PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION

Improvements in or relating to Bearings for Shafts of Grinding Machines

We, BLACK & DECKER LIMITED, a British Company, and FREDERICK WILLIAM MCCARTNEY, a British Subject, both of the Company's address, at Fairlie Road, Slough Trading Estate, Slough, Buckinghamshire, do hereby declare the nature of this invention to be as follows:—

This invention is for improvements in or relating to grinding heads and has for one of its objects to provide a bearing for the shaft of the grinding wheel which will permit a close fit to be employed between the bearing and the shaft without causing undue resistance and wear.

According to this invention, a grinding head comprises a bearing housing, two plain bearings within said housing, means for spacing said bearings apart along the shaft of the grinding wheel and a universal mounting for supporting each bearing in said housing. Preferably, the plain bearings are formed from a self-lubricating metal compound. It is found, with this arrangement, that the clearance which may be employed between the grinding-wheel shaft and the bearings may be considerably smaller than usual and may be as small as of the order of .0001". It will be appreciated that the universal mounting of the bearings will allow the bearings to accommodate any small degree of warping of the shaft which may be present, however carefully the shaft is machined. Furthermore, due to the fact that the bearings are self-aligning, it is possible to ensure that the whole bearing surface between the shaft and bearings is utilised.

The aforesaid bearings may be provided with external spherical surfaces which may be engaged by internal spherical surfaces or coned surfaces provided in mountings formed separate from or integral with the bearing housing.

In the case where the mountings are formed separate from the housing, they may be axially slidable therein and said housing may be provided at each end thereof with inwardly-directed shoulders and resilient means may be provided for retaining said slidable mountings against said shoulders. For example, a helical compression spring may be arranged between the two mountings.

Each mounting may be formed in two parts disposed one on either side of a plane transverse to the shaft axis. It will be appreciated that in the event of the shaft being slightly bent there will be a certain degree of oscillatory movement between each bearing and the two parts of its mounting. Any wear which may take place due to this movement will be automatically taken up by the action of the spring.

Each bearing may be provided with an external central cylindrical portion flanked by spherical surfaces and each of the two parts of each mounting may be provided with a cylindrical portion of larger diameter than the cylindrical portion of the bearing, flanged by a spherical portion or coned portion arranged to engage the spherical surface of the bearing.

As already indicated above, the housing may be provided with inwardly-directed shoulders against which the bearings are pressed by said springs. Either or each of said shoulders may be removable from said housing. For example, the shoulder may comprise a split-ring located in a circumferential groove in said housing.

In any of the arrangements referred to above, the housing may comprise a hollow cylindrical member and means are provided for retaining said housing in the head stock of the machine.

The following is a description of one constructional form of the invention, as applied to a grinding head of a machine for refacing the heads of valves, reference being made to the accompanying drawing, in which the figure shows a vertical section through the grinding head of the machine.

The grinding head comprises a cradle 10 arranged to support a hollow cylindrical bearing housing 11 which is clamped in the cradle by keeps 12 which are engaged by clamping nuts 13 on studs 14. Each end of the cylindrical

bearing housing is provided with an internal circumferential groove 15 in which is mounted a removable split spring-ring 16 of the kind sold under the name of " circlip ". A shaft 17 for the grinding wheel extends through the cylindrical housing and is carried by two plain bearings 18 formed from a self-lubricating metal compound. The clearance between the shaft and the bearings may be as low as of the order of .0001" where the diameter of the shaft is at least 1". It will be noted that each bearing is provided with an external cylindrical surface 19 flanked on either side by spheridal surfaces 20. Each bearing is supported by a mounting formed in two parts 21 which are spaced apart on either side of a plane transverse to the axis of the shaft. Each part is of such a size as to be axially slidable in the housing. Each part is also provided with an internal cylindrical portion 22 of a larger diameter than the diameter of the cylindrical part of the bearing and with a spherical or conical surface 23 which is arranged to engage one of the surfaces 20 of the bearing. A helical compression spring 24 is arranged to encircle the shaft between the two mountings so as to force the mountings against the shoulders provided by the circlips 16.

Axial movement of the shaft within the bearings is prevented by means of a shoulder 25 formed on the shaft and arranged to bear against an end face at the inner end of one of the bearings and by a washer 26 which is interposed between the other end of the bearing and a pulley 27 which is secured to the shaft by a suitable clamping nut 28. The grinding wheel is carried by a flanged bush 29 which abuts a shoulder 30 at the other end of the shaft. The grinding wheel is secured in position on said bush by a washer 31 and a clamping nut 32 which engages a screwed extremity of said shaft. An oiler 33 extends through the wall of the cylindrical housing 11 intermediate of the two bearings.

Dated this 19th day of March, 1938.
BOULT, WADE & TENNANT,
Chartered Patent Agents,
111/112, Hatton Garden, London, E.C.1.

COMPLETE SPECIFICATION

Improvements in or relating to Bearings for Shafts of Grinding Machines

We, BLACK & DECKER LIMITED, a British Company, and FREDERICK WILLIAM MCCARTNEY, a British Subject, both of the Company's address, at Fairlie Road, Slough Trading Estate, Slough, Buckinghamshire, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to improvements in or relating to bearings for the shafts of grinding machines and has for an object to provide an arrangement in which closely-fitting plain bearings may be employed for supporting the grinding-wheel shaft and/or the shaft on which the work is carried.

It is known in high-speed dynamo electric machines, to support a vertically-disposed flexible armature shaft in two plain bearings having spherical outer surfaces, which surfaces are engaged by spherical sockets in a bearing housing and which bearings are spring-pressed apart. It is also known to mount a fan-shaft in two composite bearing-blocks spaced apart and each comprising a liner which encircles the shaft and is provided with a spherical outer surface, which surface is supported by a felt ring flanked on either side by a part-spherical metal part, which composite bearing-blocks are spring-pressed apart.

According to this invention, in a grinding machine, a head for supporting the grinding shaft and/or the head for supporting the work-carrying shaft comprises a bearing housing, two plain bearings within said housing, means for spacing said bearings along said shaft and a universal mounting for supporting each bearing so arranged to provide for automatic alignment of the two bearings within said housing. This arrangement enables a very small clearance to be employed between each bearing and its shaft without introducing excessive frictional resistance. The employment of small bearing clearances is an important factor for accurate grinding. The clearance employed according to this invention is of the order of .0001 inches and should not be greater than .0005 inches. By a " plain bearing " is meant a bearing having an internal

cylindrical surface which is arranged to support a cylindrical journal on the shaft. The universal mounting of the plain bearings in the housing may be effected by providing each said plain bearing with an external part-spherical surface which is supported by a conical surface or a concave surface of larger radius of curvature than the external spherical surface formed on the inside of the housing, or on a part mounted therein, and by providing resilient means which are arranged to maintain each pair of engaging surfaces in contact. It is found with this arrangement, that even if the shaft is slightly warped, a small clearance may be employed between it and the bearing without causing undue resistance and wear.

Each said conical or concave surface may be formed on a part which is axially slidable in said housing and said resilient means is arranged to force said axially-slidable parts towards the respective part-spherical surfaces. For example the resilient means may comprise a helical compression spring which encircles the shaft.

Each of said axially-slidable parts may be formed in two halves separated from one another, one on either side of a plane transverse to the shaft axis, and said housing may be provided at each end thereof with a shoulder against which one half of each axially-slidable part abuts. With this arrangement, the part-spherical surface of each bearing is resiliently gripped between the two halves of said axially-slidable parts.

In a bearing mounting in which said shaft is required to resist axial thrust, the shaft is provided with a shoulder arranged to engage one end face of one of said bearings.

In one constructional form of the invention, each of the plain bearings is provided with an external central cylindrical portion flanked by part-spherical surfaces and each of the two halves of each axially-slidable part is provided with a cylindrical portion of larger diameter than the cylindrical portion of the bearing and a part-spherical or conical portion at one end thereof, arranged to encircle and engage the part-spherical surface of the bearing. Such an arrangement is found to be particularly suitable for the grinding-wheel shaft in a grinding machine.

In an alternative construction, said conical or concave surfaces are formed on the housing or a part fixed thereto and the spring means are arranged to engage the said plain bearings so as to force the part-spherical surface thereon into engagement with the conical or concave surfaces. In such an arrangement, a compression spring may be disposed between end faces formed on the two plain bearings so as to press outwardly and to maintain the part-spherical surfaces in engagement with the conical or concave surfaces.

The shaft may be provided with a shoulder and a second compression spring may be disposed between that shoulder and an end face of one of said plain bearings. Such an arrangement is suitable for mounting a rotatable chuck-shaft for holding a work-piece in a grinding machine.

In any of the arrangements referred to above, the plain bearings are formed from a self-lubricating metal compound.

The following is a description of two embodiments of the invention, reference being made to the accompanying drawings, in which:—

Figure 1 is a vertical section through a grinding head of a grinding machine, and

Figure 2 is a vertical section through a head in which the work chuck-shaft is mounted in a grinding machine.

Referring to Figure 1, the grinding head comprises a cradle 10 arranged to support a hollow cylindrical bearing housing 11 which is clamped in the cradle by keeps 12 which are engaged by clamping nuts 13 on studs 14. Each end of the cylindrical bearing housing is provided with an internal circumferential groove 15 in which is mounted a removable split spring-ring 16 of the kind sold under the name of " circlip ". A shaft 17 for the grinding wheel extends through the cylindrical housing and is carried by two plain bearings 18 formed from a self-lubricating metal compound. The clearance between the shaft and the bearings may be as low as of the order of .0001" where the diameter of the shaft is at least 1". It will be noted that each bearing is provided with an external cylindrical surface 19 flanked on either side by part-spherical surfaces 20. Each bearing is supported by a mounting formed in two parts 21 which are spaced apart on either side of a plane transverse to the axis of the shaft. Each part is of such a size as to be axially slidable in the housing. Each part is also provided with an internal cylindrical portion 22 of a larger diameter than the diameter of the cylindrical part of the bearing and with a part-spherical or conical surface 23 which is arranged to engage one of the surfaces 20 of the bearing. A helical compression spring 24 is arranged to

encircle the shaft between the two mountings so as to force the mountings against the shoulders provided by the circlips 16.

Axial movement of the shaft within the bearings is prevented by means of a shoulder 25 formed on the shaft and arranged to bear against an end face at the inner end of one of the bearings and by a washer 26 which is interposed between the other end of the bearing and a pulley 27 which is secured to the shaft by a suitable clamping nut 28. The grinding wheel is carried by a flanged bush 29 which abuts a shoulder 30 at the other end of the shaft. The grinding wheel is secured in position on said bush by a washer 31 and a clamping nut 32 which engages a screwed extremity of said shaft. An oiler 33 extends through the wall of the cylindrical housing 11 intermediate of the two bearings.

Figure 2 shows an arrangement for mounting a hollow chuck-spindle 34 in a grinding machine for refacing valves. Details of the chuck are not shown except for the manipulating member 35 which extends into the hollow chuck spindle and is arranged to engage the mechanism, whereby the jaws of the chuck are opened and closed. Secured to the hollow spindle is a driving pulley 36 which is connected through suitable belt-and-pulley gearing with a driving motor 37 located in a hollow head 38. The hollow head is provided with a hollow cylindrical bearing housing 39 which is provided with an internal conical surface 40 at that end adjacent the gripping end of the chuck spindle. Mounted in the other end of the housing is a race 41 having an internal conical face 42. The race is retained within the housing by a spring-ring 43 which engages a groove formed on the inner face of the housing. The hollow spindle is supported in two plain bearings 44 and 45. The outer surface of each plain bearing is made up of a cylindrical portion 46 and a part-spherical portion 47 which latter, in the case of the bearing 44, is arranged to engage with the conical face 40 of the housing and, in the case of the bearing 45, is arranged to engage with the conical face of the race 41. A helical compression spring 48 is arranged between the inner end faces of the bearings 44 and 45 so as to maintain the part-spherical faces in engagement with the conical faces. The hollow chuck spindle is provided with a shoulder 49 which forms one race of a ball thrust bearing 50, the other race 51 of which is engaged by a second helical compression spring 52 which engages the end face of the bearing 45. A cap 53 is arranged to encircle the conical end of the housing and the protruding end of the chuck spindle and is retained in position by a spring-ring 54 against which the cap is pressed by a helical spring 55 which at one end engages an internal shoulder on the cap and at the other end a washer 56 disposed between it and the outer end of the bearing 44.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A grinding machine in which the head for supporting the grinding shaft and/or the head for supporting the work-carrying shaft comprises a bearing housing, two plain bearings within said housing, means for spacing said bearings along said shaft and a universal mounting for supporting each bearing so arranged as to provide for automatic alignment of the two bearings within said housing.

2. A grinding machine according to claim 1, wherein the clearance between each bearing and its shaft is of the order of .0001 inches and not greater than .0005 inches.

3. A grinding machine according to either of the preceding claims, wherein each said plain bearing is provided with an external part-spherical surface which is supported by a conical surface or a concave surface of larger radius of curvature than the external spherical surface and formed on the inside of the housing, or on a part mounted therein, and wherein resilient means are arranged to maintain each pair of engaging surfaces in contact.

4. A grinding machine according to claim 3, wherein each said conical or concave surface is formed on a part which is axially-slidable in said housing and wherein said resilient means is arranged to force said axially-slidable parts towards the respective part-spherical surfaces.

5. A grinding machine according to claim 3, wherein said resilient means comprise a helical compression spring which encircles the shaft.

6. A grinding machine according to claim 4 wherein each of said axially-slidable parts is formed in two halves separated from one another on either side of a plane transverse to the shaft axis and wherein said housing is provided at each end thereof with a shoulder against which one half of each axially-slidable part abuts.

7. A grinding machine according to

either of the preceding claims 5 and 6, and in which said shaft is required to resist axial thrust, wherein said shaft is provided with a shoulder arranged to engage an end face of one of said bearings.

8. A grinding machine according to claim 6 or claim 7, wherein each of the plain bearings is provided with an external central cylindrical portion flanked by part-spherical surfaces and each of the two halves of each axially-slidable part is provided with a cylindrical portion of larger diameter than the cylindrical portion of the bearing and a conical or concave portion at one end thereof arranged to engage the part-spherical surface of the bearing.

9. A grinding machine according to claim 3, wherein said conical or concave surfaces are formed on the housing or a part mounted thereon and wherein spring means are arranged to engage said plain bearings so as to force the part-spherical surfaces thereon into engagement with the conical or concave surfaces.

10. A grinding machine according to claim 9, wherein a compression spring is disposed between opposed faces at the inner ends of the two plain bearings so as to press the bearings outwardly and maintain the part-spherical surfaces in engagement with the conical or concave surfaces.

11. A grinding machine according to claim 9, wherein said shaft is provided with a shoulder and wherein a second compression spring is disposed between the shoulder and an end face of one of said plain bearings.

12. A grinding machine according to any of the preceding claims, wherein said plain bearings are formed from a self-lubricating metal composition.

13. A grinding machine, substantially as described with reference to Figure 1 or Figure 2 of the drawing.

Dated this 4th day of November, 1938.
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Fig. 2.

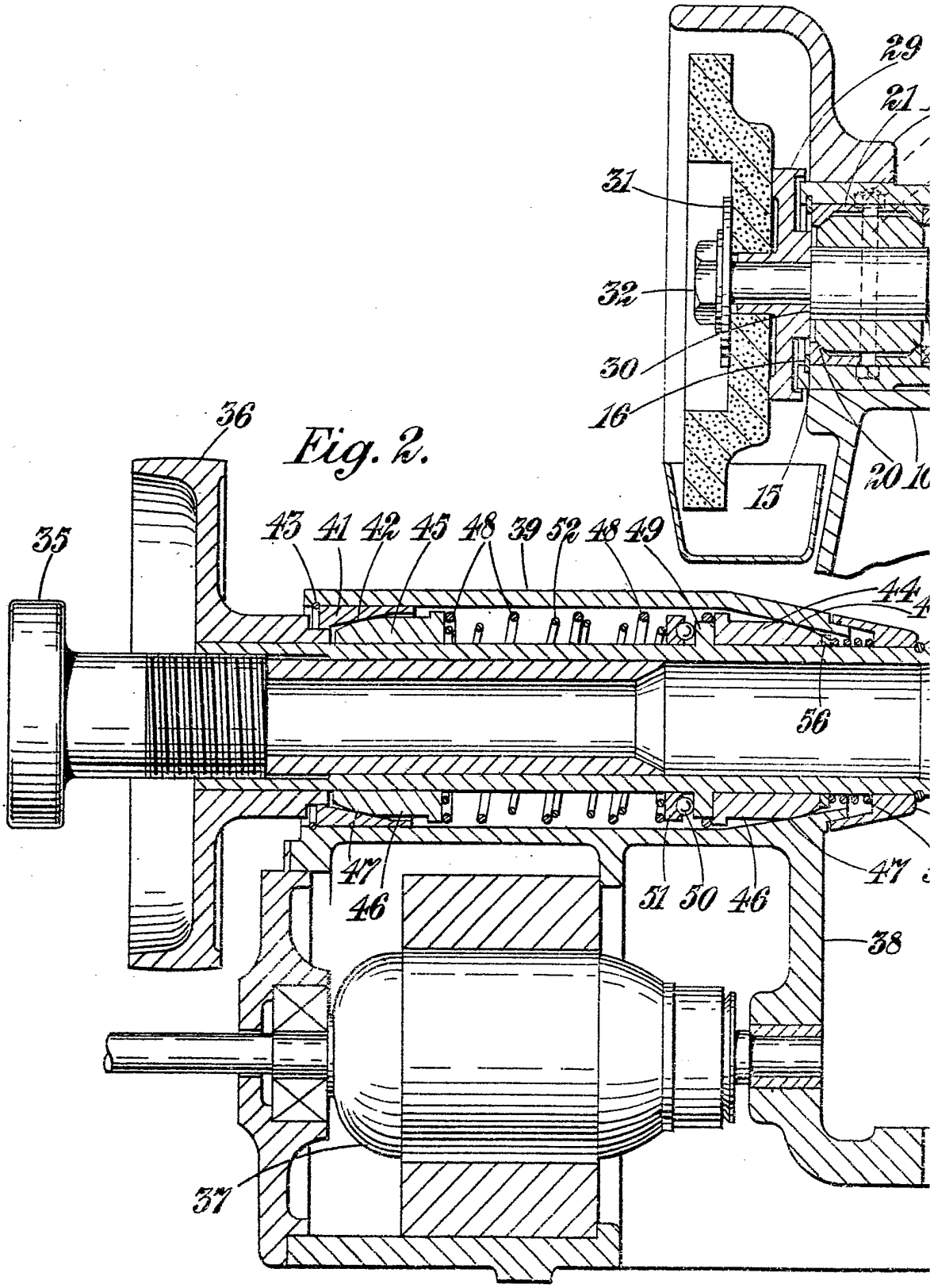

Fig. 1.

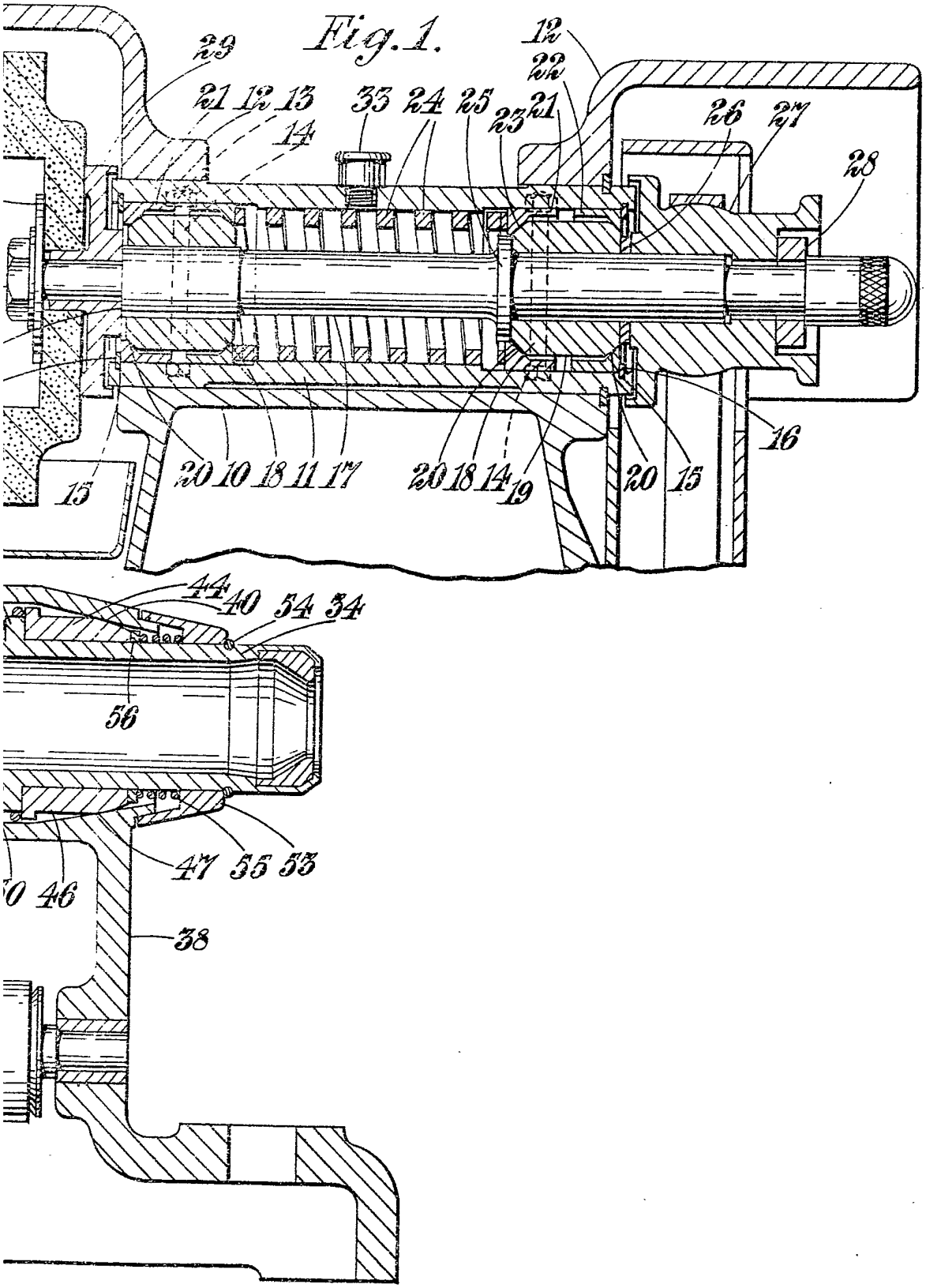

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Fig. 1.

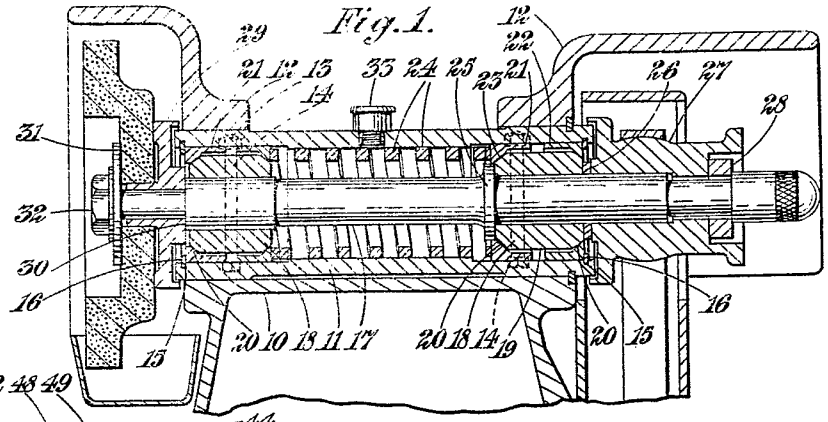
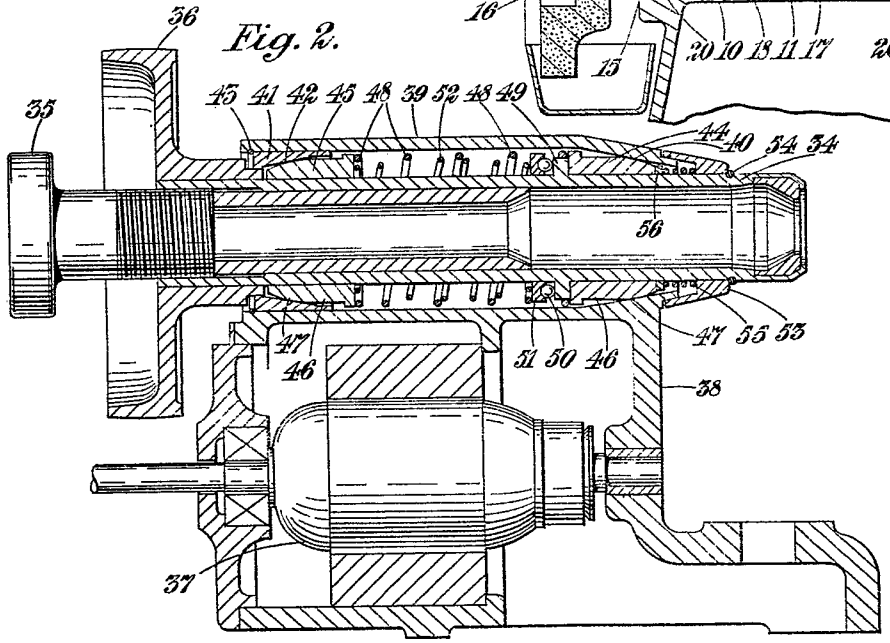


Fig. 2.



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