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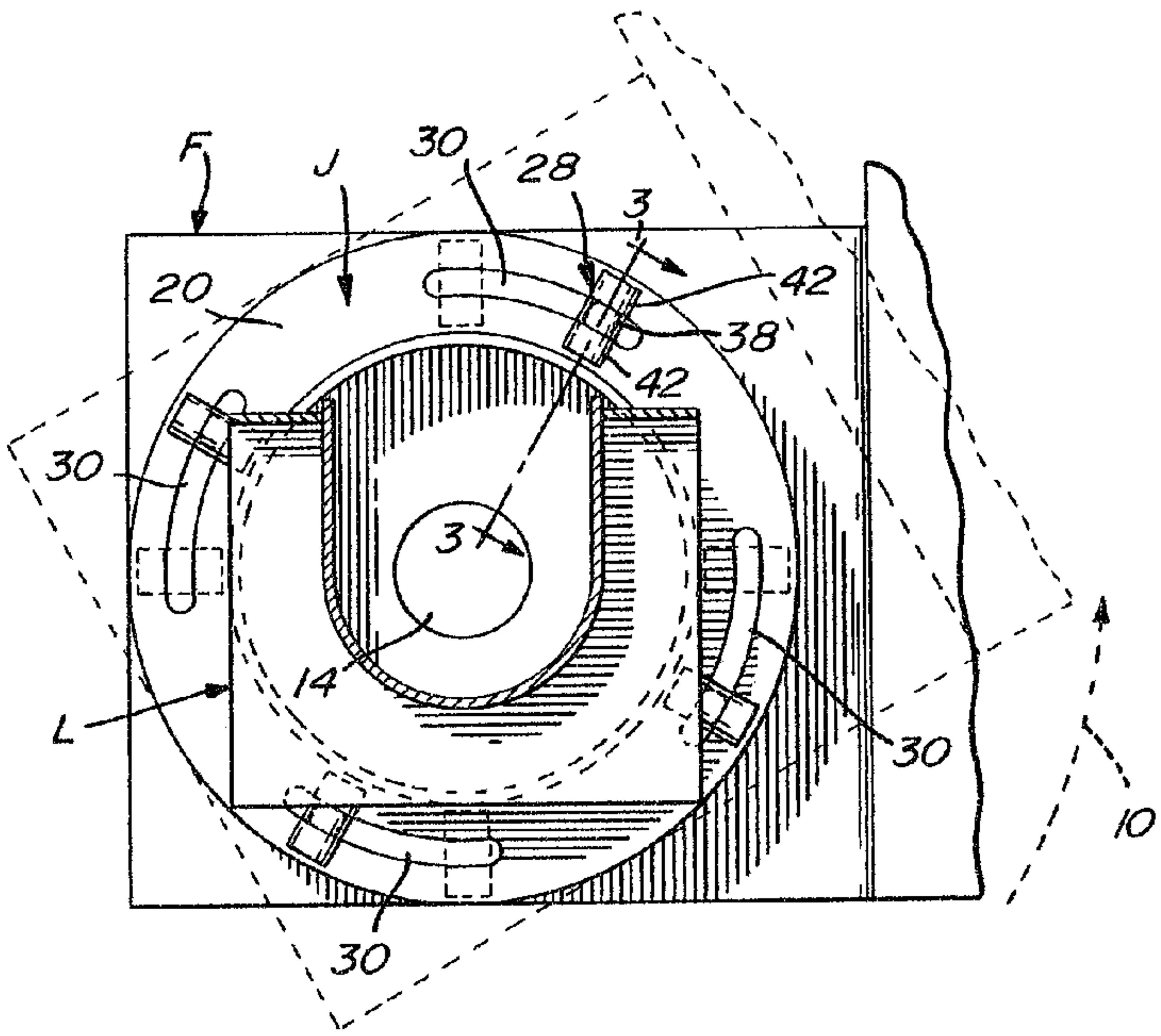
(54) **ARTICULATION SIMPLE**
(54) **ROTATING JOINT**



(57) A rotating joint for tiltable metallurgical furnaces includes first and second flanges fixedly secured respectively to a furnace which points about an axis of rotation and to an outlet launder. The adjacent flanges extend radially from the axis of rotation and face each other. The second flange includes a series of equidistant and similar arcuate slots distributed near the periphery thereof about the axis of rotation. A corresponding hole is defined in the first flange for each of the arcuate slots. A tie rod which extends through the first and second flanges and through a seal gasket provided therebetween includes at the end thereof protruding from the stationary second flange a pair of coaxial rollers which are rotatably mounted on a pin fixedly secured to the tie rod in order that the common axis of the rollers is parallel to a radius of the stationary second flange. The end of the tie rod protruding outwards of the rotating first flange is threaded to receive a nut for tightly attaching the two flanges together with the pairs of rollers bearing against the stationary second flange on each side of the arcuate slot. Therefore, upon rotation of the furnace, the first flange rotates thereby causing the tie rods to displace along respective arcuate slots with the rollers rolling on the stationary second flange while keeping a constant pressure on the flanges to maintain the seal. This allows a free motion of the furnace tilt while providing a reliable and durable seal against infiltration and leaking while molten metal flows through the rotating joint.

ROTATING JOINT

Abstract

A rotating joint for tiltable metallurgical furnaces includes first and second flanges fixedly secured respectively to a furnace which points about an axis of rotation and to an outlet launder. The adjacent flanges extend radially from the axis of rotation and face each other. The second flange includes a series of equidistant and similar arcuate slots distributed near the periphery thereof about the axis of rotation. A corresponding hole is defined in the first flange for each of the arcuate slots. A tie rod which extends through the first and second flanges and through a seal gasket provided therebetween includes at the end thereof protruding from the stationary second flange a pair of coaxial rollers which are rotatably mounted on a pin fixedly secured to the tie rod in order that the common axis of the rollers is parallel to a radius of the stationary second flange. The end of the tie rod protruding outwards of the rotating first flange is threaded to receive a nut for tightly attaching the two flanges together with the pairs of rollers bearing against the stationary second flange on each side of the arcuate slot. Therefore, upon rotation of the furnace, the first flange rotates thereby causing the tie rods to displace along respective arcuate slots with the rollers rolling on the stationary second flange while keeping a constant pressure on the flanges to maintain the seal. This allows a free motion of the furnace tilt while providing a reliable and durable seal against infiltration and leaking while molten metal flows through the rotating joint.

The present invention relates to rotating joints and, more particularly, to an improved rotating joint for tilting furnaces.

It is common for metallurgical furnace vessels to be tiltable in order to discharge molten metal therefrom. A discharge conduit for the molten metal which is connected to the furnace has its longitudinal axis coincident with the axis of rotation of the furnace. As the discharge conduit is stationary, it is necessary to provide a rotating joint at the junction of the tiltable furnace with the fixed discharge conduit.

It is standard for such a junction to include a pair of flanges with a seal positioned therebetween. One of the flanges is provided near its periphery with a series of arcuate slots with bolts extending through these slots and through the seal and the other flange. This allows for one flange to rotate as the bolts slidably displace along the slots.

Such an arrangement allowing a limited freedom of angular displacement is also used in other technical fields such as, for instance, in concrete-pipe joints (U.S. Patent No. 1,475,867 issued on November 27, 1923 to Peterson).

The above flanged pipe or trough joints of bolt and slot type are however characterized by a substantially low life expectancy as either the head of the bolt or the nut displaces under heavy friction against the stationary flange when the furnace is tilted.

U.S. Patent No. 3,291,472, issued on December 13, 1966 to Hoff, discloses another type of joint. Indeed, an annular ring is fixedly secured at right angles to the outer periphery of a drum of the furnace. The ring thus extends in a radial direction with respect to the drum. A faceplate which is fixedly mounted at the end of a discharge conduit is juxtaposed to the ring. The faceplate is recessed so that it is provided with a shoulder which is juxtaposed to the outer peripheral surface of the annular ring. A backup plate surrounds the drum and is provided with an inner peripheral diameter which is smaller than the outer peripheral diameter of the annular ring with the ring being disposed intermediate the faceplate and the backup plate. The faceplate and the backup plate are held in assembled relationship by means of a plurality of bolts which extend therethrough at a location outwards of the annular ring. Therefore, the annular ring will rotate with the furnace within the groove formed by the faceplate and the backup plate. Again, heavy friction is encountered as the annular ring displaces within this groove while being in contact with both the faceplate and the backup plate. It is nevertheless noted that the discharge conduit of the Hoff Patent reduces the "down time" to approximately one half hour which is insufficient for the furnace to cool down. However, it is questionable how much production is improved as the invention does not reduce the frequency of repair.

It is therefore an aim of the present invention to provide a rotating joint for tilting furnaces which is practically maintenance-free for resolving the problems associated with down time and joint changes.

It is also an aim of the present invention to provide a rotating joint wherein the bolt which joins the rotating flange to the non-rotating flange is provided with a roller construction adapted to bear against one of the flanges, and will thereon upon a rotational relative displacement of the flanges while maintaining the seal therebetween.

A construction in accordance with the present invention comprises a rotating joint for installing between first and second conduit means which rotate relative one to the other about an axis of rotation. The rotating joint comprises first and second parallel flange means extending radially about the axis. The flange means are mounted to adjacent ends of respective ones of the first and second conduit means and face each other. At least one arcuate slot means is defined in the first flange means about the axis. At least one elongated member extends through the first and second flange means and is slidable in the arcuate slot means. A roller means is rotatably mounted at least at a first end of the elongated member outwards of the first flange means and is adapted to bear thereagainst. A retaining means is provided at a second end of the elongated member outwards of the second flange means to secure the first and second flange means together. Therefore, upon relative rotational movement of the pair of flange means about the axis, the elongated member displaces relative to the slot means with the roller means rolling on the first flange means while maintaining a seal between the first and second flange means.

In a more specific construction in accordance with the present invention, the roller means comprises two parallel rollers disposed on each side of the slot means. The retaining means comprises a nut engaged on and completely covers the second end while bearing against the second flange means.

In a still more specific construction in accordance with the present invention, the tie rod means has a cross-section within the arcuate slot means which is substantially of rectangular shape.

In a still more specific construction in accordance with the present invention, a pin means is fixedly mounted at the first end of the tie rod means and extends transversely thereto with a longitudinal axis of the pin means extending parallel to a radius of the flange means. The rollers are rotatably mounted to the pin means.

In a still more specific construction in accordance with the present invention, the first and second flange means are respectively mounted to the first and second conduit means. The first flange means is stationary whereas the second flange means is adapted to rotate with the second conduit means. The tie rod means passes through the second flange means through a hole defined therein which is smaller than the nut.

In a still more specific construction in accordance with the present invention, the slot means has a length corresponding to a limited rotation angle of the second flange means.

In a still more specific construction in accordance with the present invention, more than one of the slot means and of the hole are respectively defined in the first and second flange means. The slot means are all similarly shaped. One tie rod means, one nut and one pair of rollers are provided for each corresponding hole and slot means.

In a still more specific construction in accordance with the present invention, four equally spaced slot means are distributed near a periphery of the stationary first flange means.

In a still more specific construction in accordance with the present invention, a ceramic seal gasket is provided between the first and second flange means.

In another specific construction in accordance with the present invention, the rotating second flange means is mounted to a tilting metallurgical furnace, whereas the stationary first flange means is mounted to a stationary launder means adapted for conveying molten metal produced by the furnace.

It is noted that Applicant's prior rotating joints had a frequency of replacement of one or two per week per tilting furnace. The first rotating joints in accordance with the present invention remain as efficient today as when they were installed a few months ago and their failure is not anticipated in the near future. These same rotating joints still provide leak free and infiltration free seals between the furnace and the launder. It is noted that each previous joint change required approximately ten manhours of work.

Having thus generally described the nature of the invention, reference will now be made to the accompanying drawings, showing by way of illustration only a preferred embodiment thereof, and in which:

Fig. 1 is a top plan view of a tilting furnace provided with a rotating joint in accordance with the present invention;

Fig. 2 is a cross-sectional view taken along lines 2-2 of Fig. 1 and showing a front view of the rotating joint;

Fig. 3 is a cross-sectional view taken along lines 3-3 of Fig. 2; and

Fig. 4 is a cross-sectional view taken along lines 4-4 of Fig. 3.

Fig. 1 is a top plan view illustrating a tilting metallurgical furnace F, a stationary launder L, that is a discharge conduit or trough for the molten metal produced by the furnace F, and a rotating joint J in accordance with the present invention provided therebetween.

The furnace F is mounted on bearings 24 with motor means which are not illustrated being provided in order to cause the furnace F to rotate along the direction shown by arrow 10 and about axis 12 so that the molten metal contained therein may be discharged from the furnace F through a furnace opening 14 defined by a cylindrical outlet pipe 16. The molten metal is then fed through the rotating joint J into the stationary launder L.

The rotating joint J includes a rotating flange 18 and a stationary flange 20 and a ceramic seal gasket 22 provided therebetween. The rotating flange 18 is installed at the end of the outlet pipe 16 whereas the stationary flange 20 is installed to the launder L. The rotating joint J and the outlet pipe 16 share an axis which is coaxial with the axis 12 of furnace tilt or rotation.

The flanges 18 and 20 are attached together with four adjustable screws 26 with roller mountings 28. To receive these adjustable screws 26, the rotating flange 18 defines a respective hole for each one of the screws 26, whereas the stationary flange 20 defines arcuate slots 30, there being the same number of arcuate slots 30 than there are adjustable screws 26.

In the present preferred embodiment, there are four adjustable screws 26 with roller mountings 28 and, thus there are also four equally spaced holes defined in the rotating flange 18 and four equally spaced similar arcuate slots 30 defined in the stationary flange 20.

The arcuate slots 30 are curved in order to be coaxial with the rotating joint J and therefore the tilt axis 12 of the furnace F. The arcuate slots 30 are of length equivalent to the angular displacement or tilt of the furnace F.

Each adjustable screw 26 includes a tie rod 32 which passes through a respective one of the arcuate slots 30 of the stationary flange 20, through the ceramic seal gasket 22 and through a respective one of the holes defined in the rotating flange 18. The portion of the tie rod 32 which coincides with the arcuate slot 30 of the stationary flange 20 has a generally rectangular cross-section for reasons which will be presented hereinafter.

A first end 34 of the tie rod 32 is threaded for receiving thereon a nut 36 which is adapted to cover completely the portion of threaded end 34 which extends beyond the rotating flange 18 in order, for instance, that molten metal does not accumulate on the threads and damage the same. The nut 36 is provided with a pair of perpendicular diametrical apertures 37 which are used to tighten the nut 36 by way of a rod (not shown) passed therethrough. The nut 36 is large enough to ensure proper pressure and solid contact on the rotating flange 18. A second end 38 of the tie rod 32 has the shape of a short cylinder transversely mounted in a fixed relationship to the tie rod 32 so that the cylindrical end 38 has its axis at right angles to the axis of the tie rod 32. A pin 40 extends centrally through the cylindrical second end 38 of the tie rod 32 and is fixedly secured thereto by way of a mounting pin 41 extending transversely through the second end 38 and the pin 40.

The roller mountings 28 include a pair of rollers 42 rotatably mounted to the pin 40 on each side of the cylindrical second end 38 of the tie rod

32 and maintained to the pin 40 by a pair of snap rings 44. The thickness of the cylindrical second end 38 is substantially equal to the width of the arcuate slots 30 in order that the cylinder-shaped rollers 42 can be positioned to bear against the stationary flange 20 on each side of a respective one of the arcuate slots 30 thereof.

The flanges 18 and 20 are secured one to the other with the ceramic seal gasket 22 therebetween by passing the threaded first end 34 of the tie rod 32 through the arcuate slot 30 of the stationary flange 20 and then through the seal gasket 22 and the corresponding hole defined in the rotating flange 18. The pin 40 of the adjustable screws 26 are then positioned parallel to a radius of the flange 20 in order that the rollers 42 will bear against the stationary flange 20 on each side of the arcuate slot 30 thereof when the nut 36 is engaged on the threaded part of the threaded first end 34 of the tie rod and tightened against the rotating flange 18. The rectangular portion of the tie rod 32 located within the arcuate slot 30 of the stationary flange 20 prevents the tie rod 32 from rotating with respect to the stationary flange 20 and thus ensures that the axis of rollers 42 remains parallel to the flange radius and that the rollers 42 remain parallel to the rotating movement.

From the above, it is readily understood that a tilting motion of the furnace F will cause the outlet pipe 16 to rotate therewith and thus also the rotating flange 18 to rotate thereby causing the tie rods 32 to displace along the arcuate slots 30 and the rollers 42 to rotate about the pin 40 while rolling on the stationary flange 20. This allows a free motion of the furnace tilt while keeping a constant pressure on the flanges 18 and 20. The ceramic seal gasket 22 used in between of the flanges 18 and 20 has high insulating properties and can be compressed.

Hence, the novelty resides in the substitution of the rollers 42 to bear against the outer stationary flange 20 of the rotating joint J around the molten metal pour central opening of the joint J while the furnace F is being tilted in place of a nut such as the nut 36 which bears against the inner rotating flange 18 of the rotating joint J. The rollers 42 ensure a durable and efficient seal to the rotating joint J.

From the above, it is easily understood that the arcuate slots could be defined on the inner rotating flange while holes would be defined on the outer stationary flange as long as the rollers are positioned to roll against the inner rotating flange and thus on each side of the arcuate slots. In such a case, the tie rods would remain stationary with the outer stationary flange while the arcuate slots of the inner rotating flange would displace therewith thereby causing the rollers to rotate about stationary axes.

A various number of arcuate slots may be provided as well as slots of different length in order to accommodate various relative tilting angles between the flanges.

The above innovative rotating joint J has been installed in Applicant's plant and has provided the assurance of a reliable seal against infiltration and leaking while molten metal flows through the joint. The rotating joint provides a practically maintenance free unit which has therefore resolved problems associated with down time and joint changes. Again, the previous joint had a frequency of change of one or two per week per tilting furnace whereas the above new rotating joint has maintained a same efficiency a few months after its installation. It has been observed that the rollers make a surprisingly big difference in maintenance costs.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A rotating joint for installing between first and second conduit means which rotate relative one to the other about an axis of rotation, comprising first and second parallel flange means extending radially about said axis of rotation from adjacent ends of respective ones of said first and second conduit means and facing each other, at least one arcuate slot means being defined in said first flange means about said axis of rotation, at least one elongated member extending through said first and second flange means and being slidable in said arcuate slot means, roller means being rotatably mounted at least at a first end of said elongated member outwards of said first flange means and being adapted to bear thereagainst, a retaining means being provided at a second end of said elongated member outwards of said second flange means for securing said first and second flange means together, whereby upon relative rotational movement of said first and second flange means about said axis of rotation, said elongated member displaces relative to said slot means with said roller means rolling on said first flange means while maintaining a seal between said first and second flange means.

2. A rotating joint as defined in Claim 1, wherein said roller means comprises two parallel rollers disposed on each side of said slot means, and wherein said elongated member comprises a tie rod means, said second end of said tie rod means being threaded, said retaining means comprising a nut engaged on said second end and bearing against said second flange means.

3. A rotating joint as defined in Claim 2, wherein said tie rod means has a cross-section within said arcuate slot means which is substantially of rectangular shape.

4. A rotating joint as defined in Claim 3, wherein a pin means is fixedly mounted at said first end of said tie rod means and extends transversely thereto with a longitudinal axis of said pin means extending parallel to a radius of said flange means, said rollers being rotatably mounted to said pin means.

5. A rotating joint as defined in Claim 4, wherein said first and second flange means are respectively mounted to said first and second conduit means, said first flange means being stationary whereas said second flange means is adapted to rotate with said second conduit means, said tie rod means passing through said second flange means through a hole defined therein which is smaller than said nut.

6. A rotating joint as defined in Claim 5, wherein said slot means has a length corresponding to a limited rotation angle of said second flange means.

7. A rotating joint as defined in Claim 6, wherein said nut completely covers said second end.

8. A rotating joint as defined in Claim 7, wherein more than one of said slot means and of said hole are respectively defined in said first and second flange means, said slot means being similarly shaped, and wherein one of said tie rod means, of said nut and of said pair of rollers are provided for each corresponding hole and slot means.

9. A rotating joint as defined in Claim 8, wherein four equally spaced slot means are distributed near a periphery of said stationary first flange means about said axis of rotation.

10. A rotating joint as defined in Claim 8, wherein a seal gasket is provided between said first and second flange means.

11. A rotating joint as defined in Claim 10, wherein said gasket is made of ceramic.

12. A rotating joint as defined in Claim 11, wherein said rotating second flange means is mounted to a tilting metallurgical furnace, and wherein said stationary first flange means is mounted to a stationary launder means adapted for conveying molten metal produced by the furnace.

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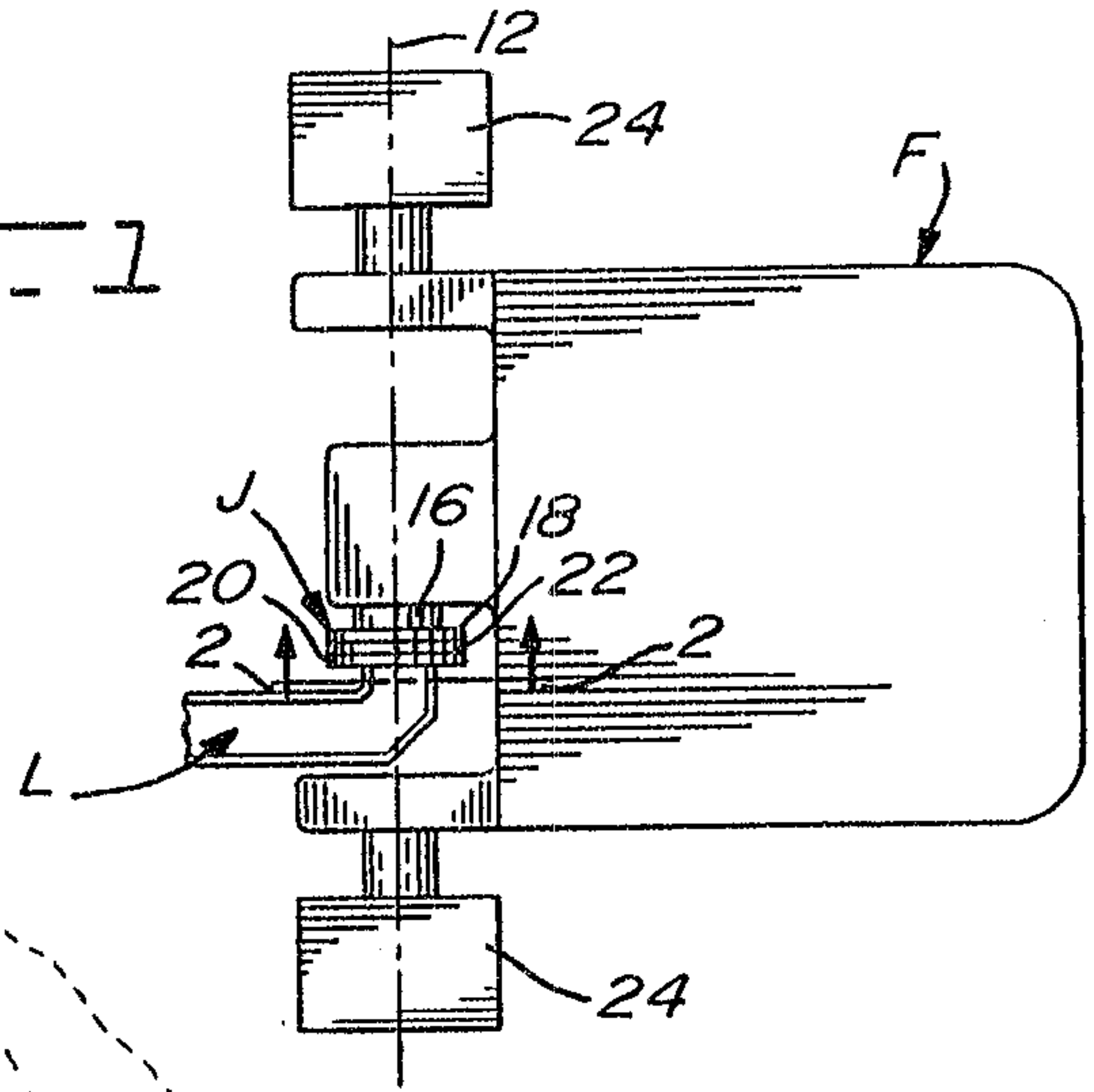

FIG. 1

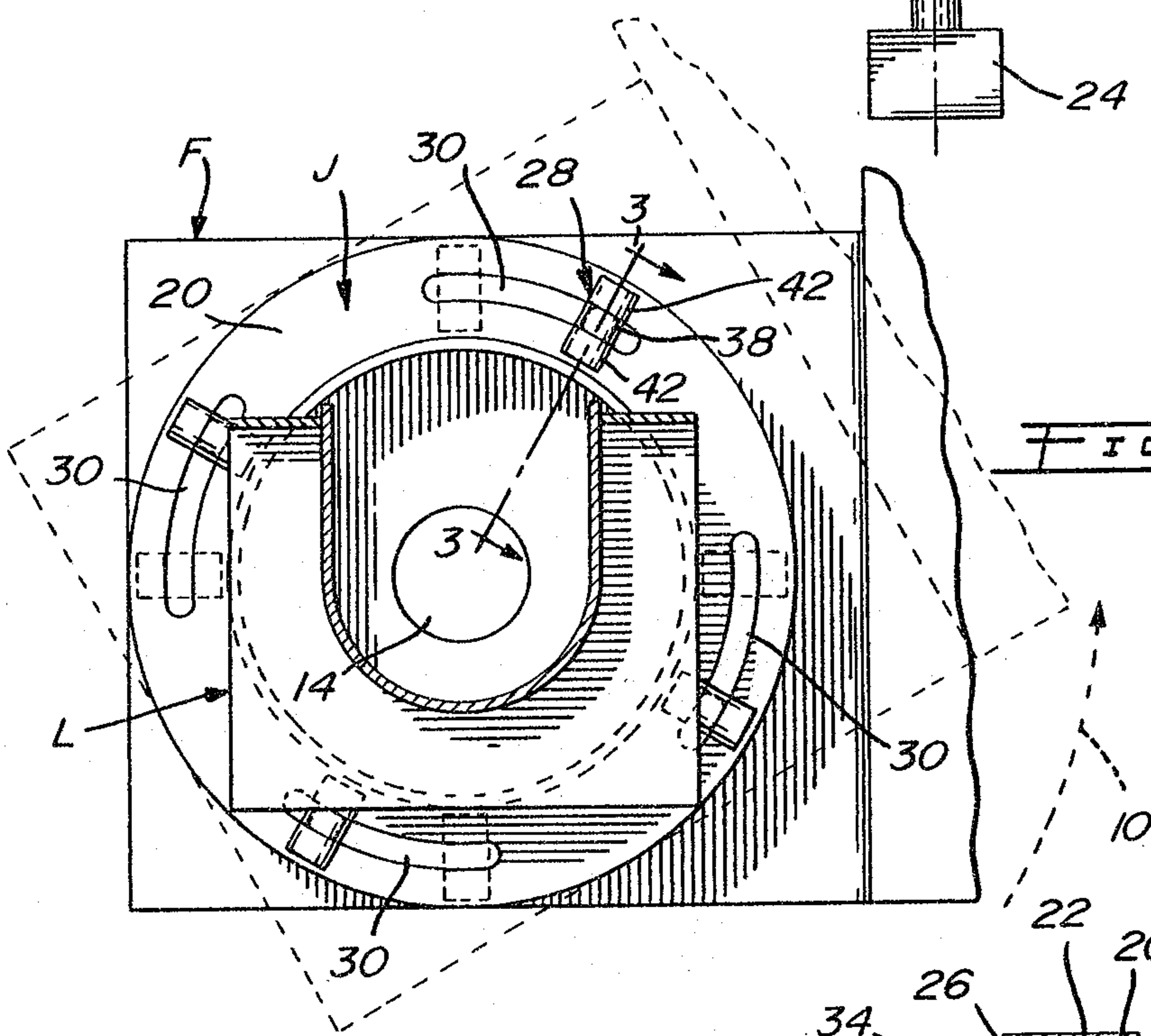

FIG. 2

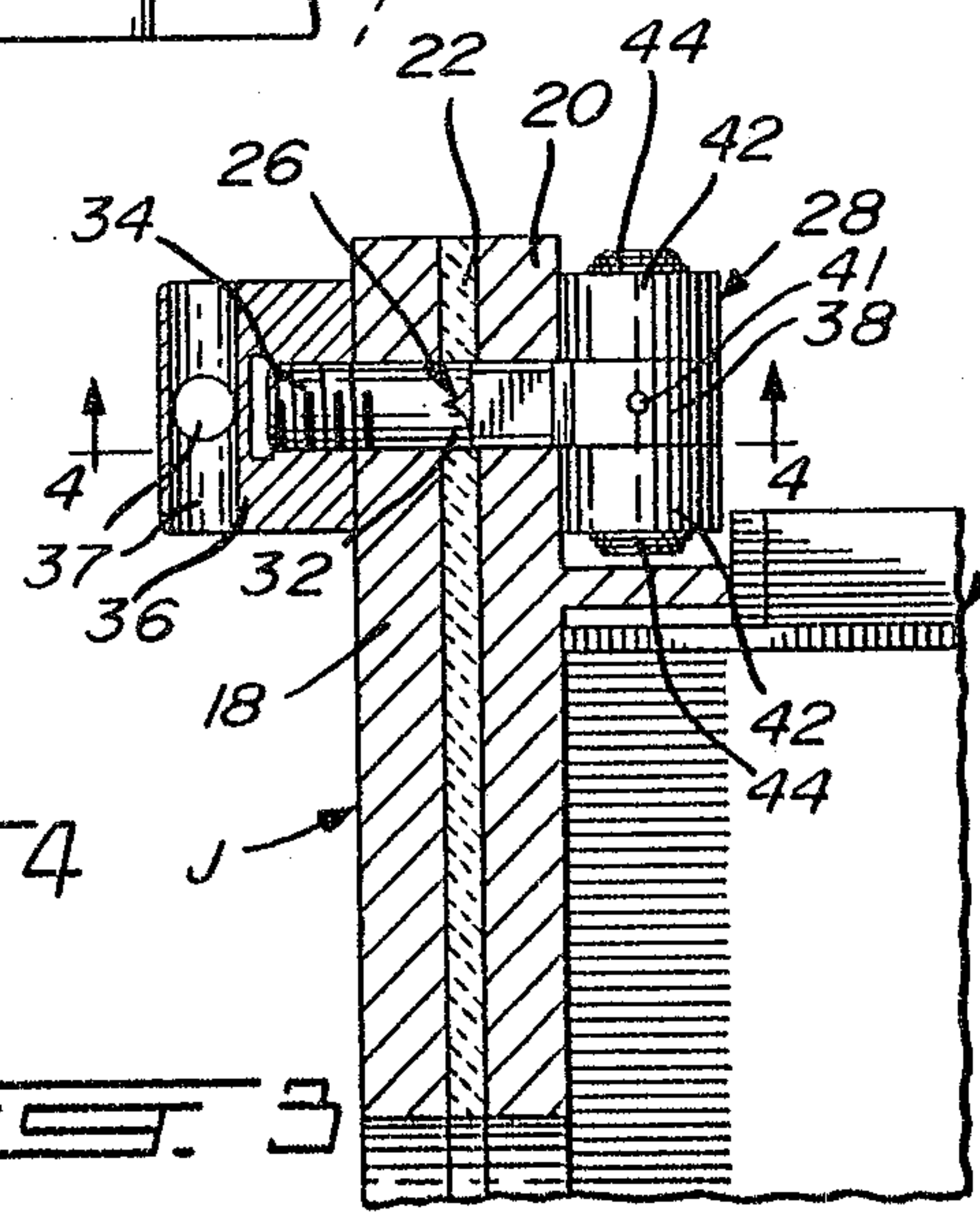

FIG. 3

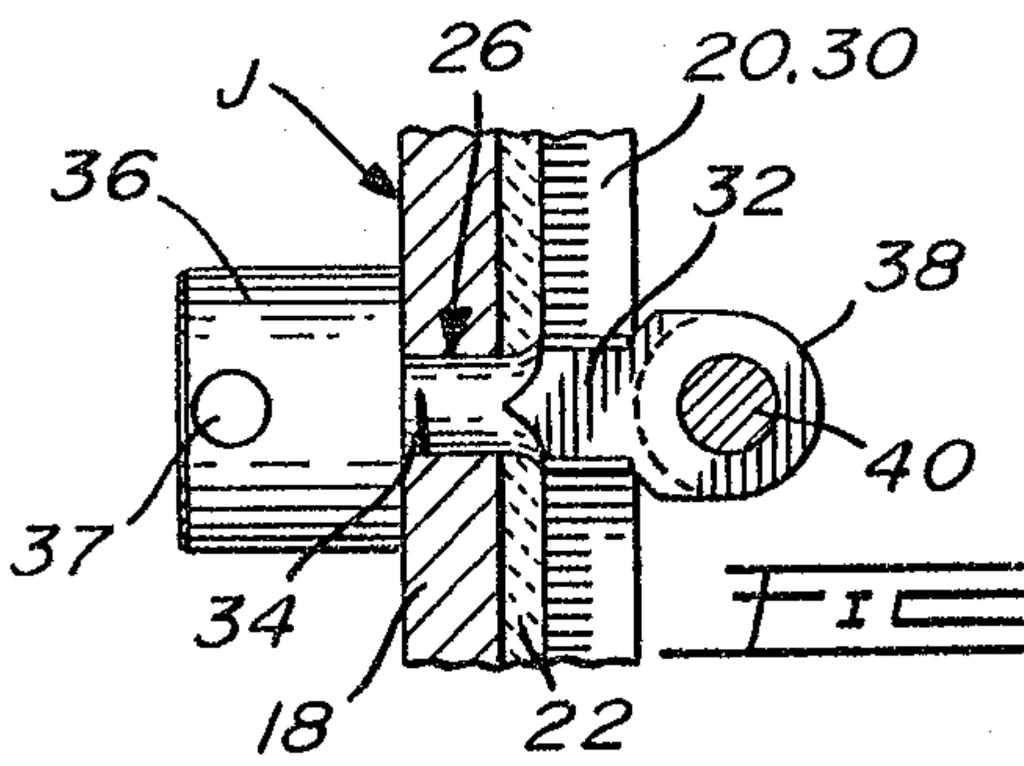

FIG. 4

PATENT AGENTS

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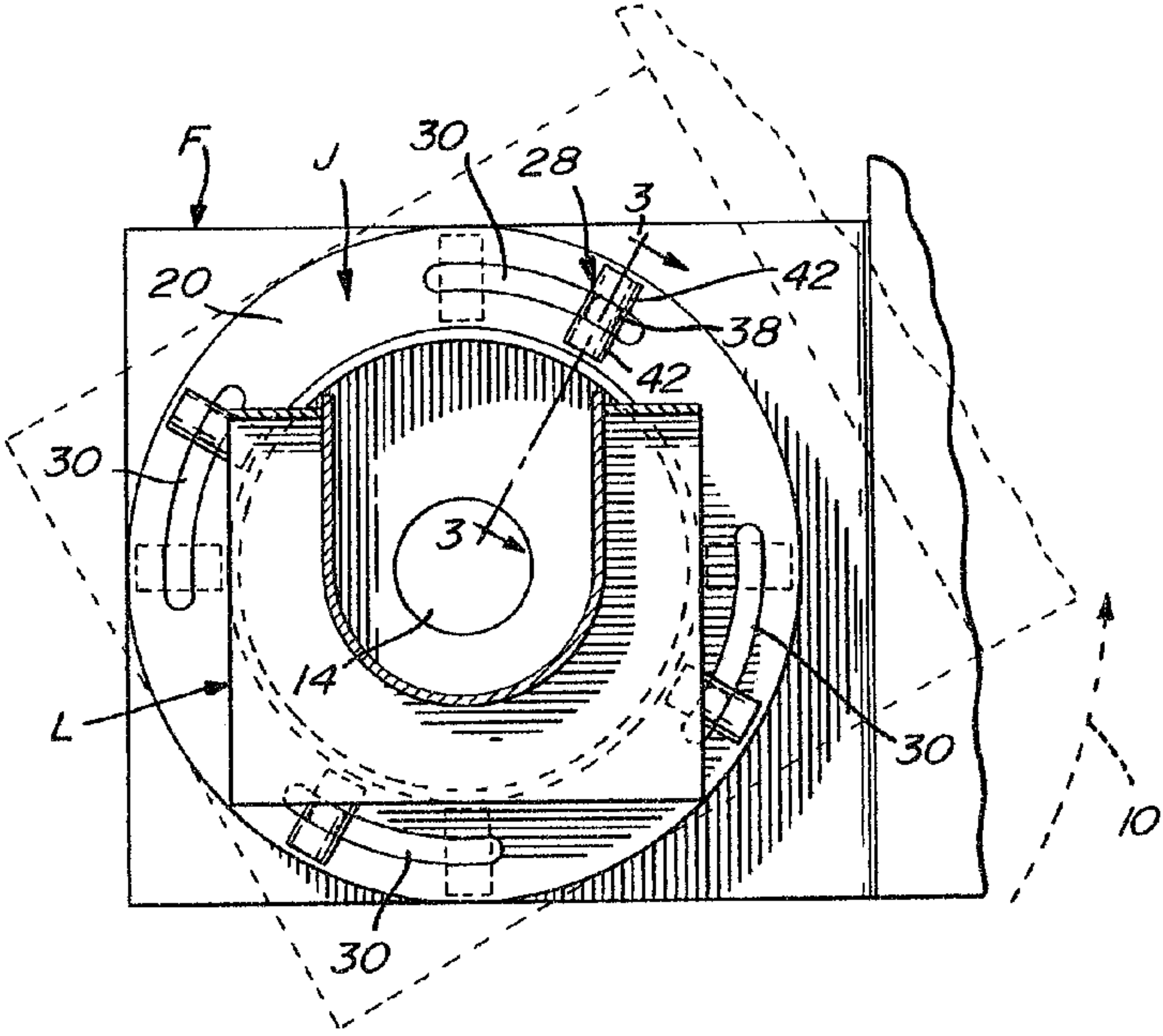
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