United States Patent [19]

Cavalli

[11] **3,732,748**

[45] **May 15, 1973**

[54] **CONTROL DEVICE FOR THE MANUAL REGULATION OF THE SPEED OF COMPRESSION-IGNITION ENGINES**

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[73] Assignee: **Fiat Societa per Azioni,** Turin, Italy

[22] Filed: **July 6, 1971**

[21] Appl. No.: **159,906**

[52] **U.S. Cl.**.....**74/502,** 74/503

[51] **Int. Cl.**.....**F16c 1/22**

[58] **Field of Search**.....74/502, 503, 504, 74/507, 509

[56] **References Cited**

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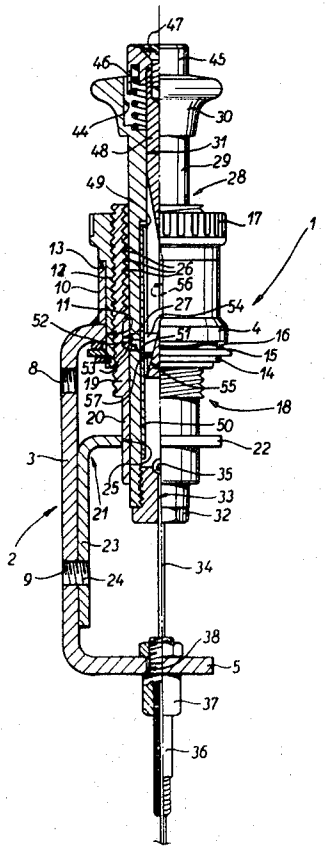
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Primary Examiner—Charles J. Myhre
Assistant Examiner—F. D. Shoemaker
Attorney—Richard C. Sughrue et al.

[57] **ABSTRACT**

The speed of a compression-ignition engine is regulated by a manually operable control device according to this invention which acts on a control lever in the engine fuel system to place the lever, with precision, selectively in engine stopped, idling speed and predetermined speed settings. The control device includes a movable body connected to an actuating cable and carrying a spring-loaded latch which is engageable in a selected detent carried by a surrounding tubular body to achieve the desired setting. The surrounding body is itself adjustable by screw action in a support so as to provide for fine adjustment of the actuating cable.

10 Claims, 7 Drawing Figures



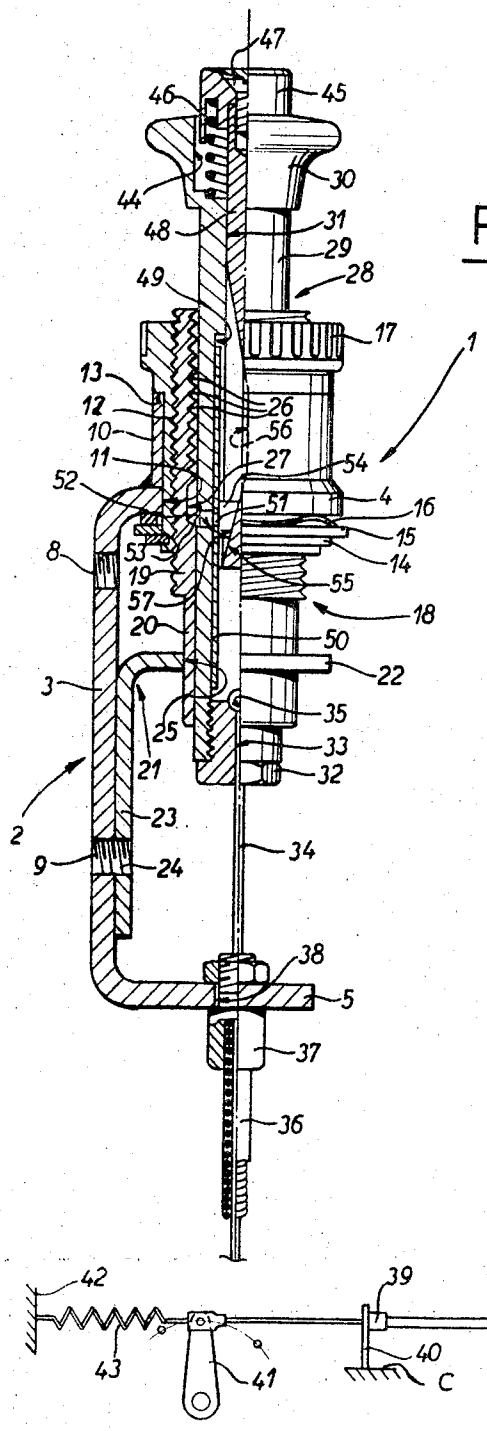
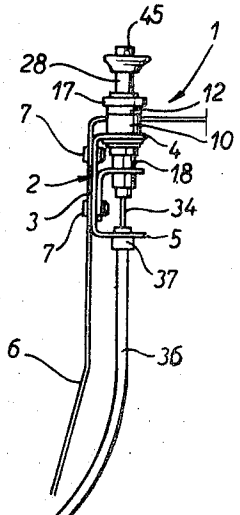


Fig. 2

Fig. 1



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ATTORNEYS

Fig. 3

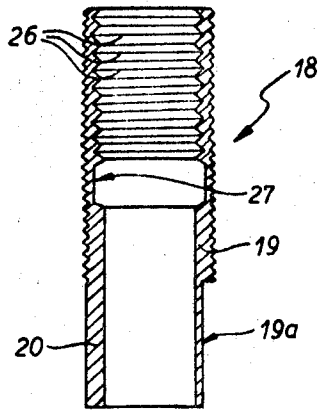


Fig. 5

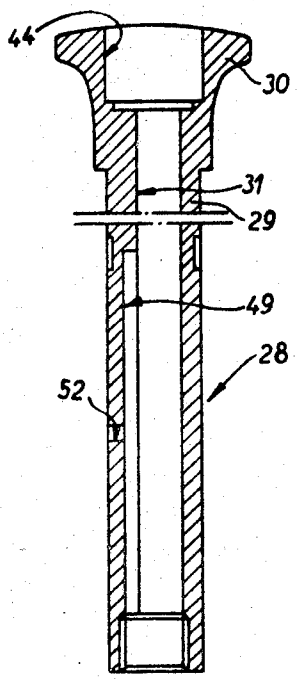


Fig. 4

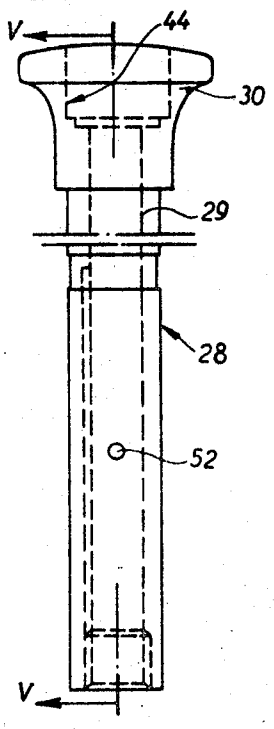


Fig. 6

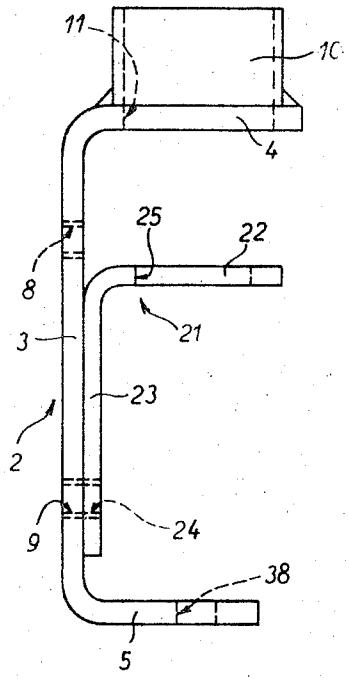
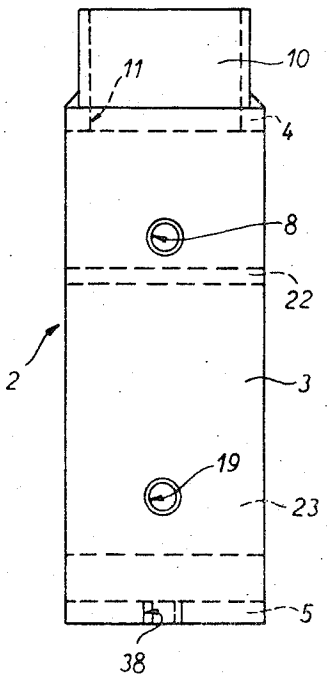


Fig. 7



CONTROL DEVICE FOR THE MANUAL REGULATION OF THE SPEED OF COMPRESSION-IGNITION ENGINES

BACKGROUND OF THE INVENTION

The invention relates to a control device for regulating the speed of compression-ignition engines. More particularly, the invention relates to a control device which allows the driver of a motor vehicle to regulate manually the speed of the engine.

Many devices for the manual regulation of the speed of a motor vehicle engine are already known.

Such devices are generally formed by a hand-operated member which acts on a cable connected to a control lever in the fuel supply system of the engine. These known devices are, however, very inaccurate and allow only a very rough manual regulation of engine speed.

An object of this invention is to provide a control device for regulating the speed of a compression-ignition engine which allows accurate regulation of the engine speed.

In a compression-ignition engine the output power is regulated by controlling the volumetric delivery of a fuel injection pump. There are three primary conditions of engine operation, that is: engine at rest — volume delivered by the pump nil; engine at idling speed — volume sufficient to develop the necessary power to maintain the engine in regular motion, and engine operating under load.

A particular object of this invention is to provide a speed regulating device which can control accurately the volume of fuel delivered to the engine when the latter is idling. If this volume is too low the engine runs irregularly with unpleasant and damaging vibrations. Under these conditions an excessive load on the engine causes the engine speed to drop too much, with consequent difficulty of transition between the various gear speeds.

A further object of this invention is to provide a device which allows transition from any speed regime, that is, from any regulated speed, to a minimum constant speed without requiring any adjustment on the part of the driver.

SUMMARY OF THE INVENTION

According to the invention there is provided a control device for the manual regulation of the speed of a compression-ignition engine, comprising a first tubular internally threaded body supported rotatably by an external support and axially fixed relative to the latter, a second tubular body having an external screw thread cooperating with the internal thread of the first body, a third tubular body mounted for relative axial sliding movement within the second body, stop means operable from the outside, and carried by the third tubular body, said stop means being adapted to cooperate selectively with detents carried by the second tubular body to control the axial position relative to the latter of the third tubular body, and a cable connected to the third tubular body and slidable within a sheath adapted to be fixed relative to the external support, said cable being arranged in use of the device to interconnect one axial end of the third tubular body to a control lever which controls the fuel supply to the engine, to move said lever against the action of elastic biasing means.

By means of the control device according to this invention it is possible to place the third tubular body in a predetermined number of positions with respect to the second by displacing the third tubular body axially within the second and then locking the third tubular body with respect to the second through the stop means. The number of said positions is equal to the number of detents carried to the second tubular body; to each of the positions there corresponds a certain displacement of the control cable corresponding to a certain engine speed increment.

It is possible, moreover, to adjust the speed of the engine, particularly the idling speed, in each of said positions of the third tubular member by displacing simultaneously the second and third bodies through rotation of the first tubular body relative to the support.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be more clearly understood from the detailed description which follows, by way of non-limiting example, with reference to the accompanying drawings, in which:

FIG. 1 is a schematic elevational view of a control device according to one embodiment of the invention, showing its connection to a control lever in the fuel supply system of an engine;

FIG. 2 is an enlarged view of the device as shown in FIG. 1, partly in longitudinal section;

FIG. 3 is a longitudinal sectional view of the first tubular body of the device shown in FIG. 2;

FIG. 4 is a side view of the third tubular body of the device shown in FIG. 2;

FIG. 5 is a section carried on line V—V of FIG. 4, and

FIGS. 6 and 7 are front side elevational views respectively of the fixed support of the device shown in FIG. 2.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

In the drawings, reference numeral 1 indicates generally a control device for the regulation of the speed of a compression-ignition engine.

The control device 1 is mounted on a C-shaped support 2 comprising a central part 3 and upper and lower limbs 4 and 5 extending parallel to each other from the same side of the central part 3. The central part 3 is connected to a supporting wall 6, on the side remote from that from which the limbs 4 and 5 extend, by means of two bolts 7 which engage in respective threaded bores 8 and 9 formed in the central part 3 and perpendicular to the latter.

To the outside surface of the limb 4 there is connected a cylindrical socket 10 the axis of which is parallel to the central part 3. Where it is joined to the socket 10 the upper limb 4 has a through hole 11 coaxial with the socket 10, having a diameter equal to the internal diameter of the socket 10.

A first tubular body 12 is rotatably mounted within the socket 10. The tubular body 12 is internally threaded and has an external annular shoulder 13 which abuts the upper end of the socket 10 in order to retain the first tubular body 12 against axial movement in one direction relative to the socket 10.

The first tubular body 12 passes through the socket 10 and the hole 11 and has, on its external surface which projects beyond the hole 11, an annular groove

in which a circlip **14** is located. Between the circlip **14** and the limb **4** of the support **2** are placed an annular washer **15** and a wavy washer **16** coaxial with the tubular body **12.** The wavy washer **16** cooperates with the inside surface of the limb **4** so as to anchor the first tubular body **12** axially with respect to the support **2,** eliminating any possibility of axial play between the body **12** and the support **2.** At its other end, projecting beyond the socket **10,** the first tubular body **12** is formed with an annular knurled portion **17.**

The tubular body **12** is threaded internally to receive a cooperating externally threaded portion **19** of a second tubular body **18** having a length greater than that of the first tubular body **12.** The second tubular body **18** has a cylindrical portion **20,** coaxial with the threaded portion **19** and projecting beyond the first tubular body **12** towards the limb **5** of the support **3.** The cylindrical portion **20,** as shown in FIG. **3,** is provided with a longitudinally extending recessed flat surface zone **19***a*.

The cylindrical portion **20** of the second tubular body **18** can slide axially in a second support member **21,** formed by an L-shaped bracket, one arm **23** of which is placed flat against the central part **3** of the support **2** and has a threaded hole **24** in which the bolt **7** which passes through the bore **9** engages, the arm **23** being fixed to the central part **3,** for example by spot welding (FIG. **2**). The other arm **22** of the support **21** is parallel to the limb **4** of the support **2** and has a through hole **25** coaxial with the second tubular body **18** and having a diameter equal to the external diameter of the latter. The cylindrical portion **20** of the second tubular body **18** is located in the hole **25** so as to be supported by the support **21.**

The hole **25** is provided with a flat segment which cooperates with the flat zone **19***a* of the tubular body **18** so that the latter is able to slide axially within the hole **25** but cannot rotate about its own axis.

On its internal surface the second tubular body **18** is formed, in correspondence with the threaded portion **19** of the latter, with a plurality of detents spaced apart evenly in the direction of the axis of the tubular body **18,** each detent comprising an annular circumferential groove **26** of substantially triangular cross section. The annular grooves **26** form a continuous succession from approximately the middle of the tubular body **18** to the end of the latter which corresponds with the knurled portion **17** of the first tubular body **12.** An annular circumferential groove **27** with a substantially trapezoidal cross section is formed substantially in correspondence with the middle of the second tubular body **18,** at the inner end of the series of grooves **26.**

A third tubular body **28** is mounted slidingly within the second tubular body **18,** both ends of the third tubular body **28** projecting beyond the ends of the second tubular body **18.** The third tubular body **28** has a cylindrical upper portion **29** mounted slidingly within the second tubular body **18** and projecting beyond the end of the latter outside the support **2,** the projecting end of the cylindrical portion **29** being surmounted by a knob **30.**

The third tubular body **28** has a through bore **31** coaxial with the tubular body **28** and threaded at its lower end remote from that at which the knob **30** is mounted. The internally threaded end of the tubular body **28** cooperates with an external screw thread of a plug **32** which closes the said lower end of the bore **31** of the cylindrical portion **29.**

The plug **32** has an axial through bore **33** through which a cable **34** passes. The end of the cable **34** within the tubular body **28** is provided with an anchoring ball **35.** The cable **34** passes into a flexible sheath **36** one end of which is anchored, by means of a threaded end ferrule **37,** in a hole **38** formed in the lower limb **5** of the support **2,** coaxially with the hole **11.** At its other end (FIG. **1**) the sheath **36** is connected through a ferrule **39** to a support **40** fixed to the chassis of the motor vehicle, shown diagrammatically at C.

The cable **34** projects from the end of the sheath **36** at the support **40** and is connected to the end of a control lever **41** in the fuel supply system of the engine. A helical spring **43** is interposed between the end of the cable **34** connected to the lever **41** and a wall **42** of the engine of the motor vehicle.

The bore **31** of the third tubular body **28** communicates, at its end opposite to that closed by the plug **32,** with a cylindrical counterbore **44,** communicating with the outside and disposed within the knob **30.** A cylindrical push-button **45** is mounted for axial sliding movement in the counterbore **44,** the push-button **45** being biased away from the bore **31** by a helical spring **46** which is compressed between the surface of the push-button **45** inside the counterbore **44** and the bottom of the latter. The push-button **45** is connected by means of a screw **47** to a rod **48** extending axially into the bore **31.**

On the inside surface of the bore **31** a longitudinally extending groove **49** is formed, the groove **49** having a substantially rectangular cross section. A laminar spring **50** is located in the groove **49** and has, in its central region, a through hole **51** communicating with a radial hole **52** in the wall of the third tubular body **28.** A stop pin **53** is located slidingly in the holes **51** and **52.** The pin **53** is supported by and projects radially from a member **54** with a substantially prismatic shape located within the bore **31.** The stop pin **53** has a bevelled free end in the shape of a wedge and has such a length that, when the member **54** presses the laminar spring **50** against the bottom of the groove **49,** the bevelled end of the pin **53** projects from the external surface of the tubular body **28,** through the holes **51** and **52** and engages either in the annular groove **27** or in one of the annular grooves **26** of the second tubular body **18.**

The member **54** has a wedge face **55,** opposite that supporting the stop pin **53,** inclined to the axis of the body **28** so as to form with the bottom wall of the groove **49** an acute angle, the face **55** being inclined towards the limb **5** of the support **2.**

The member **54** is mounted slidingly within a longitudinal groove **56** in the surface of the rod **48.** The groove **56** has a bottom surface with a ramp portion **57** extending to almost the free end of the rod **48,** parallel to the wedge face **55** of the member **54** and in sliding face-to-face contact therewith.

The inclination of the wedge face **55** and of the ramp portion **57** to the axis of the tubular body **28** is such that when the wedge face **55** slides on the inclined ramp portion **57** of the groove **56** for an axial distance equal to the permitted movement of the push-button **45** against the action of its spring **46,** the stop pin **53,** under the action of the laminar spring **50,** is retracted through the hole **52** so that it ceases to engage in the annular groove **26** or **27.**

In the control device 1 just described, therefore, depression of the push-button 45 causes the wedge face 55 of the member 54 to slide on the inclined ramp portion 57 of the groove 56 and the retraction of the stop pin 53. When the pin 53 has fully retracted inside the hole 52, the third tubular body 28 may be pushed axially until the inner end of the knob 30 abuts the adjacent end of the second tubular body 18: this causes the cable 34 to be displaced under the tension of the spring 43, moving the control lever 41 to a setting in which it cuts off the fuel supply to the engine and stops the operation of the engine.

To regulate the idling speed of the engine the push-button 45 is released and the body 28 moved by the knob 30 to a position in which the pin 53 engages in the annular groove 27. In this position, rotation of the first tubular body 12, with the assistance of the knurled portion 17 of the latter, causes the second tubular body 18 to be displaced axially until it reaches a position at which the engine has the desired idling speed. This idling speed can be adjusted, independently of other controls of the engine speed, and once set, can be achieved repeatedly simply by engaging the stop pin 53 in the groove 27.

To maintain the engine at a speed which is different from the idling speed, the push-button 45 is depressed to retract the stop pin 53 inside the hole 52 and the third tubular body 28 is displaced axially by means of the knob 30 until the pin 53 is located in correspondence with one of the annular grooves 26 at which the engine has the desired speed.

By depressing the push-button 45 and sliding the third tubular body 28 it is not possible to vary the engine speed over a continuous range: the speed of the engine can be varied in this way only by equal discrete intervals, by engaging the stop pin 53 with successive annular grooves 26. It is, however, possible to effect continuous regulation of the speed of the engine within each said discrete interval by rotation of the first tubular body 12, using the knurled portion 17.

It will be appreciated that practical details of embodiments of the control device can be varied widely from which has been illustrated and described by way of example, without departing from the scope of this invention.

What is claimed is:

1. Control device for the manual regulation of the speed of a compression-ignition engine, said device comprising;

i. an external support;

ii. a first tubular internally threaded body supported rotatably by said external support and axially fixed relative to the latter;

iii. a second tubular body having an external screw thread engaged with the internal thread of said first tubular body;

iv. a third tubular body slidable axially within said second tubular body;

v. stop means carried by said third tubular body;

vi. means operable from the outside and controlling said stop means;

vii. a plurality of detents carried by said second tubular body and selectively engageable by said stop means to control the axial position of said third tubular body relative to said second tubular body;

viii. a cable attached to one end of said third tubular body, and

ix. a sheath within which said cable slides, in use of the device, against the action of elastic biasing means,

said cable being connectable to a control lever which controls the fuel supply to the engine in dependence on the axial position of said third tubular body relative to said first tubular body.

2. Control device according to claim 1, wherein said second tubular body comprises an externally threaded first portion which cooperates with the internal thread of said first tubular body and a cylindrical second portion projecting beyond the first tubular body and including a further support member, rigidly connected to said support, in which said cylindrical portion is slidably mounted.

3. Control device according to claim 2, wherein said detents of said second tubular body are provided on the internal surface of the latter in correspondence with the threaded portion and extend from the free end of the said threaded portion to substantially the middle of said second tubular body.

4. Control device according to claim 3, wherein said detents comprise a series of annular grooves of substantially triangular cross section and an innermost annular groove of trapezoidal cross section on the internal surface of said second tubular body.

5. Control device according to claim 1, wherein said third tubular body projects at both ends from the second tubular body and has, at its end projecting from the threaded portion of the second tubular body, opposite to the end connected to said cable, a knob having a counterbore communicating with the outside and with the internal bore of said third tubular body.

6. Control device according to claim 5, including a rod mounted slidingly in the bore of said third tubular body, a push-button connected to one end of said rod and slidable axially in the counterbore of said knob, elastic biasing means in said counterbore acting upon said push-button to urge the latter out of said counterbore, said rod extending within the bore of said third tubular body at least as far as the innermost detent of said second tubular body.

7. Control device according to claim 6, wherein said rod has a longitudinal groove the bottom surface of which includes a ramp portion extending to the free end of the rod and inclined at an acute angle to the axis of the bore of the third tubular body, said ramp portion being inclined towards the knob, and said groove receiving said stop means.

8. Control device according to claim 7, wherein said stop means comprise a substantially prismatic member, mounted slidingly in the longitudinal groove of the rod and having an inclined wedge face cooperating with said ramp portion of said groove, a stop pin attached to the prismatic member and having its axis perpendicular to that of said third tubular body, said stop pin passing through a radial hole in the wall of the third tubular body, and resilient biasing means acting on said stop pin and urging the latter radially inwardly, said stop pin having a bevelled end adapted to engage, upon radial sliding movement of said pin against the action of said resilient biasing means, in one of said detents of the second tubular body.

9. Control device according to claim 8, wherein the resilient biasing means acting on said stop pin comprise a laminar spring located in a longitudinal groove in the surface of the bore of said third tubular body, said lami-

nar spring having a central hole, coaxial with said radial hole in the wall of said third tubular body to permit the passage therethrough of said stop pin.

10. Control device according to claim **9**, wherein the inclination of the wedge face of the prismatic member and of the ramp portion of the longitudinal groove in the rod is such as to cause the stop pin to retract completely inside the radial hole in the third tubular body under the action of the laminar spring upon axial displacement of the rod equal to the permitted movement of the push-button.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,732,748 Dated May 15, 1973

Inventor(s) Paolo CAVALLI

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In The Heading:

The claim to priority was omitted. Should Read:

July 6, 1970, ITALY----------69322-A/70

Signed and sealed this 27th day of November 1973.

(SEAL)
Attest;

EDWARD M.FLETCHER,JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.