United States Patent [19]

Metalsky et al.

[11] **3,874,845**

[45] **Apr. 1, 1975**

[54] **CONTROL OPERATOR**

[75] Inventors: **William J. Metalsky,** Warminster; **William A. Reynolds,** Philadelphia, both of Pa.

[73] Assignee: **Abar Corporation,** Feasterville, Pa.

[22] Filed: **Apr. 24, 1974**

[21] Appl. No.: **463,433**

[52] **U.S. Cl.** **432/266,** 432/203, 432/205

[51] **Int. Cl.** **F27b 9/04**

[58] **Field of Search** 432/203, 205, 266; 13/31

[56] **References Cited**

UNITED STATES PATENTS

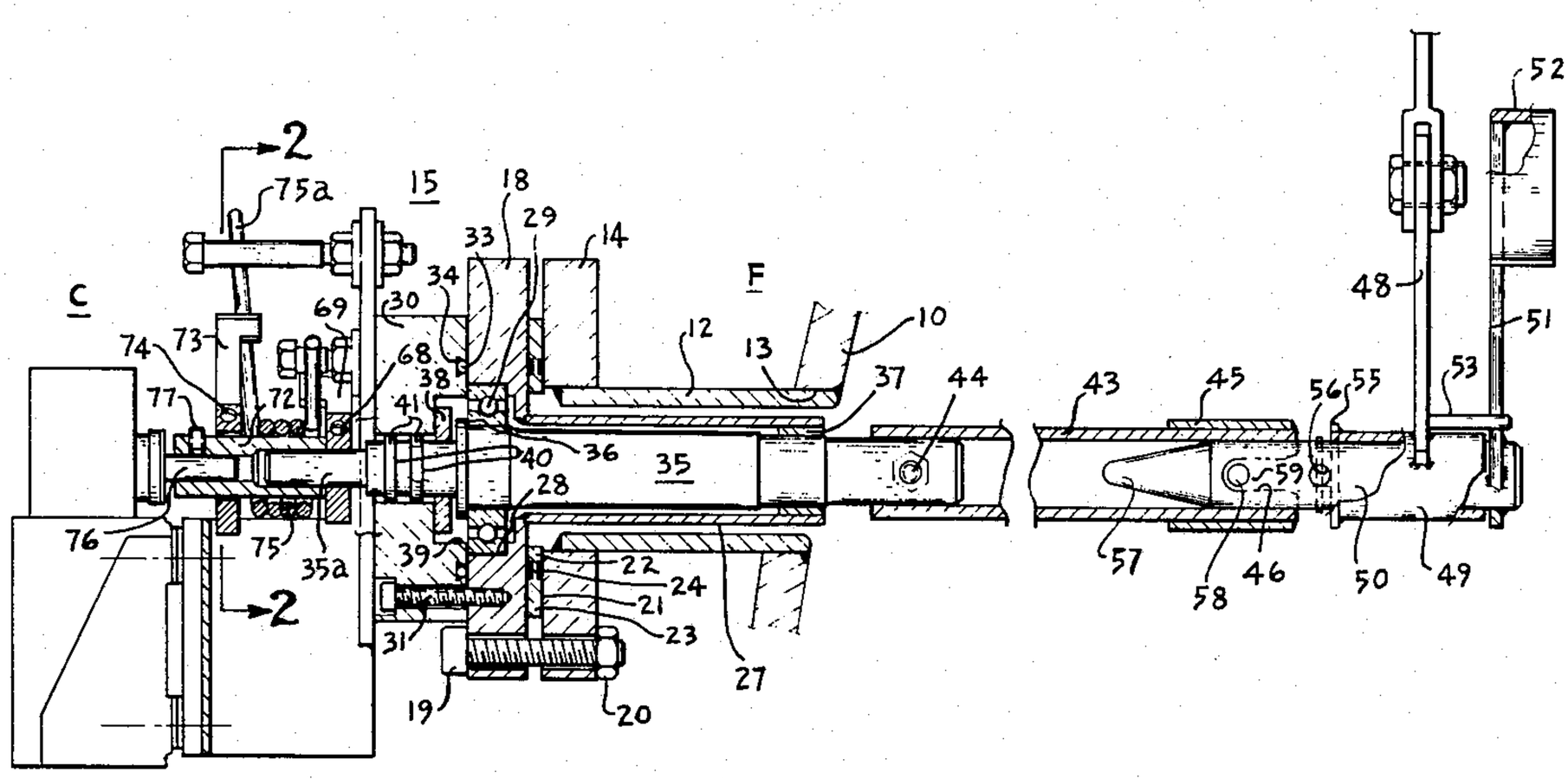
3,606,286	9/1971	Lundstrom	437/205
3,625,499	12/1971	Westeren et al.	432/205

Primary Examiner—John J. Camby
Attorney, Agent, or Firm—Zachary T. Wobensmith, II; Zachary T. Wobensmith, III

[57] **ABSTRACT**

A control operator is disclosed which is particularly useful for actuation by advancing work pieces in the interior of a high temperature vacuum furnace, the operator having a portion extending through the furnace wall for actuating an externally disposed control device, such as an electrical circuit control switch or a fluid valve, the operator being replaceable as a unit, having provisions for sealing against pressure or vacuum leakage and for effectively reducing heat conductivity from the interior to the exterior.

10 Claims, 4 Drawing Figures



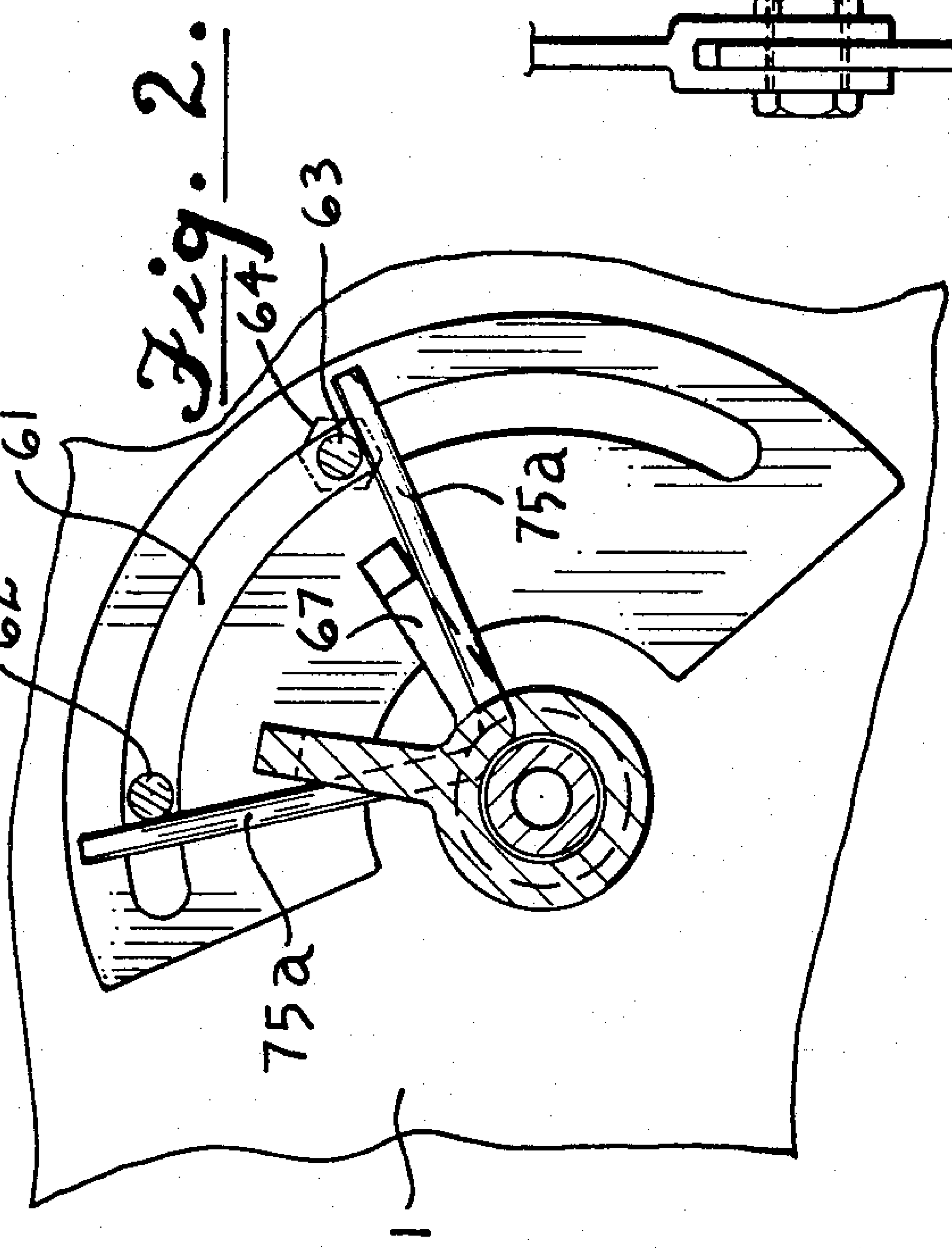


Fig. 2.

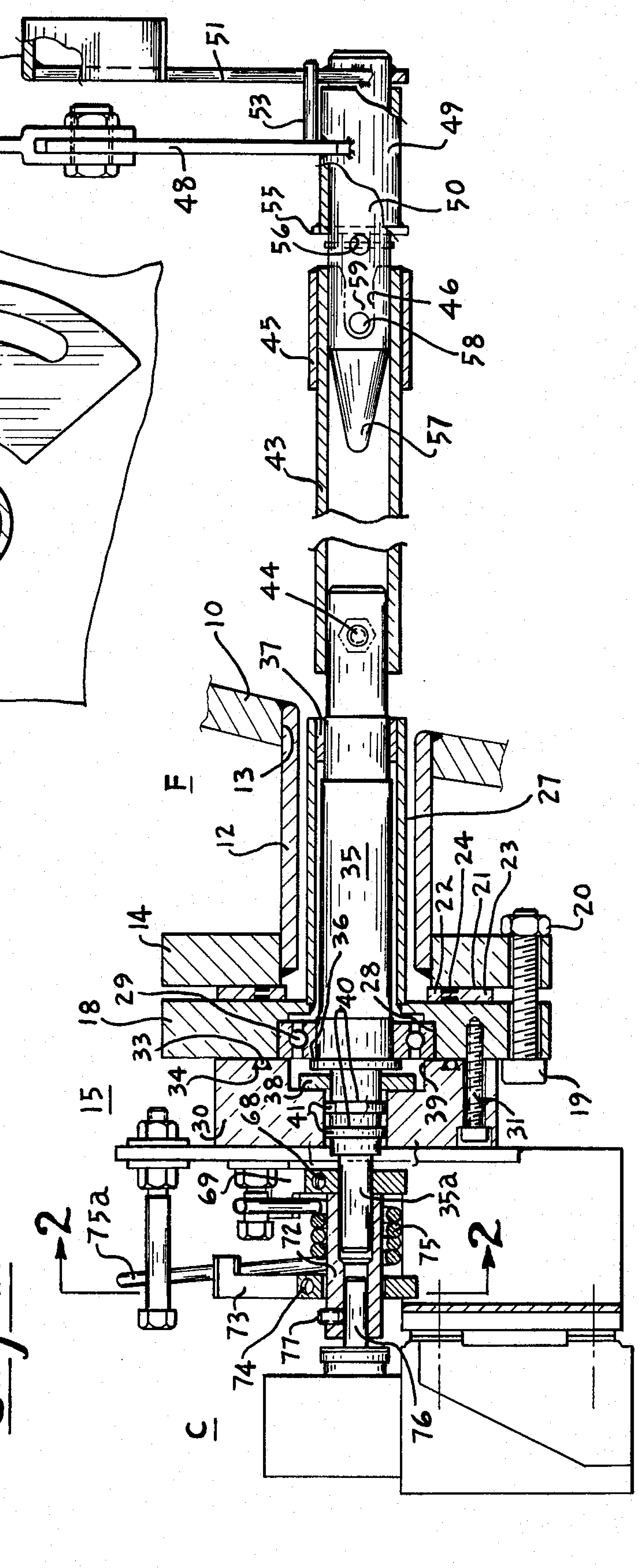


Fig. 1.

Fig. 3.

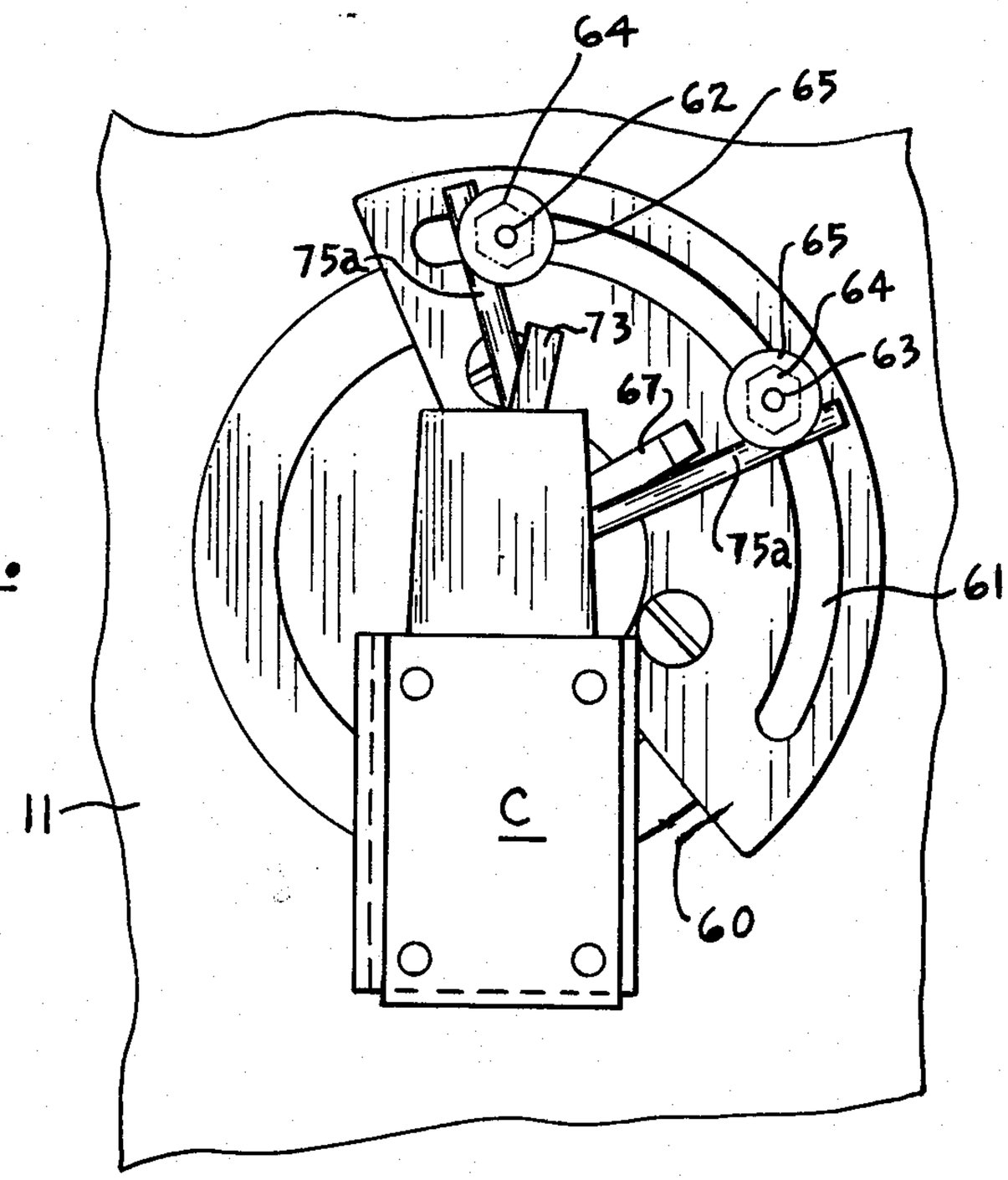
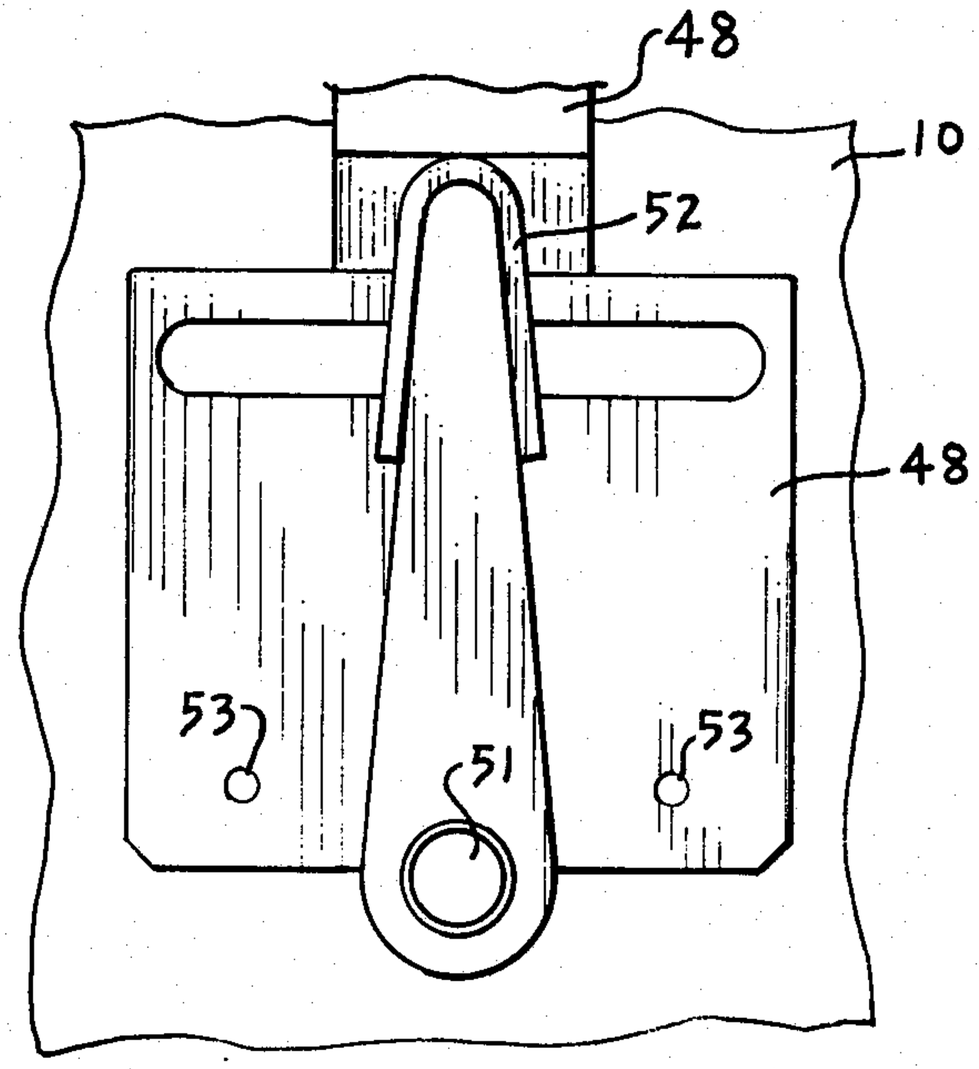


Fig. 4.



CONTROL OPERATOR

REFERENCE TO RELATED APPLICATION

The present invention is useful in connection with but is not limited for use with a vacuum furnace disclosed in the co-pending application of Benjamin A. Kreider and William J. Metalsky, filed Apr. 22, 1974, Ser. No. 462,961.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to control operators particularly adapted for use with vacuum electric furnaces.

2. Description of the Prior Art

Furnaces have heretofore been proposed in which the work pieces are advanced through a plurality of treating zones at least one of which is at high temperature.

The work pieces may be advanced on wheeled trucks, as in the U.S. Patents to Kugel, U.S. Pat. No. 802,517 and Borner, U.S. Pat. Nos. 3,583,690 and 3,625,496, and Austin et al., British patent No. 565,104; or by endless chains as in the U.S. Patents to Kochendorfer, U.S. Pat. No. 1,252,813 and Bielfeldt, U.S. Pat. No. 3,609,295, or with overhead trackways for movable elements such as in the U.S. patents to Miskella, U.S. Pat. No. 2,814,684, and Oetjen et al., U.S. Pat. No. 3,192,645.

It is ordinarily not feasible to locate control devices, such as electrical circuit control switches of fluid valves with a vacuum furnace.

Where the temperature gradient between the interior and exterior of the furnace is not great or where the pressure differential between the interior and the exterior of the furnace is slight no serious problems occur in locating control devices on the exterior for actuation from the interior.

One actuator suitable for use with ordinary conveyors is shown in the U.S. patent to Camillis et al., U.S. Pat. No. 3,076,069 but this is not suitable for use with vacuum furnaces nor where high temperature differentials are present.

In vacuum furnaces, where the interior temperatures are of the order of 800° F. or higher and may run to 2,400° F., and the vacuum is of the order of 10^{-3} inches of mercury serious problems arise which become greater as the vacuum is increased. The interior temperatures are too high to permit of locating control devices such as switches or valves inside the furnace. No satisfactory control operator for use in this environment has heretofore, to our knowledge, been available.

SUMMARY OF THE INVENTION

In accordance with the invention a control operator is provided, which is particularly suitable for but is not limited to use with vacuum electric furnaces, having a movable sensing element disposed within the furnace, thermally isolated by a shaft and with shaft operated control devices mounted exteriorly of the furnace, the support for the shaft being disposed exteriorly of the furnace for isolation from the interior furnace temperature. The control operator is advantageously a cartridge type unit for quick replacement.

It is the principal object of the invention to provide a control operator which is particularly suited for use with vacuum electric furnaces.

It is a further object of the invention to provide a control operator of the character aforesaid which can be readily applied and replaced if desired.

It is a further object of the invention to provide a control operator which is sealed against vacuum leakage and which functions at high temperature differentials.

Other objects and advantageous features of the invention will be apparent from the description and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The nature and characteristic features of the invention will be more readily understood from the following description taken in connection with the accompanying drawings forming part hereof, in which:

FIG. **1** is a vertical longitudinal central sectional view of a control operator in accordance with the invention;

FIG. **2** is a vertical transverse sectional view taken approximately on the line **2—2** of FIG. **1**;

FIG. **3** is an end elevational view of the control operator of FIG. **1** as seen from the left of FIG. **1**; and

FIG. **4** is an end elevational view of the control operator of FIG. **1** as seen from the right of FIG. **1.**

It should, of course, be understood that the description and drawings herein are illustrative merely and that various modifications and changes can be made in the structure disclosed without departing from the spirit of the invention.

Like numerals refer to like parts throughout the several views.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now more particularly to the drawings a fragmentary portion of the wall of a vacuum electric furnace F of well known type is shown at **10.**

A mounting tube **12** is provided, extending through openings **13** in the wall **10** and welded thereto to prevent vacuum leakage at this location. The mounting tube **12** extends outwardly and at its outer end has secured thereto a mounting flange **14.**

The cartridge unit, shown generally at **15** includes a supporting ring **18** which is detachably secured to the mounting flange **14** by bolts **19** and retaining nuts **20.** An annular packing **21,** interposed between the ring **18** and flange **14** and compressed by tightening of the bolts **19** prevents vacuum or fluid leakage at this location. The annular packing **21** can comprise inner and outer annular rings **22** and **23** with an interposed O-ring **24.**

The supporting ring **18** has a sleeve **27** secured thereto which extends inwardly within the mounting tube **12.** The supporting ring **18** has an annular groove **28** for the reception of the outer race of a bearing **29,** such as a ball bearing.

A retainer plate **30,** held in engagement with the supporting ring **18** by bolts **31** threaded thereinto, prevents displacement of the bearing **29.**

A packing **33** such as an O-ring, in a groove **34** in one face of the plate **30** interposed between the plate **30** and ring **18** and engaging one face of the ring **18** prevents vacuum or fluid leakage at this location.

A shaft **35** is provided having a shoulder **36** against one side of which the inner race of the bearing **29** is engaged. The shaft **35,** extending inwardly of the terminus of the sleeve **27** is journaled in a tubular bearing **37** carried in the sleeve **27.**

The other side of the shoulder **36** engages a thrust collar **38** in a recess **39** in the plate **30.**

The shaft **35** has a portion **35***a* of reduced diameter extending through the plate **30** with spaced grooves **40** for the reception of packings **41,** such as O-rings, for the prevention of vacuum or fluid leakage at this location.

The shaft **35,** inwardly of the furnace wall **10** has a hollow tubular sleeve shaft **43** secured thereto by a bolt **44.** The hollow shaft **43** by reason of reduced cross section of metal has a reduced tendency for heat transfer to the shaft **35.**

The hollow shaft **43** has a collar **45** secured thereto with a transverse end slot **46.**

The interior wall **10** of the furnace has secured thereto by a bracket (not shown) a hanger plate **48** with a tubular bearing **49** secured thereto through which a stub shaft **50** extends. The shaft **50,** on its outer end, has an actuator arm **51** fixed thereto. The arm **51** has an end portion **52** for engagement by the element causing its movement. The hanger plate **48** is provided with limit stop pins **53** for limiting the swinging movement of the arm **51** and the shaft **50** connected thereto.

The stub shaft **50** is retained in the bearing **49** by a washer **55** and pin **56** and has a tapered end **57** to facilitate insertion into the end of the tubular shaft **43.** A transverse pin **58** held in place by a transverse wire **59** is received within the end slot **46** to key the stub shaft **50** to the tubular shaft **43.**

The retainer plate **30** has mounted outwardly thereof and carried thereby a frame plate **60.** The frame plate **60** has an arcuate slot **61** for the adjustable mounting therealong of return spring force adjustment pins **62** and **63** held in adjusted position by nuts **64** and washers **65.**

The shaft portion **35***a* has an adjustable return spring abutment **67** carried thereon and held in adjusted position by a set screw **68.**

The shaft portion **35***a* also has rotatably carried therein a return spring mounting sleeve **72** with an adjustable spring abutment **73** mounted thereon and held in adjusted position by a set screw **74.**

A return or restoring spring **75** is provided having a plurality of turns disposed on the exterior of the spring mounting sleeve **72** with ends **75***a* for respective engagement with the pins **62** and **63.**

The spring mounting sleeve **72** has an actuating shaft **76** secured therein by a set screw **77.** The shaft **76** actuates the device C to be controlled and which in turn determines a control function to be exercised and which may be an electrical circuit controlling switch, a rheostat, a fluid flow control valve, or the like.

The mode of operation will now be pointed out.

Upon movement of an object within the furnace F, such movement may be utilized to swing the arm **52** from its normal upright position through a limited angular movement. Movement of the arm **52** is effective through the stub shaft **50,** the tubular shaft **43,** and the shaft **35.** Turning movement of the shaft **35** through the spring abutment **67,** spring **75** and spring abutment **73** is effective to turn the shaft **76** of the control device C.

Upon release of the arm **52,** the spring **75** is effective to return the arm **52** to its original position.

The force exerted by the spring **75** can be adjusted as desired by adjustment of the positions of the pins **62** and **63** along the slot **61.**

Movement of the shaft **76** can be restricted, as desired, by adjustment of the limit stops **67** and **73** by their respective alternate engagement with the spring ends **75***a* of the spring **75.**

The provision of the tubular shaft **43** reduces the area for heat transfer therealong from the hot zone of the furnace which may be of the order of 2,400° F. to the exterior of the furnace F which is at ambient temperature.

The provisions outside the furnace F for preventing vacuum leakage as well as the bearing **30** are at locations removed from and isolated from zones of high temperature and thus are protected against such high temperatures.

The structure with its cartridge construction, detachably mounted on the mounting flange **14,** and with the easily removable stub shaft **50** can be quickly and easily replaced if desired.

We claim:

1. Control mechanism for use with a vessel having the interior and exterior subject to temperature and pressure differentials comprising

a tubular mounting member fixedly mounted to and through a wall of the vessel,

a supporting member detachably secured to said mounting member and having a sleeve extending therefrom and within the tubular mounting member,

a shaft member rotatably carried in said supporting member,

said shaft member having a portion extending within said sleeve and inwardly therebeyond with a hollow tubular extension,

an actuator for said shaft member supported within the vessel including an arm detachably connected to said tubular extension,

a control element,

a resilient connection between said shaft member and control element for restoring said actuator to a predetermined position, and

members for preventing gaseous leakage along said shaft and with respect to said supporting member.

2. Control mechanism as defined in claim **1** in which said supporting member has a retaining member in engagement therewith for retaining said shaft member against axial displacement.

3. Control mechanism as defined in claim **1** in which a retaining member is provided in detachable engagement with said supporting member, and

said last mentioned members include packings interposed between said shaft member and said retaining member.

4. Control mechanism as defined in claim **1** in which a retaining member is provided in detachable engagement with said supporting member, and

said leakage preventing members include a sealing member between said retaining member and said supporting member.

5. Control mechanism as defined in claim **1** in which said last mentioned members include a packing between said supporting member and said mounting member.

6. Control mechanism as defined in claim **1** in which said resilient connection includes

a spring mounting sleeve,

a coil spring carried on said sleeve and having ends, and

members engages with said ends for adjusting the force exerted by said spring.

7. Control mechanism as defined in claim 6 in which limit stop members are provided for limiting the movement of said spring mounting sleeve.

8. Control mechanism as defined in claim 1 in which the support for said actuator includes a journal for a portion of said shaft member.

9. Control mechanism as defined in claim 1 in which said actuator includes an actuating arm secured to a

portion of said shaft member, and

said portion of said shaft member is detachably connected to said hollow tubular extension.

10. Control mechanism as defined in claim 8 in which limit stop members for said actuator are provided carried by the support for said actuator.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,874,845 Dated April 1, 1975

Inventor(s) William J. Metalsky et al.

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

In the Grant (ONLY) insert sheet 1 of the drawings containing Figures 1 and 2, as part of Letters Patent 3,874,845.

Signed and Sealed this

sixteenth Day of *December 1975*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks

USCOMM-DC 60376-P69
U.S. GOVERNMENT PRINTING OFFICE : 969-930

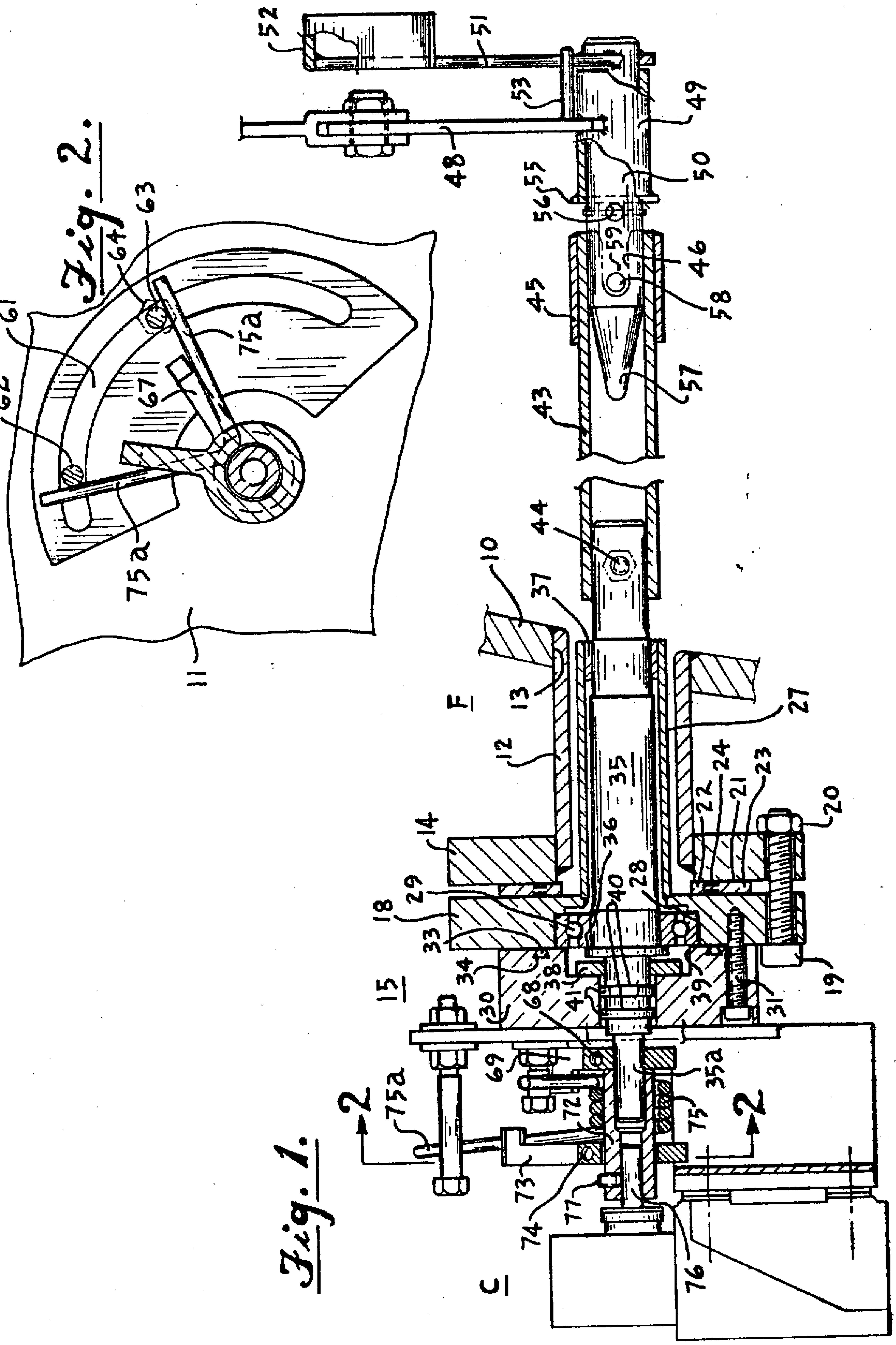


Fig. 2.

Fig. 1.