# United States Patent [19]

**Goeke et al.**

[11] **3,750,497**

[45] **Aug. 7, 1973**


[54] **ADJUSTING MECHANISM FOR RADIALLY MOVABLE TOOLS IN ROTARY TUBULAR TOOL HOLDERS OF SHAVING MACHINES FOR WIRE OR THE LIKE**


[75] Inventors: **Alfons Goeke; Franz Riedel; Karl Gustav Weck,** all of Solingen, Germany

[73] Assignee: **Th. Kieserling & Albrecht,** Solingen, Germany



[22] Filed: **Nov. 17, 1971**

[21] Appl. No.: **199,628**

[30] **Foreign Application Priority Data**

Dec. 10, 1970 Germany ..... P 20 60 760.7

[52] **U.S. Cl.** ..... **82/20**

[51] **Int. Cl.** ..... **B23b 5/00**

[58] **Field of Search** ..... 82/20, 30, 34



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 3,486,403 | 12/1969 | Schweer et al. | 82/20 |
| 3,099,929 | 8/1963 | Lindemann | 82/20 |



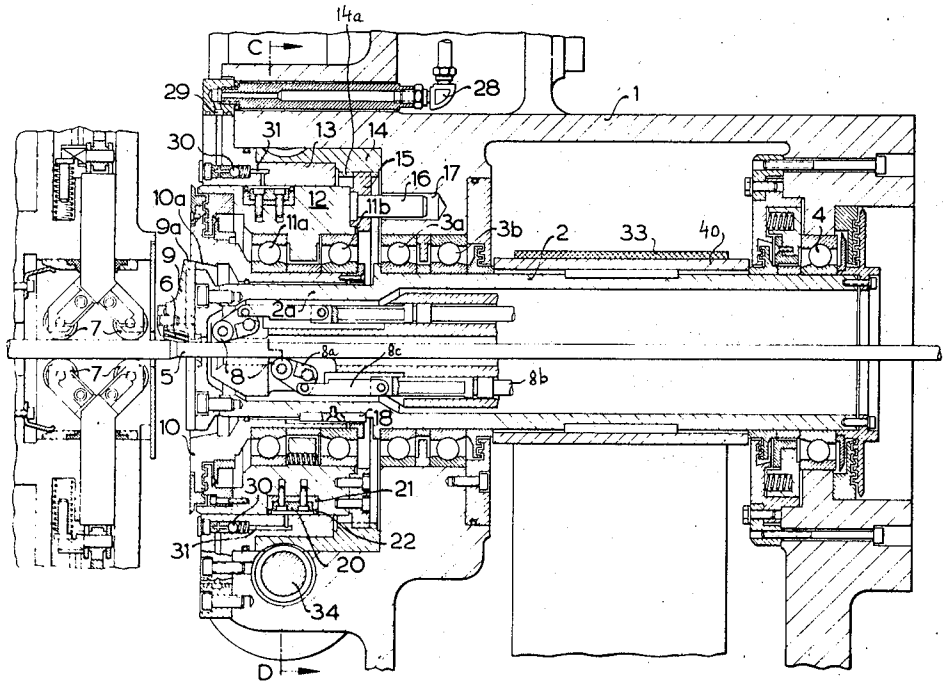
*Primary Examiner*—Andrew R. Juhasz
*Assistant Examiner*—Z. R. Bilinsky
*Attorney*—Michael S. Striker



[57] **ABSTRACT**

A shaving machine for rolled wire or the like wherein the tubular shaving head carries one or moreshaving tools which are caused to move radially in response to axial movement of an adjusting sleeve which is connected to the inner race of an axially movable antifriction bearing spacedly surrounding the shaving head. The outer race of the bearing is provided with annuli of equidistant plenum chambers which are sealed by a stationary ring-shaped guide surrounding the bearing and having conduits for admission of pressurized fluid into the plenum chambers. The plenum chambers serve as a stabilizing or cushioning means for holding the bearing against radial movements with reference to the frame. The adjusting sleeve is loosely coupled to the shaving head so that it rotates with but need not share vibratory or other stray movements of the shaving head. This insures that such stray movements need not be shared by the tools whose supports are biased against a conical internal surface of the adjusting sleeve.


**10 Claims, 3 Drawing Figures**



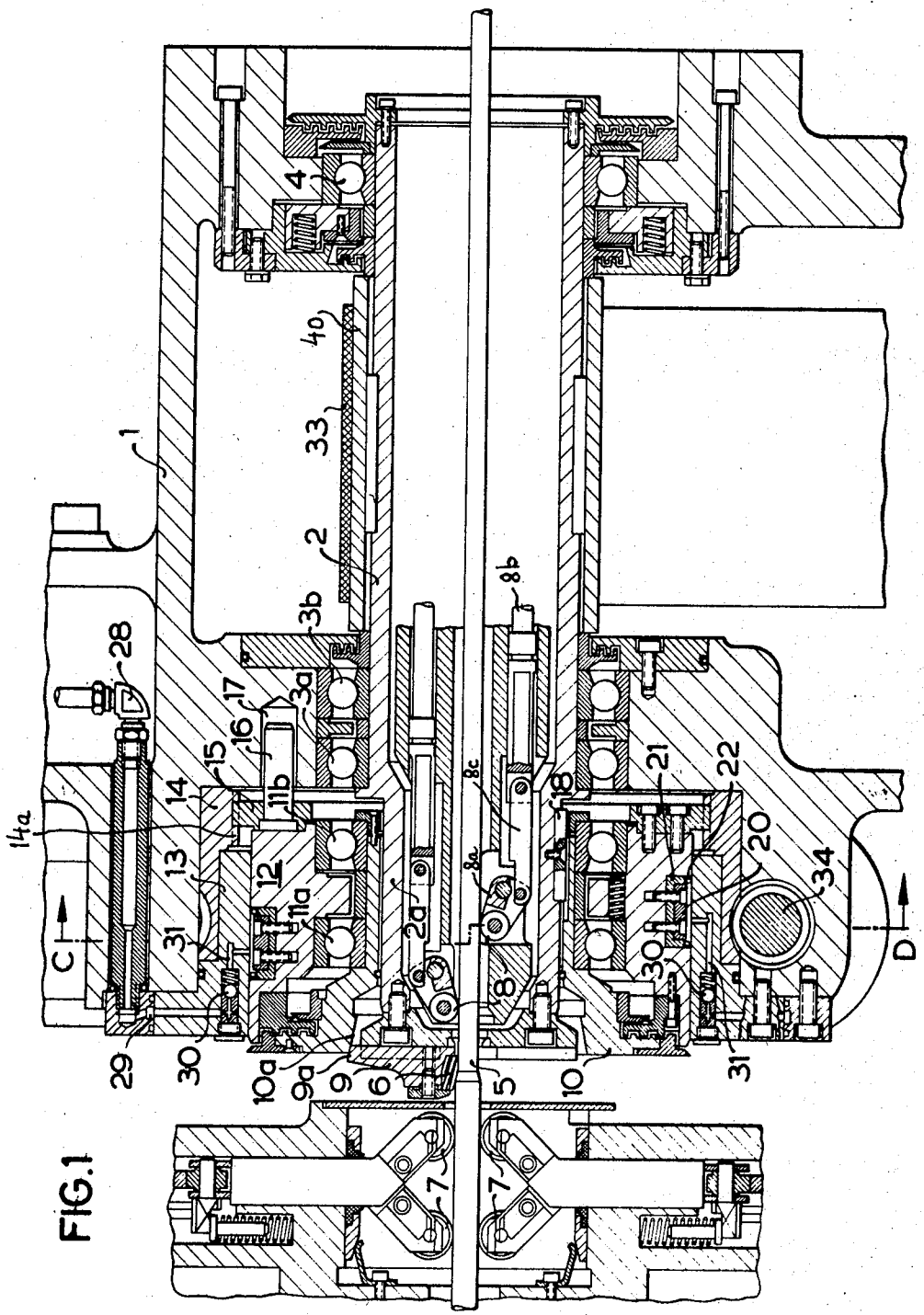

1
2
3a
3b
4
5
6
7
8
8a
8b
8c
9
9a
10
10a
11a
11b
12
13
14
14a
15
16
17
18
20
21
22
28
29
30
31
33
34
40
C
D

FIG.1

FIG. 2

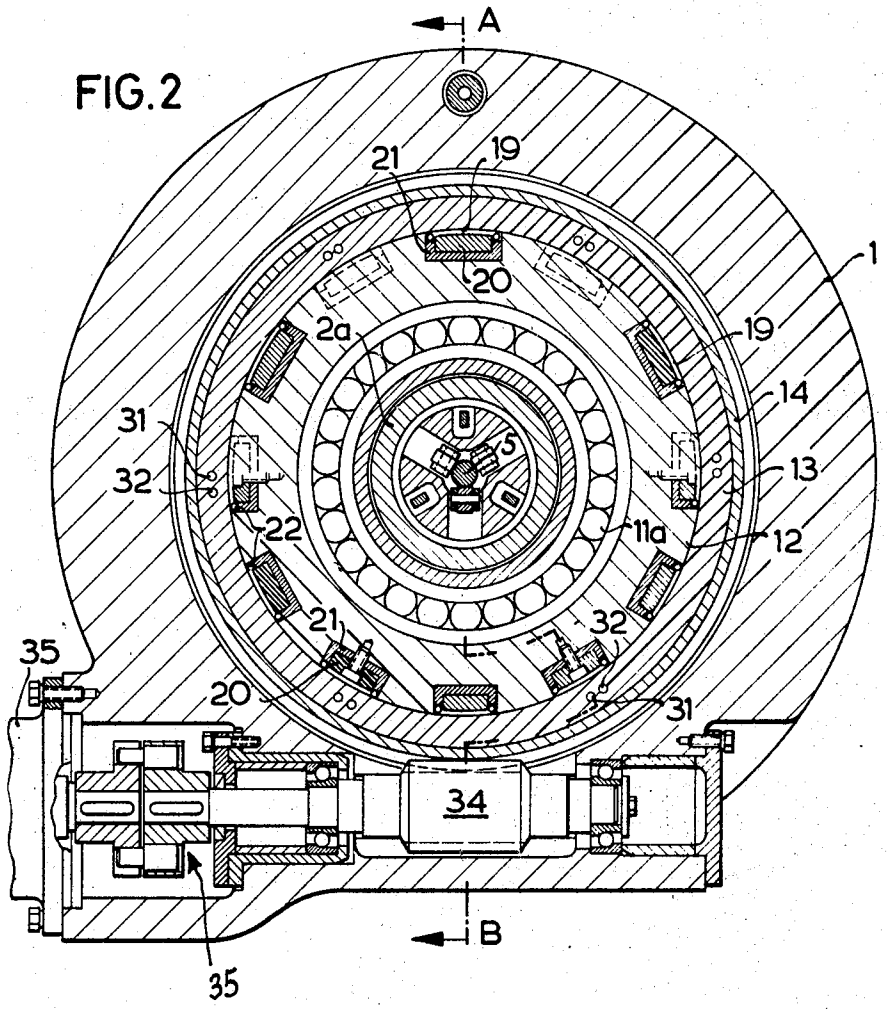
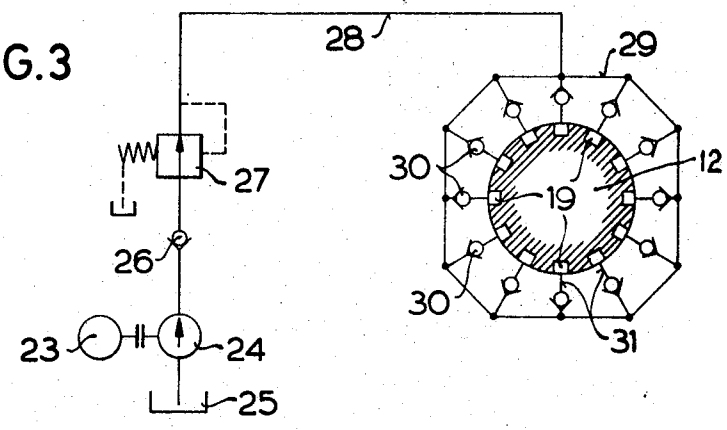

A
21
19
20
1
2a
19
14
31
5
13
32
22
11a
12
21
32
35
20
31
34
B
35

FIG. 3


28
29
27
30
12
19
26
30
23
24
31
25

# ADJUSTING MECHANISM FOR RADIALLY MOVABLE TOOLS IN ROTARY TUBULAR TOOL HOLDERS OF SHAVING MACHINES FOR WIRE OR THE LIKE

## BACKGROUND OF THE INVENTION

The present invention relates to machines for shaving or analogous treatment of elongated metallic workpieces, such as tubes, rods, rolled wire or the like. More particularly, the invention relates to improvements in an adjusting mechanism which can be employed to effect radial movements of one or more tools, rolls, rollers, tool supports and/or analogous adjustable elements in the rotary tubular tool holder or head of a shaving or analogous material removing machine. Still more particularly, the invention relates to improvements in adjusting mechanisms of the type wherein one or more tools or other adjustable elements are caused to move radially of a rotary tubular holder in response to axial displacements of a preferably sleeve-like adjusting member which is mounted on and rotates with the tubular holder. As a rule, such adjusting member is provided with a conical internal surface which is in permanent abutment with conical surfaces of the radially adjustable elements so that such elements are caused or allowed to move radially of the tubular holder in response to axial displacements of the adjusting member.

When a shaving machine is used to remove material from the external surface of rolled wire or wire rods having a smaller diameter, the tool holder or shaving head must normally be driven at a very high speed. The quality of surface finish on such small-diameter workpieces depends to a great extent on the stability of the material removing tools. Thus, chatter marks or other types of unevennesses will appear if the shaving head is allowed to vibrate at elevated speeds and if such vibratory movements are transmitted to the tools which rotate with the shaving head. In other words, it is desirable to mount the tools in such a way that their distance from the path for the workpiece which is fed lengthwise through the revolving shaving head should remain unchanged even if the shaving head is allowed to perform vibratory and/or other stray movements, especially when the shaving head is driven at a very high speed.

German Pat. No. 1,188,413 discloses a shaving machine wherein the adjusting sleeve which serves to effect radial adjustments of tools in the rotary shaving head is operatively connected with the inner race of one main antifriction bearing for the shaving head. The outer race of such main bearing is movable with reference to the axis of the shaving head to thereby effect axial adjustments of the sleeve which latter, in turn, effects radial adjustments of the tools. The inner race of movable main bearing is keyed to the shaving head so that such parts rotate as a unit but the inner race is free to move axially of the shaving head in response to each axial displacement of the outer race with reference to the frame of the shaving machine. The outer race is connected with a ring which is keyed to the frame so that it is free to move axially with the outer race but is held against angular movement. The means for moving the outer race axially of the shaving head is coupled to the aforementioned ring.

The just described shaving machine exhibits a serious drawback, namely, that the stability of the shaving head varis in response to changes in axial position of the movable main bearing. Thus, the likelihood that the shaving head would vibrate and that such vibrations will be transmitted to the tools in the shaving head is increased when the nature of desired axial adjustment of the adjusting sleeve is such that the movable main bearing must be moved toward the other main bearing or bearings. The axially movable main bearing is normally the one which is nearest to the shaving station so that, when such bearing is caused to move away from the shaving station, the likelihood of vibration of the shaving head and shaving tools increases with the result that the cutting edges of the tools will leave chatter marks on the peripheral surface of the workpiece. The aforementioned ring which is coupled to and effects axial movements of the outer race of the movable main bearing is a simple sliding fit in the frame of the shaving machine. It was found that such mounting of the ring in the frame is unsatisfactory because it does not prevent undue vibrations of the movable bearing and of the shaving head when the shaving head is driven at a high speed, and especially when the movable bearing is caused to move in a direction away from the shaving station.

German Utility Model No. 1,951,782 discloses a shaving machine wherein the adjusting sleeve for radially movable shaving tools is installed directly on the shaving head. The adjusting sleeve is mounted on roller bearings which are constructed in such a way that the likelihood of transmitting detrimental forces to the bearings during vibration of the shaving head is reduced. The front main antifriction bearing for the shaving head is fixedly mounted in the frame of the shaving machine. The adjusting sleeve is movable axially by means of a worm which rotates a worm wheel having an internal thread in mesh with the outer race of the roller bearing which is movable axially to thus shift the adjusting sleeve. Such shaving machines are also incapable of preventing, with a requisite degree of certainty, all undesirable radial displacements or other stray movements of the shaving head with the result that the shaving tools are likely to produce chatter marks.

## SUMMARY OF THE INVENTION

An object of the invention is to provide a shaving or like machine for treatment of elongated rod-like or tubular workpieces, such as rolled wire, with a novel and improved adjusting mechanism for one or more tools, rolls, rollers or analogous adjustable elements which are movable radially of a rotary tubular holder in response to axial movements of an adjusting member, and to construct and assemble the adjusting mechanism in such a way that eventual vibrations or other stray movements of the tubular holder, especially when the holder rotates at a high speed, are unlikely to or cannot be transmitted to the radially movable elements.

Another object of the invention is to provide a novel and improved mounting for the adjusting sleeve which serves to effect radial movements of one or more tools or analogous adjustable elements in a rotary tubular holder, the improved mounting being capable of preventing the transmission of stray movements from the tubular holder to the adjusting sleeve.

The invention is embodied in a machine tool, particularly in a machine for shaving or analogous treatment of rolled wire or similar elongated metallic workpieces. The machine comprises a stationary frame, a tubular holder (such as the shaving head of a shaving machine)

which is rotatably mounted in the frame and might exhibit the tendency to vibrate, especially when driven at a high speed, at least one antifriction bearing surrounding the holder and having inner and outer races which are movable as a unit axially of the holder but are rotatable relative to each other, stabilizing means disposed between the outer race and the frame (such stabilizing means preferably comprises one or more annuli of plenum chambers provided in the periphery of the outer race and being connected with a pump or another suitable source of pressurized fluid by way of conduit means provided in a stationary guide member which surrounds the outer race with minimal clearance), for holding the races of the bearing against other but axial movements with reference to the frame, means for moving the outer race axially of the holder whereby the inner race shares such axial movements of the outer race, a preferably sleeve-like adjusting member connected with the inner race for angular and axial movement with the latter, at least one tool, tool support or an analogous adjustable element mounted in the holder and arranged to move radially of the holder in response to axial movements of the adjusting member, and torque transmitting means connecting the adjusting member to the holder with at least some freedom of (preferably radial) movement of the holder with reference to the adjusting member so that vibratory and/or other stray movements of the holder need not be shared by the adjusting member and the adjustable element.

Since the races of the bearing are held against other but axial movements with reference to the frame, since the inner race is preferably rigid with the adjusting member, and since the adjusting member merely shares the angular movements of the holder, eventual stray movements of the holder need not be transmitted to the adjustable element or elements which thus remain at a selected distance from the path for the workpieces.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved adjusting mechanism itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawing.

## BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a fragmentary central longitudinal vertical sectional view of a shaving machine with a tubular holder for tools which are adjustable by a mechanism embodying the present invention, the section being taken in the direction of arrows as seen from the line A–B of FIG. **2**;

FIG. **2** is a transverse vertical sectional view as seen in the direction of arrows from the line C–D of FIG. **1**; and

FIG. **3** is a diagrammatic view of the hydraulic circuit of the stabilizing means in the adjusting mechanism.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIGS. **1** and **2**, there is shown a portion of a machine which can be utilized, for example, for shaving or analogous treatment of rolled wire or wire rods **5**. The machine comprises a frame **1** provided with main antifriction bearings **3***a*, **3***b* and **4** for a rotary tubular tool holder or shaving head **2**. An intermediate portion of the head **2** constitutes or is connected with a pulley **40** which is driven by an endless flat belt **33** so that the shaving head rotates about the axis of the elongated workpiece **5**. A feeding unit which is mounted upstream of the shaving station (at the left-hand end of the shaving head **2**, as viewed in FIG. **1**) comprises driven advancing or feeding rollers **7** which are adjustable simultaneously radially toward and away from the path for the workpiece **5**. The construction of the mechanism which serves to effect appropriate adjustments of the advancing rollers **7** forms no part of the present invention.

The shaving head **2** supports two axially spaced sets of guide rolls **8** which are installed downstream of the shaving station and are adjustable (individually and/or simultaneously) radially of the path for the workpiece **5**. For example, each set of guide rolls **8** may comprise three equidistant rolls. The construction of the mechanism which serves to effect radial adjustments of the guide rolls **8** forms no part of the present invention; as shown in FIG. **1**, each guide roll **8** can be mounted in the shaving head **2** on a lever **8***a* which can be pivoted by a motion transmitting rod **8***b* and link **8***c*.

The shaving station accommodates at least one but preferably several material removing tools or knives **6** which are movable radially of the shaving head **2** and each of which is mounted in the shaving head by means of a support **9** having a conical external surface **9***a*. The conical surfaces **9***a* of all supports **9** are permanently biased against a conical internal surface **10***a* provided in a sleeve-like adjusting member **10** which surrounds the adjacent portion **2***a* of the shaving head **2** and is secured thereto by one or more torque transmitting keys **18** or the like so that it is compelled to share the angular movements of but is movable axially with reference to the shaving head. Also, the shaving head **2** has a certain freedom of radial movement with reference to the adjusting sleeve **10**. The tools **6** rotate with the shaving head **2** and are movable radially toward or away from the path for the workpiece **5**, depending upon whether the adjusting sleeve **10** is caused to move axially in a direction to the left or to the right, as viewed in FIG. **1**. The means for biasing the surfaces **9***a* of the supports **9** against the conical internal surface **10***a* of the sleeve **10** is not shown in the drawing. In accordance with a feature of the invention, the aforementioned clearance between the peripheral surface of the shaving head portion **2***a* and the internal surface of the adjusting sleeve **10** is so large that eventual vibrations or other stray movements of the shaving head are unlikely to be transmitted to the sleeve **10** and tools **6**.

The adjusting sleeve **10** is rotatable and movable axially with the inner races of two auxiliary antifriction bearings **11***a*, **11***b* which comprise a common outer race **12**. The outer race **12** is received with minimal clearance in a guide ring **13** which is fixedly secured to the frame **1**. The arrangement is such that all axial movements of the outer race **12** are transmitted to the inner races of the auxiliary bearings **11***a*, **11***b* and such inner races move the adjusting sleeve **10** axially of the shaving head **2** to thereby change the radial positions of tools **6**, i.e., the distance between the cutting edges of tools **6** and the axis of the shaving head.

The guide ring **13** is surrounded by a portion of a worm wheel **14** which is rotatable in the frame **1** and

can be rotated by a worm **34** driven by the output member of a reversible gear motor **35** or an analogous prime mover through the intermediary of a suitable clutch **35a** shown in FIG. **2.** The right-hand portion of the worm wheel **14** (as viewed in FIG. **1**) is provided with internal threads **14a** meshing with the external threads of a ring **15** which is secured to and can be said to form part of the outer race **12.** The ring **15** has an axially parallel projection or stud **16** which extends into a blind bore **17** of the frame **1** to hold the outer race **12** against rotation but to allow this outer race to move axially in response to rotation of the worm wheel **14.** The reversible motor **35** is preferably of the variable-speed type so that it can move the outer race **12** (and hence the entire auxiliary antifriction bearings **11***a*, **11***b* and the adjusting sleeve **10**) axially in a desired direction in order to effect necessary radial displacements of the tools **6.**

The peripheral surface of the outer race **12** is provided with an annulus of equidistant plenum chambers **19** which can be staggered with reference to each other in the axial direction of the shaving head **2** to effect a desirable axial stabilization of the outer race **12.** The arrangement is such that one-half of the total number of plenum chambers **19** form a first annulus located in a first plane and the remaining chambers **19** form a second annulus which is located in a second plane. The two planes are normal to the axis of the outer race **12** and the chambers **19** of one of the two annuli alternate with the chambers of the other annulus, as considered in the circumferential direction of the outer race **12.** In order to reduce the volume of pressurized hydraulic fluid which fills the chambers **19,** each of these chambers preferably constitutes a tapped bore provided in an internally threaded socket **21** which is recessed into the peripheral surface of the outer race **12** and receives an externally threaded disk **20.** The curvature of the exposed external surfaces of the disks **20** preferably complements the curvature of the internal surface of the fixed guide ring **13.** The outer end face of each socket **21** is adjacent to a sealing ring **22** which bears against the internal surface of the guide ring **13** to thus prevent excessive leakage of pressurized fluid from the respective chamber **19.** Such fluid is pressurized by a pump **24** (FIG. **3**) which is driven by an electric motor **23** and draws hydraulic fluid from a tank **25.** The pressurized fluid is caused to flow through a supply conduit **28** containing a one-way ball check valve **26** and a pressure regulating valve **27** to thereupon flow into a distributor conduit **29.** The latter is in communication with the chambers **19** by means of conduits **31** containing one-way ball check valves **30.** If necessary, the fluid in any one of the chambers **19** can be evacuated by way of a discrete discharge conduit **32** which is normally sealed. The conduits **29, 31** and **32** are machined into the guide ring **13.** Two of the check valves **30** and the corresponding conduits **31** are illustrated in greater detail in FIG. **1.** The conduit **28** is mounted in the frame **1** (see the upper portion of FIG. **1**). The plenum chambers **19** together constitute a stabilizing or cushioning means which insures that the outer race **12** (and hence the inner races of the auxiliary bearings **11***a*, **11***b* and the adjusting sleeve **10**) cannot move radially of the fixedly mounted guide ring **13** which can be said to form a component part of the frame **1.**

An important advantage of the improved adjusting mechanism for the tools **6** is that the torque-transmitting connection between the portion **2***a* of the shaving head **2** and the adjusting sleeve **10** is such that eventual vibrations of the shaving head need not necessarily be transmitted to the adjusting sleeve. On the other hand, the plenum chambers **19** insure that the adjusting sleeve **10** is held against stray movements with reference to the frame **1** with the result that, even if the shaving head **2** vibrates or performs other undesirable stray movements, the adjusting sleeve **10** is capable of rotating at the exact speed of the shaving head but without being compelled to share the stray movements of the latter. This reduces the likelihood that the cutting edges of the knives **6** would produce chatter marks, even if the machine is used for the shaving of small-diameter workpieces and even if the shaving head **2** is caused to rotate at a very high speed.

The pressurized fluid in the chambers **19** prevents any appreciable radial movements of the outer race **12** of the auxiliary bearings **11***a*, **11***b* with reference to the path for the workpiece **5.** The inner races of the bearings **11***a*, **11**b hold the adjusting sleeve **10** against radial movement with reference to the outer race **12.** Consequently, the adjusting sleeve **10** is compelled to rotate about a fixed axis even if the axis of rotation of the shaving head **2** deviates from such fixed axis, i.e., even if the shaving head is caused to vibrate while it rotates about the workpiece **5.** Such mounting of the adjusting sleeve **10** insures that the distance between the cutting edges of the tools **6** and the path for the workpiece **5** changes only when the adjusting sleeve is caused to move axially in response to a clockwise or counterclockwise rotation of the worm **34** under the action of the motor **35.** The aforementioned clearance or freedom with which the adjusting sleeve **10** is coupled for rotation with the shaving head **2** insures that the shaving head can perform stray movements but that such movements need not and normally are not transmitted to the adjusting sleeve and tools **6.** Also, such clearance reduces the likelihood of excessive stressing of auxiliary bearings **11***a*, **11***b* when the shaving head **2** vibrates. In the absence of a clearance, the bearings **11***a*, **11***b* would be subjected to substantial stresses because the chambers **19** prevent radial movements of the adjusting sleeve **10,** i.e., the bearings **11a, 11b** would have to take up all such stresses which would arise due to the fact that the adjusting sleeve **10** cannot participate in radial or other stray movements of the shaving head.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features which fairly constitute essential characteristics of the generic and specific aspects of our contribution to the art and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended

**1.** In a machine tool, particularly in a machine for shaving or analogous treatment of rolled wire or similar elongated workpieces, a combination comprising a frame; a tubular holder rotatably mounted in said frame; at least one antifriction bearing spacedly surrounding said holder and having inner and outer races movable as a unit axially of said holder, said inner race being rotatable relative to said outer race; stabilizing means for holding said races against other but axial

movement with reference to said frame; means for moving said outer race axially of said holder; an adjusting member connected with said inner race for angular and axial movement therewith; at least one adjustable element installed in said holder and arranged to move radially of said holder in response to axial movements of said adjusting member; and torque transmitting means connecting said adjusting member to said holder with at least some radial freedom of movement of said holder relative to said adjusting member so that stray movements of said holder need not be shared by said adjusting member and said adjustable element.

**2.** A combination as defined in claim **1**, wherein said stabilizing means comprises a plurality of circumferentially spaced plenum chambers interposed between said outer race and said frame.

**3.** A combination as defined in claim **2**, further comprising a source of pressurized fluid, conduit means connecting said source with said chambers, and one-way valve means provided in said conduit means for each of said chambers to prevent return flow of pressurized fluid from said chambers toward said source.

**4.** A combination as defined in claim **3**, further comrpising pressure regulating valve means provided in said conduit means.

**5.** A combination as defined in claim **4**, further comprising additional one-way valve means provided in said conduit means between said source and said pressure regulating valve means.

**6.** A combintion as defined in claim **1**, wherein said stabilizing means comprises at least one annulus of at least substantially equidistant plenum chambers provided in the peripheral surface of said outer race.

**7.** A combination as defined in claim **1**, wherein said means for moving said outer race axially of said holder comprises a worm wheel rotatably mounted in said frame and coaxially surrounding said outer race, said worm wheel having internal threads, an externally threaded ring-shaped member meshing with said worm wheel and connected with said outer race, means for holding said externally threaded member against rotation with reference to said frame while permitting said externally threaded member to move axially in response to rotation of said worm wheel, and a driven worm meshing with said worm wheel and arranged to rotate the latter in either of two directions.

**8.** A combination as defined in claim **7**, wherein said frame comprises an annular guide member interposed between said worm wheel and said outer race, said guide member being received with minimal clearance in said wrom wheel and receiving with minimal clearance said outer race, said stabilizing means comprising a plurality of plenum chambers disposed between said outer race and said guide member, a source of pressurized fluid, and conduit means connecting said source with said plenum chambers by way of said guide member.

**9.** A combination as defined in claim **1**, wherein said stabilizing means comprises at least two annuli of equidistant plenum chambers provided in the periphery of said outer race, the plenum chambers of one of said annuli being staggered with reference to the plenum chambers of the other annulus as considered in the axial and circumferential directions of said outer race.

**10.** A combination as defined in claim **1**, wherein said adjusting member is a sleeve which is coaxial with said races, which surround said holder with clearance, and is provided with a conical internal surface, said element having a conical surface which is complementary to and is in permanent abutment with the conical surface of said sleeve.

* * * * *