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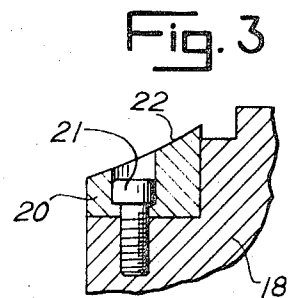
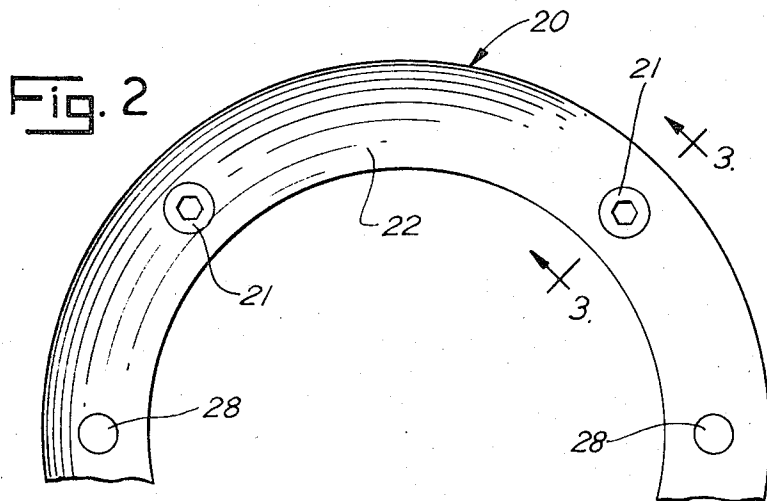
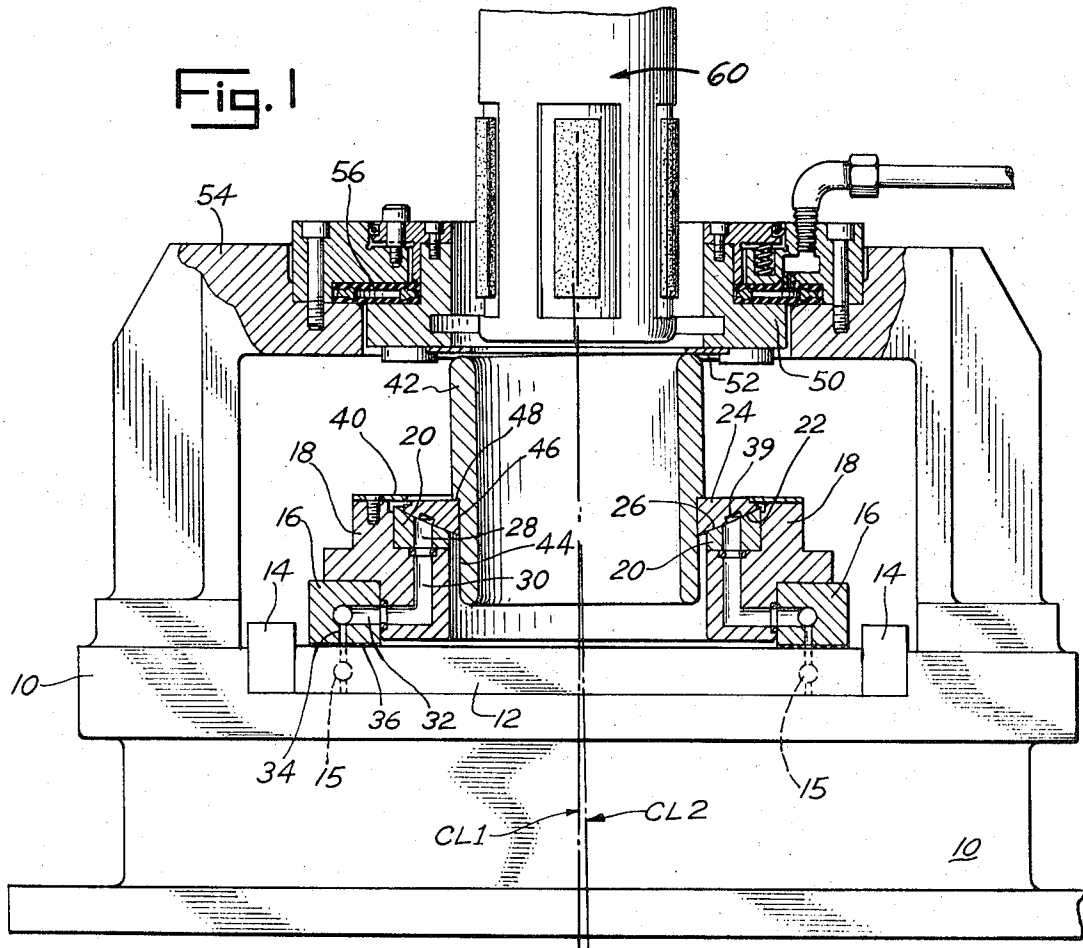
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3,552,069

FLOATING SEAT STRUCTURE FOR HONING MACHINES AND THE LIKE

Filed Aug. 4, 1967

2 Sheets-Sheet 1



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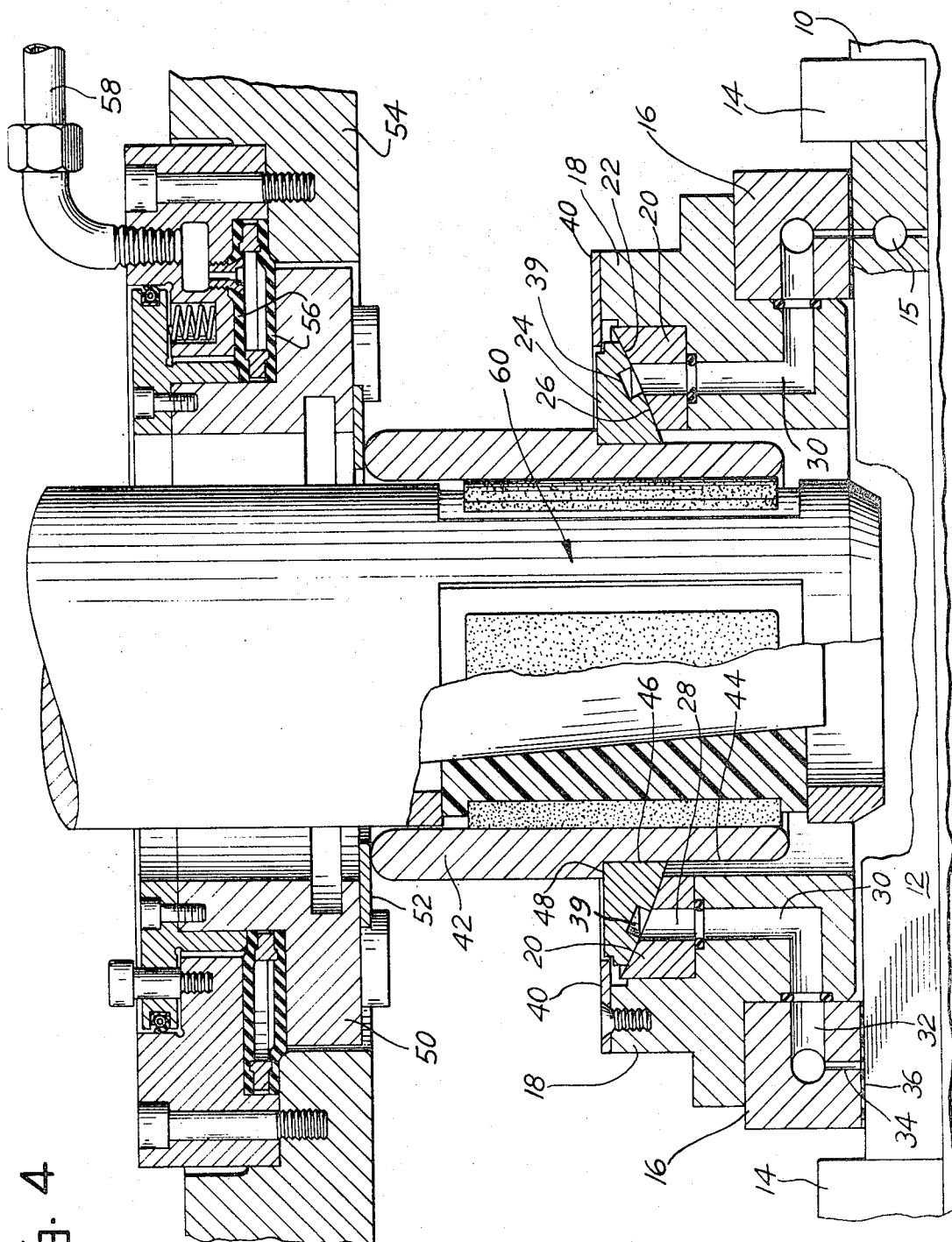


Fig. 4

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1

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FLOATING SEAT STRUCTURE FOR HONING MACHINES AND THE LIKE

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7 Claims

ABSTRACT OF THE DISCLOSURE

A floating seat structure for honing machines, drilling machines, reaming machines and the like, which coacts with a workpiece and is floated on a film of fluid under pressure so as to readily seek an aligned position with respect to a tool before a workpiece clamping means is operated.

This invention relates to a floating seat structure of simple, durable and inexpensive construction, suitable for use in connection with machine tools such as honing machines and the like, and which is operable to properly align a workpiece before the honing operation commences.

One object of the invention is to provide a floating seat structure in which a stationary supporting member is mounted on the base of the honing machine and has a spherical surface, a workpiece supporting member being supported thereon and also having a spherical surface, one of the surfaces being concave and the other convex whereby the two interfit with each other in such manner that the workpiece supporting member may be universally adjusted within small limits to a position of alignment with the hone or other tool before clamping means for the workpiece is operated.

Another object is to provide means for supplying fluid pressure such as compressed air or oil under pressure to the seat structure during a workpiece aligning operation so that the workpiece supporting member can float substantially without friction to a properly aligned position prior to the workpiece clamping means approaching its final clamped position.

A further object is to provide the stationary supporting member and the floating workpiece supporting member of cylinder shape to accommodate a portion of the workpiece projecting thereinto.

Still a further object is to provide the workpiece supporting member with a surface adapted to be located in a plane substantially normal to the axes of the bore to be honed and the hone or other tool to be used for machining such bore, the workpiece itself having an annular shoulder or the like adapted to rest on such surface, and which shoulder may or may not be truly normal to such bore, the floating seat structure thereby compensating for any off-normal relationship and permitting alignment of such bore by the tool and with respect to its axis.

An additional object is to provide a workpiece supporting member having a bore adapted to receive a cylindrical portion of a workpiece and a surface normal to such bore adapted to coact with the shoulder of the workpiece, clamping means thereupon being operable to fix the workpiece with respect to the machine tool table whereupon the desired tool operation is effected with assurance that the bore of the workpiece will be uniformly enlarged to a finished diameter and retain its original orientation.

Another additional object is to insure proper floating of the workpiece supporting member relative to the stationary supporting member by supplying fluid pressure annularly to the spherical surfaces by means of a port in one surface and an annular groove in the other.

With these and other objects in view, my invention consists in the construction, arrangement and combination

2

of the various parts of my floating seat structure, whereby the objects above contemplated are attained, as hereinafter more fully set forth, pointed out in my claims and illustrated in detail on the accompanying drawings, wherein:

FIG. 1 is a vertical cross section through workpiece supporting and clamping means of a honing machine and showing a hone in side elevation about to enter a workpiece in the form of a bearing or cylinder sleeve;

FIG. 2 is a plan view of a portion of a stationary supporting ring used in my floating seat structure, the same being enlarged with respect to claim 1;

FIG. 3 is a vertical sectional view on the line 3—3 of FIG. 2 showing how the ring of FIG. 2 is secured to a support therefor and

FIG. 4 is a sectional view somewhat similar to FIG. 1 and on an enlarged scale showing my floating seat structure aligned by the hone, and the workpiece clamped and ready for the honing operation in the bore of the workpiece.

On the accompanying drawings I have used the reference numeral 10 to indicate the base of a honing machine such as one of the type shown in the Hunt et al. Pat. No. 3,289,356. A way plate 12 is floatingly mounted on the base 10 between side guides 14 as shown in the patent, the floating mount being achieved by introducing fluid pressure, such as compressed air or oil under pressure, from passageways 15 (FIG. 1) to the lower surface of the way plate 12 for substantially friction-free workpiece locating operations including sliding of the way plate to and from workpiece finishing and reloading positions as disclosed in said patent.

In association with the way plate 12 I provide a primary stationary support 16, a secondary stationary support 18 and a tertiary stationary supporting member 20. The member 20 is the one with which I am particularly concerned in the present disclosure, the supports 16 and 18 being merely intermediate supports between the stationary supporting member 20 and the way plate 12.

The stationary supporting member 20 has a spherical surface 22, and a workpiece supporting member 24 is located thereabove and has a spherical surface 26 interfitting with the spherical surface 22. One of the surfaces is convex and the other concave, the member 20 being shown as having the concave surface and the member 24 as having the convex surface. These surfaces may in some instances be reversed depending upon the requirement for the particular workpiece to be accommodated.

The stationary supporting member 20 is mounted on the secondary stationary support 18 as by screws 21 shown in FIGS. 2 and 3. The member 20 is provided with one or more ports 28. The ports 28 communicate with passageways 30 and 32 in the members 18 and 16 respectively, and by means of passageways 34 with the fluid pressure passageways 15 of the way plate 12. Alternatively the ports 28 may be supplied with fluid pressure in any other desired manner. A gasket 36 may be provided between the way plate 12 and the primary stationary support 16 to seal the fluid pressure passageway system.

The spherical surface 26 of the workpiece supporting member 24 is provided with an annular groove 39 to communicate with the ports 28 and thus supply the fluid pressure around the entire spherical surface for equal pressure distribution. Alternatively the member 24 may be provided with one or more ports and the member 20 with an annular groove communicating with each other. A retainer washer 40 is secured to the support 18 to prevent dislocation of the member 24 with respect to the member 20 but permit some misalignment such as shown in FIG. 1 wherein the workpiece supporting member 24 (axis CL 2) is tilted slightly counterclockwise relative to the tool axis CL1.

A workpiece 42 is illustrated in the form of a bearing sleeve, the periphery of which is indicated at 44 and which periphery fits within a bore 46 of the workpiece supporting member 24. The member 24 and the members 18 and 20 are cylinder shaped to accommodate a part of the bearing sleeve but can have other configurations for other types of workpieces and still utilize the floating seat concept of my present invention. As illustrated a shoulder 48 on the bearing sleeve 42 is adapted to contact and rest on the upper surface of the workpiece supporting member 44.

A workpiece clamping ring 50 having a workpiece clamp support 54 which as shown in FIG. 1 is stationary with respect to the base 10. An annular, double-diaphragm connection 56 is illustrated whereby the ring 50 and the washer 52 may be normally in the elevated position of FIG. 1 to permit positioning of the workpiece (bearing sleeve 42), after which the double diaphragm connection 56 is operated to effect a clamping operation as illustrated in FIG. 4 by the introduction of fluid pressure through a conduit 58. The double-diaphragm arrangement illustrated permits a small angle of tilting of the workpiece engaging washer 52 to accommodate enough out-of-normal relationship of the shoulder 48 and the upper surface of the member 24 to the tool axis CL1 to take care of normal manufacturing tolerances and still permit coincident alignment of the axis CL2 with the axis CL1 upon actuation of the clamping mechanism as just described.

In the proper orientation of workpieces for honing operations and the like I have found it desirable to provide a floating seat structure for the workpiece so that a hone or the like 60 may enter a bore of the workpiece, then be expanded to contact of the honing elements with the bore of the workpiece, after which a workpiece clamping operation may be effected for clamping the workpiece in the hone-aligned position prior to the honing operation. The floating seat structure disclosed accomplishes this desirable result with assurance that the workpiece will remain clamped in the aligned position during the honing operation. Accordingly, fluid pressure may be supplied to the ports 28 and the annular groove 39, either continuously or at the time of alignment only, which will result in escape between the spherical surfaces 22 and 26 with a chattering effect. This jostles the workpiece supporting member 24 to the aligned position prior to operation of the workpiece clamping means. Thereafter the workpiece clamping means when operative will insure that the workpiece remains in the aligned position during the honing operation. The workpiece supporting member 24 may be of the specific design shown in the drawings by way of illustration or of other configurations to suit the workpiece involved.

Some changes may be made in the construction and arrangement of the parts of my floating seat structure without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims any modified forms of structure or use of mechanical equivalents which may reasonably be included within their scope.

I claim as my invention:

1. In a machine tool for processing a workpiece, said machine tool being of the type which includes a base, a tool for processing said workpiece mounted on said base and a member mounted on said base for supporting said workpiece during processing by said tool, the improvement comprising a stationary portion on said workpiece supporting member, a floating portion engaging said workpiece on said workpiece supporting member, one of said portions having a spherical convex surface and the other of said portions having a spherical concave surface, said surfaces being in sliding engagement and means for introducing a pressurized fluid film between said convex and concave surfaces, while maintaining said sliding engagement, after said tool has been moved into the processing position relative to said workpiece and for jostling said floating portion with said pressurized fluid thereby universally adjusting said workpiece to the aligned position relative to said tool.

2. A floating seat structure according to claim 1 wherein said workpiece supporting member and said stationary supporting member are cylinder-shaped to accommodate a portion of the workpiece projecting thereinto.

3. A floating seat structure according to claim 1 wherein said workpiece supporting member has a surface adapted to be tilted by a tool upon coaction therewith into a plane normal to the tool axis.

4. A floating seat structure according to claim 1 wherein said means to supply fluid pressure between said spherical surfaces comprises a supply duct in one surface and an annular groove in the other surface in communication with said supply duct in all positions of said stationary and floating members relative to each other.

5. A floating seat structure according to claim 2 wherein said workpiece supporting member has a surface normal to the cylinder axis of said supporting members to engage a shoulder of the workpiece projecting thereinto.

6. The apparatus of claim 1 wherein means are provided for clamping said workpiece to said workpiece support after said workpiece has been jostled into the aligned position and during the processing of said workpiece by said tool.

7. The apparatus of claim 1 wherein said machine tool is a honing machine and said tool is a honing tool.

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51—34, 217, 227; 77—55