# United States Patent [19]

**Hehl**

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[54] **ROTARY ASSEMBLY FOR THE ADJUSTMENT OF HYDRAULIC THROTTLE VALVES IN INJECTION MOLDING MACHINES**


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[51] **Int. Cl.**[2] ........................................ **G05G 1/10**

[58] **Field of Search** ............ 74/527, 531, 553, 10.2; 403/196, 197, 199, 201



[56] **References Cited**

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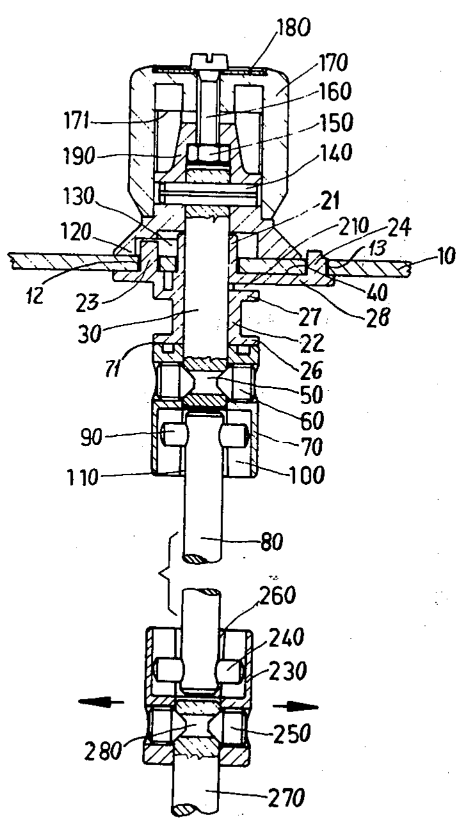
[57] **ABSTRACT**

A rotary assembly for the adjustment of hydraulic throttle valves and the like having a bearing member and an integral adjustably clampable sleeve member engaging the machine wall from one side, a knob and dial flange engaging the wall from the other side, and an adjustment shaft connecting the knob to the throttle valve via axially yielding coupling members. The bearing member further includes, as integral parts, an abutment finger and a centering finger serving as a zero mark.

**12 Claims, 4 Drawing Figures**

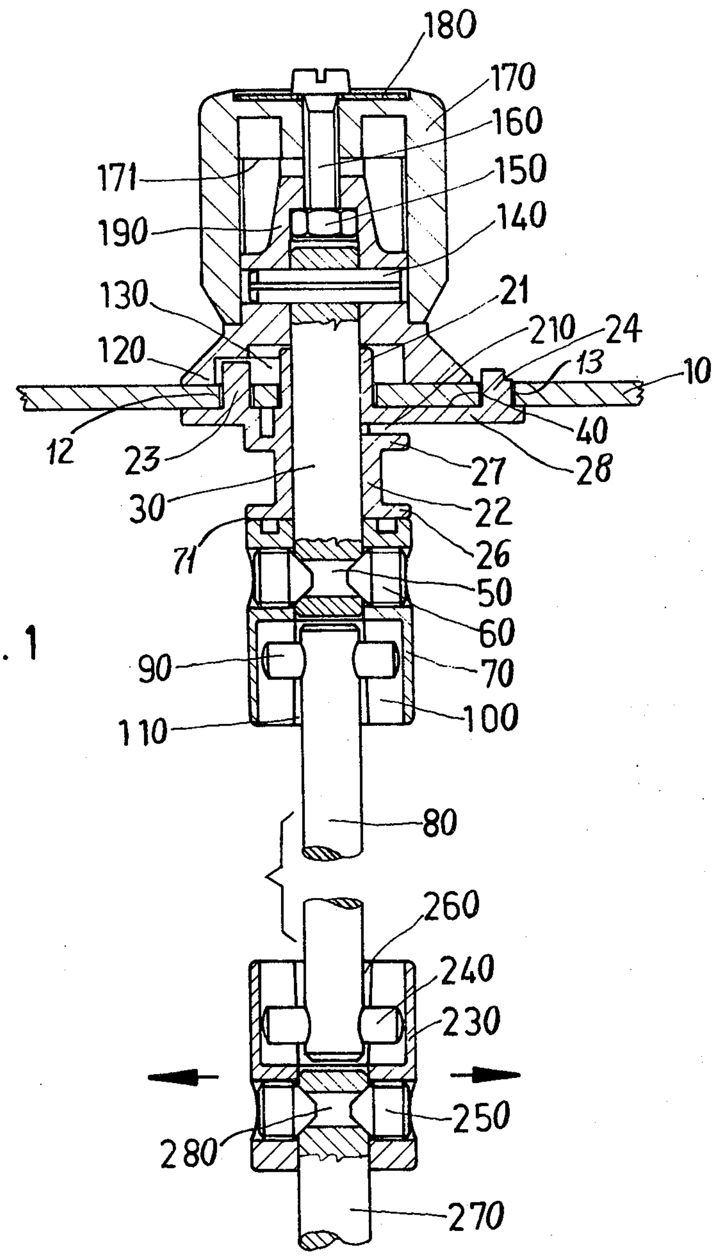

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Fig. 1

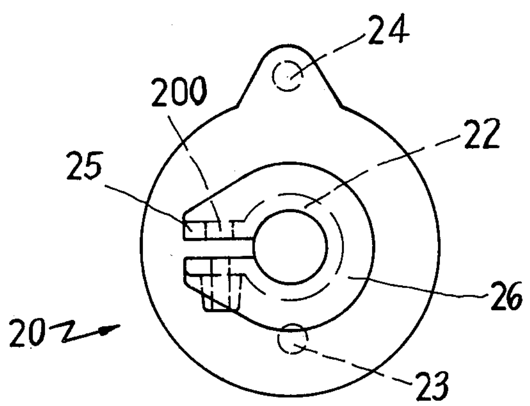


Fig. 2

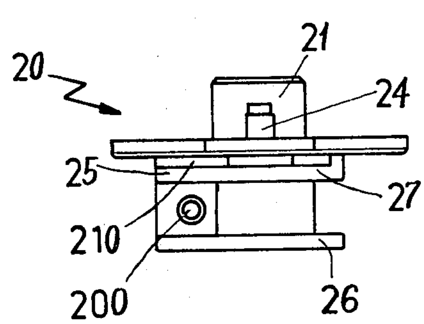


Fig. 3

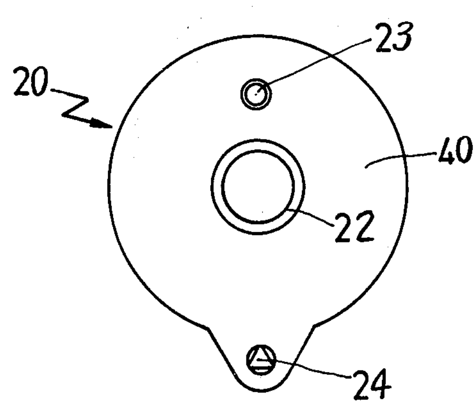


Fig. 4

# ROTARY ASSEMBLY FOR THE ADJUSTMENT OF HYDRAULIC THROTTLE VALVES IN INJECTION MOLDING MACHINES

## BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to rotary adjustment means for throttle valves, and in particular to rotary assemblies for the adjustment of remotely located hydraulic throttle valves in injection molding machines, especially where a plurality of hydraulic throttle valves are mounted on the rear side of the machine and the corresponding adjustment knobs and dials are arranged on the front side of the machine and where some of the knobs are axially offset in relation to the throttle valves.

2. Description of the Prior Art

From the prior art in this field are known various knob and dial arrangements for the rotary adjustment of throttle valves in hydraulic systems. The principal requirements for these assemblies are a delimitation of the total angular motion permitted and the maintenance of a given setting against machine vibrations and inadvertant adjustment through contact with an adjustment knob. One such prior art assembly includes a central adjustment shaft with a radially extending abutment finger for the limitation of the total angular displacement. This device also includes an adjustably clampable sleeve member engaging the adjustment shaft, the abutment finger of the latter engaging a radial slot in the sleeve member, the end points of the slot being determined by transverse faces of the sleeve member. Production and assembly of these parts are comparatively costly and time consuming, because the adjustable sleeve member has to be separately mounted on a wall of the machine base, an abutment finger has to be attached to the adjustment shaft during assembly, and a separate zero mark has to be provided on the wall adjacent the dial flange of the adjustment knob. An additional difficulty arises from the fact that the clampable sleeve member determines the axial alignment of the adjustment shaft, necessitating close manufacturing tolerances and accurate positioning of the sleeve member.

## SUMMARY OF THE INVENTION

It is a primary objective of the present invention to provide an improved rotary assembly for the adjustment of hydraulic throttle valves, whereby the adjustment shaft is independently journalled near the adjustment knob and adjustably clampable for frictional positioning, with the component parts of the assembly designed for economical mass production and maximum ease of assembly.

The present invention proposes to attain the above objective by suggesting a rotary adjustment assembly comprising a bearing member with a centering flange and bearing sleeve to which the adjustably clampable sleeve member forms an axial extension, the centering flange being arranged for abutment against a wall of the machine base and engaging the latter with at least one centering finger extending through a bore in said wall.

An additional advantageous feature of the invention results from the arrangement of three aligned bores in the machine wall cooperating with three axial extensions on the bearing member: a central larger bore receiving the bearing sleeve of the bearing member, a second smaller bore receiving a centering finger, and a third likewise smaller bore receiving a second finger, both fingers reaching beyond the machine wall. The second finger serves as an abutment finger limiting the angular motions of the adjustment knob, while the centering finger also conveniently serves as a zero mark.

A still further advantage of the present invention resides in the possibility of arranging the rotary adjustment assembly remotely from the location of the hydraulic throttle valve itself. This feature is particularly desirable in the case of injection molding machines, where a number of hydraulic throttle valves are arranged in a valve cluster on the back side of the machine, while the associated control knobs are arranged on the front side of the machine. In this case, it is not only necessary to provide the rotary connections reaching through the machine base, it may also be desirable, or necessary, to space the adjustment knobs on the front of the machine further apart than the spacing of the clustered throttle valves. The present invention, by suggesting a bearing member with an integral centering flange and bearing sleeve in axial alignment with the clampable sleeve member, provides independent bearing support for the adjustment assembly, making it possible to transmit the adjustment motion between the adjustment knob and the throttle valve via axially yielding transmission means. A convenient version of such a yielding transmission means is suggested, the latter including a coupling shaft with a cross pin on each extremity, the pins engaging cooperating grooved or slotted coupling hubs attached to the adjustment shaft and to a shaft extension of the throttle valve, respectively, thereby forming universal joints with limited angular yielding capability.

Finally, the bearing member with the bearing sleeve, centering finger, abutment finger, and clampable sleeve member is designed to be injection-moldable as one integral part. The coupling hub of the universal joint, the adjustment knob and the dial hub of the suggested rotary adjustment assembly are likewise designed to be injection-moldable.

## BRIEF DESCRIPTION OF THE DRAWINGS

Further special features and advantages of the invention will become apparent from the description following below, when taken together with the accompanying drawing which illustrates, by way of example, an embodiment of the invention, represented in the various figures as follows:

FIG. **1** shows a longitudinal cross section of a rotary adjustment assembly embodying the invention;

FIG. **2** is an axial end view of the bearing member of the assembly of FIG. **1**;

FIG. **3** shows the bearing member of FIG. **2** in a plan view; and

FIG. **4** shows the bearing member of FIG. **2** from the opposite axial side.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

As can be seen in FIG. **1**, the rotary adjustment assembly of the invention is mounted in a wall **10** which, for example, would be the front wall panel of the machine base of an injection molding machine. The rotary assembly would in this case reach across the machine base to its rear wall (not shown in the drawing) on which would be mounted a number of hydraulic throttle valves. The rotary assembly illustrated serves for adjusting the valve setting through rotation of the assembly from the front side of the machine, where the operator is normally stationed. The hydraulic system of an injection molding machine normally includes a plurality of such throttle valves, controlling the speed of its hydraulic drives. They include controls for the opening speed and closing speed of the die closing unit, for the speed of the injection unit, for the speed of the part ejection unit, and other units, as the case may be. The corresponding throttle valves may be arranged in the form of a valve cluster mounted to the rear wall of the machine base, each throttle valve being coupled to a rotary adjustment assembly reaching through the machine base. An arrangement of this type is disclosed in my co-pending application Ser. No. 473,690, filed May 28, 1974.

The machine wall **10** has three bores for mounting of the rotary assembly, a large central bore **11**, a first smaller bore **12**, and a second smaller bore **13** arranged opposite bore **12**. A bearing member **20** engages these three bores with matching axial extensions, thereby centering and positioning it on wall **10**. The central one of these extensions is a bearing sleeve **21**, the first smaller extension is an abutment finger **23** and the second smaller extension is a centering finger **24**. The bearing sleeve **21** of the bearing member **20** thus forms a central journal for a matching adjustment shaft **30** which extends through sleeve **21** across the wall **10**. To the outer end portion of the adjustment shaft **30** is fixedly attached a dial hub **190** by means of an elastic pin **140** which extends transversely through the dial hub **190** and shaft **30**. The dial hub **190** includes a dial flange **120** engaging the wall **10** from the outside. To the inner end portion of shaft **30** is attached a coupling hub **70** which carries two set screws **60** engaging a positioning bore **50** in the shaft **30**. The coupling hub **70** thus provides a bearing face **71** with which it engages a flange portion **26** of the bearing member **20**. The two hubs on the adjustment shaft **30** thus confine between them the bearing member **20** and the wall **10**, thereby axially positioning these two parts and eliminating the need for additional fasteners, while at the same time determining the axial position of shaft **30**. The dial hub **190** carries a cap-shaped adjustment knob **170**, by means of which the adjustment shaft **30** can be rotated. The knob **170** is clamped against the hub **190** by means of a clamping screw **160** and a captive nut **150**, the knob engaging the hub by means of a cross-shaped profile **171**. The knob **170** may further include an identification disc **180**.

In FIGS. **2–4** is separately shown the bearing member **20** of the rotary assembly which not only serves to align and support the adjustment shaft **30**, but also includes a means for providing an adjustable frictional resistance on the rotary assembly, in order to prevent any movement of the latter under operating vibrations, or as a result of inadvertant contact with the knob **170**. For this purpose, the bearing member **20** includes on its inwardly facing side an extension of the bearing sleeve **21** in the form of an adjustably clampable sleeve member **22**. This sleeve member **22** includes an outer flange portion **26** and an inner flange portion **27**, giving the sleeve member **22** the shape of a clamping collar or pipe clamp. An axially oriented slit, flanked by parallel wall portions **25** and traversed by a bore **200**, divides the sleeve member into two leg portions. The bore **200** in one leg portion is threaded, to cooperate with a suitable clamping screw (not shown). The inner flange portion **27** of this clampable sleeve member **22** is integrally attached to the main flange **28** of the bearing member **20**, but only on a portion of its circumference, a radial slit **210** separating the upper leg portion and the flange portion **27** (FIG. **2**) from flange **28**. Thus, when a clamping screw is tightened in the bore **200**, the sleeve member **22** is closed until it frictionally engages the adjustment shaft **30** (FIG. **1**).

The two smaller axial extensions of the bearing member **20** serve each a special purpose in addition to that of positioning and centering the rotary adjustment assembly in the machine wall **10**. The abutment finger **23**, by reaching into a sector-shaped recess **130** of the dial flange **120** of the dial hub **190**, provides angular displacement limits for the assembly, the displacement limits being determined by the sector angle of recess **130**. The centering finger **24** of the bearing member **20**, arranged just outside the periphery of the dial flange **120**, thereby serves as a convenient zero mark for the latter.

As can best be seen in FIGS. **2–4**, the three axial extensions **21, 23,** and **24**, as well as the clampable sleeve member **22** are integral parts of bearing member **20**, being designed for production as an injection-molded plastic part. Similarly, the dial hub **190**, the knob **170**, and the coupling hub **70** are designed for injection molding from plastic material. These parts are therefore inexpensive to manufacture and very easy to assemble, yet they are robust and durable.

A hydraulic throttle valve which is to be adjusted by means of the novel rotary adjustment assembly has a shaft extension **270** (FIG. **1**) carrying a coupling hub **230** which is similar to the coupling hub **70** on shaft **30**. Between these two coupling hubs extends a coupling shaft **80** engaging longitudinal grooves **100** and **290** of the coupling hubs **70** and **230**, respectively, by means of cross pins **90** and **240** in the end portions of the coupling shaft **80**.

Although the shaft assembly is shown in FIG. **1** in axial alignment with the shaft extension **270** of the throttle valve, it is obvious from the drawing that such alignment is not a prerequisite with the embodiment illustrated. An axially offset arrangement may be desirable or necessary, for example, when several hydraulic throttle valves are arranged in a close cluster, at distances from each other which would require the adjustment knobs **170** to be located too close to each other for convenient setting by hand. The adjustment assembly of FIG. **1** therefore allows for a certain degree of angular deviation between the shaft extension **270** of the throttle valve and the coupling shaft **80**, on the one hand, and between the coupling shaft **80** and the adjustment shaft **30**, on the other hand. The grooves **100** and **290** of the coupling hubs and the cross pins **90** and **240** of the coupling shaft **80** then form universal joints for the transmission of the rotational displacement of the knob **170** to the shaft extension **270**. In order to permit this universal joint action, the central bores of the coupling hubs **70** and **230** are oversize with respect to the diameter of the coupling shaft **80**, while the grooves **100** and **290** guide the cross pins **90** and **240**, respectively, with minimal radial clearance. A further simplification of design is achieved when, instead of providing oversize hub bores **110** and **260**, the diameter of the coupling shaft **80** is made smaller than the diameter of shaft **30** and shaft extension **270**.

This coupling arrangement has the additional advantage of conveniently compensating for manufacturing tolerances in the distance between the front and rear walls of the machine base which may affect the axial distance between the throttle valves and the adjustment knobs **170.**

Of course, the coupling hubs and coupling shaft could be replaced by other coupling means permitting transmission of rotary displacement over offset axes of the throttle valve and adjustment knob. Such transmission could, for instance, also be accomplished by means of a flexible shaft, or with coupling means including only one universal joint.

It should be understood, of course, that the foregoing disclosure describes only a preferred embodiment of the invention and that it is intended to cover all changes and modifications of this example of the invention which fall within the scope of the appended claims.

I claim:

**1.** A rotary adjustment assembly adapted for adusting the angular setting of a rotary control member, such as, for example, a hydraulic throttle valve of an injection molding machine, the assembly comprising in combination:

a stationary machine wall having a central bore and at least one parallelly spaced smaller bore extending therethrough;

a stationary bearing member having a centering flange abutting against the wall from one side, said flange including a bearing sleeve in coaxial alignment with the central bore of the wall and a smaller axial extension engaging said smaller bore;

a rotatable adjustment shaft extending through the bearing member to both sides of the wall, said shaft being journalled in the bearing sleeve, thereby defining the rotational center axis of the assembly;

an adustably clampable sleeve member connected to the stationary bearing member and engaging the adjustment shaft with adjustable frictional resistance against rotation;

means for coupling the adjustment shaft to a rotary control member; and

means for rotating the adjustment shaft against said frictional resistance.

**2.** A rotary assembly as defined in claim **1,** wherein the clampable sleeve member surrounds the adjustment shaft in the manner of a pipe clamp, having an axially oriented slot which divides the sleeve into two flexible leg portions, and a transverse clamping screw engaging the leg portions adjacent the slot.

**3.** A rotary assembly as defined in claim **2,** wherein one leg portion of the clampable sleeve member is integrally connected to the bearing member, while the other leg portion is axially separated from the bearing member by a radial gap.

**4.** A rotary assembly as defined in claim **1,** wherein:

the bearing sleeve extends axially from the centering flange through the central bore of the wall;

the smaller axial extension extends through its associated smaller bore a distance beyond the wall;

the shaft rotating means includes a dial hub and a dial flange mounted on the shaft and axially abutting against the stationary wall from the side opposite the centering flange; and

said dial hub flange includes an axial recess inside which is received the end of said smaller axial extension, the latter thereby serving as an abutment finger, whereby the arcuate width of said recess and the diameter of said abutment finger determine the angular displaceability of the rotary adjustment assembly.

**5.** A rotary assembly as defined in claim **4,** wherein the shaft rotating means further includes a knob which is removably attached to the dial hub and which engages the latter by means of a cross-shaped profile, the hub having matching recesses.

**6.** A rotary assembly as defined in claim **4,** wherein:

the stationary wall has a third bore extending through it, said bore being likewise parallelly spaced from its central bore;

the bearing member further includes another axial extension serving as a centering finger, the latter reaching through said third bore and defining a zero mark; and

the dial flange carries gradation markings radially adjacent the zero mark of said centering finger.

**7.** A rotary assembly as defined in claim **6,** wherein the dial hub and the dial flange are one integral part and fixedly attached to the adjustment shaft, thereby positioning the latter relative to the stationary wall in one axial direction; and

the adjustment shaft is solidary with a collar member engaging the bearing member from the opposite axial direction, thereby positioning the shaft and the bearing member relative to the stationary wall in the other axial direction.

**8.** A rotary assembly as defined in claim **7,** wherein the shaft coupling means includes a coupling hub which is fixedly attached to the adjustment shaft, the latter thereby serving as said collar member.

**9.** A rotary assembly as defined in claim **1,** wherein the rotary control member whose setting is to be adjusted by the adjustment assembly is axially spaced a considerable distance therefrom, said member including a short shaft extension which is oriented generally toward the adjustment assembly; and

the shaft coupling means further includes means for transmitting the rotation of said assembly to the control member under conditions of an axially offset orientation of the former in relation to the latter.

**10.** A rotary assembly as defined in claim **9,** wherein the rotation transmitting means includes a coupling hub fixedly attached to the shaft extension of the control member, and a coupling shaft extending between the coupling hubs of the shaft extension and adjustment shaft and engaging both hubs in the manner of a universal joint.

**11.** A rotary assembly as defined in claim **10,** wherein:

the two coupling hubs are similar in structure, each having an axial extension reaching beyond the shaft to which it is attached;

each coupling hub extension includes a bore in alignment with the shaft and a pair of diametrally opposite longitudinal grooves open to the bore;

the coupling shaft has end portions received within the bores of the two coupling hub extensions, the diameter of the former being considerably smaller than the diameter of the latter; and

each shaft end portion carries a cross pin of a diameter corresponding to the width of said grooves in the coupling hubs, thereby connecting the adjustment shaft to the shaft extension of the control member with a considerable longitudinal positioning tolerance and axial alignment tolerance, but with minimal angular tolerance.

**12.** A rotary assembly as defined in claim **1,** wherein:

the bearing member is injection-molded and includes, as integral portions thereof, said bearing sleeve, said smaller axial extension, and said clampable sleeve member;

the shaft coupling means includes two injection-molded coupling hubs; and

the shaft rotating means includes an integrally injection-molded dial hub and dial flange and a detachable, likewise injection-molded knob.

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