the piston 9 is likewise provided with a central, through-bore 15 through which the central tube 14 is extended, at a distance from the wall of the bore 15.

A nut 16 is firmly connected to the free rear end of the central tube and is with the major portion of its length provided inside the central tube. The nut 16 is preferably manufactured from a plastic material, and as is illustrated especially in Fig. 5, a number of slits 16a, preferably three, are provided extending from the forward end of the nut 16 and along a substantial portion of its length, whereby a number of resilient sections 16b are formed. A groove 16c is provided adjacent the forward ends of the resilient sections 16b, and a biasing means, such as an O-ring 17, is provided in this groove, whereby the O-ring 17 has such a diameter that in its mounted position it exerts a force against the sections 16b of the nut for pressing the same inwardly towards each other.

It is also clear from Fig. 3 that the rear end 5 of the oscillator is likewise provided with a central aperture 10 in which a screw 11 is rotatably journalled by means of roller bearings 18 which are only schematically illustrated. The screw 11 is provided with a finished, for instance polished, worm thread having a suitable pitch and extends with its forward end into the hollow piston rod 8, thereby engaging the nut 16 which is provided with a corresponding thread. It is obvious that through the compressive force supplied by the O-ring 17 the resilient sections 16b of the nut 16 will be firmly pressed against the screw 11, whereby an engagement substantially free from play is achieved between the threads of the nut and the screw. A guide tube 19 is firmly supported in the rear end wall 5, surrounding the central aperture 10 therein. Accordingly, the guide tube 19 is likewise extended inside the hollow piston rod 8 and terminates with its free end at a short distance from the bottom of the bore 13, when the piston rod is in its rear position. This means that the guide tube 19 surrounds the central tube 14 with a small gap 12 therebetween, and also surrounds the nut 16 and the screw 11 situated within the central tube 14. It will be understood that the purpose of the guide tube 19 is to stabilize the structure by acting as a guide for the nut 16 and the central tube 14. The outer periphery of the guide tube 19 is sealed relative to the bore 15 of the piston 9 by means of seals 20 for preventing pressure fluid rearward of the piston to enter the interior of the piston rod.

The screw 11 extends with its rear, non-threaded end outside the rear end wall 5 and into a recess 21 provided in the valve block 6. Adjacent its rear end the screw is likewise sealed in relation to the central opening 10 by means of seals which are not illustrated in detail, and these seals are provided in order to prevent exit of lubricant used for lubricating the screw and the nut. At the rear end of the screw 11, in the recess 21, the screw is provided with a code disk 22 which at its outer circumference, is provided with a great number of evenly distributed teeth 23, as illustrated in Fig. 5. It must be pointed out that for the sake of clarity the teeth 23 of the code disk 22 are illustrated in Fig. 5 being slightly enlarged and having exaggerated gaps between the teeth, compared to the configuration suitable for achieving highly accurate stroke length adjustment. In the recess 21 there is also provided a reading fork or head 24 of a conventional structure and comprising a light emitting diod in one leg and a photocell in the other leg. The reading fork is positioned such that it straddles the code disk, and when the screw is rotated the toothed outer circumference of the code

disk 22 will therefore effect pulsing of the light emitted from the light emitting diod and detected by the photocell. Through a block terminal 25 these pulses are conducted to an electronic control circuit 39 illustrated schematically in Fig. 6 and briefly described below.

Figs. 1-3 and Fig. 4 schematically illustrate that the valve block 6 comprises an inlet 26 for pressure fluid supplied from a pressure fluid source 27, and an outlet 28 for discharging pressure fluid to a pressureless reservoir 29. A pressure limiting or reducing valve 30 is provided in connection with the pressure fluid inlet 26 and serves to keep the working pressure at a constant, predetermined level. From the pressure limiting valve 30 the pressure fluid is conducted to a flow regulator valve 31 provided for adjusting the pressure fluid flow and thereby the translational velocity of the oscillator. The valve block 6 is furthermore provided with two two-way valves or on/off valves 32, 33 operating in the manner illustrated in the pressure fluid diagram of Fig. 4. The actual connecting bores of the valve blocks 6 are not illustrated but may be formed in a manner obvious to a man skilled in the art for achieving the circuit schematically illustrated in Fig. 4.

With reference to the pressure fluid diagram it is clear that regulated pressure fluid is continuously conducted to a first working port 34 (compare also with Fig. 3) which continuously supplies pressure fluid to the front side of the piston 9 through a passage 35 in the rear end wall 5, a connecting pipe 36 and a passage 37 in the front end wall 4. Pressure fluid for extending the piston rod 8 is conducted to the rear side of the piston 9 through the first two-way valve 32, a second, not illustrated working port and a likewise not illustrated passage in the rear end wall 5, when the first two-way valve 32 is in its open condition. When retracting the piston and piston rod, with the first two-way valve in its closed condition, pressure fluid is conducted from the rear side of the piston 9 through the passage (not shown) in the rear end wall 5, through the second working port in the valve block 6, communicating with the passage of the rear end wall 5, through the second, open two-way valve 33 and through the outlet 28 of the valve block 6 and into a reservoar 29. Alternatively the pressure fluid behind the piston 9 may be discharged through a separate outlet port in the rear end wall 5 and to the second two-way valve 33 (illustrated by means of a chain-dotted line in Fig. 4).

As described above pressure fluid is continuously supplied to the front side of the piston 9 having a smaller active or effective area than the rear side of the piston, whereby the oscillator operates with a differential pressure. This is especially advantageous when the oscillator is employed for driving spray pipes where it is important that the oscillator does not stop in the position where its direction of movement is reversed. Due to the above described regulation of the pressure fluid flow and pressure by means of the valves 30 and 31 and due to the fact that the effective areas of the piston 9 are dimensioned such that the effective area at the rear side of the piston is double the effective area at the front side of the piston rod, it is furthermore possible to achieve that the oscillator operates with the same speed in both directions.

In order to determin the starting point for measuring the stroke length of the oscillator 1 a preferred embodiment of the invention employs an inductive sensor 38 positioned in the rear end wall 5 and detecting the home position of the piston 9, i.e. the end position against the rear end wall 5. This inductive sensor 38 is likewise connected to the electronic control circuit 39 through the block terminal 25. The electronic control circuit 39 is schematically illustrated in Fig. 6 and comprises a main switch 41 for activating the system, a start pulse switch 42 for starting and a counter unit 43 for counting pulses.

In the initial position the piston 9 of the oscillator is in its home position, i.e. against the rear end wall 5, and pressure fluid acts upon the front side of the piston and the rear side of the piston is unloaded or pressureless due to the fact that the first two-way valve 32 is in its closed condition and the second two-way valve 33 is in its open condition. When the piston 9 is in its home position the counter unit 43 is reset and may be programmed for a desired stroke length, i.e. a pulse number corresponding to the desired stroke length, through an operation panel 40. When the desired stroke length has been programmed a starting pulse is given through the start pulse switch 42 whereby the first two-way valve 32 opens and the second two-way valve 33 closes so that pressure fluid is introduced at the rear side of the piston 9 and moves the piston 9 to the left in Fig. 3 against the pressure acting upon the smaller area at the front side of the piston. As the piston 9 and the piston rod 8 move to the left the central tube 14 and the nut 16 are also moved to the left, whereby the screw 11 engaging the nut through its threads, starts to rotate. The rotation of the screw 11 also causes the code disk 22 to rotate so that its toothed outer circumference generates pulses in the reading head or fork 24, said pulses being conducted to the counter unit 43 of the control circuit 39.

In this connection it shall also be pointed out that through the above described design of the nut having flexible sections being pressed together by the O-ring 17, very high accuracy is achieved in

the detection of the stroke length, and with a suitable design of the code disk it is more specifically possible to achieve an accuracy of up to approximately five hundreds of a millimeter in the detection of the stroke length.

At this stage it should also be mentioned that the accuracy of the stroke length adjustment is dependent i.a. upon the toothing of the code disk 22 and the pitch of the thread of the screw 11 and of the nut 16. When choosing the pitch for the thread it should also be taken into consideration that the pitch may not be chosen too small since the resistance to the transmission of the linear movement of the nut 16 to a rotational movement for the screw 11 increases with the reduction of the pitch, whereas the accuracy is increased with the reduction of the pitch for the thread, i.e. that the rotational movement of the screw increases per unit of length of the linear movement of the nut 16. Accordingly, the pitch must be chosen such as to be optimal with reference to both these parameters.

When the programmed number of pulses have been detected by the reading fork 24 and have been transmitted to the counter unit, the latter gives a signal to the oscillator to reverse, and more specifically this is accomplished by transmitting the signals to the valves 32, 33 so that the first two-way valve 32 closes and the second two-way valve 33 opens, whereby pressure fluid at the rear side of the piston 9 is conducted to the pressureless reservoar 29 and the pressure fluid constantly acting upon the front side of the piston 9 immediately reverses the direction of movement and starts to move the piston 9 to the right in Fig. 3, and with a speed corresponding to that of the movement to the left, since the pressure fluid acts upon an area which is the same size as the differential area for the movement to the left. The piston 9 and the piston rod 8 are moved to the right until they reach the home position against the rear end wall 5, whereby the inductive sensor 38, when detecting the home position, gives a signal for resetting the counter unit 43 and for opening the first two-way valve 32 and for closing the second two-way valve 33, whereupon the process is repeated in such a way that an oscillating movement back and forth is achieved.

When it is desired to stop the oscillator the main switch 41 is opened, whereby the oscillator finishes the commenced stroke due to the fact that a relay 50 is connected in parallel with the main switch 41, said relay being maintained activated as long as the home position is not detected by the sensor 38. When the oscillator subsequently reaches the home position the relay 50 releases and the oscillator stops.

The control circuit may also be provided with a not illustrated movement monitoring stopping the oscillator after an adjustable delay in the absence of pulsing during operation. A signal output from the monitoring may for instance be employed for activating an alarm.

In view of the above description it should now be obvious that the oscillator 1 suggested according to the invention permits very accurate setting of the stroke length as well as the translational velocity of the oscillator, whereby the velocity of the oscillator is also the same in both directions of movement. A further advantage of specific importance in connection with oscillating spray pipes is also, as mentioned above, that the oscillator reverses without any delay or standstill at all.

Claims

1. Fluid-powered precision oscillator having a cylindrical housing (3), a piston (9) displaceable in the housing and being connected to a piston rod (8) extended through a front end wall (4) of the housing, and a control means (11, 16, 22, 24, 39) for automatically reversing the direction of movement of the piston and of the piston rod, wherein the piston rod (8) is hollow and a screw (11) is rotatably journalled in a rear end wall (5) of the housing (3), with a first end thereof extending into the hollow piston rod (9) and engaging a nut (16) fixed to the piston rod (8) and at a second end thereof carrying a toothed code disk (22) cooperating with a reading fork (24) for feeding pulses corresponding to the movement of the piston (9) and of the piston rod (8) to a control circuit (39) which in turn emits signals for operating the oscillator (1) dependent upon the pulses fed into the circuit, **characterized** by a continuous pressure fluid supply (35, 36, 37) to the front side of the piston (9) and by a pressure fluid supply to the rear side of the piston (9) controlled by means of a first two-way valve (32) and a pressure fluid discharge from the rear side of the piston (9) controlled by means of a second two-way valve (33).

2. Fluid-powered precision oscillator according to claim 1, **characterized** in that the piston rod (8) is provided with a central bore (13) extending along the major portion of its length, opening towards the piston (9) but being closed towards the free outer end of the piston rod (8), in that a central tube (14) is mounted cantilevered in connection with the bottom of the bore (13), is extended through the bore (13) substantially up to a position at a level with the surface of the piston (9) facing the

rear end wall (5) and in its free end carries the nut (16), and in that the nut (16) and the central tube (14) with a small clearance are surrounded by a guide tube (19) attached to the rear end wall (5) and extended into the bore (13), said guide tube at its outer circumference being sealed against a central aperture (15) extending completely through the piston (9), by means of seals (20).

3. Fluid-powered precision oscillator according to claim 1 or 2, **characterized** by a pressure limiting valve (30) and a flow regulator valve (31) for setting the pressure and flow respectively of the pressure fluid supplied to the front and rear side respectively of the piston.

4. Fluid-powered precision oscillator according to claim 3, **characterized** in that the first and second two-way valves (32, 33), the pressure limiting valve (30) and the flow regulator valve (31) are provided in a valve block (6) attached directly to the rear end wall (5).

5. Fluid-powered precision oscillator according to any of the preceding claims, **characterized** in that the ratio of the effective areas at the front and rear side respectively of the piston is 1:2.

6. Fluid-powered precision oscillator according to any of the preceding claims, **characterized** in that the control circuit (39) comprises a counter unit (39) programmable with the pulse number corresponding to the desired stroke length, intended for recording the pulses detected by the reading fork (24) during the operation of the oscillator (1) and intended for comparing the detected pulses with the programmed pulse number.

7. Fluid-powered precision oscillator according to claim 6, **characterized** in that an inductive sensor (38) for detecting the home position of the piston (9) against the rear end wall (5) and for resetting the counter unit when detecting the home position is connected to the control circuit (39).

8. Fluid-powered precision oscillator according to any of the preceding claims, **characterized** in that the nut (16) is provided with a number of, preferably three, slits (16a) extended from one of its ends and distributed around its circumference, for forming resilient sections (16b), and in that a groove (16c) is provided around the circumference of the nut (16) in the region of the resilient sections (16b) and in that a means biasing the sections (16b) inwardly towards each other is provided in the groove (16c).

9. Fluid-powered precision oscillator according to claim 8, **characterized** in that the screw (11) is provided with a finished or polished worm thread and in that the nut is provided with a corresponding internal thread.

Patentansprüche

1. Fluidangetriebener Präzisionsoszillator mit einem zylindrischen Gehäuse (3), einem Kolben (9), der in dem Gehäuse verstellbar und mit einer Kolbenstange (8) verbunden ist, die sich durch die Vorderendwand (4) des Gehäuses erstreckt, und einer Steuereinrichtung (11, 16, 22, 24, 39) zum automatischen Umkehren der Bewegungsrichtung des Kolbens und der Kolbenstange, wobei die Kolbenstange (8) hohl und eine Schraube (11) in einer Hinterendwand (5) des Gehäuses (3) drehbar gelagert ist, wobei sich ein erstes Ende der Schraube in die hohle Kolbenstange (9) hinein erstreckt und in eine Mutter (16) eingreift, die an der Kolbenstange (8) befestigt ist, und wobei die Schraube an einem zweiten Ende eine gezahnte Codescheibe (22) trägt, die mit einer Auslesegabel (24) zusammenwirkt, um der Bewegung des Kolbens (9) und der Kolbenstange (8) entsprechende Impulse einem Steuerschaltkreis (39) zuzuführen, der zum Betreiben des Oszillators (9) seinerseits Signale ausgibt, die von den dem Schaltkreis zugeführten Impulsen abhängen,
gekennzeichnet durch
eine kontinuierliche Druckfluidzuführung (35, 36, 37) zu der Vorderseite des Kolbens (9) und durch eine Druckfluidzuführung zu der Rückseite des Kolbens (9), die mittels eines ersten Zweiwegeventils (32) gesteuert ist, und einen Druckfluidauslaß von der Rückseite des Kolbens (9), der mittels eines zweiten Zweiwegeventils (33) gesteuert ist.

2. Fluidangetriebener Präzisionsoszillator nach Anspruch 1,
dadurch **gekennzeichnet,**
daß die Kolbenstange (8) mit einer zentralen Bohrung (13) versehen ist, die sich längs des Hauptbereichs ihrer Länge erstreckt, sich zum Kolben (9) öffnet, jedoch zum freien Außenende der Kolbenstange (8) geschlossen ist, daß ein zentrales Rohr (14) in Verbindung mit dem Boden der Bohrung (13) frei tragend angebracht ist, sich durch die Bohrung (13) im wesentlichen bis zu einer Position auf einer Höhe mit der Oberfläche des der Rückend-

wand (5) gegenüberliegenden Kolbens (9) erstreckt und in seinem freien Ende die Schraube (16) trägt, und daß die Schraube (16) und das zentrale Rohr (14) mit einem kleinen Zwischenraum durch ein Führungsrohr (19) umschlossen sind, das an der Rückendwand (5) befestigt ist und sich in die Bohrung (13) hinein erstreckt, wobei das Führungsrohr an seinem Außenumfang mittels Dichtungen (20) gegenüber einer zentralen Öffnung (15) abgedichtet ist, die sich vollständig durch den Kolben (9) erstreckt.

3. Fluidangetriebener Präzisionsoszillator nach Anspruch 1 oder 2,
gekennzeichnet durch
ein Druckbegrenzungsventil (30) und ein Durchflußregulierventil (31) zum Einstellen des Drucks und des Durchflusses des der Vorder- und Rückseite des Kolbens zugeführten Druckfluids.

4. Fluidangetriebener Präzisionsoszillator nach Anspruch 3,
dadurch **gekennzeichnet,**
daß die ersten und zweiten Zweiwegeventile (32, 33), das Druckbegrenzungsventil (30) und das Durchflußregulierventil (31) in einem Ventilblock (6) vorgesehen sind, der direkt an der Rückendwand (5) befestigt ist.

5. Fluidangetriebener Präzisionsoszillator nach einem der vorangehenden Ansprüche,
dadurch **gekennzeichnet,**
daß das Verhältnis der effektiven Flächen an der Vorder- und Rückseite des Kolbens 1 : 2 ist.

6. Fluidangetriebener Präzisionsoszillator nach einem der vorangehenden Ansprüche,
dadurch **gekennzeichnet,**
daß der Steuerschaltkreis (39) eine Zählereinheit (39) umfaßt, die mit der der gewünschten Hublänge entsprechenden Impulsanzahl programmierbar und dazu bestimmt ist, die durch die Auslesegabel (24) während des Betriebs des Oszillators (1) erfaßten Impulse aufzuzeichnen sowie dazu, die erfaßten Impulse mit der progammierten Impulsanzahl zu vergleichen.

7. Fluidangetriebener Präzisionsosziallator nach Anspruch 6,
dadurch **gekennzeichnet,**
daß ein Induktionssensor (38) zum Erfassen der Ruheposition des Kolbens (9) gegenüber der Rückendwand (5) und zum Zurücksetzen der Zählereinheit, wenn die Ruheposition erfaßt wird, an den Steuerschaltkreis (39) angeschlossen ist.

8. Fluidangetriebener Präzisionsoszillator nach einem der vorangehenden Ansprüche,
dadurch **gekennzeichnet,**
daß die Mutter (16) mit einer Anzahl von vorzugsweise drei Schlitzen (16a) versehen ist, die sich von einer ihrer Enden erstrecken und um ihren Umfang herum verteilt sind, um federnde Bereiche (16b) zu bilden, und daß eine Nut (16c) um den Umfang der Mutter (16) herum in dem Bereich der federnden Bereiche (16b) vorgesehen ist, und daß in der Nut (16c) eine Einrichtung zum Vorspannen der Bereiche (16b) nach innen aufeinander zu vorgesehen ist.

9. Fluidangetriebener Präzisionsoszillator nach Anspruch 8,
dadurch **gekennzeichnet,**
daß die Schraube (11) mit einem feingearbeiteten oder polierten Schneckengewinde versehen ist, und daß die Mutter mit einem entsprechenden Innengewinde versehen ist.

Revendications

1. Oscillateur de précision alimenté par un fluide et possédant un boîtier cylindrique (3), un piston (9) déplaçable dans le boîtier et raccordé à une tige de piston (8) traversant une paroi d'extrémité frontale (4) du boîtier, et des moyens de commande (11, 16, 22, 24, 39) pour inverser de façon automatique le déplacement du piston et de la tige de piston, et dans lequel la tige de piston (8) est creuse et une vis (11) est tourillonnée de manière à pouvoir tourner dans une paroi d'extrémité arrière (5) du boîtier (3), une première extrémité de la vis pénétrant dans une tige de piston creuse (9) et engrenant avec un écrou (16) fixé à la tige de piston (8), tandis que la vis porte, à une seconde extrémité, un disque de codage denté (22), qui coopère avec une fourche de lecture (24) servant à envoyer des impulsions correspondant au déplacement du piston (9) et de la tige de piston (8) à un circuit de commande (39), qui à son tour envoie des signaux pour faire fonctionner l'oscillateur (1) en fonction des impulsions envoyées dans le circuit, caractérisé par une alimentation continue en fluide sous pression (35, 36, 37) au côté avant du piston (9) et par une alimentation en fluide sous pression envoyée au côté arrière du piston (9) commandé au moyen d'une première soupape à deux voies (32) et d'un refoulement du fluide sous pression à partir du côté arrière

du piston (9), commandée au moyen d'une seconde soupape à deux voies (33).

2. Oscillateur de précision alimenté par un fluide selon la revendication 1, caractérisé en ce que la tige de piston (8) comporte un perçage central (13) qui s'étend sur la majeure partie de sa longueur, est ouvert en direction du piston (9), mais est fermé en direction de l'extrémité extérieure libre de la tige de piston (8), en ce qu'un tube central (14) est monté en console en liaison avec le fond du perçage (13), traverse le perçage (13) essentiellement jusque dans une position située de niveau avec la surface du piston (9) tourné vers la paroi d'extrémité arrière (5) et porte, dans son extrémité libre, l'écrou (16), et en ce que l'écrou (16) et le tube central (14) séparés par un faible jeu sont entourés par un tube de guidage (19) fixé à la paroi d'extrémité arrière (5) et pénétrant dans le perçage (13), ledit tube de guidage étant étanchéifié, au niveau de sa circonférence extérieure, par rapport à une ouverture centrale (15) qui traverse complètement le piston (9), à l'aide de joints d'étanchéité (20).

3. Oscillateur de précision alimenté par un fluide selon la revendication 1 ou 2, caractérisé par une soupape de limitation de pression (30) et une soupape de régulation de débit (31) servant à régler respectivement la pression et le débit du fluide sous pression envoyé respectivement au côté avant et au côté arrière du piston.

4. Oscillateur de précision alimenté par un fluide selon la revendication 3, caractérisé en ce que les première et seconde soupapes à deux voies (32, 33), la soupape de limitation de pression (30) et la soupape de régulation de débit (31) sont prévues dans un bloc de soupapes (6) fixé directement à la paroi d'extrémité arrière (5).

5. Oscillateur de précision alimenté par un fluide selon l'une quelconque des revendications précédentes, caractérisé en ce que le rapport des surfaces effectives présentes respectivement au niveau du côté avant et du côté arrière du piston est égal à 1:2.

6. Oscillateur de précision alimenté par un fluide selon l'une quelconque des revendications précédentes, caractérisé en ce que le circuit de commande (39) comprend une unité de comptage (39) programmable au moyen du nombre d'impulsions correspondant à la longueur de course désirée, et prévue pour l'enregistrement des impulsions détectées par la fourche de lecture (24) pendant le fonctionnement de l'oscillateur (1) et servant à comparer les impulsions détectées au nombre programmé d'impulsions.

7. Oscillateur de précision alimenté par un fluide selon la revendication 6, caractérisé en ce qu'un capteur inductif (38) servant à détecter la position de repos du piston (9) contre la paroi d'extrémité arrière (5) et à régler l'unité de comptage lors de la détection de la position de repos, est raccordé au circuit de commande (39).

8. Oscillateur de précision alimenté par un fluide selon l'une quelconque des revendications précédentes, caractérisé en ce que l'écrou (16) comporte un certain nombre de fentes (16a), de préférence trois, qui s'étendent à partir de l'une de ses extrémités et sont réparties autour de sa circonférence, pour former des sections élastiques (16b), et en ce qu'une gorge (16c) est prévue sur la circonférence de l'écrou (16), dans la région des sections élastiques (16b) et en ce que des moyens servant à repousser les sections (16b) vers l'intérieur en direction les unes des autres et disposées dans la gorge (16).

9. Oscillateur de précision alimenté par un fluide selon la revendication 8, caractérisé en ce que la vis (11) comporte un filet de vis sans fin fini ou poli et en ce que l'écrou comporte un taraudage correspondant.

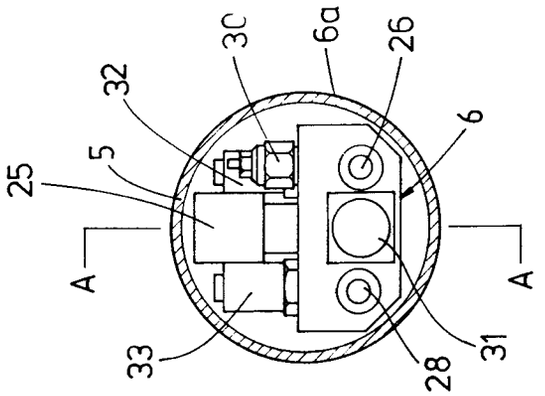

Fig. 2

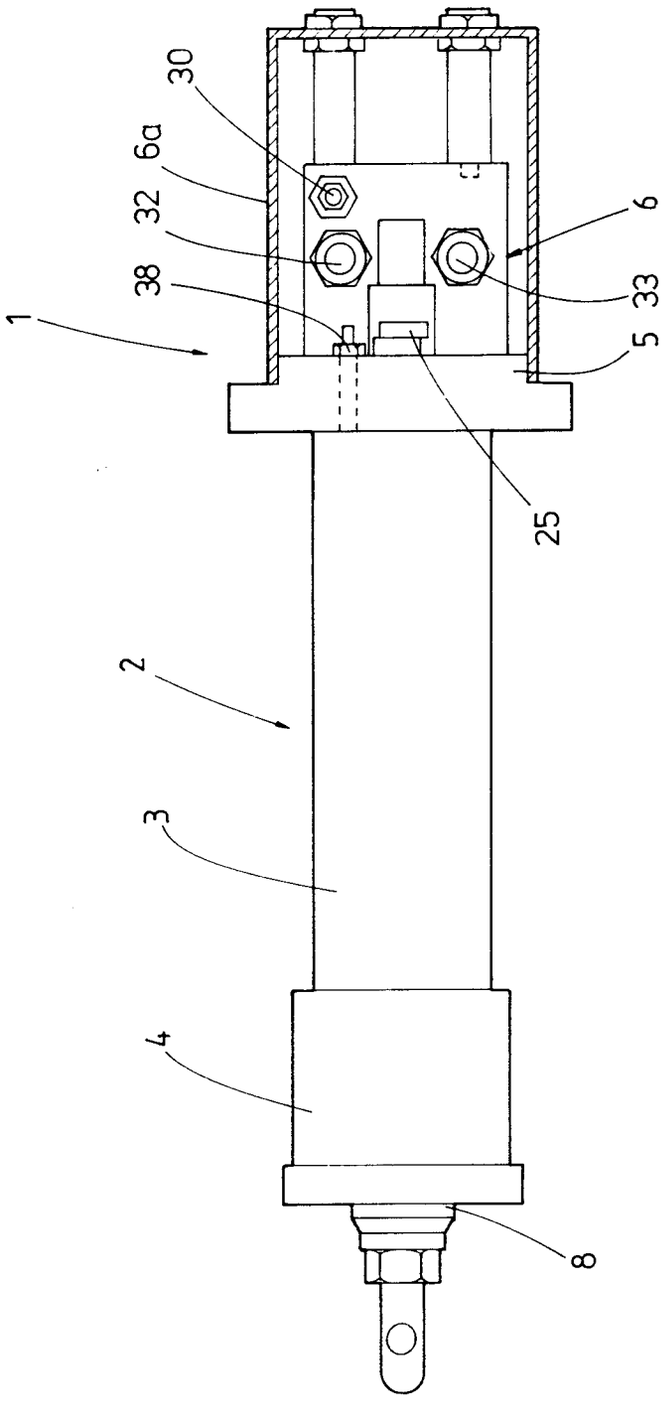

Fig. 1

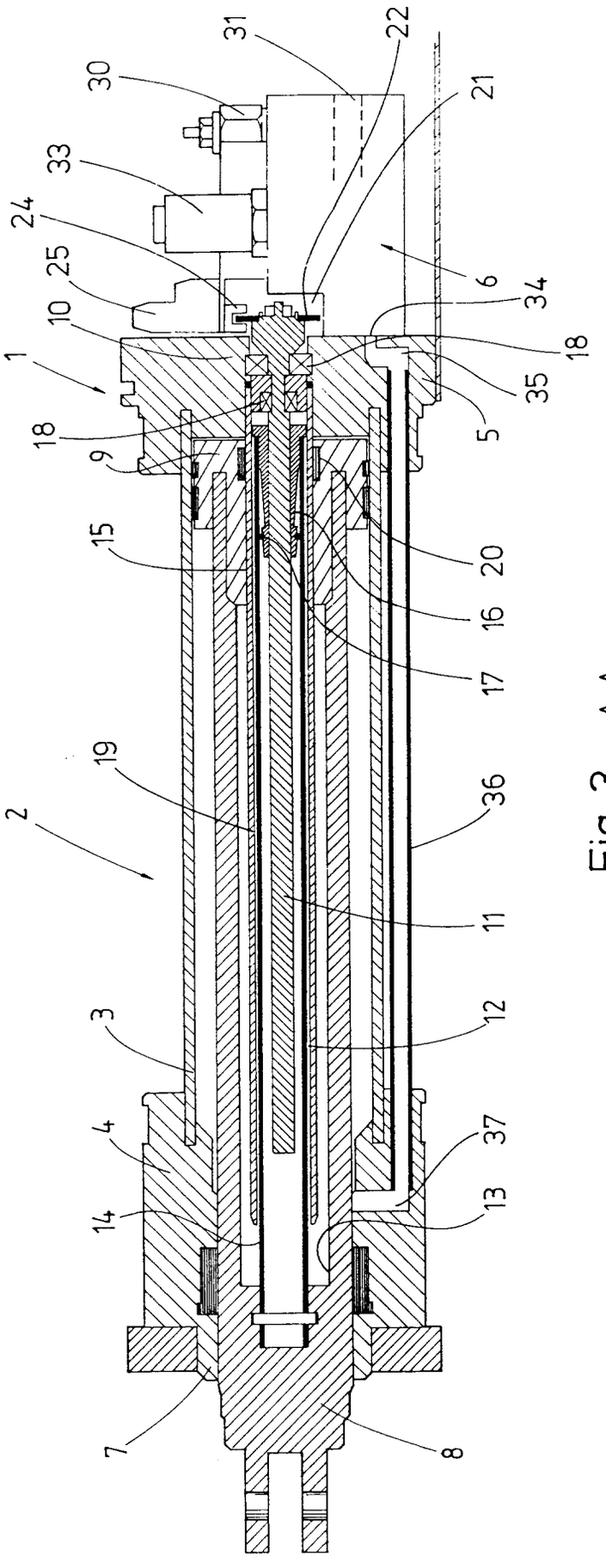
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Fig. 3 A-A

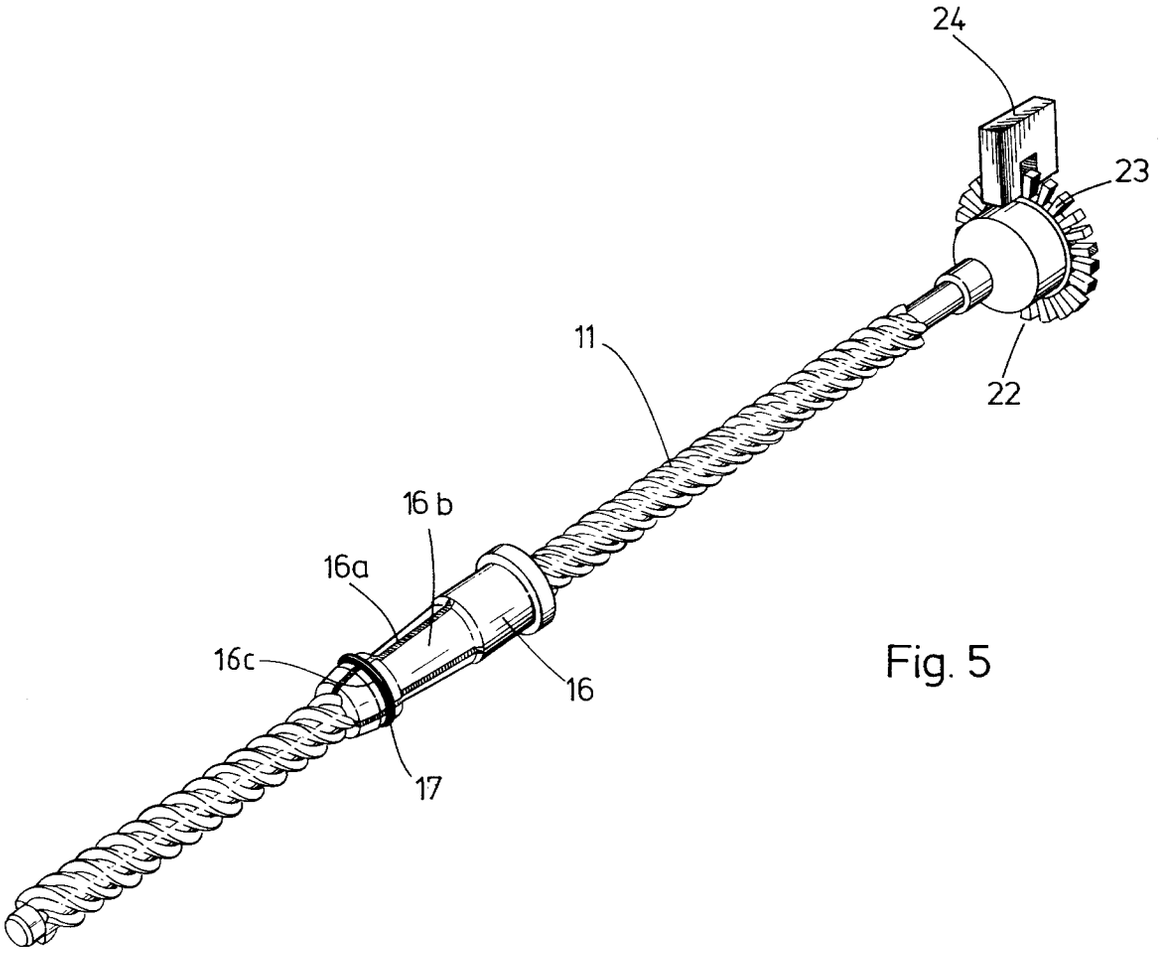

Fig. 5

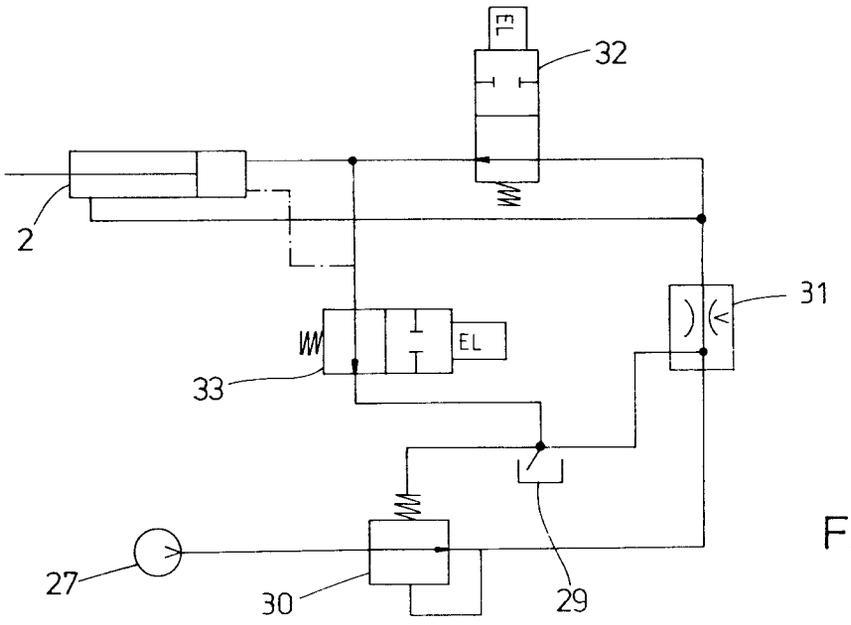

Fig. 4

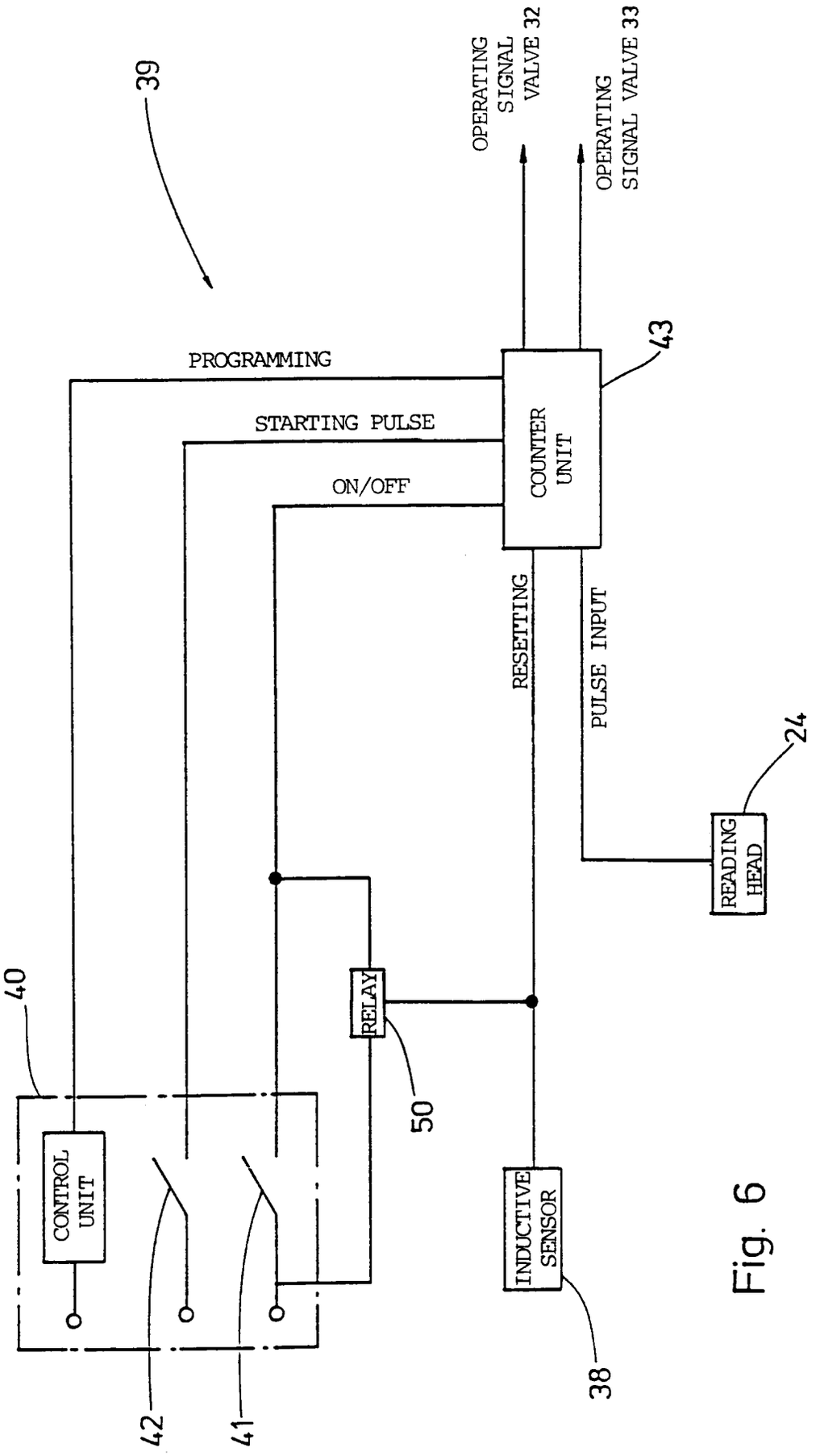
39
OPERATING SIGNAL VALVE 32
OPERATING SIGNAL VALVE 33
PROGRAMMING
STARTING PULSE
ON/OFF
COUNTER UNIT
43
RESETTING
PULSE INPUT
READING HEAD
24
40
RELAY
50
CONTROL UNIT
INDUCTIVE SENSOR
38
42
41

Fig. 6