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- (54) Benævnelse: **Brandslukningspistol med justerbart slukningsmiddelflow og justerbar dosering for tilsætningsmiddel**
- (56) Fremdragne publikationer:
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US-A1- 2004 084 192

DESCRIPTION

[0001] The invention lies in the field of large scale fire fighting nozzles, and more particularly in the field of fire fighting nozzles having a selectable discharge gap providing a wide range of fixed-flows, of nozzles requiring independently selectable additive proportioning.

[0002] In the field of large scale (0.95 cubic metres per minute (250 gpm) or greater) fire fighting nozzles, fixed-flow" nozzles, in general, have long been traditional. A nozzle is "fixed-flow," or is referred to as "fixed-flow," when the nozzle discharge gap is fixed during use. The reference or term is used even when the discharge gap is selectively adjustable.

[0003] A nozzle discharge gap is typically the annular gap defined between a portion of a nozzle barrel and a nozzle bafflehead. One traditional adjustable fixed-flow nozzle design, for instance, permits the gap to be manually adjusted by screwing in and out a bafflehead located at the discharge end of the nozzle barrel.

[0004] In "fixed-flow" nozzles the flow rate, or gpm, varies with the square root of supplied fluid pressure. Although in practice there can be a significant variation in the fire fighting fluid supply pressure, variations which can run possibly +/- 50%, the variation in the square root of that pressure is not great. Thus, the resulting variation in flow rate caused by a varying supply pressure is not too great. Thus, such nozzles, with the discharge gap fixed during flow, are referred to as "fixed-flow" nozzles.

[0005] (In contrast, by way of background, so called "automatic or "pressure regulating" nozzles automatically vary a nozzle discharge gap during use to attempt to maintain a pre-selected discharge pressure. Typically in such nozzles a bafflehead, assisting in defining the discharge gap, will be automatically adjusted to attempt to maintain a pre-selected discharge pressure. Since range tends to vary directly with pressure, "pressure regulating" nozzles tend to deliver fluid at a fixed range notwithstanding variations in supply pressure. Flow rate, however, in "pressure regulating" nozzles varies significantly. The flow rate varies with the variation in discharge gap used to target the discharge pressure. From this condition arises the contrast with "fixed-flow" nozzles. The instant invention is directed to improved "fixed-flow" nozzles.)

[0006] Additive, usually a foam or foaming concentrate, is frequently supplied to a fire fighting nozzle. It is designed by manufacturers to be proportioned into fire fighting fluid at a stated ratio, typically 1%, 3%, 6%, 10%. Various means have been developed in the industry to adapt for changing additive products during a job; that is, means have been developed to change from a product with one proportioning ratio to an additive product with another proportioning ratio. One such means has been the provision for the manual insertion of variable orifices in a flow path or line between an additive source and a nozzle. Small insertable orifices would be provided for additives designed to be mixed at lower ratios; larger orifices would be provided for additives designed to be mixed at higher ratios. Another variation, Klein US Patent

4,224,956, discloses a simple, manually adjustable proportioning valve, the valve adjustable between a set of stop positions, in order to proportion at different ratios.

[0007] The desire and/or ability to significantly adjust flow rate in a "fixed-flow" nozzle greatly complicates, however, this selection of a proper orifice. When flow rate can be widely adjusted, such as between 0.95 cubic metres per minute (250 gpm) and 1.89 cubic metres per minute (500 gpm) or greater, a selection of the proper orifice for proportioning additive, which is dependent upon flow rate (e.g. upon the adjusted size of the gap of the discharge,) becomes complex.

[0008] (In the field of "automatic" nozzles, discussed above, means have been invented [by the instant inventor] wherein an automatic variation in the discharge gap automatically provides a coordinated variation in a port in the additive fluid flow path, the variation being coordinated in two ways. One variation in port size is calibrated to automatically vary additive flow rate with variations in primary fluid flow rate caused by the nozzle's system of automatic adjustment. A second variation of port size is also calibrated to vary port size in accordance with a selected variation in the proportioning ratio of the additive. See published patent application number US 2004/0084192 A1.)

[0009] The instant invention provides for a selectable "fixed flow" fire fighting nozzle with independently selectable, gap coordinated additive proportioning ratios. The additive proportioning ratios and flow rate selections are coordinated, but they are selectable independently of each other. That is, a fire fighter can select, independently, preferably by turning a dial, a flow rate and a proportioning ratio. A turn of the dial can select a different flow rate for the same proportioning ratio or a different proportioning ratio for the same flow rate, or both different. The instant invention provides a pre-calibrated orifice system, calibrated with a bafflehead adjustment system that controls discharge gap, such that bafflehead adjustment and additive orifice selection are independently selectable. For instance, if a nozzle provided for the selection between three flow rates and three additive ratios, then three bafflehead positions and nine orifice positions would be provided, one orifice position for each additive ratio at each flow rate. The orifice system lies in a fluid communication path between an additive source and the discharge end of the nozzle. To the best of applicant's knowledge, no prior art system has coordinated and cross calibrated a selection of nozzle-flow rates and a selection of additive ratio proportioning orifices.

[0010] The invention comprises a fire fighting nozzle having a selectively adjustable discharge gap and an independently selectable, gap coordinated additive proportioning system. Nozzle elements define a selectively adjustable discharge gap and are structured in combination such that the gap is selectively adjustable between a plurality of positions. The nozzle includes an additive passageway associated with the nozzle, the passageway defined in a path of fluid communication between a nozzle discharge and an additive source. The passageway is selectively adjustable between at least four configurations. At least two configurations are correlated with at least two discharge gap positions. A selective adjustment of nozzle elements is independent of, but coordinated with, a selective adjustment of the additive passageway.

[0011] The invention also includes a method for discharging fire fighting fluid at a manually adjustable flow rate and providing for independently selectable, gap coordinated additive proportioning. The method includes relatively adjusting nozzle elements to define one of a plurality of selectively adjustable discharge gaps for the nozzle, each gap coordinated with one of a plurality of selectable additive proportioning ratios. The method includes adjusting an additive passageway, defined in a line of fluid communication between a nozzle discharge and an additive source, to one of at least four configurations. Each configuration corresponds to one of at least two discharge gap positions and to one of at least two additive proportioning ratios. The relative adjusting of nozzle elements is coordinated with an adjusting of additive passageway, and the discharge gap and additive proportioning ratios can be independently selected.

[0012] A better understanding of the present invention can be obtained when the following detailed description of the preferred embodiments are considered in conjunction with the following drawings, in which:

Figure 1 is a prospective view of a preferred embodiment.

Figure 2 is a more detailed view of a portion of the embodiment of Figure 1.

Figure 3 is a view of a part of the embodiment of Figure 1 and Figure 2.

Figure 4 is a view of a combination of parts of the embodiment of Figures 1 and 2.

Figure 5 is a view of a part of the embodiment of Figure 1.

Figure 6 is a view of a part of the embodiment of Figure 1.

Figure 7 is a view of a combination of parts of the embodiment of Figure 1.

Figure 8 is a further view of parts of the embodiment of Figure 1.

Figure 9 illustrates portions of a part of the embodiment of Figure 1.

Figure 10 illustrates a plurality of parts, separated, of the embodiment of Figure 1.

Figure 11 illustrates part of the embodiment of Figure 1 and of Figure 10.

Figure 12 illustrates a combination of parts of the embodiment of Figure 1.

Figure 13 illustrates a combination of parts of the embodiment of Figure 1.

Figure 14 is a Y Z cross section drawing, where Z corresponds with the longitudinal axis of the nozzle. Figure 15 is a X Y cross section drawing of the nozzle illustrated in Figure 14.

Figures 16A-E illustrate the nozzle of the embodiment of Figures 14 and 15, set for different flow rates and additive ratios.

Figures 17A-E are a cross section of the embodiment of Figure 1.

Figures 18 illustrates coordinated additive ports for a preferred embodiment.

[0013] The drawings are primarily illustrative. It would be understood that structure may have been simplified and details omitted in order to convey certain aspects of the invention. Scale may be sacrificed to clarity.

[0014] Figure 1 illustrates a fire fighting nozzle of a preferred embodiment of the instant invention. The nozzle includes what is referred to as a fixed nozzle body or barrel portion labeled FNB and a rotating nozzle body or barrel portion labeled RNB.

[0015] The FNB and RNB body portions, as disclosed more fully below, are barrel elements that rotate relative to each other. The relative rotation between the two nozzle or barrel elements causes metering tube element MT, better illustrated in Figure 11, containing a bafflehead with an attached mixing chamber plate and a sleeve with various additive ports, to rotate. Rotating nozzle body elements are coordinated with the metering tube elements such that metering tube elements rotate with rotating body elements. A pattern control sleeve RNBSL, as is known in the art, is also indicated.

[0016] The nozzle of Figure 1 contains a passageway for the supply of an additive into the major fluid flow barrel of the nozzle. Additive flows into the nozzle through a fluid communication channel defined by element AC.

[0017] As more particularly illustrated in Figure 2, element AC is associated with element ABN that helps to affix element AC to the nozzle. Around element AC is affixed a pivoting arm AAL having a tilting point ASP. Pivoting arm AAL tilts on its axis, effected by pressing down on pads AA, to raise and lower the tilting element point ASP. Rotating nozzle element RNB contains slots RNDBS. Element point ASP can be raised, by pressure on pads AA, such that the point ASP rises out of one rotating nozzle element RNDBS slot. The nozzle ring or dial element RNDB can then be rotated such that element ASP can be lowered into a succeeding or other RNDBS slot. Each slot RNDBS provides for the coordination and selection of particular flow rate (selected discharge gap) and a particular additive ratio.

[0018] Figure 3 further illustrates the tilting arm AAL with its point ASP and a base element ACB and the pressure pads AA. Figure 4 further illustrates the above elements including affixing element ABN.

[0019] Figure 5 illustrates a nozzle or barrel element FNB. Nozzle or barrel element RNB rotates with respect to nozzle or barrel element FNB. Nozzle element FNB defines a passageway or chamber for additive fluid, as also illustrated in Figure 14. Although barrel elements FNB and RNB rotate with respect to each other, element FNB is typically viewed as fixed since it would be awkward to rotate element AC to any substantial degree.

[0020] Figure 6 illustrates a fixed tube nozzle element FT. Nozzle element FT is designed to be secured to nozzle element FNB, as further illustrated in Figure 7. Additive that enters the nozzle through the passageway defined by element AC will enter an additive passageway FNAC defined by element FNB and will subsequently pass through a metering port MTAP and a fixed tube port FTAP and into the interior of fixed tubular element FT. It can be seen that interior fixed tube element FT contains a helical or spiral slot FTHS at its downstream end. The term "helical or spiral" is used to indicate general shape. Neither a precise helix or spiral is necessary.

[0021] Figure 8 illustrates an eductor fitting FTE and a screen FTSC that are attached to the upstream end of element FT. Figure 9 illustrates in greater detail the helical or spiral slot FTHS at the downstream end of element FT. Element FT in Figure 9 is also shown as having metering tube lug or pin MTL in its helical or spiral slot.

[0022] Figure 10 illustrates parts that combine generally to form parts of rotating nozzle body RNB, as well as metering tube MT, which fits inside of and rotates with nozzle body RNB. Figure 10 illustrates annular ring dial RNBD having handle RNBDH. Annular ring RNBD attaches to nozzle element RNB, such as by set screw. Nozzle or barrel element RNBL contains interior fins RNBF attaching to an inner annular cylinder labeled RNBI. Inner annular cylinder RNBI contains two keyways RNBK. Sliding sleeve RNBSL, as discussed above, is also shown in the drawing. Also, in Figure 10 is illustrated slots MTS. Part MT rotates with RNB by virtue of two slots MTS into which the keyways RNBK fit. Part MT also contains a location MTLL, illustrated in Figure 11, for locating a lug or pin MTL to turn within the helical or spiral slot FTHS of element FT. The movement of the pin or lug in the slot tends to translate tube MT with respect to body portion RNB and FNB as tube MT rotates.

[0023] Figure 11 illustrates part MT and its portions in greater detail. As can be shown in Figure 11, MT provides at its downstream end a bafflehead MTBH that combines with other elements of the nozzle to define a variable discharge gap VDG. See Figure 14. At the upstream end of element MT a sleeve contains a series of variably sized orifices MTAP. Orifices MTAP rotate with respect to fixed orifice FTAP in additive passageway FNAC defined by element FNB. Depending upon the alignment of a variable orifice MTAP with fixed orifice FTAP in the additive chamber, the fluid communication passageway for the additive from its source through nozzle N is figured and adjusted.

[0024] Figure 12 illustrates the coordination of element MT with its bafflehead MTBH at the downstream end, together with nozzle element RNBG, which should be affixed to the inside passageway of the nozzle or barrel element RNB at the discharge end. Element RNBG and the downstream bafflehead end of element MT define a variable discharge gap VDG therebetween for the nozzle, thereby permitting and defining a variation of flow in the nozzle. That is, as element MT translates along the longitudinal axis of the nozzle with respect to element RNBG, the discharge gap VDG is widened and/or narrowed. Further, as element MT rotates, different orifices MTAP are aligned under a fixed orifice FTAP in relation to additive passageway FNAC. Again, element MT rotates with RNB by virtue of a keyway and slot mechanism between them.

Element MT translates with respect to nozzle elements by virtue of movement of a lug or pin of element MT in a helical or spiral slot of element FT.

[0025] Figure 13 illustrates a mixing chamber plate MTMP, typically affixed to the downstream end of element MT providing the bafflehead.

[0026] Figures 14 and 15 provide two cross section views of the nozzle of the embodiment of Figure 1. By virtue of Figures 14 and 15 the assembly of the above referenced parts into the nozzle is illustrated. In Figure 14 fitting HFT is a fitting provided for attachment between a hose or line and nozzle element FNB. Element FTS attaches to fixed element FNB. Element FTS provides a seal to separate a high pressure zone from a low pressure zone within the nozzle. Element FTS helps permit element MT of the nozzle to translate and rotate within it. Figure 14 illustrates additive chamber FNAC defined in element FNB with tubular element FT shown as providing an additive port FTAP. Port FTAP, and whichever additive port MTAP of element MT that is rotated within and aligned with fixed additive port FTAP, if any, together define an additive passageway flowing through element FNB and downstream through element FT.

[0027] An X Y cross section of the embodiment of Figure 1 and Figure 14 is provided in Figure 15 and indicated by location in Figure 14.

[0028] Figures 16A-E are similar to Figures 14 and 15, with the difference that they show orientations of the nozzle for different flow rates and different additive proportioning percentages. Figures 14 and 15 show a nozzle where a flow rate of 0.95 cubic metres per minute (250 gpm) and a proportioning ratio of 1% has been selected. Figure 16A shows an orientation of the nozzle arranged for a flow rate of 0.95 cubic metres per minute (250 gpm) and a ratio of 3%. Figure 16B illustrates an orientation of the nozzle for a flow rate of 1.89 cubic metres per minute (500 gpm) and an additive proportioning ratio of 3%. Figure 16C is a Y Z cross section of the nozzle in accordance of Figure 1 showing an arrangement of the nozzle for a flow rate of 1.89 cubic metres per minute (500 gpm) and an additive ratio of 3%. Figure 16D illustrates an orientation of the nozzle for a flow rate of 2.84 cubic metres per minute (750 gpm) and an additive ratio of 1%. Figure 16E illustrates a flush position wherein no additive will flow into the nozzle.

[0029] Figures 17A-E illustrate the nozzle of the preferred embodiment of Figure 1, in perspective and in cross section. In Figures 17A-E some parts are numbered. Table I, below, correlates these numbered parts with their common name. In Table I, as indicated, part number four corresponds to fixed nozzle body FNB; part number 5 corresponds to fixed tube eductor FTE; part number 6 corresponds to fixed tube screen FTSC; part number 8 corresponds to additive chamber block ACB; part number 10 corresponds to foam or additive inlet channel AC; part number 15 corresponds to a fixed tube FT; part number 16 corresponds to metering tube MT; part number 17 corresponds to the metering tube mixing plate MTMP and part number 18 corresponds to the pattern control sleeve RNBSL. The solely numbered parts on Table I have not previously been referred to.

TABLE I

NO.	DESCRIPTION	REFERENCE NO.
1	SWIVEL INLET NUT	
2	GASKET, SWIVEL ADAPTER	
3	BALL BEARING	
4	NOZZLE BODY	FNB
5	FOAM EDUCTING JET	FTE
6	JET INLET GUARD	FTSC
7	FOAM SEAL	
8	LATCH MOUNTING BLOCK	ACB
9	FLOW LOCK	
10	FOAM INLET ADAPTER	AC
11	STREAM STRAIGHTENER MODULE	
12	FLOW LOCK RING	
13	NOZZLE ASSEMBLY ROD	
14	OUTLET NOZZLE/BEARING HEAD	
15	CENTER TUBE/FOAM TUBE	FT
16	BAFFLE HEAD/METERING TUBE	MT
17	FLOOD PLATE	MTMP
18	PATTERN CONTROL SLEEVE	RNBSL
19	ADAPTER	
20	HANDLE	
21	SETSCREW	
22	NOZZLE FLOW LABEL	
23	SET SCREW	
24	NOZZLE IDENTIFICATION LABEL	
25	SETSCREW	
26	SCREW, PAN HEAD	
27	SCREW, BUTT ON HEAD	
28	SETSCREW	

[0030] Figure 18 illustrates the metering tube additive ports MTAP in their dimensions as if the cylindrical metering tube were straightened into a flat strip. Figure 18 gives a sense of the calibration of the metering tube additive ports with the position of the metering tube both by rotation and longitudinally within the nozzle.

[0031] The foregoing description of preferred embodiments of the invention is presented for purposes of illustration and description, and is not intended to be exhaustive or to limit the invention to the precise form or embodiment disclosed. The description was selected to best explain the principles of the invention and their practical application to enable others skilled in the art to best utilize the invention in various embodiments. It is intended that the scope of the invention is not to be limited by the specification, but to be defined by the claims set forth below. Since the foregoing disclosure and description of the invention are illustrative and explanatory thereof, various changes in the size, shape, and materials, as well as in the details of the illustrated device may be made without departing from the scope of the claims. The invention is claimed using terminology that depends upon a historic presumption that recitation of a single element covers one or more, and recitation of two elements covers two or more, and the like. Also, the drawings and illustration herein have not necessarily been produced to scale.

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not

form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US4224956A [0006]
- US20040084192A1 [0008]

PATENTKRAV:

1. En brandslukningspistol med en selektivt justerbar udløbsåbning (VDG) og et uafhængigt justerbart, åbningskoordineret doseringssystem af tilsætningsmiddel, pistolen omfatter:
relativt justerbare cylinder- og baffel-elementer (RNBG, MTBH), som definerer den selektivt justerbare udløbsåbning (VDG), cylinder- og baffel-elementerne (RNBG, MTBH) er struktureret i kombination på en sådan måde, at baffel-elementet (MTBH) roterer og overfører i forhold til cylinderaksen, og åbningen (VDG) er selektivt justerbar imellem et flertal af positioner;
hvor det roterende og overførende baffel-element (MTBH) omfatter en manchetedel med et flertal af forskelligt store porte (MTAP), og pistolen omfatter derudover en passage for tilsætningsmiddel associeret med pistolen, passagen er defineret i en sti af væskedommunikation imellem en pistolåbning og en tilsætningsmiddelkilde, hvor baffel-elementet (MTBH) og manchetedelen er struktureret i kombination på en sådan måde, at baffel-elementet (MTBH) roterer og overfører i forhold til cylinderaksen, manchetten roterer for at indsætte en port (MTAP) med en anden størrelse i tilsætningsmiddelpassagen, og hvor passagen er selektivt justerbar imellem mindst fire konfigurationer, konfigurationerne korrelerer mindst to positioner for udløbsåbningen med mindst to doseringsforhold for tilsætningsmiddel; og
hvor en selektiv justering af cylinder- og baffel-elementerne (RNBG, MTBH) er uafhængig af, men koordineret med, en selektiv justering af tilsætningsmiddelpassagen.
2. Pistolen ifølge patentkrav 1, omfattende en spiralformet kanal (FTHS) og en efterfølgende øsken eller et ben (MTL), hver især associeret med en af en relativt roterende del af pistolen på en sådan måde, at den relative rotation får baffel-elementet (MTBH) til at overføre.
3. Pistolen ifølge patentkrav 1, omfattende en notgang (RNBK) og en åbning (MTS), hver især associeret med baffel-elementet (MTBH) eller en relativt roterende pistoldel (RNB) på en sådan måde, at rotationen af pistoldelen (RNB) medfører rotation af notgangen og åbningen (RNBK, MTS)) og baffel-elementet (MTBH).
4. En metode til udsprøjtning af brandslukningsvæske ved en selektivt justerbar flowrate og tilvejebringelse for uafhængigt valgbart, åbningskoordineret dosering af tilsætningsmiddel, omfattende relativ justering af et cylinderelement (RNBG) og et baffel-element (MTBH) for at definere en af et flertal af selektivt justerbare

- udløbsåbninger (VDG), hver åbning er koordineret med en af et flertal af valgbare doseringsforhold for tilsætningsmiddel;
- justering af en tilsætningsmiddelpassage, defineret i en ledning af væskedommunikation imellem en pistolåbning og en tilsætningsmiddelskilde, ved
- 5 rotation af en manchetedel på baffel-elementet (MTBH) for at indsætte en af et flertal af åbninger (MTAP) i tilsætningsmiddelpassagen svarende til en af mindst fire konfigurationer, konfigurationerne korrelerer mindst to positioner for udløbsåbningen med mindst to doseringsforhold; og
- 10 hvor den relative justering af cylinder-elementet (RNBG) og baffel-elementet (MTBH) er koordineret med en justering af tilsætningsmiddelpassagen, og hvor udløbsåbningen (VDG) og doseringsforholdet for tilsætningsmiddel kan vælges uafhængigt.
5. Metoden ifølge patentkrav 4, omfattende at et baffel-element formes som spiral omkring en cylinderakse.
- 15 6. Pistolen ifølge patentkrav 1, hvor udløbsåbningen har en diameter på mindst 6,35 cm (2 ½ tommer), og pistolen har en flowrate på mindst op til 946 lpm (250 gpm).
- 20 7. Metoden ifølge patentkrav 4, hvor en udløbsåbning har en diameter på mindst 6,35 cm (2 ½ tommer), og omfattende udsprøjtning af brandslukningsvæske på mindst op til 946 lpm (250 gpm).

DRAWINGS

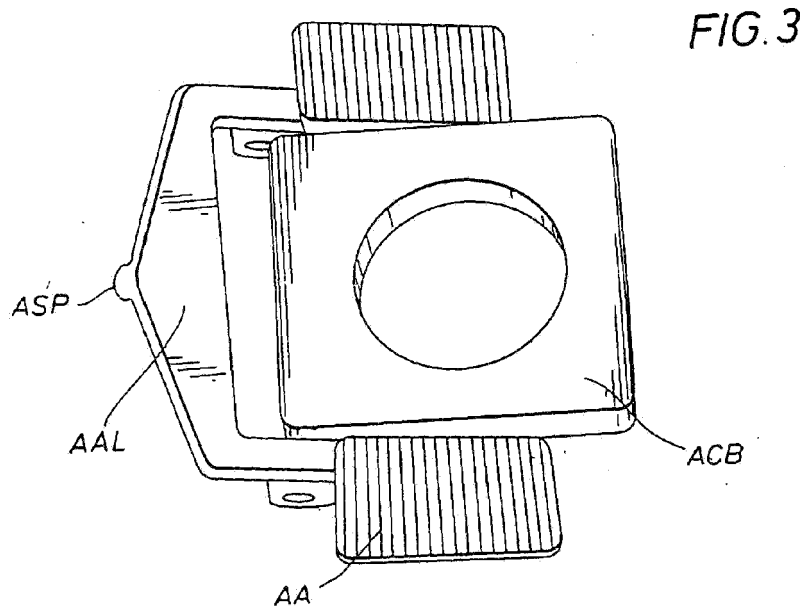
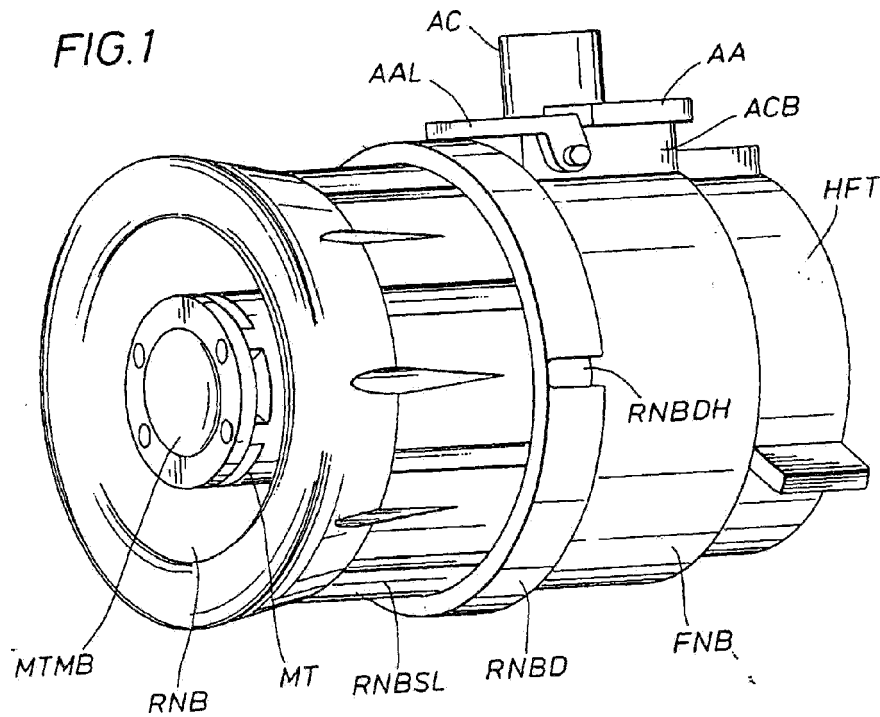


FIG. 2

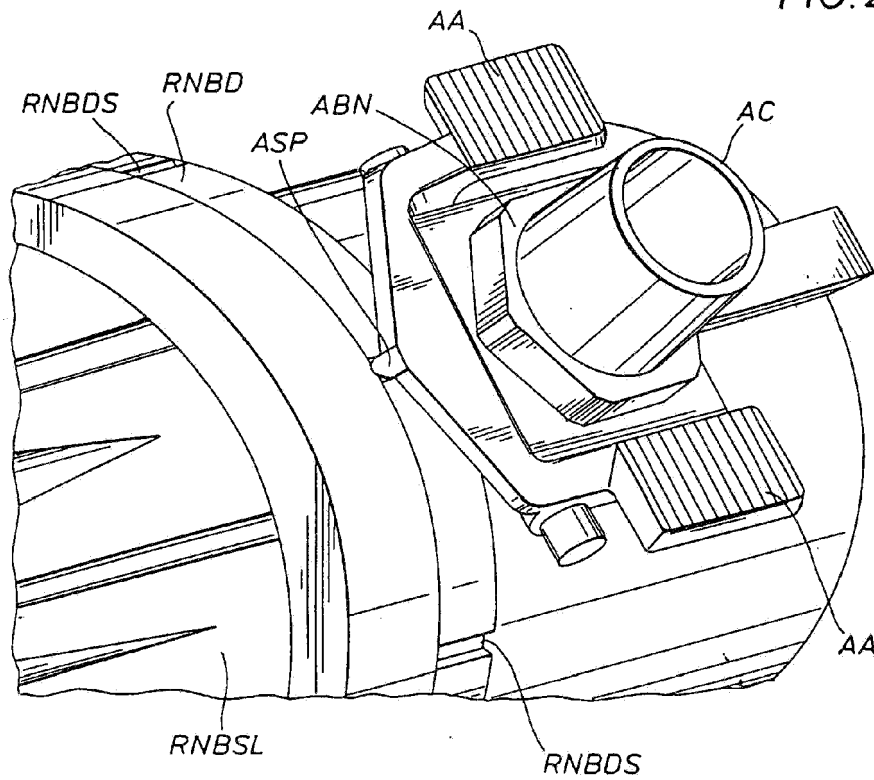
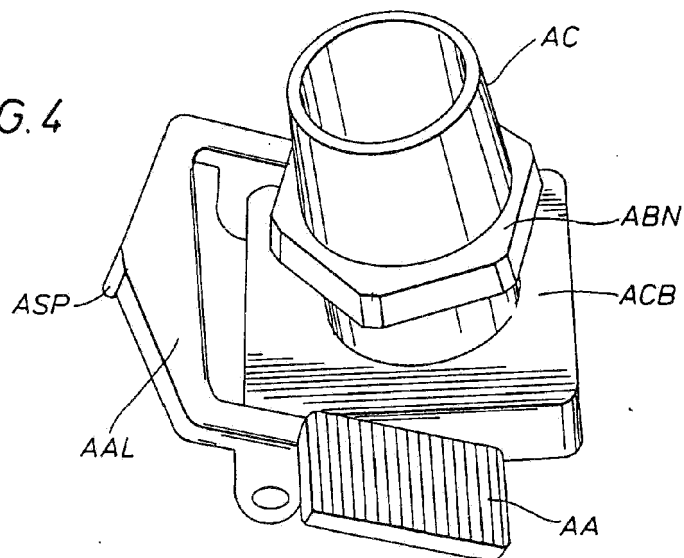


FIG. 4



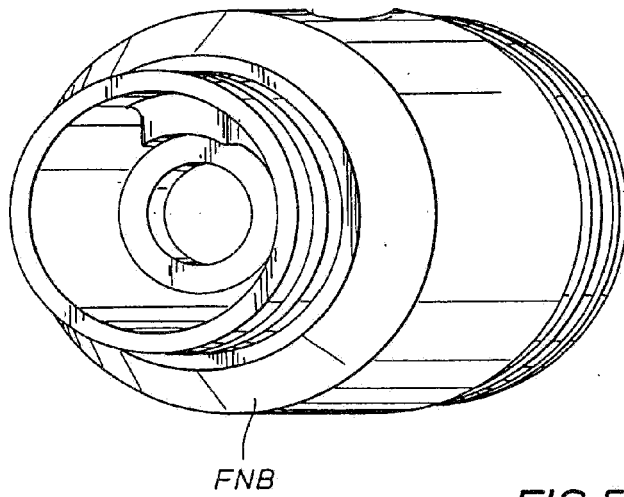


FIG. 5

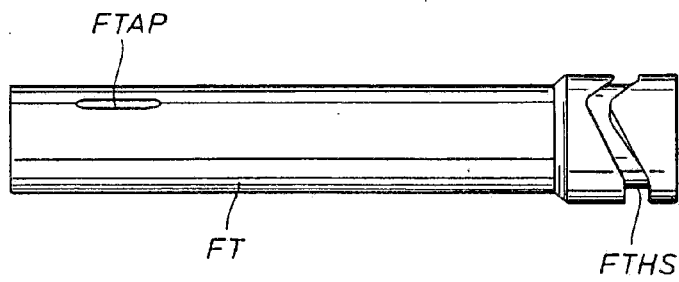


FIG. 6

FIG.7

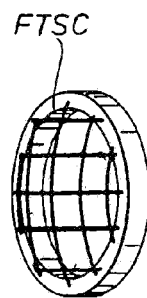
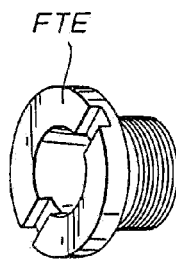
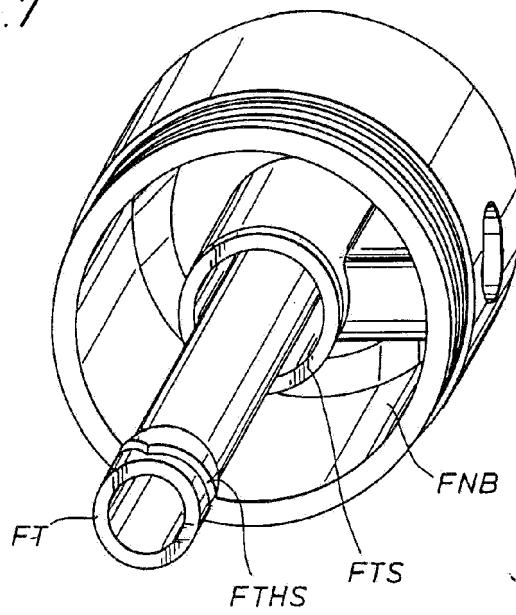


FIG.8

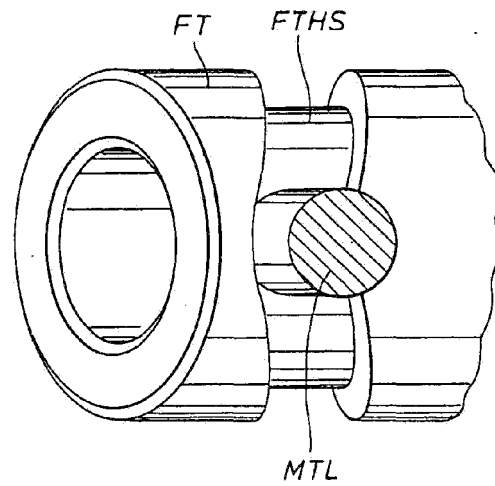


FIG. 9

FIG. 11

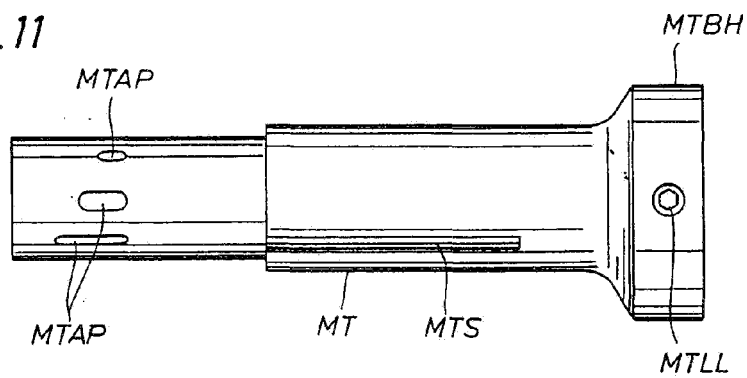
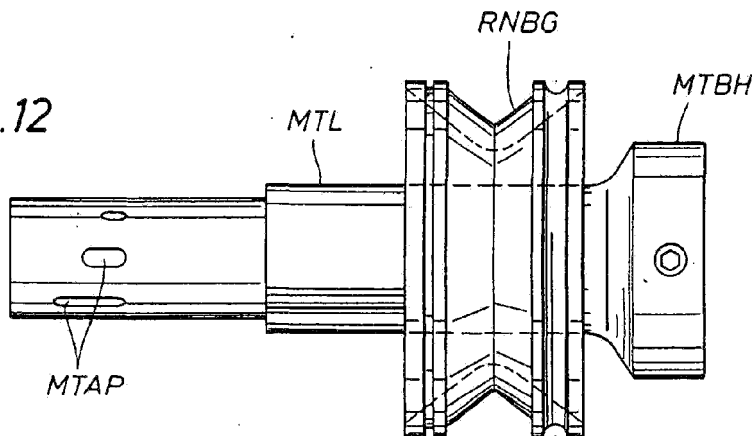


FIG. 12



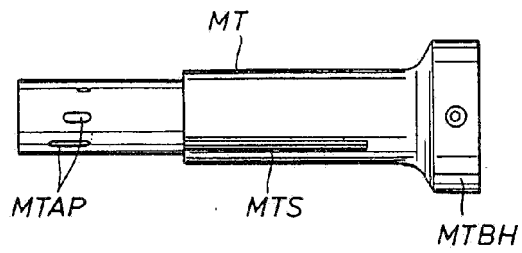


FIG. 10A

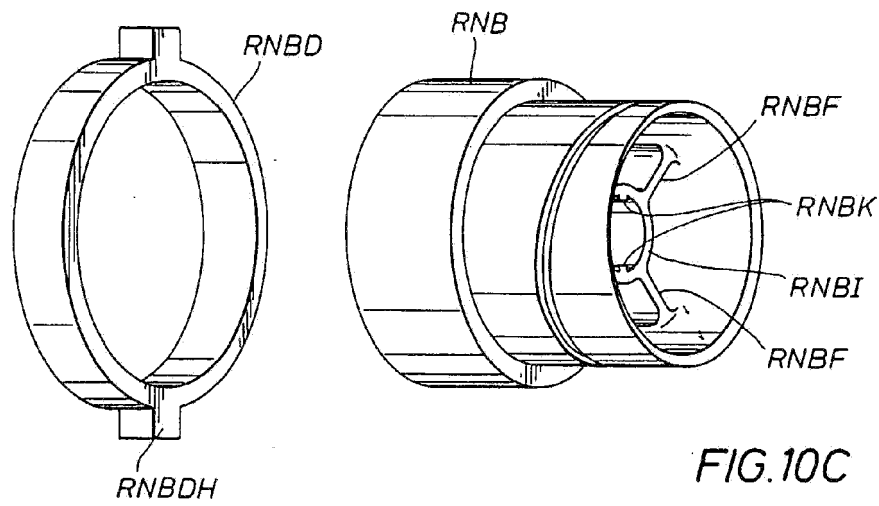


FIG. 10C

FIG. 10B

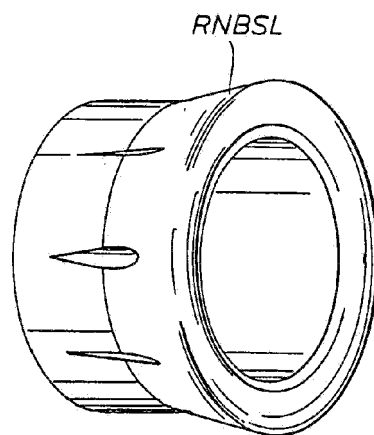


FIG. 10D

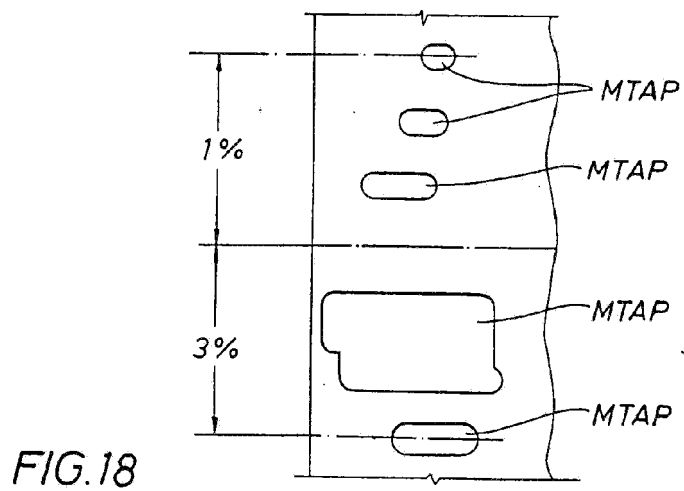
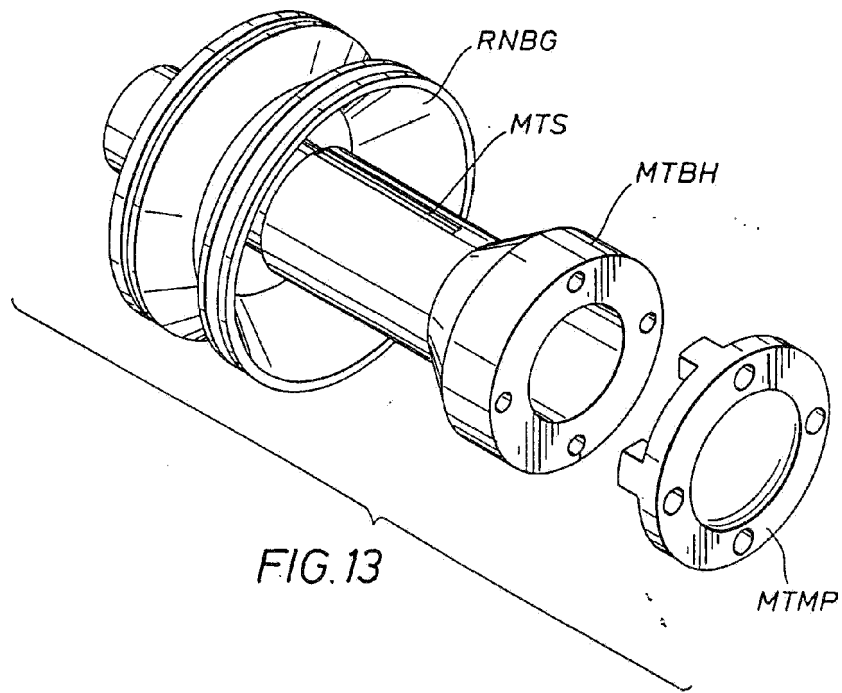


FIG. 14

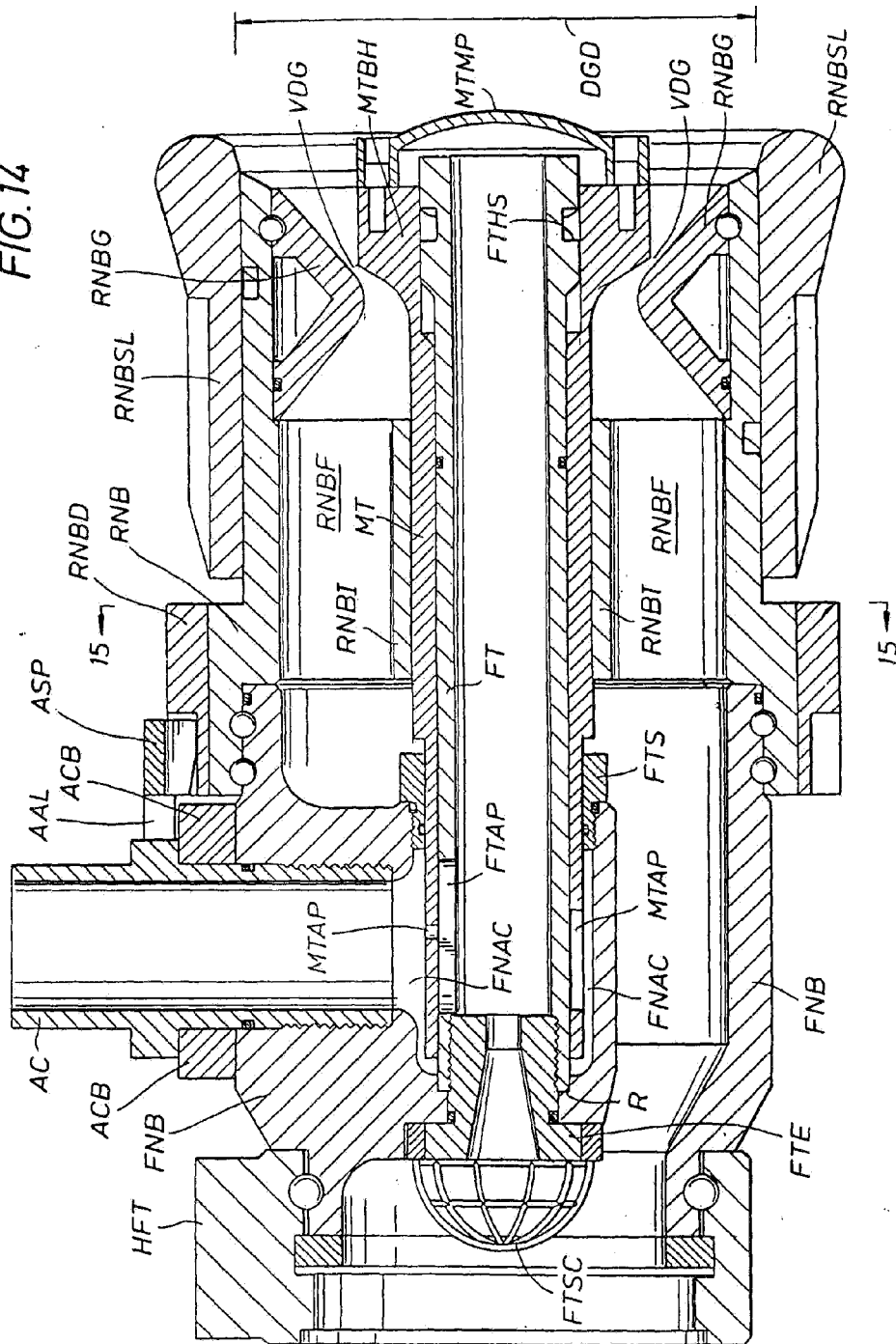


FIG.16A

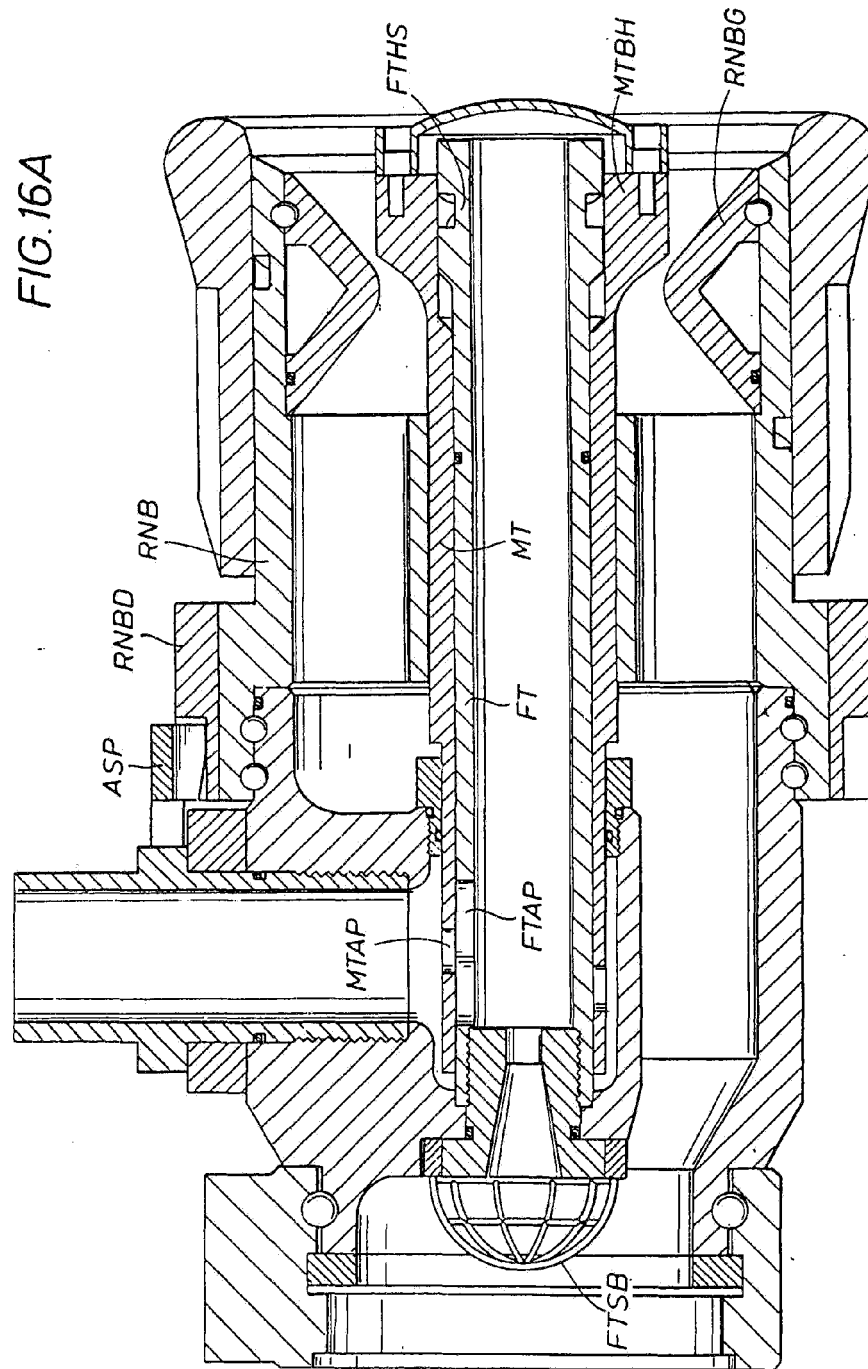


FIG.16B

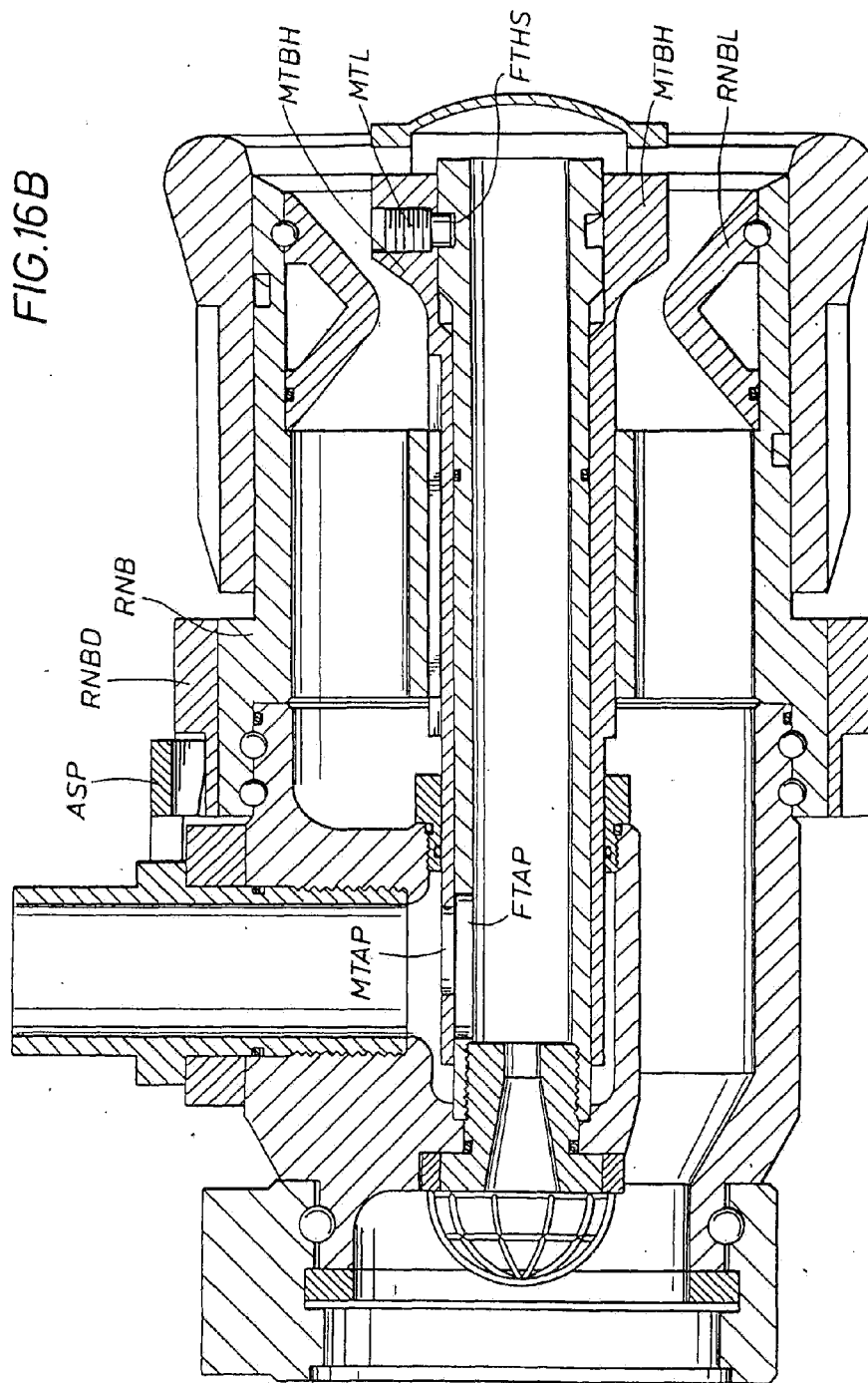


FIG. 16C

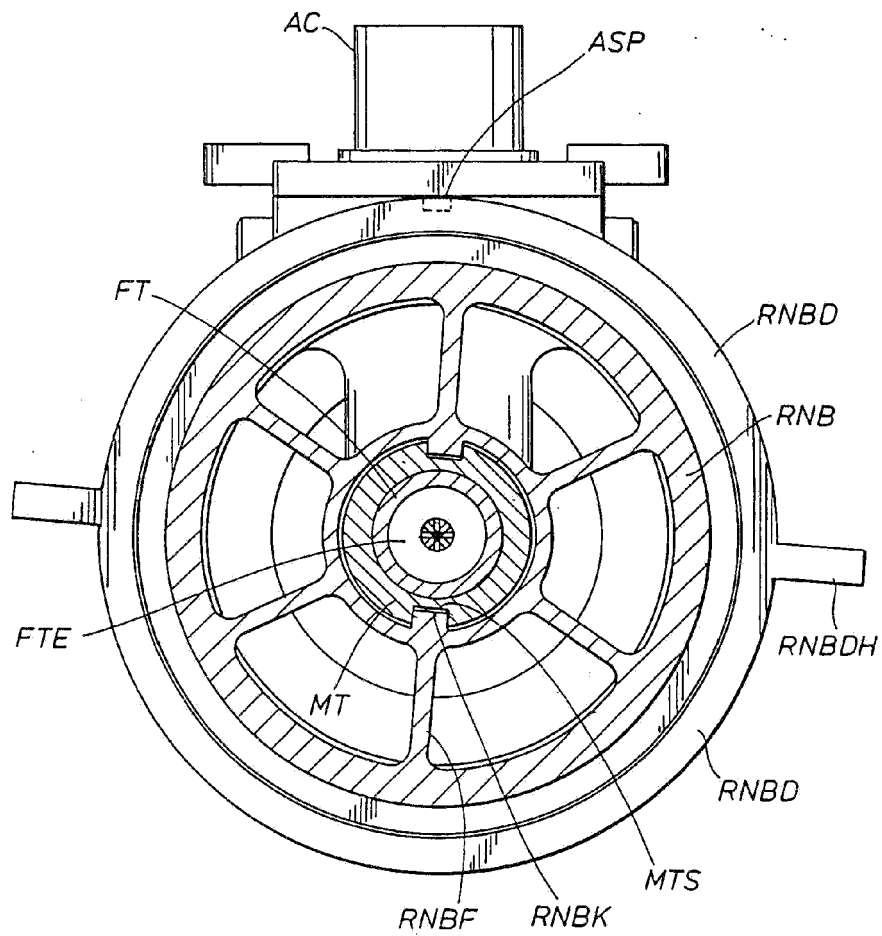
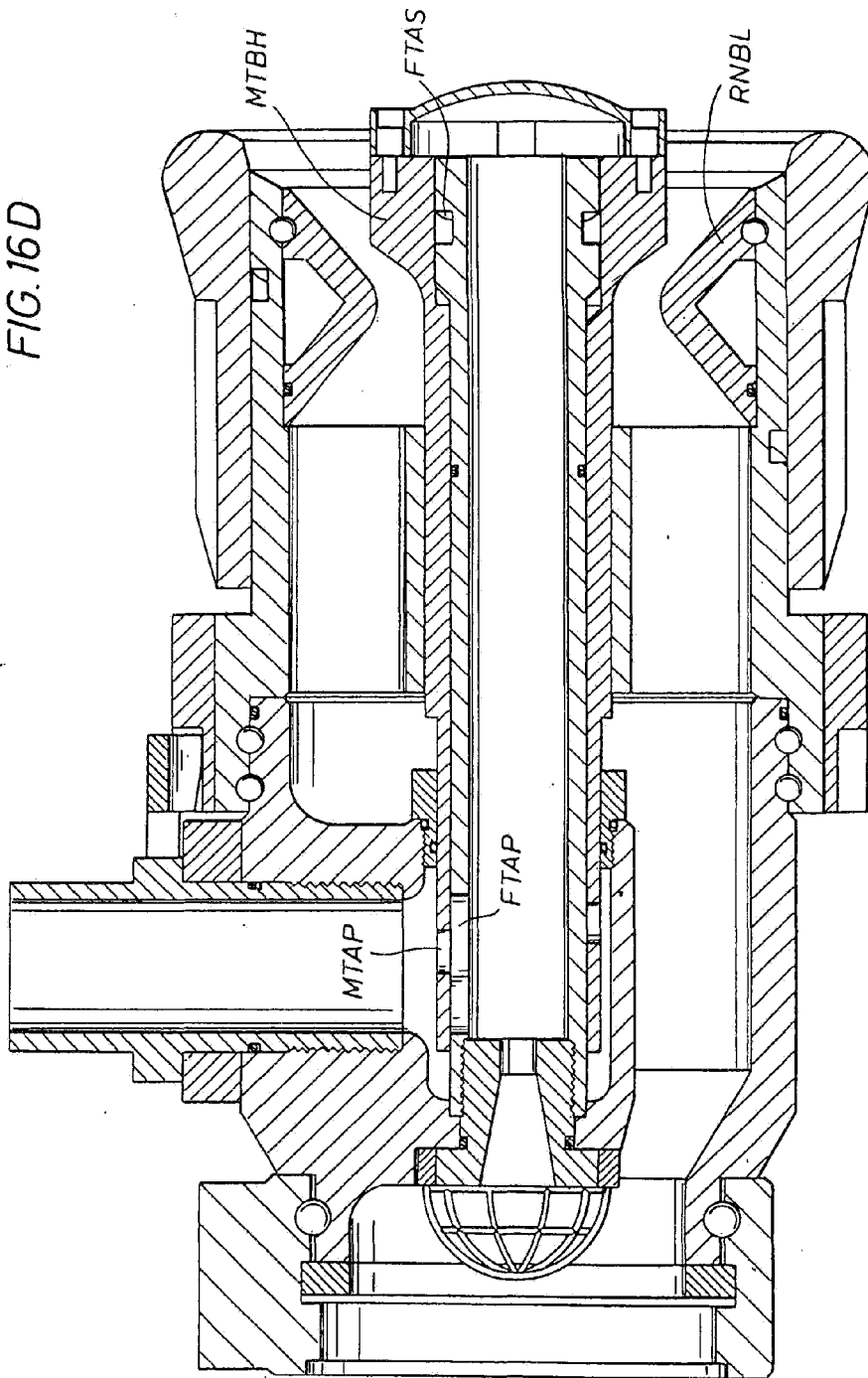


FIG. 16D



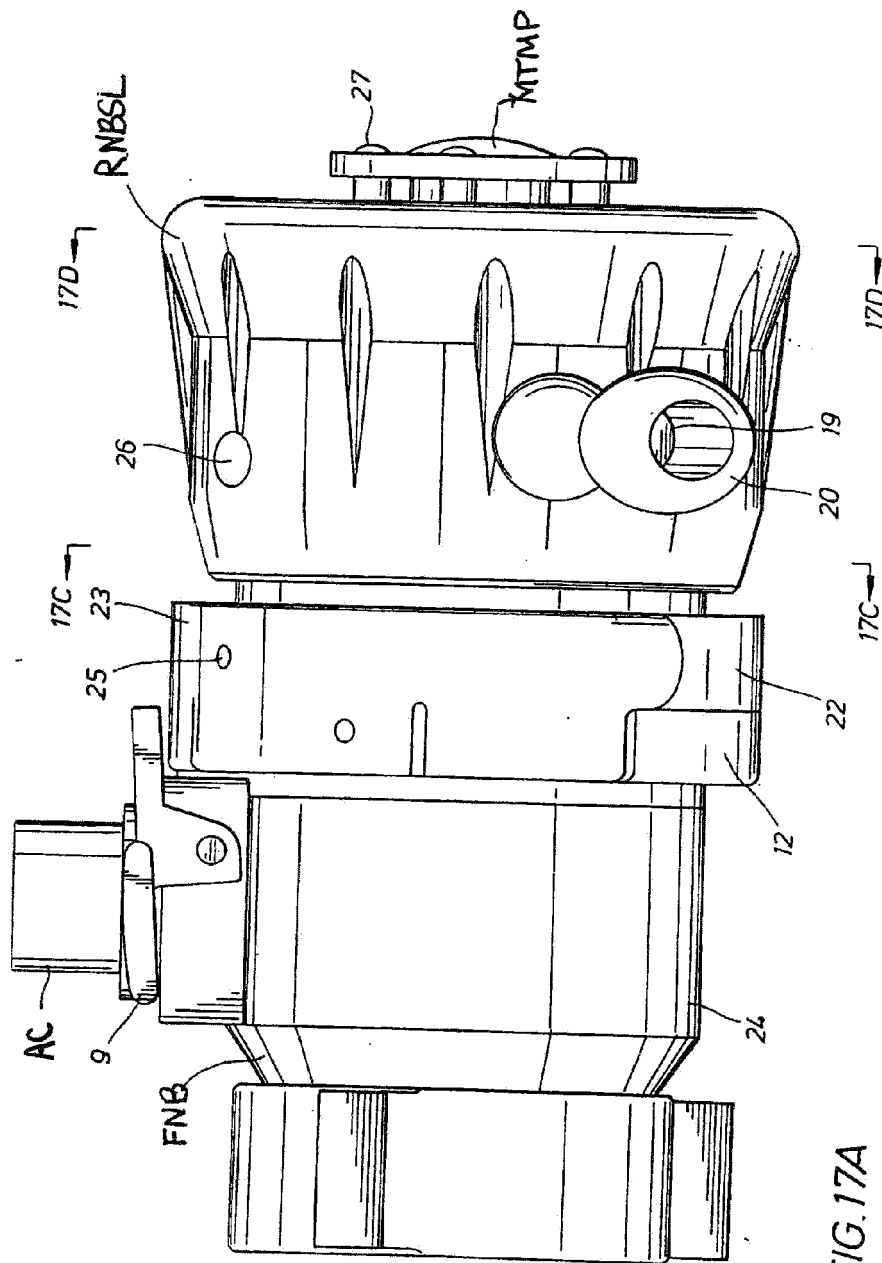


FIG. 17A

FIG. 17B

