Oct. 13, 1970 R. DAUME 3,533,596

SYSTEM FOR THE ADJUSTMENT OF A VALVE

Filed July 15, 1968 2 Sheets-Sheet 1

FIG. 1

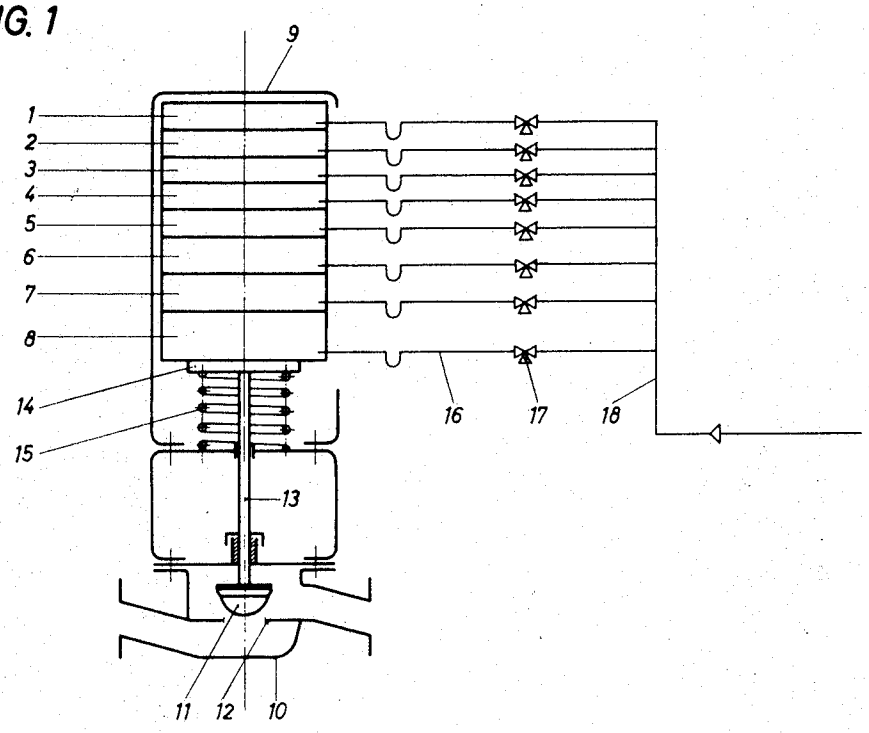
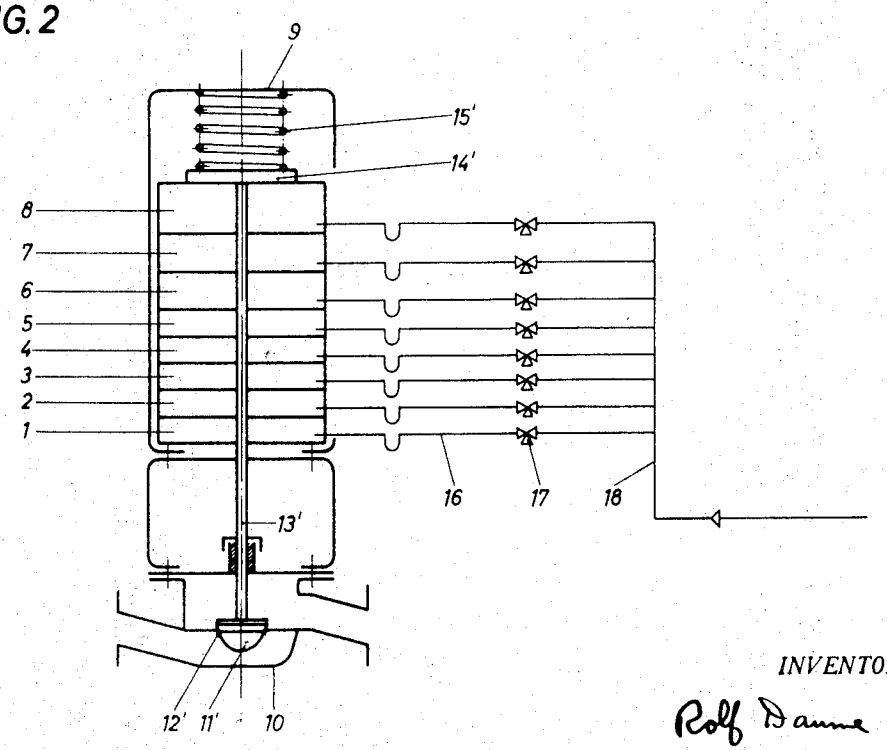


FIG. 2



INVENTOR:

Rolf Daume

BY:

Darbo, Robertson & Vandenburgh,

Attys.

Oct. 13, 1970 R. DAUME 3,533,596

SYSTEM FOR THE ADJUSTMENT OF A VALVE

Filed July 15. 1968 2 Sheets-Sheet 2

FIG. 3

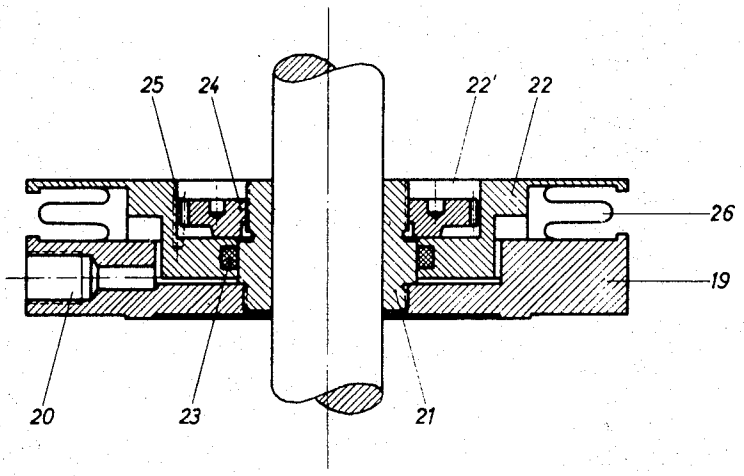
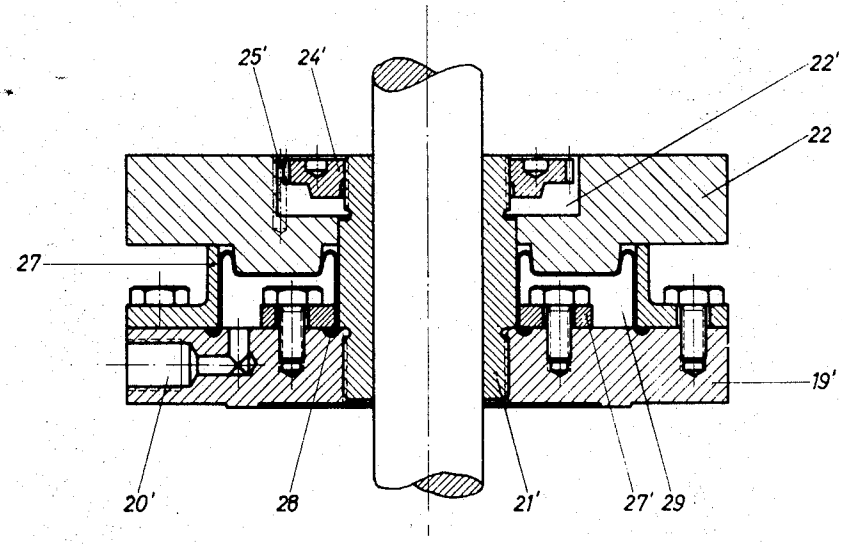


FIG. 4



INVENTOR.

Rolf Daume

BY:

Dambo, Robertson & Vandenburgh.

attys.

United States Patent Office 3,533,596 Patented Oct. 13, 1970

3,533,596

SYSTEM FOR THE ADJUSTMENT OF A VALVE

Rolf Daume, Grossburgwedel, Germany, assignor of one-half to W. Daume Regelarmaturen, Hannover, Germany

Filed July 15, 1968, Ser. No. 744,893
Int. Cl. F15b 11/18; F16k 31/17
U.S. Cl. 251—61 4 Claims

ABSTRACT OF THE DISCLOSURE

A valve operator comprises a plurality of actuating segments, fluid operated, and having discrete movements based on a binary system. Each actuating element comprises a guiding member, a rigid base part affixed to the guiding member, a movable cover part on the guiding member, an adjustable stop secured to the guiding member and positioned to limit the movement of the cover part, and a sealing diaphragm between the base part and the cover part.

BACKGROUND AND SUMMARY OF THE INVENTION

The invention relates to a valve assembly having means for the adjustment of the lift of the valve by a plurality of lifting elements which are biased by a pressure medium. The object of the invention is to subdivide the overall lift or stroke of a valve into a plurality of stroke units and to facilitate the accurate and reliable adjustment of a valve in accordance with a predetermined number of stroke units. A valve of the kind heretofore described and adjustable in accordance with digital values is of special significance in regulating systems which operate with digital measured values.

According to the invention, an adjustable assembly in which the lift of the valve is adjustable, the assembly having a plurality of contiguously stacked lifting elements, said lifting elements each being individually biasable by fluid pressure to provide a discrete amount of lift against a common valve spring. Each of the lifting elements therefore executes a precisely definable stroke and if a plurality of lifting elements are simultaneously biased by fluid pressure their strokes will be summated, the strokes of the individual lifting elements being appropriately adjusted in a binary code grading. For example, if eight lifting elements are provided and their strokes are adjusted in accordance with a binary grading the stroke units listed in the following table will result for the individual lifting elements:

	2^n	Stroke units
Lifting element:		
1	2^0	1
2	2^1	2
3	2^2	4
4	2^3	8
5	2^4	16
6	2^5	32
7	2^6	64
8	2^7	128
Total		255

This provides a total of 255 stroke units. For example, if it is desired to adjust the valve by 72 stroke units, the lifting element **7** and the lifting element **4** must be actuated to be simultaneously biased by fluid pressure so that the stroke units (**64** and **8**) of said elements are summated to provide the desired overall lift of 72. Within the overall lift of 255 units it is therefore possible to achieve any desired lift by actuating the required number of individual lift elements in this manner. The accuracy of valve setting can be adapted to the appropriate requirements by suitable increase or reduction of the number of lifting elements.

The construction of the lifting elements is of course an important criterion for obtaining a precise and reliable valve setting. Accordingly, each lifting element may comprise a rigid base part which is provided with a fluid pressure inlet and a rigid cover part, adapted to move axially relative to said base part and sealing means for providing a fluid tight seal to the space between the base and cover part.

The system may be so constructed that the cover part slides on a guiding member which is screwmounted on the base part, an adjustable nut being screwed to said guiding member to provide an adjustable stop by which the movement of said cover is limited. The stop nut can be very sensitively adjusted and may be fixed in any position by suitable means. A bellows diaphragm is preferably disposed between the base part and the cover part and the cover part is sealed on its sliding surface by means of a ring seal. Sealing may also be obtained by a preformed diaphragm being mounted on the base part to bear against the underside of the cover part and adapted to close an annular chamber between bottom part and cover part, said chamber communicating with the fluid pressure inlet.

The supply of fluid pressure to the individual lifting elements is preferably made via flexible connecting lines and individually controllable three-way valves, compressed air, hydraulic oil or hydraulic water serving as the fluid pressure medium. The three-way valves may be constructed as remotely controlled solenoid valves.

Exemplified embodiments of the invention are explained hereinbelow by reference to the illustrations in which:

FIG. 1 is a digitally controllable valve which may be closed in steps;

FIG. 2 shows a valve of the kind heretofore described which can be opened in steps;

FIG. 3 is a section through a lifting element; and

FIG. 4 is a section through a lifting element of another design.

A valve closure member **11**, co-operating with a valve seat **12**, is disposed in a valve housing **10**. A spring seat **14** against which a valve spring **15** thrusts to raise the valve closure member **11** off the valve seat **12**, is mounted on the shank or rod **13** of the valve closure member **11**. One element **8** of a plurality of contiguously stacked lifting elements **1–8** which are accommodated in a housing **9**, bears upon the spring seat **14**. The uppermost lifting element **1** bears on the housing **9**. Each of the lifting elements **1–8** is connected by means of a flexible pipeline **16** through a three-way valve **17** to a pressure source duct **18**.

Each of the lifting elements **1–8** is constructed in a manner illustrated in FIG. 3 the elements each having a rigid base part **19**, in which there is a threaded connection **20** for the flexible pressure source pipeline **16**, the base part being sealingly screwmounted to a guiding sleeve **21**. A rigid cover **22**, whose sliding surface is sealed by a ring seal **23**, slides upon the guiding sleeve **21**. A stop nut **24**, screwed on to a thread of the guiding sleeve **21**, is disposed in a recess **22'** of the cover **22**. The stop nut **24** is provided with a toothed edge in which a locking pin **25** is located to prevent rotation of the lock nut **24**. A bellows diaphragm **26** is provided for sealing purposes between the cover **22** and the base part **19**.

If fluid pressure is admitted through the pipeline **16** to the chamber formed between the base part **19** and the cover part **22**, said cover part **22** will bear against the stop nut **24** and the entire lifting element will become thicker by an amount depending on the adjustment of the stop nut **24**. The lift traversed by the lifting element is differently adjusted for each of the contiguously stacked

lifting elements **1–8**, in accordance with the binary code as specified in the table hereinabove. The stop nut **24** is adjusted so that the lifting element **1** can traverse only a very small amount of lift, while the lifting element **8** can traverse a relatively large amount of lift.

In the unpressurised condition all lifting elements **1–8** are compressed by the valve spring **15**. If fluid pressure is admitted into one or simultaneously into a plurality of the lifting elements **1–8**, the affected lifting element or elements will be thickened by the amount of lift associated therewith, the lifts being summated and the valve closure member **11** is driven in the closing direction, against the action exerted by the valve spring **15**, into a position corresponding to the summated lift.

In the embodiment illustrated in FIG. 2 the valve closure **11'** is biased to the closed position. In this case the valve spindle or rod **13** extends through the guiding sleeves **21** of the lifting elements **1–8** which are disposed in the reverse sequence in this case. The valve spring seat **14'** is disposed above the lifting elements **1–8** and the valve spring **15'** acts in the closing direction of the valve **11', 12'**.

FIG. 4 is another embodiment of a lifting element. A preformed diaphragm is mounted on the base part **19** by means of a ring flange **27** and a locking ring **27'**, the underside of the cover **22** bearing against said diaphragm **28** which is adapted to close an annular pressure chamber **29** which communicates with the pressure source connection **20'**. In the unpressurised condition the cover **22** bears on the flange ring **27** under the bias of the spring **15'**. When fluid pressure is admitted through the flexible pipeline **16**, the cover **22** will bear against the adjustable stop nut **24'** so that a precisely defined amount of lift is traversed.

What is claimed is:

1. In a motor operated valve apparatus wherein the valve closure is biased in one direction by a valve spring and the motor acts on the valve closure in the opposite direction, the improvement in said motor comprising:

a plurality of actuating means, each of said means having two portions forming a pair, spaced from each other and movable with respect to each other along a line, each of said means being fluid actuated and when no fluid under pressure is applied thereto said portions being a first distance apart and when fluid under pressure is applied thereto said portions being a second distance apart, said first distances being separated from said second distances by respective discrete amounts, said plurality of means being positioned with said pairs in a contiguous series and with said line of each lying in a line common to all, one end of said series being fixed and the other end being operatively connected to said closure, whereby a total linear movement is obtained which is the sum of the movement of each pair which total movement produces a movement of the valve closure which closure movement is a function of said total movement, each said actuating means comprising

a rigid base part having a fluid pressure connection communicating with one side of the part at a port,

a cover part positioned at said side of the base part with a space therebetween,

sealing means between said parts for enclosing said space while permitting relative movement between the parts,

one of said parts being movable with respect to the other of the parts,

a guiding member, said one part being movable on said guiding member, the other part being affixed to said guiding member, and

an adjustable stop secured to said guiding member and positioned to limit the movement of the one part with respect to the other part; and

control means connected to said actuating means for applying fluid under pressure selectively to each of said actuating means.

2. In an apparatus as set forth in claim **1**, wherein said discrete amounts are related to each other in accordance with a binary code grading.

3. An apparatus as set forth in claim **1**, wherein said sealing means comprises a bellows.

4. An apparatus as set forth in claim **3**, wherein said bellows is affixed to said base part and defines an expansible chamber communicating with said port, said cover part bearing against said bellows.

References Cited

UNITED STATES PATENTS

2,969,042	1/1961	Lite et al.	235—201
3,141,388	7/1964	Brandstadter	91—167 X
3,155,365	11/1964	Hartung et al.	251—60 X
3,307,584	3/1967	Czernek	137—625.64

ARNOLD ROSENTHAL, Primary Examiner

U.S. Cl. X.R.

91—167; 92—107; 235—201; 251—63.4