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⑤④ **Fuel atomisers for oil burners.**

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⑤⑥ References cited:
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GB-A-1 470 671
US-A-1 785 802
US-A-1 785 804
US-A-4 002 297
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Description

This invention relates to oil fuel atomisers for use in oil burners.

In US—A—1 785 802 there is disclosed an atomiser for an oil burner comprising a body having an exit leading outwardly from an annular mixing region, means for injecting oil through oil inlet ports into the mixing region and means for injecting an atomising fluid into the mixing region at a plurality of positions in a wall of the mixing region to form an oil spray. In that specification, the mixing region is an annular groove.

Since the date of the above-mentioned reference, there have been very considerable developments in the construction of atomisers for oil burners. Improved atomisation enables the emission of unburned carbon to be reduced even although, in modern practice, much lower quality oil fuel is employed in large boilers. These developments have produced burners with improved efficiency and consistency of atomisation, even with the much larger throughput of fuel now required and also provide for directing the atomised fuel into the furnace in an improved manner.

A common practice in oil burners for large boilers is to use atomisers of the Y-jet type in which a number of ports are arranged at an angle to the burner axis to produce a hollow conical spray. Each exit port has a co-axial atomising fluid port for injection of the atomising fluid (which may be steam or air) and also has an oil port entering at an angle. A degree of mixing between the atomising fluid and oil takes place in the exit port and the two phase mixture then expands out of the exit port to form a spray. One of the problems with this type of atomiser is that the jet of oil from the oil port tends to impinge on the opposite side of the exit port where it forms a thick film. This thick film can persist through the exit port to the end thereof and hence lead to the formation of relatively large oil droplets.

In British Patent Specification No. 1470671 there is described an atomiser in which the oil is introduced into the exit ports either axisymmetrically (that is symmetrical with regard to the axis of the exit port) through an annular port or symmetrically through a number of discrete oil ports. This arrangement prevents the formation of a thick asymmetric oil film. In the construction described in the British Specification No. 1470671, the ports are formed as a number of inserts which are mounted in a unitary body. This construction gives a significant improvement in performance over a Y-jet but there can be problems in the cleaning of this type of atomiser.

In accordance with the present invention a multi-jet atomiser for an oil burner comprises a body having a plurality of exit ports leading outwardly from an annular mixing chamber to form a hollow conical spray, means for injecting oil through oil inlet ports into the mixing chamber, the oil being injected at each inlet port in a direction to produce a toroidal recirculation in the annular mixing chamber with the injected oil from

each inlet port passing close to an exit port at approximately right angles to the axis of that exit port and means for injecting an atomising fluid into the mixing chamber at a plurality of positions in a wall of the mixing chamber.

With this construction, the atomising fluid is injected into a turbulent recirculating flow region through ports in the wall of the mixing chamber opposite the exit ports. The atomising fluid thus becomes well mixed with the oil and carries part of the recirculating mixture into the exit ports in the appropriate directions to pass through these ports and to expand outwardly therefrom as a fine spray.

Conveniently there is provided a plenum chamber or a plurality of plenum chambers through which the oil is fed into the aforementioned oil inlet ports.

The aforementioned annular mixing chamber preferably has a curved surface opposite each oil injection port shaped to direct the impinging oil around a curved path towards the axis of the burner assembly and hence to promote the toroidal recirculation.

The aforesaid means for injecting an atomising fluid into the mixing chamber may be at a plurality of positions in a wall of the mixing chamber opposite the exit ports.

The mixing chamber may have walls shaped to guide the injected oil in a direction across the exit ports and thence around in a recirculatory path over the wall opposite the exit ports.

Conveniently the annular mixing chamber and, if provided, the plenum chamber or chambers are constituted by regions between the end of a main burner body element containing a central atomising fluid passage extending axially through the body element to atomising fluid injection ports in the end thereof and a cap which is secured, e.g. threaded, onto the main burner body element and which has the aforesaid exit ports.

Alternatively the main burner body element may contain a central oil passage extending axially through the body element to said oil inlet ports. In this case the atomising fluid is passed through passages around the central oil passage.

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

Figure 1 is a front elevation of an atomiser for an oil burner;

Figure 2 is a section along the line 2—2 of Figure 1 through the front part of the burner, showing the atomiser; and

Figures 3, 4 and 5 are sections, similar to Figure 2, through the front parts of burners forming further embodiments of the invention.

Referring to Figures 1 and 2, the atomiser has a main elongate body member 10 with a central passage 11 extending axially through the member 10 towards the end thereof to carry an atomising fluid, either steam or air. This passage 11 terminates in a frusto conical face 12 from which a number of ports 13 extend, these ports leading into an annular mixing chamber 15. This

mixing chamber has a plurality of exit ports 14 as seen most clearly in Figure 1. These ports 14 are formed in cap member 16, internally threaded at 17, which fits over the end of the body member 10. In the particular embodiment, the ports 13 and the ports 14 are at angles of about 45° to the axis of the assembly. These ports 13 and 14 need not necessarily be at the same angle to the axis of the assembly. The angles for the exit ports 14 would depend on the desired cone angle of the spray. In some cases it may be preferred to make the inlet ports 13 parallel to the axis of the assembly.

Oil from an annular region 20 around the outside of the body member 10 passes through a plurality of oil ducts 21 in the cap member 16, into an annular plenum chamber 22. From the plenum chamber, the oil is injected into a mixing chamber 15 through a ring of ports 23 through an up-standing part 24 in the body member 10. The injection from the ports 23 into the mixing chamber is in a direction such as to produce a toroidal circulation of the oil in the mixing chamber 15. The oil ports 23 are arranged to produce oil jets which pass close to the exit ports 14 at approximately right angles to the axis of the exit ports. These oil jets are directed towards a curved surface 25 of the mixing chamber, this surface being shaped so that the oil is diverted around a curved path inwardly towards the axis of the burner assembly. This shaping facilitates the recirculation of the injected oil. It will be seen that the atomising fluid is injected through the ports 13 into the mixing chamber at an angle to the direction of injection of the oil through ports 23. In the mixing chamber, the atomising fluid becomes well mixed with the oil. In the particular example illustrated two rows of ports 13 are provided for injection of the atomising fluid. The oil is injected at ports 23 in the form of oil jets. A proportion of the recirculating mixture will emerge from the mixing chamber 15 through the interstices between these oil jets and will pass out through the exit ports 14 as a two-phase mixture which expands out of these ports to form a fine spray.

The plenum chamber 22 and mixing chamber 15 are formed as gaps between the cap member 16 and the main body member 10. The shaping of these members 10, 16 is such that, when the cap member is screwed in position on the body member, the gaps between the cap member and body member form the mixing chamber and plenum chamber. By providing a plenum chamber 22, there need not be equal numbers of ducts 21 and ports 23 and they do not have to be accurately aligned on assembly.

The exit ports 14 have their axes defining a cone, the axis of this cone being aligned with the longitudinal axis of the burner and the apex of the cone being on that longitudinal axis. The oil spray from the plurality of exit ports 14 thus is in the general form of a hollow cone. In the mixing chamber 15 the atomising fluid is injected through ports on the opposite wall of the chamber, that is the wall facing the exit ports. This wall is conical. It is not necessary in this construc-

tion however that the cap member 16 is angularly aligned with respect to the body element 10. Alignment of the injection ports and exit ports is not critical and, in the particular embodiment illustrated, there are two rows of injection ports 13 and one row of exit ports 14. The fluid entering the exit ports is well mixed in the mixing chamber and is forced into the exit ports. This construction gives good atomisation.

The simple construction having a cap 16 screwed onto the body member 10 enables the atomiser to be easily cleaned after these parts are separated.

In the above-described embodiment, the exit ports 14 are evenly spaced with their axes lying on the same cone. In some cases, however, it may be advantageous to have these exit ports on more than one cone. The ports 14 need not necessarily be evenly spaced; they may be irregularly spaced or grouped.

In Figures 1 and 2, the atomising fluid ports are directly opposite and pointing towards the exit ports. Figure 3 illustrates a modification of that construction and the same reference characters are used to indicate corresponding components. In Figure 3 the atomising fluid inlets to the mixing chamber, as shown at 30, produce atomising fluid jets which tend to counter the toroidal circulation produced by the oil jets 23. This may be advantageous in some cases to enhance mixing with the oil. In this construction, because the inlets to the atomising fluid ports 30 are at a greater distance from the atomiser axis than in the arrangement of Figures 1 and 2, it is easier to provide the requisite number of ports.

In the constructions of Figures 1, 2 and 3, the atomising fluid is fed axially through a central passage 11 in the main burner body 10. In some cases, as shown in Figures 4 and 5, it may be preferred to reverse the position of the oil and atomising fluid feeds, the oil feed being axially through a passage 41 and the atomising fluid being from an annular region 42 around the outside of the body member 10. This arrangement makes the incorporation of sufficient atomising fluid port area much easier by locating these ports as far as possible from the atomiser axis. The fact that the oil ports shown at 43 in Figure 4 are now much closer to the axis is not too much of an imposition because the total oil port area is generally significantly less than the total atomising fluid port area.

Figure 5 illustrates a modification of Figure 4 in which the oil ports, shown at 50, are approximately parallel to the atomiser axis. The mixing chamber wall is shaped to direct the oil jets across the approach region to the exit ports. This arrangement may simplify manufacture.

Claims

1. A multi-jet atomiser for an oil burner comprising a body (10, 16) having a plurality of exit ports (14) leading outwardly from an annular mixing chamber (15) to form a hollow conical

spray, means (21, 22) for injecting oil through oil inlet ports (23 or 43 or 50) into the mixing chamber (15), the oil being injected at each oil inlet port (23 or 43 or 50) in a direction to produce a toroidal recirculation in the annular mixing chamber (15) with the injected oil from each inlet port (23 or 43 or 40) passing close to an exit port (14) at approximately right angles to the axis of the exit port and means (11, 13 or 30 or 42) for injecting an atomising fluid into the mixing chamber at a plurality of positions in a wall of the mixing chamber.

2. A multi-jet atomiser as claimed in claim 1 wherein said means (11, 13 or 30) for injecting an atomising fluid into the mixing chamber are at a plurality of positions in a wall of the mixing chamber opposite the exit ports (14).

3. A multi-jet atomiser as claimed in claim 1 wherein the mixing chamber (15) has walls shaped to guide the injected oil in a direction across the exit ports (14) and thence around in a recirculatory path over the wall (25) opposite the exit ports.

4. A multi-jet atomiser for an oil burner as claimed in any of the preceding claims and having a plenum chamber (22) or a plurality of plenum chambers through which the oil is fed into said oil inlet ports (23).

5. A multi-jet atomiser for an oil burner as claimed in any of the preceding claims wherein the annular mixing chamber (15) is constituted by regions between the end of a main burner body element (10) containing a central atomising fluid passage (11) extending axially through the body element to atomising fluid injection ports (13) in the end thereof and a cap (16) which is secured onto the main burner body element and which has the said exit ports (14).

6. A multi-jet atomiser for an oil burner as claimed in any of claims 1 to 3 and having a plenum chamber (22 Figures 3, 4 or 5) or a plurality of plenum chambers through which the atomising fluid is fed into the mixing chamber (15).

7. A multi-jet atomiser for an oil burner as claimed in any of claims 1 to 4 or 6 wherein the annular mixing chamber (15) is constituted by regions between the end of a main burner body element (10) containing a central oil passage (41) extending axially through the body element to said oil inlet ports (43 or 50) and a cap (16) which is secured onto the main burner body element (10) and which has said exit ports (14).

8. A multi-jet atomiser as claimed in claim 5 as appendant to claim 4 wherein said cap (16) and said main burner body element (10) have co-operating surfaces defining said plenum chamber (22) or chambers.

9. A multi-jet atomiser for an oil burner as claimed in any of the preceding claims wherein said annular mixing chamber (15) has a curved surface (25) opposite each oil inlet port shaped to direct the impinging oil around a curved path towards the axis of the burner assembly and hence to promote the toroidal recirculation.

10. A multi-jet atomiser as claimed in any of the preceding claims wherein said exit ports (14) comprise a plurality of ports (14) evenly spaced around the longitudinal axis of the burner, the axes of the ports defining a conical surface symmetrically around and with its apex on said longitudinal axis.

Revendications

1. Atomiseur à gicleurs multiples pour un brûleur à combustible liquide comprenant un corps (10, 16) présentant plusieurs orifices de sortie (14) conduisant vers l'extérieur à partir d'une chambre annulaire (15) de mélange afin de former une pulvérisation conique creuse, des moyens (21, 22) destinés à injecter un combustible liquide par des orifices (23 ou 43 ou 50) d'entrée de combustible liquide dans la chambre de mélange (15), le combustible liquide étant injecté à chaque orifice (23 ou 43 ou 50) d'entrée de combustible liquide dans une direction produisant un recyclage toroïdal dans la chambre annulaire (15) de mélange, le combustible liquide injecté à partir de chaque orifice d'entrée (23 ou 43 ou 50) passant à proximité d'un orifice de sortie (14) à peu près perpendiculairement à l'axe de l'orifice de sortie, et des moyens (11, 13 ou 30 ou 42) destinés à injecter un fluide d'atomisation dans la chambre de mélange en plusieurs positions situées dans une paroi de la chambre de mélange.

2. Atomiseur à gicleurs multiples selon la revendication 1, dans lequel lesdits moyens (11, 13 ou 30) destinés à injecter un fluide d'atomisation dans la chambre de mélange se trouvent en plusieurs positions situées dans une paroi de la chambre de mélange et opposées aux orifices de sortie (14).

3. Atomiseur à gicleurs multiples selon la revendication 1, dans lequel la chambre (15) de mélange comporte des parois configurées de façon à guider le combustible liquide injecté dans une direction transversale aux orifices de sortie (14) et donc suivant un trajet de recyclage passant sur la paroi (25) opposée aux orifices de sortie.

4. Atomiseur à gicleurs multiples pour un brûleur à combustible liquide selon l'une quelconque des revendications précédentes, et comportant une chambre intermédiaire (22) ou plusieurs chambres intermédiaires à travers lesquelles le combustible liquide est introduit dans lesdits orifices (23) d'entrée de combustible liquide.

5. Atomiseur à gicleurs multiples pour un brûleur à combustible liquide selon l'une quelconque des revendications précédentes, dans lequel la chambre annulaire (15) de mélange est constituée par des régions situées entre l'extrémité d'un élément de corps principal (10) du brûleur contenant un canal central (11) à fluide d'atomisation s'étendant axialement à travers l'élément de corps jusqu'à des orifices (13) d'injection de fluide d'atomisation situés à son extrémité, et un chapeau (16) qui est fixé sur l'élément de corps principal du brûleur et qui présente lesdits orifices (14) de sortie.

6. Atomiseur à gicleurs multiples pour un brûleur à huile combustible selon l'une quelconque des revendications 1 à 3 et comportant une chambre intermédiaire (22, figures 3, 4 ou 5) ou plusieurs chambres intermédiaires à travers lesquelles le fluide d'atomisation est introduit dans la chambre de mélange (15).

7. Atomiseur à gicleurs multiples pour un brûleur à combustible liquide selon l'une quelconque des revendications 1 à 4 ou 6, dans lequel la chambre annulaire (15) de mélange est constituée par des régions comprises entre l'extrémité d'un élément de corps principal (10) du brûleur contenant un canal central (41) de combustible liquide s'étendant axialement à travers l'élément de corps jusqu'auxdits orifices (43 ou 50) d'entrée de combustible liquide, et un chapeau (16) qui est fixé sur l'élément de corps principal (10) du brûleur et qui présente lesdits orifices de sortie (14).

8. Atomiseur à gicleurs multiples selon la revendication 5 en dépendance de la revendication 4, dans lequel ledit chapeau (16) et ledit élément de corps principal (10) du brûleur présentent des surfaces coopérantes définissant ladite chambre intermédiaire (22) ou lesdites chambres intermédiaires.

9. Atomiseur à gicleurs multiples pour un brûleur à combustible selon l'une quelconque des revendications précédentes, dans lequel ladite chambre annulaire (15) de mélange présente une surface incurvée (25) opposée à chaque orifice d'entrée de combustible liquide et configurée de façon à diriger le combustible liquide l'atteignant suivant un trajet incurvé vers l'axe de l'ensemble du brûleur et donc à favoriser le recyclage toroïdal.

10. Atomiseur à gicleurs multiples selon l'une quelconque des revendications précédentes, dans lequel lesdits orifices de sortie (14) comprennent plusieurs orifices (14) espacés régulièrement autour de l'axe longitudinal du brûleur, les axes des orifices définissant une surface conique entourant symétriquement ledit axe longitudinal et dont le sommet est situé sur ledit axe longitudinal.

Patentansprüche

1. Zerstäuber mit mehreren Düsen für einen Ölbrenner, mit einem Hauptteil (10, 16), der eine Vielzahl von Auslaßöffnungen (14), die von einer ringförmigen Mischkammer (15) zum Bilden eines hohlen kegelförmigen Sprühnebels nach außen führen, der Mittel (21, 22) zum Einspritzen von Öl durch Öleinlaßöffnungen (23 oder 43 oder 50) in die Mischkammer (15), wobei das Öl bei jeder Öleinlaßöffnung (23 oder 43 oder 50) in einer solchen Richtung eingespritzt wird, daß eine ringförmige Umwälzströmung in der ringförmigen Mischkammer (15) erzeugt wird, wobei das eingespritzte Öl von jeder Einlaßöffnung (23 oder 43 oder 50) dicht bei einer Auslaßöffnung (14) im ungefähr rechten Winkel zur Achse der Auslaß-

öffnung vorbeiströmt, und der Mittel (11, 13 oder 30 oder 42) zum Einspritzen eines Vernebelungsfluids in die Mischkammer an einer Vielzahl von Stellen in einer Wand der Mischkammer aufweist.

2. Zerstäuber mit mehreren Düsen nach Anspruch 1, bei dem die Mittel (11, 13 oder 30) zum Einspritzen eines Vernebelungsfluids in die Mischkammer an einer Vielzahl von Stellen in einer Wand der Mischkammer gegenüber den Auslaßöffnungen (14) vorgesehen sind.

3. Zerstäuber mit mehreren Düsen nach Anspruch 1, bei dem die Mischkammer (15) Wände aufweist, die zum Führen des eingespritzten Öles in eine Richtung über die Auslaßöffnungen (14) hinweg und von dort herum in einem Umwälzweg über die Wand (25) gegenüber den Auslaßöffnungen geformt ist.

4. Zerstäuber mit mehreren Düsen für einen Ölbrenner nach einem der vorstehenden Ansprüche, der eine Speicherkammer (22) oder eine Vielzahl von Speicherkammern aufweist, durch die das Öl in die Einlaßöffnungen (23) gespeist wird.

5. Zerstäuber mit mehreren Düsen für einen Ölbrenner nach einem der vorstehenden Ansprüche, bei dem die ringförmige Mischkammer (15) durch Breiche zwischen dem Ende eines Brennerhauptelementes (10), der einen mittigen Durchlaß (11) für das Vernebelungsfluid aufweist, der sich axial durch das Hauptelement zu Einspritzöffnungen (13) für das Vernebelungsfluid in dessen Ende erstreckt, und einer Kappe (16) gebildet wird, die auf dem Brennerhauptelement befestigt ist und die die Auslaßöffnungen (14) aufweist.

6. Zerstäuber mit mehreren Düsen für einen Ölbrenner nach einem der Ansprüche 1 bis 3, der eine Speicherkammer (22, Fig. 3, 4 oder 5) oder eine Vielzahl von Speicherkammern aufweist, durch die das Vernebelungsfluid in die Mischkammer (15) zugeführt wird.

7. Zerstäuber mit mehreren Düsen für einen Ölbrenner nach einem der Ansprüche 1 bis 4 oder 6, bei dem die ringförmige Mischkammer (15) durch Bereiche zwischen dem Ende eines Brennerhauptelementes (10), der einen mittigen Öldurchlaß (41) aufweist, der sich axial durch das Hauptelement zu den Öleinlaßöffnungen (43 oder 50) erstreckt, und einer Kappe (16) gebildet wird, die auf dem Brennerhauptelement (10) befestigt ist und die die Auslaßöffnungen (14) aufweist.

8. Zerstäuber mit mehreren Düsen nach Anspruch 5 in Abhängigkeit von Anspruch 4, bei dem die Kappe (16) und das Brennerhauptelement (10) zusammenwirkende Oberflächen aufweisen, die die Speicherkammer (22) oder Kammern begrenzen.

9. Zerstäuber mit mehreren Düsen für einen Ölbrenner nach einem der vorstehenden Ansprüche, bei dem die ringförmige Mischkammer (15) eine gekrümmte Oberfläche (25) gegenüber der Öleinlaßöffnung aufweist, die so geformt ist, daß das auftreffende Öl auf einem gekrümmten Weg zur Achse der Brenneranordnung gerichtet wird, wodurch die ringförmige Umwälzströmung unterstützt wird.

10. Zerstäuber mit mehreren Düsen nach einem

der vorstehenden Ansprüche, bei denen die Auslaßöffnungen (14) eine Vielzahl von Öffnungen (14) aufweisen, die um die Längsachse des Brenners in gleichförmigen Abständen angeordnet

sind, wobei die Achsen der Öffnungen eine kegelförmige Oberfläche definieren, die symmetrisch um die Längsachse so angeordnet ist, daß sich ihre Spitze auf der Längsachse befindet.

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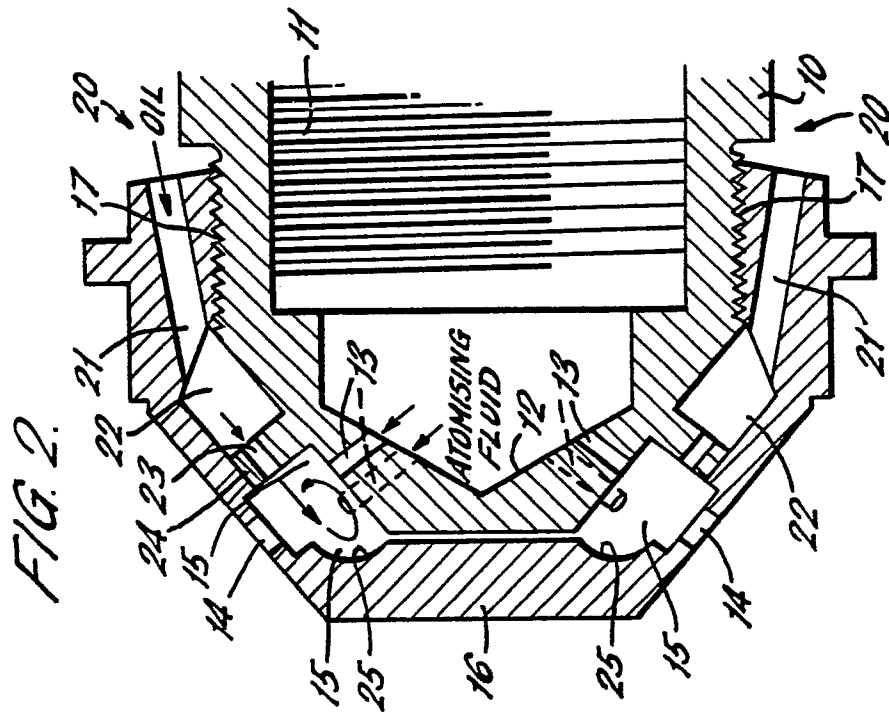
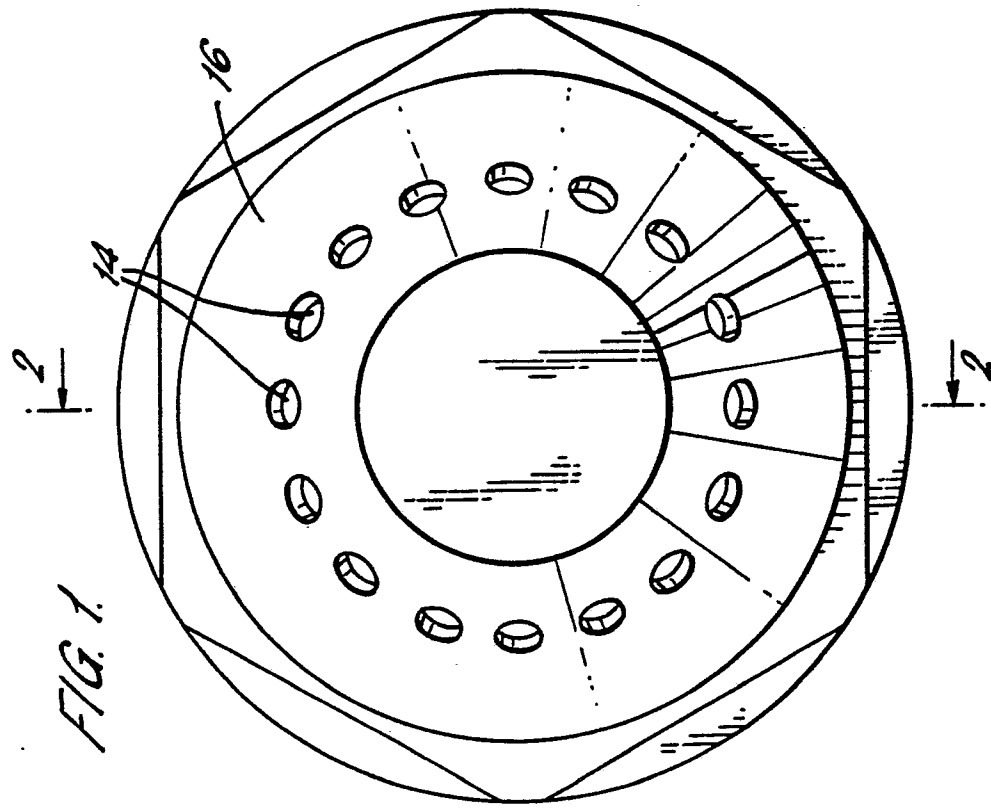


FIG. 3.

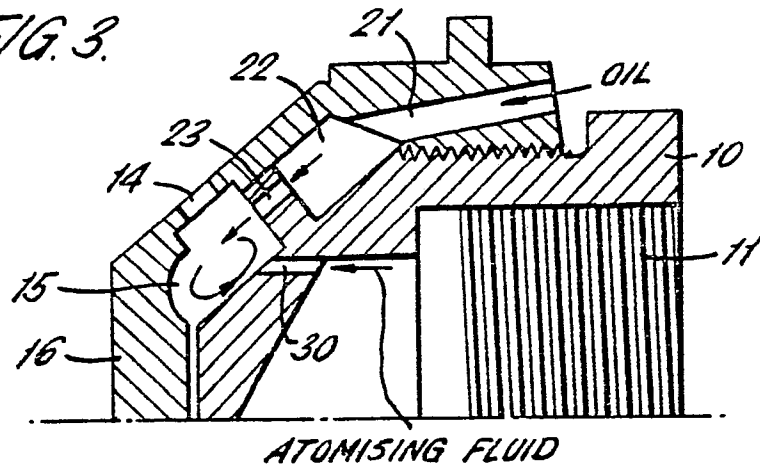


FIG. 4.

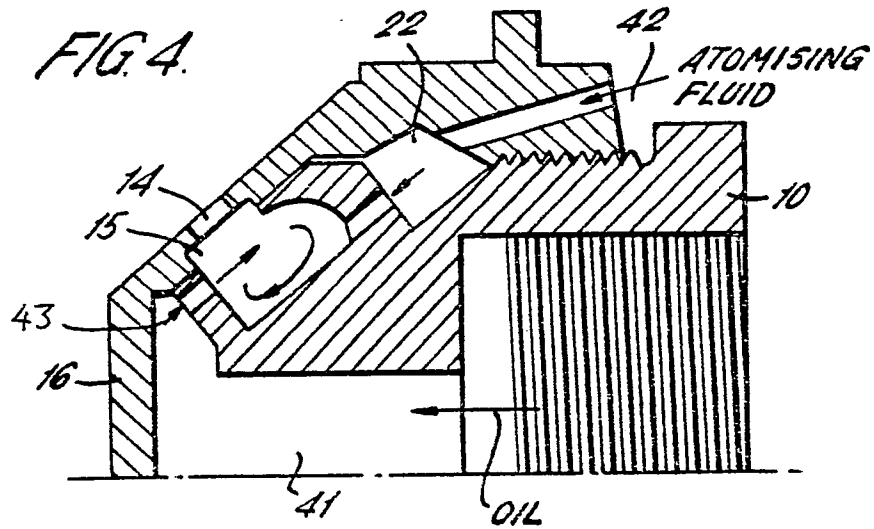


FIG. 5.

