(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 084 055 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
21.08.2019 Bulletin 2019/34

(21) Application number: **14872808.2**

(22) Date of filing: **19.12.2014**

(51) Int Cl.:
D04B 35/28 *(2006.01)*

(86) International application number:
PCT/US2014/071579

(87) International publication number:
WO 2015/095748 (25.06.2015 Gazette 2015/25)

(54) **DIRECT INJECTION LUBRICATION SYSTEM FOR KNITTING MACHINES**

SCHMIERSYSTEM MIT DIREKTEINSPRITZUNG FÜR STRICKMASCHINEN

SYSTÈME DE LUBRIFICATION À INJECTION DIRECTE POUR MACHINES À TRICOTER

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **20.12.2013 US 201361919184 P**

(43) Date of publication of application:
26.10.2016 Bulletin 2016/43

(73) Proprietor: **Memminger-IRO GmbH**
72280 Dornstetten (DE)

(72) Inventor: **RUBINSTEIN, Jeffrey**
West Hempstead, NY 11552 (US)

(74) Representative: **Frese Patent - Patentanwälte**
Fitzner & Frese PartGmbB
Hüttenallee 237b
47800 Krefeld (DE)

(56) References cited:
EP-A1- 0 427 047
DE-A1- 2 004 770
DE-A1- 2 320 635
GB-A- 1 218 324
US-A- 3 096 023
US-A- 3 481 431
US-A- 3 726 482
US-A- 4 353 435
US-A- 5 181 585
US-A1- 2002 144 865
US-B1- 6 322 336
US-B1- 6 571 918

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 3 084 055 B1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] Related Application: Priority is claimed to U.S. Provisional Patent Application, Serial No. 61/919,184 having filing date December 20, 2013.

A. Field of the Invention:

[0002] This invention is in the field of lubrication systems for knitting machines, and particularly for direct injection lubrication systems that will either spray oil or project solid oil drops onto the knitting elements of a knitting machine, and will lubricate such elements in a metered and controlled manner.

B. Background and Prior Art

[0003] Machines where the present invention is particularly applicable include single knit knitting machines, double knit knitting machines, circular and flat sweater knitting machines and numerous other machines that require frequent periodic lubrication. Some examples of machines in current use include those sold under the trade names, Mayer and Cie, Terrot, Fukuhara, Orizio, Vanguard, Pai Lung, etc.

[0004] Lubrication methods for the above-noted machines include solid drop pulse lubricators and microdrop projectile lubricators by Memminger Pulsonic Lubricators, and mist/spray lubricators sold by Uniwave, Inc., Div. of Memminger.

[0005] One of these systems ejects an oil mist/spray from multiple ports (up to 24 ports) through multiple nozzles that are connected by plastic or other tubing. The system uses electricity and compressed air to form the spray and distribute the oil in an even steady flow to each nozzle outlet.

[0006] The second system ejects pulses of solid drops of oil several times each minute through multiple ports also using nozzles and tubing. The system uses electricity only, as no compressed air is needed to perform the function.

[0007] Both of these solid drop and mist/spray lubrication systems have features that are either unsatisfactory and/or could be improved.

(1) It is not possible for either of the systems to provide both types of spray and solid drop lubrication; and thus, without common components the volume of each is less and the cost per unit is more;

(2) both lubrication systems are difficult to repair when clogs occur;

(3) the Uniwave mist/spray lubricators use a relatively large amount of compressed air which in a factory with a large number of knitting machines, is quite expensive.

(4) in such systems it is not practical to use a central source of oil supply, so that each unit needs its own oil tank.

[0008] This has been the situation in operation of knitting machines for at least sixty-five years.

[0009] It is recognized within the industry that the oil drop pulse systems do not distribute the lubricant evenly on the knitting elements. While the spray systems do a better job of oil distribution, they use relatively large amounts of compressed air which has a high energy cost and can contaminate the lubricant with water that is inherent with compressed air systems.

[0010] While the industry has been well aware of certain problems including: (a) that oil mist pervading the air and environment in the vicinity of a large number of knitting machines in a factory setting is both dangerous to human health and unpleasant and can stain or otherwise damage the knitted product, and (b) can cause dust or other particles in the air to clump together and fall onto machinery, the floor and persons.

[0011] One known solution has been to employ lubrication systems where the oil/compressed air flow employs anti-fog nozzles which re-condense the oil via cyclone spinning into droplets instead of mist. This solves the problem of oil mist in the environment, but adds considerable cost.

[0012] EP 0 427 047 A1 describes a lubrication device which includes oil/air mixing sections. The mixing sections each are adapted to mix lubrication oil and compressed air, resulting in the lubricating oil being fed to a lubrication section of the knitting machine while being carried on the compressed air.

[0013] Further lubrication devices are disclosed in DE 20 40 770 A1 and in GB 1 218 324.

[0014] Thus, the industry has had a solution for over thirty years but an expensive one, with no known evidence of any different or less expensive approach being developed to dealing with the inherent problems. My new invention is a "direct injection" apparatus with improved characteristics of both spray and pulse systems while reducing cost of operation.

Summary and Objects of the Invention

[0015] A first object of the new device is to provide the end user a choice of spray or pulse oil lubrication and be able to switch between the two types of lubrication at any time.

[0016] Oil lubrication and an oil lubricator do not form part of the invention but represent background art that is useful for understanding of the invention.

[0017] Another object is to reduce the cost of manufacture by using common parts in the manufacture of both types of lubricator,

[0018] A further object is to allow the water to pass through the system in such a small amount to result in less ill effects.

[0019] An additional object is to reduce the cost of manufacture for making a "pulse only" model.

[0020] Another object is to reduce the amount of compressed air needed for mist/spray lubrication and thus

reduce the cost of operation.

[0021] A still further object is to provide a practical way to have a central source of lubricant for multiple lubricators rather than have mandatory individual oil reservoirs.

[0022] A further object is to allow use of one nozzle type for both spray and pulse lubrication. The new nozzle would be less expensive than the present spray nozzle.

[0023] A still further object is to allow for easier and less expensive repair when and if repair is necessary.

[0024] Another object is to improve efficiency and profitability of the operation including cost and operation of apparatus and operation of factory using such apparatus,

[0025] Another object is to provide apparatus that can use a wider variation of lubricants including lubricant types that have emulsifying agents with the tendency to form clogs when contaminated with moisture. This will allow lubricants that are easier to remove from fabric.

[0026] The new "Direct Inject" system (to be called a "Direct Inject" system in this patent application) can perform both functions mentioned above from one unit. That is each output can be mist/spray or solid oil drops depending on the nozzle and tubing configuration.

[0027] The Direct Inject lubricator will be less prone to allowing water from the compressed air to mix with the lubrication oil in the spray/mist mode.

[0028] In a pulse only model, the Direct Inject unit will be less expensive to manufacture then the present pulse units.

[0029] When using a central source of oil to multiple lubricators, the Direct Inject system will be more compact and can be mounted in a smaller space then the present systems (no separate oil tank supply on each unit)

[0030] The use of pulse lubrication with the present invention will avoid the need for large compressed air volume and the large energy cost associated with compressed air in the spray mode lubrication. Alternately, use in spray mode will provide for even distribution of the lubricant when such is needed. When purchased in the pulse only version, the new unit will be less expensive to manufacture. Due to the simplicity of design, the new unit will need less maintenance and be easier to repair when repair is necessary.

[0031] This new lubrication system can be made into many configurations. The most important four will be:

1. A lubricator that can spray oil from each of its multi nozzles or put out solid, pressure driven drops oil. Each output can be changed from spray to pulse or vice versa by simply changing the configuration of the plastic coupling tube that runs from the "oil generator" to the output nozzle. Due to the fact that the output is ejected under pressure, the lubricant will be propelled at least several centimeters (inches) from the nozzle.
2. A lubricator that can expel solid oil drops only.
3. Either of the above can receive its oil supply from its own individual reservoir or receive the supply from a central source that can be supplying multiple units, thereby eliminating the need for individual reservoirs.
4. Each nozzle will be of the special design which will allow the use of a wide variety of viscosities. By adjusting the air pressure from 0,14 bar (2 pounds per square inch) to 0,69 bar (10 PSI) or more, both lower viscosity and higher viscosities lubricants can be used. Due to the special design of the nozzle tip, the nozzle will allow oil spray to eject the oil several centimeters (inches) from the tip without causing wasteful oil dripping at the exit point. That special "no drip" design accomplishes its task due to the inside hole (bore) of the nozzle (axially inward of the tip) being approximately 0,508 mm (0.020 of an inch) in diameter with the bore of the tip of the nozzle being approximately 1,016 mm (0.040 of an inch) in diameter. This same nozzle will also allow pulsed solid oil drops to properly exit the nozzle without oil dripping at the exit point.

[0032] In the spray mode, pressurized oil input is supplied either by a pressurized central source or a pressurized oil reservoir. When the individual reservoir model is used, filtered compressed air will power the oil tank pressurization. Oil output will be controlled by a solenoid valve that is controlled by a pulse timer that can be set to opening the valve in a pulse manner several times per minute depending on what volume of output is required. The oil then enters a pressure regulator with gauge so that the oil pressure can be set to whatever the operator prefers. The oil then enters the oil chamber of the "Direct Inject Oil Generator" that is shown in drawing marked Direct Inject Oil Generator.

[0033] For a better understanding of terminology used in this invention, "fog" is oil whose droplets are so small as to stay airborne in the environment rather than adhere to metal surfaces, and "mist" is oil droplets that are so large that they adhere to solid services and do not become airborne. In one of the embodiments disclosed herein as seen in Fig. 2, an oil reservoir is placed after the air regulator and before the timed solenoid valve. Nozzles are the final point of the system that are aimed at the knitting machine portion that is to be lubricated. Barbs are the part of the soft were flexible tubing that fits with its proximal end over the top of the generator, and its distal end engaging a nozzle

[0034] When a pressurized oil pulse is released by the solenoid valve, the oil is forced up the tubes at the top of the oil chamber. These metal oil chamber exit tubes have one way check balls so that the ejected oil cannot go back in the oil chamber. At the exit of the tube, the oil is joined by compressed air (suggested air pressure at this point is from 0,14 bar to 0,34 bar (2 to 5 PSI)) that is supplied by the air chamber of the Oil Generator and exits from inside of the outer barb and causes the oil/compressed air mix to travel through a plastic coupling tube that is mounted on the outside of the larger outside barb and finally the nozzle (see drawing marked Injection Out-

let and Direct Inject Oil Generator and nozzle). Suggested oil pressure at the Direct Inject oil chamber is approximately 0,69 bar (10 PSI). If the operator wishes to have any or ail of the nozzles be pulse oil instead of spray, the plastic tube that has been placed on the outside barb is replace with plastic tube that mounts on the inside oil chamber tube. This inside plastic tube also serves as a seal to block the escape of compressed air.

[0035] The "pulse only" model of the Direct Injection lubricator is the same as the spray except that the filter, solenoid and air regulator used for the preparation of the compressed air to the air chamber of the oil generator is eliminated. The direct injection lubrication system can be used in any application that needs metered constant spray or solid oil drop lubrication, such as gears, chains, escalators, oil rig equipment, looms, etc.

Brief Description of the Drawings

[0036]

Figure 1A is a top plan view of a factory floor plan showing schematically a plurality of knitting machines coupled to a common compressed air supply.
Figure 1B is an enlarged fragmentary view showing an oil lubricator of Fig. 1A,
Figure 1C is a flow diagram showing how the new lubricator is fluid coupled to a source of lubricant,
Figure 2 is a schematic outline of elements in a solid oil drop lubricator not forming part of the invention,
Figure 3 is a fragmentary schematic elevation view partially in section of the oil generator, Figure 4 is an enlarged schematic view of an injection outlet barb,Figure 5 is an enlarged schematic top plan view of the top, middle and bottom coins of the oil generator,
Figure 6 is a greatly enlarged schematic elevation view of the middle coin in the oil generator, and
Figure 7 is an enlarged schematic elevation view of a nozzle.

Detailed Description of the Preferred Embodiments

[0037] Figure 1A shows schematically a factory floor plan 1 which includes a plurality of knitting machines 2, supplied by compressed air from compressor 3 via air conduits 4. Also shown schematically are oil containers 5 for providing required oil supplied to each of the knitting machines 2.

[0038] Figure 1B shows schematically an oil supply lubricator 5 with its multiple ejection tubes 6 each terminating in an injection outlet 7.

[0039] Figure 1C shows a flow diagram for an oil spray lubricator 10 of the present invention which includes source 12 of compressed air at approximately 6,21 bar (90 PSI) which air typically includes some percentage of water. The compressed air flows through filter 14 to clean the compressed air and reduce the water quantity therein. The compressed air flows next to solenoid-operated valve 16 which effectively is an on/off valve that is turned on each time the system is to direct the lubrication spray onto the knitting machine knitting elements. From the solenoid the air flows through regulator 18 which reduces the initial approximately 6,21 bar (90 PSI) air pressure down to 0,14 to 0,69 bar (2-10 PSI) or sometimes preferable 0,14 to 0,34 bar (2-5 PSI) depending on the operation parameters selected. This air flow proceeds next into the oil generator 20.

[0040] Also in this system, is oil from a source 22 which is usually from an individual reservoir as seen in Fig. 2, or from a central source at about 0,34 bar (5 PSI) or more. Oil flows into regulator 24 where pressure is reduced from said approximately 0,34 bar (5 PSI) or more down to the preferred operating pressure, and thence to solenoid-operated pulse timer 26, 28 which ejects the oil in this example, 5 times per minute (once every 12 seconds), with each opening lasting for a split second such as about two or three tenths of a second. The oil then flows into the oil generator where it is combined with the air input from regulator
18 and ejected (spit out) as spray through multiple outlets 29, as further described below.

[0041] Figure 2 illustrates schematically a solid oil drop lubricator 30 not forming part of the invention that differs in part from the above-described spray lubricator 10 in figure 1C, in that it has no compressed air input mixing with the oil. Accordingly there is oil from a source 22S after the regulator 24S, then to solenoid-operated pulse timer 26S, 28S, and finally to oil generator 30S and its output nozzles 32S.

[0042] The oil generator 20 in figure 1C and generator 30S in figure 2 share common features, but generator 20 in figure 1C mixes oil with compressed air as further described below, Figure 3 illustrates schematically a Direct Inject Oil Generator 40 as may be used with a spray lubricator or a solid drop lubricator.

[0043] In figure 3, within housing 42 has oil inlet 44 at the bottom providing oil at approximately 0,69 bar (10 PSI) corresponding generally to oil from regulator 24, in figure 1C. Within housing 42 of oil generator 40, are lower coin 46, herein called "coin" because of its configuration, middle coin 48 and upper coin 50, where the oil chamber 52 is defined between lower and middle coins 46 and 48 respectively; coins may also be referred to as partitions or walls. Above middle coin 48 is an air inlet 54 (that corresponds to the airflow out of regulator 18 in figure 1C), flowing into air chamber 56 in figure 3, or flowing directly into air ducts, i.e. the annular space surrounding oil tubes 58. Oil from oil chamber 52 in figure 3 flows into tubes 58 with outlets 58a, while air into air chamber 56 flows upward and out of the annular space 60 that surrounds oil flow tubes 58. As will be further described, the oil flow out of each tube 58 has been pulsed into a drop form (as described above for figures 1C and 2), which is spit outward, while there is a tubular flow of air in annular space 60 surrounding and carrying this droplet to each

of the outlet nozzles as further described below. The lower middle and upper coins 46, 48 will be described later.

[0044] Figure 4 shows the oil and air flow ducts, oil tube 58 (fig. 3), 72 (fig. 4) and air tube 76, that extend from the top of the oil generator 40 in figure 3. Figure 7 shows a nozzle 82 that is situated at the top end of (extension) coupling tube 90 coupling it to the outlet air and oil tubes 72, 76 of figure 4, which correspond to the outlets at the top of figure 3. Figure 4 as an enlarged view illustrates an injection outlet 70 which includes the small central oil tube 72 with a central bore 73 that carries the oil 75 to the nozzle 82, see figure 7. Surrounding inner oil tube 72 is outer air tube 76 with annular space 60 between said inner oil tube 72 and outer oil tube 76. This annular space 60 is seen earlier in figure 3. As earlier mentioned, annular space 60 is the flow channel through which the compressed air flows. At the outer surface of outer oil tube 76 are barbs 80, figure 4, which function to secure this outlet air tube arrangement 76 in the end of coupling tube 90 that surrounds outlet air tube 76 and leads to the nozzle 82. Barbs 80 are typically discs or inclined washers which frictionally and sealingly engage the bore surface of the coupling tube 90 made of plastic into which they are inserted. As seen in figures 3 and 4 coupling tube 90 has its lower end slid over outer air tube 76 and over and engaging barbs 80. Nozzle 82 has nozzle barbs 94 that sealingly engage the upper end of coupling tube 90.

[0045] Figure 3 illustrates two separate modes of oil discharge: (a) the three outlet tube assemblies indicated in the drawing by I, II and III on the left, provide air/oil spray; and (B) the outer tube assembly indicated by IV on the right, provides oil droplets only because the airflow has been blocked off. For the outlet on the right side on the right side for pulsed oil mode the lower end 90L of plastic coupling tube 90 is situated in the annular space 60 to block and bar air flow, so that only oil is ejected through nozzle 82. Thus, this oil generator can be operated in spray mode per the nozzle connection shown in I, II or III on the left side of this figure, or in solid oil drop mode per the nozzle connection shown on the right side IV of this figure. An operator can elect to have all nozzles of a generator set for spray mode or all in oil drop mode or some combination thereof. Thus, a single generator design with its nozzles can be used for a variety of situations, for example with cotton yarn the operator may prefer pulsed oil droplets to save the use of costly compressed air, or spray for nylon yarn to avoid staining the fabric.

[0046] Figure 5 provides enlarged top plan views of the top coin 50, middle coin 48 and lower coin 46, Each of said three coins has the form of a disk perforated by various holes, and each of said coins is sealed with O-rings. Lock retainer rings 46R and 50R secure lower and upper coins within the housing

[0047] Returning now to figure 5, upper and middle coins 50 and 48 have identical hole patterns through which are situated and supported fourteen tubes 58 which are also shown in figure 3. Alternate hole patterns for other numbers of oil tubes are possible. Bottom coin 46 has a central aperture 46A which is threaded to receive oil inlet pipe as seen in figure 3. Coins 48 and 46 are inserted upward to a shoulder and secured by lock ring 46R; coin 50 is inserted downward to a shoulder and secured by its lock ring 50R.

[0048] Figure 6 is an enlarged elevation view of the middle coin 48 and one typical oil flow tube 58 as seen in figure 3. Tube 58 includes a one-way check valve 62 that allows oil flow upward and bars any reverse downward flow. For convenience and description the embodiment disclosed herein employs terms "up and down"; however the oil generator is not restricted to this orientation.

[0049] When a drop of oil is pulsed out of the inner oil tube 58 in figure 3 or 72 in figure 4 which drop is joined by the airflow through annular space 60 in figure 3 or annular space 78 in figure 4, the air oil mix is ejected outward. The coupling tube 90 is along the outside diameter of the outer air tube 76. Airflow via the annular space 78 in figure 4 between the tubes 72, 76 will blow the oil drop along until it arrives at its nozzle 82 and is ejected out into the knitting machine elements.

[0050] Oil droplets from the inner tube 72 are blown along by the very low-pressure air perhaps, about 0,14 to 0,34 bar (2 to 5 PSI). This low pressure will not break the oil up into mist, as this air has laminar flow along the inside wall of the plastic coupling tube 90 until it arrives at the nozzle 82, and from the nozzle 82 the air/oil mixture is ejected into the part of the machine to be lubricated, all without mist formation. This is one of the principal achievements of the present invention.

[0051] If the outlet nozzle 82 receives an air/oil mixture or solid oil from its plastic feed coupling tube 90 that extends at the top of the direct inject oil generator or the spray lubricator, it will still operate properly. If the nozzle 82 receives solid oil, it will spit out a droplet on the time of the pulsed cycle. If the nozzle 82 receives air/oil mixture, it will spit out the oil in such a way that it will spit the output several centimeters (inches) from the nozzle 82 without oil drip at the nozzles 82 and without any breakup of the oil into fog. The oil arrives at the inlet of the nozzle 82 as solid oil unbroken and in this apparatus will be ejected undisturbed and without forming oil fog that could contaminate ambient air in the factory.

[0052] And additional feature of the present invention concerns the form of the top of the exit nozzle 82. When oil comes to the tip of a conventional nozzle formed with a straight (continuous bore diameter) it may be blown into a mist and/or result in a drip and not be regularly spitted out in the desired oil droplet form. In the new nozzle 82 as seen in figure 7, the nozzle 82 has bore diameter D1 (about 0,762 mm (0.030 inches) but may vary to a much larger diameter), that is reduced to diameter D2 (about 0,508 mm (0.020 inches)), and that is expanded at the tip to diameter D3 (about 1,016 mm (0.040 inches)). The D3 portion has length L3 (about 3,175 mm (0.125

inches) but may be longer). In an alternative, the D2 plus D3 portions have length L2 + L3 (about 3,175 mm (0.125 inches)). From this the airflow carrying the oil droplet will expand slightly in the D3 portion to a lower pressure such that the oil will resist dripping at the nozzle tip and will remain in droplet form. As described earlier pressure drops between the D2 and D3 diameter portions. Also, as described above, this is a significant achievement to avoid oil dripping from the nozzle and the negative consequences of wasting expensive lubricant.

[0053] As already mentioned, oil lubrication and especially the solid oil drop lubricator 30 shown in figure 2 does not form part of the invention.

Claims

1. An oil spray lubricator system for knitting machines (2), operable with a source (12) of compressed air and a source (22) of lubricating oil under pressure, comprising at least one oil spray lubricator (10) with:

a. an air flow filter (14) adapted to receive compressed air flowing from said source (12) thereof and to reduce water in the air flow,
b. a valve (16) adapted to control said air flow,
c. a first regulator (18) adapted to set a selected pressure of said air flow, and
d. a second regulator (24) adapted to receive an oil flow from said source (22) thereof and to set selected pressure of said oil flow,
e. a pulse timer (26, 28) adapted to eject said oil flow in a selected frequency of pulses,
f. a multi-port oil generator (20, 40) having an oil chamber (52) having an oil inlet (44), an air inlet (54) and multiple oil tubes (58, 72) each of which has an inlet and an outlet and is situated within a larger bore diameter air tube (76) that surrounds said oil tube (58, 72) and creates an annular space (60) between said oil tube (58, 72) and air tube (76), and
g. at least one nozzle (82),

the oil spray lubricator (10) is configured such that compressed air from said source (12) thereof flows through said air flow filter (14), valve (16) and first regulator (18), whereby the air is filtered and pressure regulated, and thence flows to said multi-port oil generator air inlet (54), and
wherein oil from said source (22) thereof flows through said second regulator (24) and pulse timer (26, 28), and thence to said multi-port oil generator oil inlet (44) and through said oil tubes (58, 72), and where said airflow entering said multi-port oil generator air inlet (54) flows into said annular spaces (60), and
whereby said oil flow through said oil tubes (58, 72) and said airflow through said annular spaces (60) mix and flow to and through said nozzle (82),
producing an oil spray directible onto said knitting machine (2), wherein said multi-port oil generator (20, 40) comprises a housing (42), **characterized in that** a lower wall of said housing defines a lower coin (46) perforated to define at least one oil inlet (44),
wherein said multi-port oil generator (20, 40) comprises within said housing (42) a middle coin (48) above said lower coin (46) perforated to define first openings for said oil tubes (58, 72),
and an upper coin (50) defining second openings larger than said first openings to receive said air tubes (76), with said oil tubes (58, 72) within,
thereby enabling airflow to entrain the oil flow at said outlets (58a) of the said oil tubes (58, 72) and to direct same to said nozzles (82).

2. An oil spray lubricator system according to claim 1, wherein for each oil spray lubricator (10) said outlets (58a) of said oil tubes (58, 72) and an outlets of said air tubes (76) are situated outside said housing (42), wherein each of said at least one oil spray lubricators (10) further comprises for each nozzle (82) a coupling tube (90) having a proximal end that can be in fluid connection with said outlet of said oil tubes (58, 72) and said outlet of said air tube (76) and a distal end that can be in fluid connection with said proximal end of said nozzle (82).

3. The oil spray lubricator system according to claim 2 where said coupling tube (90) includes a flexible plastic tube.

4. The oil spray lubricator system according to one of the claims 1 to 3 where said nozzle (82) comprises a tube having proximal and distal ends and a central bore and: (i) having a bore diameter D3 at the distal end and extending proximally, (ii) having a diameter D2 less than a diameter D1 and extending proximally from the diameter D3 portion, and (iii) having the diameter D1 greater that the D2 portion and extending proximally from the D2 portion.

5. The oil spray lubricator system of claim 4 where diameter D1 of said nozzle (82), is approximately 0,508 mm (0.03 inches), diameter D2 is approximately 0,762 mm (0.02 inches), and diameter D3 is approximately 1,016 mm (0.04 inches).

6. The oil spray lubricator system according to one of claims 2 to 5 where (a) said proximal end of said coupling tube (90) is slid over the outer surface of said oil tube (58, 72) and at least one part thereof is inserted into said annular space (60) to receive only oil flow, or (b) said proximal end of said coupling tube (90) is slid over the outer surface of said air tube (76) to receive both airflow and oil flow, while said distal end of said coupling tube (90) engages said proximal

end of said nozzle (82).

7. The oil spray lubricator system according to claim 6 where said air tube (76) has outward radially extending barbs (80) on the outer surface, and said barbs (80) of said air tube (76) securely engage a bore surface of said proximal end of said coupling tube (90).

8. The oil spray lubricator system of claim 6 where said nozzle (82) has radially outward extending barbs (94) at the outer surface at its proximal end,
whereby said distal end of said coupling tube (90) is slid axially onto said proximal end of said nozzle (82), where said barbs (94) of said nozzle (82) securely engages a bore surface of said distal end of said coupling tube (90).

9. The oil spray lubricator system according to one of the claims 1 to 8, operable with a source of compressed air, such as a compressor (3), at a source of lubricating oil under pressure, such as oil container (5), comprising:

a plurality of knitting machines (2),
an oil spray lubricator (10), associated with each of said knitting machines (2), and
a conduit system supplying compressed air and lubricating oil under pressure to each of said oil spray lubricator (10).

10. The oil spray lubricator system of claim 1, wherein the pressure of said compressed air from said source (12) thereof is 0,69 bar (10 PSI) or more, said first regulator is adapted to reduce said air pressure to about 0,69 bar (10 PSI), said oil from said source (22) thereof is at a pressure of about 0,34 bar (5 PSI), and said oil pulse timer is adapted to eject the oil spray about 5 times per minute, with each pulse lasting for about 0.2 to 0.3 of a second, and said oil spray is ejected from said nozzle at about 0,14 to 0,34 bar (2 to 5 PSI).

Patentansprüche

1. Ölnebel-Schmiersystem für Strickmaschinen (2) das mit einer Druckluft-Quelle (12) und mit einer Schmieröl-Quelle (22) unter Druck betreibbar ist, wobei das Ölnebel-Schmiersystem mindestens eine Ölnebel-Schmiereinrichtung (10) umfasst, mit:

a. einen Luftstromfilter (14), der dafür ausgelegt ist, Druckluft zu empfangen, die von der Druckluft-Quelle (12) strömt, und Wasser in dem Luftstrom zu verringern,
b. ein Ventil (16), das dafür ausgelegt ist, den Luftstrom zu steuern,
c. einen ersten Regler (18), der dafür ausgelegt ist, einen ausgewählten Druck des Luftstroms einzustellen, und
d. einen zweiten Regler (24), der dafür ausgelegt ist, einen Ölstrom von der Schmieröl-Quelle (22) zu empfangen und einen ausgewählten Druck des Ölstroms einzustellen,
e. einen Impulszeitgeber (26, 28), der dafür ausgelegt ist, den Ölstrom in einer ausgewählten Frequenz von Impulsen auszustoßen,
f. einen Mehrweg-Ölgenerator (20, 40), der eine Ölkammer (52) mit einem Öleinlass (44), mit einem Lufteinlass (54) und mit mehreren Ölrohren (58, 52), von denen jedes einen Einlass und einen Auslass aufweist und sich in einem Luftrohr (76) mit größerem Bohrungsdurchmesser befindet, das das Ölrohr (58, 72) umgibt und zwischen dem Ölrohr (58, 72) und dem Luftrohr (76) einen Ringraum (60) erzeugt, aufweist, und
g. mindestens eine Düse (82),

wobei die Ölnebel-Schmiereinrichtung (10) in der Weise konfiguriert ist, dass Druckluft von der Druckluft-Quelle (12) durch den Luftstromfilter (14), durch das Ventil (16) und durch den ersten Regler (18) strömt, wodurch die Luft gefiltert wird und der Druck geregelt wird, und somit zu dem Lufteinlass (54) des Mehrweg-Ölgenerators strömt, und
wobei Öl von der Schmieröl-Quelle (22) durch den zweiten Regler (24) und durch den Impulszeitgeber (26, 28) und somit zu dem Öleinlass (44) des Mehrweg-Ölgenerators und durch die Ölrohre (58, 72) strömt, und wobei der in den Lufteinlass (54) des Mehrweg-Ölgenerators eintretende Luftstrom in die Ringräume (60) strömt, und wodurch sich der Ölstrom durch die Ölrohre (58, 72) und der Luftstrom durch die Ringräume (60) mischen und zu der und durch die Düse (82) strömen, wobei sie einen Ölnebel erzeugen, der auf die Strickmaschine (2) gelenkt werden kann,
wobei der Mehrweg-Ölgenerator (20, 40) ein Gehäuse (42) umfasst,
dadurch gekennzeichnet, dass
eine untere Wand des Gehäuses eine untere geprägte Scheibe (46) definiert, die gelocht ist, um mindestens einen Öleinlass (44) zu definieren,
wobei der Mehrweg-Ölgenerator (20,40) in dem Gehäuse (42) über der unteren geprägten Scheibe (46) eine mittlere geprägte Scheibe (48), die gelocht ist, um erste Öffnungen für die Ölrohre (58, 72) zu definieren,
und eine obere geprägte Scheibe (50)umfasst, die zweite Öffnungen definiert, die größer als die ersten Öffnungen sind, um die Luftrohre (76) mit den Ölrohren (58, 72) darin aufzunehmen,,
wodurch ermöglicht wird, dass der Luftstrom den Ölstrom bei den Auslässen (58a) der Ölrohre (58, 72) mitführt und diesen zu den Düsen (82) lenkt.

2. Ölnebel-Schmiersystem nach Anspruch 1, wobei sich die Auslässe (58a) der Ölrohre (58, 72) und die Auslässe der Luftrohre (76) für jede Ölnebel-Schmiereinrichtung (10) außerhalb des Gehäuses (42) befinden,
wobei jede der mindestens einen Ölnebel-Schmiereinrichtungen (10) ferner für jede Düse (82) ein Kupplungsrohr (90) mit einem proximalen Ende umfasst, das mit dem Auslass der Ölrohre (58, 72) und mit dem Auslass des Luftrohrs (76) in Fluidverbindung stehen kann, und ein distales Ende, das mit dem proximalen Ende der Düse (82) in Fluidverbindung stehen kann.

3. Ölnebel-Schmiersystem nach Anspruch 2, wobei das Kupplungsrohr (90) ein biegsames Kunststoffrohr enthält.

4. Ölnebel-Schmiersystem nach einem der Ansprüche 1 bis 3, wobei die Düse (82) ein Rohr mit proximalem und distalem Ende und einer zentralen Bohrung umfasst, und:

(i) bei dem distalen Ende einen Bohrungsdurchmesser D3 aufweist und proximal verläuft, (ii) einen Durchmesser D2 kleiner als ein Durchmesser D1 aufweist und von dem Abschnitt mit dem Durchmesser D3 proximal ausgeht, und (iii) den Durchmesser D1 größer als der Abschnitt D2 aufweist und von dem Abschnitt D2 proximal ausgeht.

5. Ölnebel-Schmiersystem nach Anspruch 4, wobei der Durchmesser D1 der Düse (82) näherungsweise 0,508 mm (0,03 Zoll) beträgt, der Durchmesser D2 näherungsweise 0,762 mm (0,02 Zoll) beträgt und der Durchmesser D3 näherungsweise 1,016 mm (0,04 Zoll) beträgt.

6. Ölnebel-Schmiersystem nach einem der Ansprüche 2 bis 5, wobei (a) das proximale Ende des Kupplungsrohrs (90) über die Außenoberfläche des Ölrohrs (58, 72) geschoben ist und mindestens ein Teil davon in den Ringraum (60) eingeführt ist, um nur den Ölstrom zu empfangen, oder (b) das proximale Ende des Kupplungsrohrs (90) über die Außenoberfläche des Ölrohrs (76) geschoben ist, um sowohl den Luftstrom als auch den Ölstrom zu empfangen, während das distale Ende des Kupplungsrohrs (90) mit dem proximalen Ende der Düse (82) in Eingriff ist.

7. Ölnebel-Schmiersystem nach Anspruch 6, wobei das Luftrohr (76) an der Außenoberfläche radial nach außen verlaufende Widerhaken (80) aufweist und wobei die Widerhaken (80) des Luftrohrs (76) mit einer Bohrungsoberfläche des proximalen Endes des Kupplungsrohrs (90) fest in Eingriff sind.

8. Ölnebel-Schmiersystem nach Anspruch 6, wobei die Düse (82) bei ihrem proximalen Ende an der Außenoberfläche radial nach außen verlaufende Widerhaken (94) aufweist,
wodurch das distale Ende des Kupplungsrohrs (90) axial auf das proximale Ende der Düse (82) geschoben ist,
wobei die Widerhaken (94) der Düse (82) mit einer Bohrungsoberfläche des distalen Endes des Kupplungsrohrs (90) fest in Eingriff sind.

9. Ölnebel-Schmiersystem nach einem der Ansprüche 1 bis 8, das bei einer Quelle von Schmieröl unter Druck wie etwa einem Ölbehälter (5) mit einer Quelle von Druckluft wie etwa einem Kompressor (3) betreibbar ist, wobei das Ölnebel-Schmiersystem umfasst:

mehrere Strickmaschinen (2),
eine Ölnebel-Schmiereinrichtung (10), die jeder der Strickmaschinen (2) zugeordnet ist, und
ein Leitungssystem, das jeder der Ölnebel-Schmiereinrichtung (10) Druckluft und Schmieröl unter Druck zuführt.

10. Ölnebel-Schmiersystem nach Anspruch 1, wobei der Druck der Druckluft von der Druckluft-Quelle (12) 0,69 Bar (10 PSI) oder mehr beträgt, wobei der erste Regler dafür ausgelegt ist, die Druckluft auf etwa 0,69 Bar (10 PSI) zu verringern, wobei das Öl von der Schmieröl-Quelle (22) unter einem Druck von etwa 0,34 Bar (5 PSI) steht und wobei der Ölimpulszeitgeber dafür ausgelegt ist, den Ölstrahl etwa 5mal pro Minute auszustoßen, wobei jeder Impuls etwa 0,2 bis 0,3 Sekunden dauert, und wobei der Ölstrahl aus der Düse mit etwa 0,14 bis 0,34 Bar (2 bis 5 PSI) ausgestoßen wird.

Revendications

1. Système de lubrification à pulvérisation d'huile pour machines à tricoter (2), pouvant fonctionner avec une source (12) d'air comprimé et une source (22) d'huile de lubrification sous pression, comprenant au moins un lubrificateur à pulvérisation d'huile (10) avec :

a. un filtre d'écoulement d'air (14) adapté pour recevoir l'air comprimé s'écoulant de ladite source (12) et pour réduire la quantité d'eau dans l'écoulement d'air,
b. une soupape (16) adaptée pour commander ledit écoulement d'air,
c. un premier régulateur (18) adapté pour régler une pression sélectionnée dudit écoulement d'air, et
d. un second régulateur (24) adapté pour rece-

voir un écoulement d'huile provenant de ladite source (22) et pour régler la pression sélectionnée dudit écoulement d'huile,
e. une minuterie d'impulsions (26, 28) adaptée pour éjecter ledit écoulement d'huile dans une fréquence sélectionnée d'impulsions,
f. un générateur d'huile à ports multiples (20, 40) ayant une chambre à huile (52) ayant une entrée d'huile (44), une entrée d'air (54) et plusieurs tubes d'huile (58, 72) dont chacun a une entrée et une sortie et est situé dans un tube d'air (76) de plus grand alésage qui entoure ledit tube d'huile (58, 72) et crée un espace annulaire (60) entre ledit tube d'huile (58, 72) et le tube d'air (76), et
g. au moins une buse (82),

le lubrificateur à pulvérisation d'huile (10) est configuré de telle sorte que l'air comprimé provenant de ladite source (12) s'écoule à travers ledit filtre d'écoulement d'air (14), ladite soupape (16) et ledit premier régulateur (18), dans lequel l'air est filtré et régulé en pression, et s'écoule de là vers ladite entrée d'air (54) de générateur d'huile à ports multiples, et
dans lequel l'huile provenant de ladite source (22) s'écoule à travers ledit second régulateur (24) et la minuterie d'impulsions (26, 28), puis à ladite entrée d'huile (44) de générateur d'huile à ports multiples et à travers lesdits tubes d'huile (58, 72), et
où ledit écoulement d'air entrant dans ladite entrée d'air (54) de générateur d'huile à ports multiples s'écoule dans lesdits espaces annulaires (60), et
où ledit écoulement d'huile à travers lesdits tubes d'huile (58, 72) et ledit écoulement d'air à travers lesdits espaces annulaires (60) se mélangent et s'écoulent vers et à travers ladite buse (82), produisant une pulvérisation d'huile pouvant être dirigé sur ladite machine à tricoter (2),
dans lequel ledit générateur d'huile à ports multiples (20, 40) comprend un boîtier (42),
caractérisé en ce qu'une paroi inférieure dudit boîtier définit une pièce inférieure (46) perforé pour définir au moins une entrée d'huile (44),
dans lequel ledit générateur d'huile à ports multiples (20, 40) comprend, à l'intérieur dudit boîtier (42), une pièce médiane (48) au-dessus de ladite pièce inférieure (46) perforée pour définir les premières ouvertures pour lesdits tubes d'huile (58, 72),
et une pièce supérieure (50) définissant des secondes ouvertures plus grandes que lesdites premières ouvertures pour recevoir lesdits tubes d'air (76), avec lesdits tubes d'huile (58, 72) à l'intérieur,
permettant ainsi à l'écoulement d'air d'entraîner l'écoulement d'huile auxdites sorties (58a) desdits tubes d'huile (58, 72) et de les diriger vers lesdites buses (82).

2. Système de lubrification à pulvérisation d'huile selon la revendication 1,
dans lequel, pour chaque lubrificateur à pulvérisation d'huile (10), lesdites sorties (58a) desdits tubes d'huile (58, 72) et des sorties desdits tubes d'air (76) sont situés à l'extérieur dudit boîtier (42),
dans lequel chacun desdits au moins un lubrificateur à pulvérisation d'huile (10) comprend en outre pour chaque buse (82) un tube de couplage (90) ayant une extrémité proximale qui peut être en connexion fluidique avec ladite sortie desdits tubes d'huile (58, 72) et ladite sortie desdits tubes d'air (76) et une extrémité distale qui peut être en connexion fluidique avec ladite extrémité proximale de ladite buse (82).

3. Système de lubrification à pulvérisation d'huile selon la revendication 2, dans lequel ledit tube de couplage (90) comprend un tube en plastique flexible.

4. Système de lubrification à pulvérisation d'huile selon l'une des revendications 1 à 3 où ladite buse (82) comprend un tube ayant des extrémités proximales et distales et un alésage central et : (i) ayant un diamètre d'alésage D3 à l'extrémité distale et s'étendant de manière proximale, (ii) ayant un diamètre D2 inférieur à un diamètre D1 et s'étendant de manière proximale à partir de la partie de diamètre D3 et (iii) ayant le diamètre D1 supérieur à la partie D2 et s'étendant de manière proximale depuis la partie D2.

5. Système de lubrification à pulvérisation d'huile selon la revendication 4 où le diamètre D1 de ladite buse (82), est d'environ 0,508 mm (0,03 pouce), le diamètre D2 est d'environ 0,762 mm (0,02 pouce), et le diamètre D3 est d'environ 1,016 mm (0,04 pouce).

6. Système de lubrification à pulvérisation d'huile selon l'une des revendications 2 à 5 où (a) ladite extrémité proximale dudit tube de couplage (90) est glissée sur la surface extérieure dudit tube d'huile (58, 72) et au moins une partie de celui-ci est insérée dans ledit espace annulaire (60) pour recevoir uniquement l'écoulement d'huile où (b) ladite extrémité proximale dudit tube de couplage (90) est glissée sur la surface extérieure dudit tube d'air (76) pour recevoir à la fois un écoulement d'air et un écoulement d'huile, tandis que ladite extrémité distale dudit tube de couplage (90) est en prise avec ladite extrémité proximale de ladite buse (82).

7. Système de lubrification à pulvérisation d'huile selon la revendication 6 où ledit tube d'air (76) a des ardillons (80) s'étendant radialement vers l'extérieur sur la surface extérieure, et lesdits ardillons (80) dudit tube d'air (76) sont solidement en prises avec une surface d'alésage de ladite extrémité proximale dudit tube de couplage (90).

8. Système de lubrification à pulvérisation d'huile selon la revendication 6, dans lequel ladite buse (82) a des ardillons (94) s'étendant radialement vers l'extérieur au niveau de la surface externe à son extrémité proximale,
où ladite extrémité distale dudit tube de couplage (90) est glissée axialement sur ladite extrémité proximale de ladite buse (82), où lesdits ardillons (94) de ladite buse (82) sont solidement en prises avec une surface d'alésage de ladite extrémité distale dudit tube de couplage (90).

9. Système de lubrification à pulvérisation d'huile selon l'une des revendications 1 à 8, fonctionnant avec une source d'air comprimé, tel qu'un compresseur (3), à une source d'huile lubrifiante sous pression, tel qu'un réservoir d'huile (5), comprenant :

une pluralité de machines à tricoter (2),
un lubrificateur à pulvérisation d'huile (10), associé à chacune desdites machines à tricoter (2), et
un système de conduits d'alimentation en air comprimé et en huile lubrifiante sous pression pour chacun desdits lubrificateurs à pulvérisation d'huile (10).

10. Système de lubrification à pulvérisation d'huile selon la revendication 1, dans lequel la pression dudit air comprimé provenant de ladite source (12) est de 0,69 bar (10 PSI) ou plus, ledit premier régulateur est adapté pour réduire ladite pression d'air à environ 0,69 bar (10 PSI), ladite huile provenant de ladite source (22) est à une pression d'environ 0,34 bar (5 PSI), et ledit minuteur d'impulsions d'huile est conçu pour éjecter la pulvérisation d'huile environ 5 fois par minute, chaque impulsion ayant une durée d'environ 0,2 à 0,3 seconde, et ladite pulvérisation d'huile est éjecté de ladite buse à une pression d'environ 0, 14 à 0,34 bar (2 à 5 PSI).

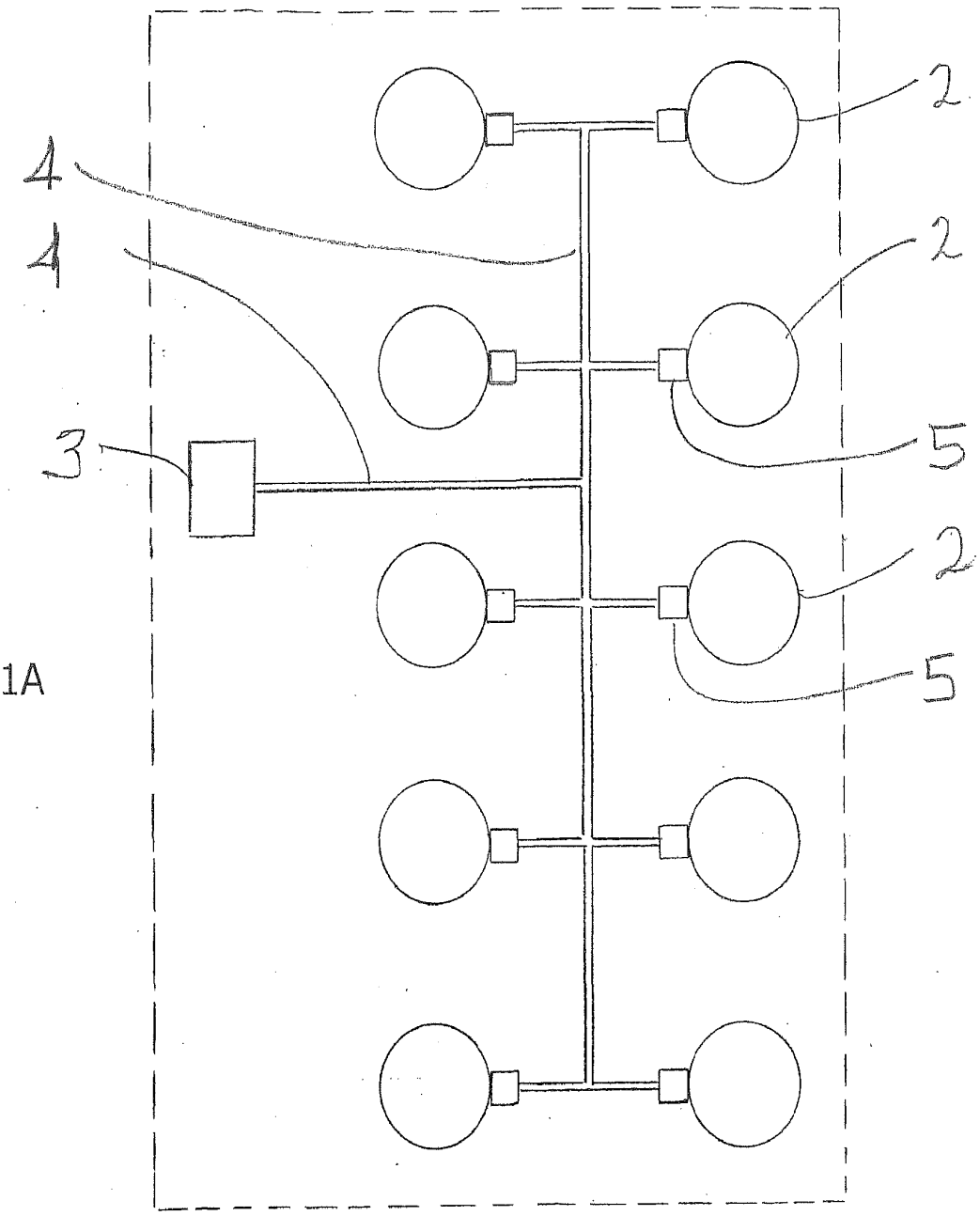


FIG. 1A

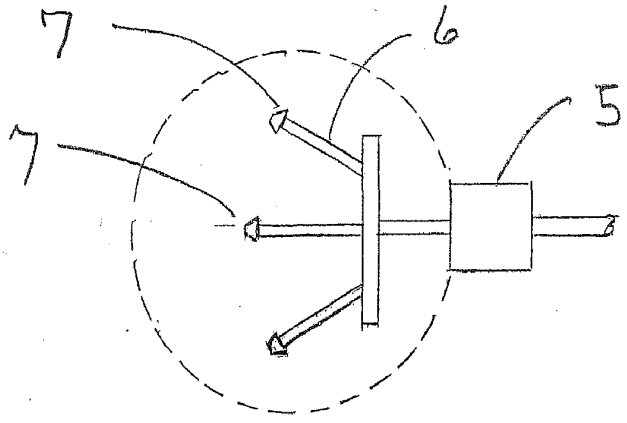


FIG. 1B

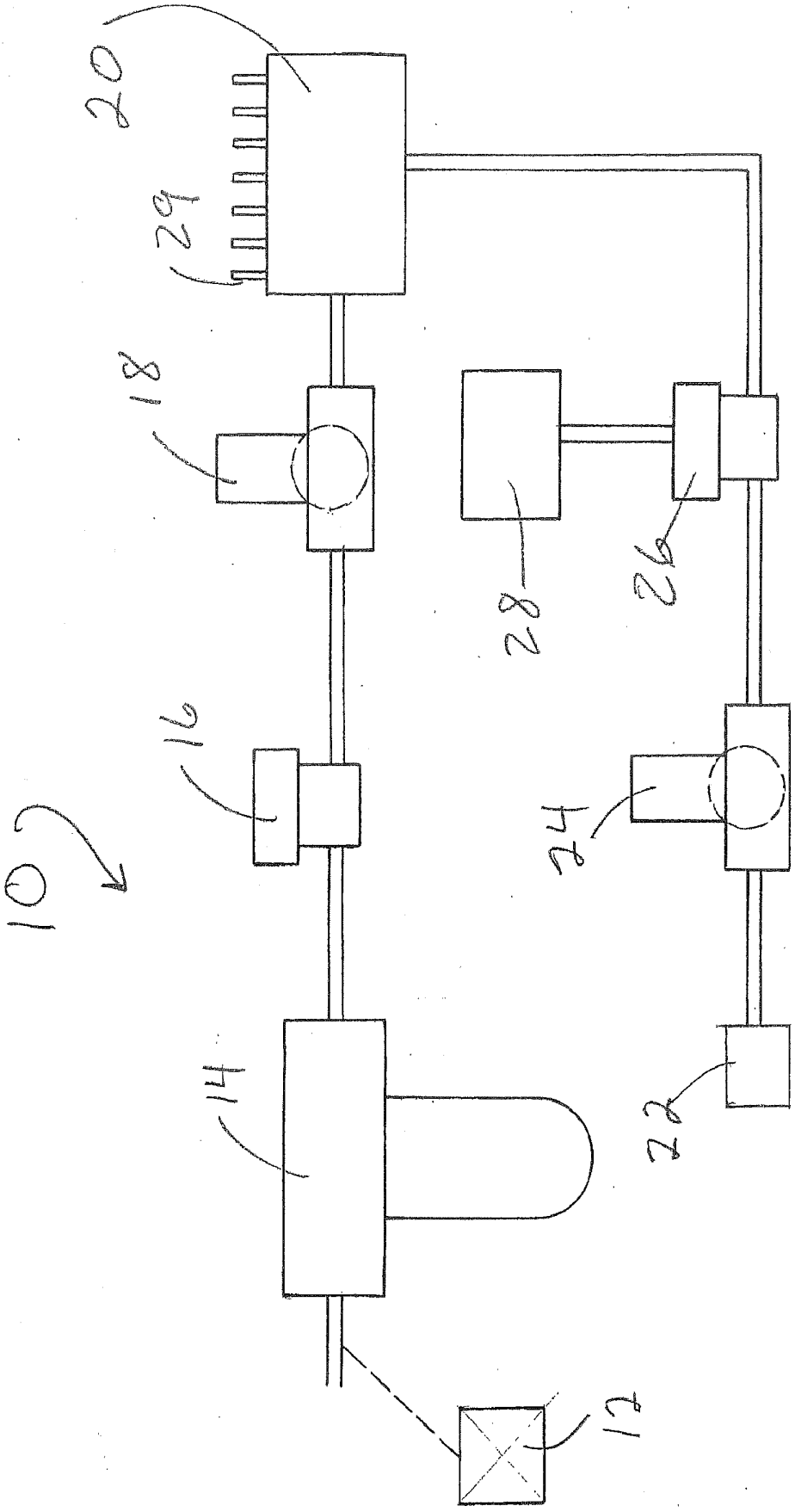


FIG. 1C

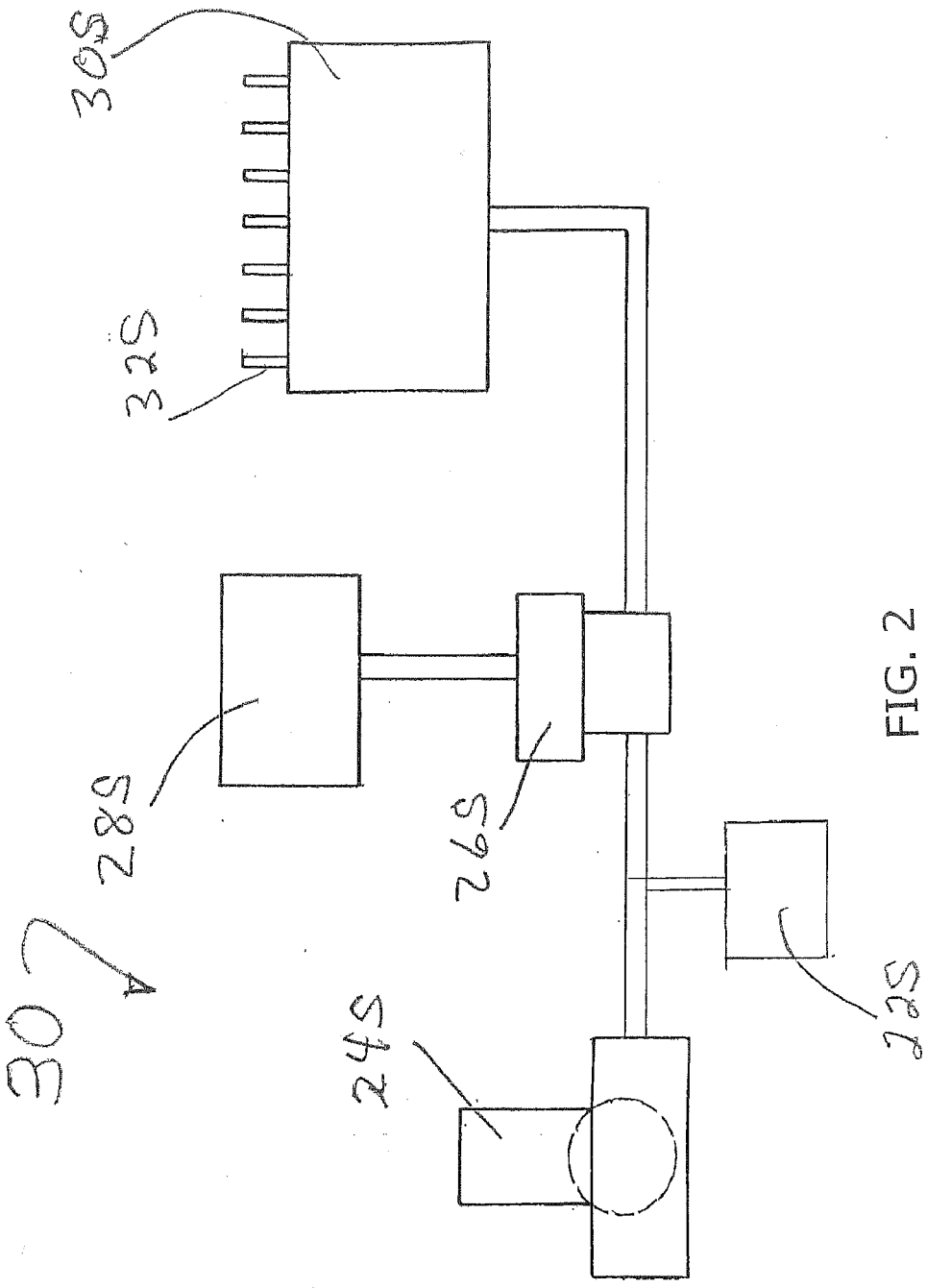


FIG. 2

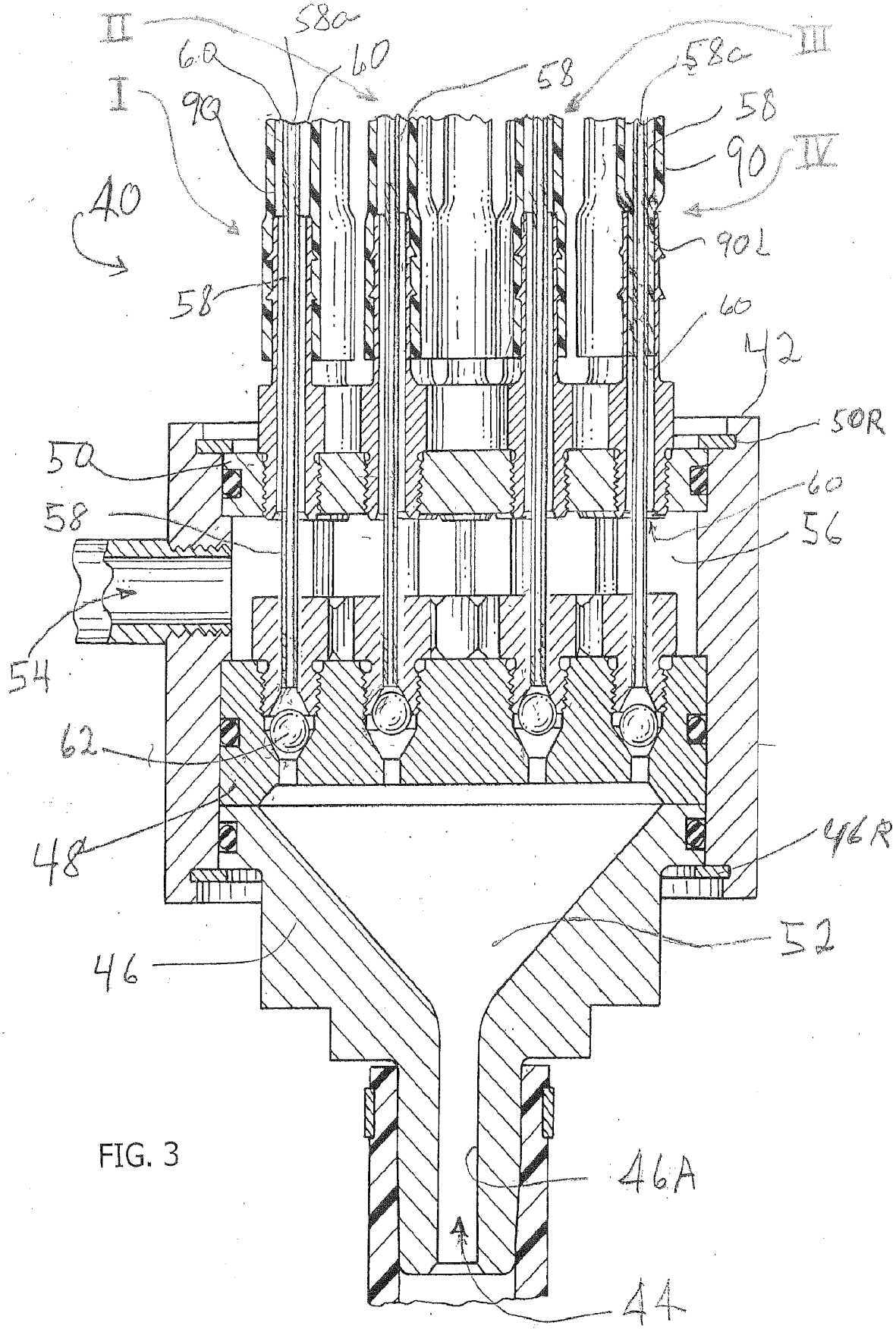

II
58a
60
60
58
58a
III
I
90
58
90
IV
40
90L
58
60
42
50R
50
60
58
56
54
62
48
46R
52
46
46A
44

FIG. 3

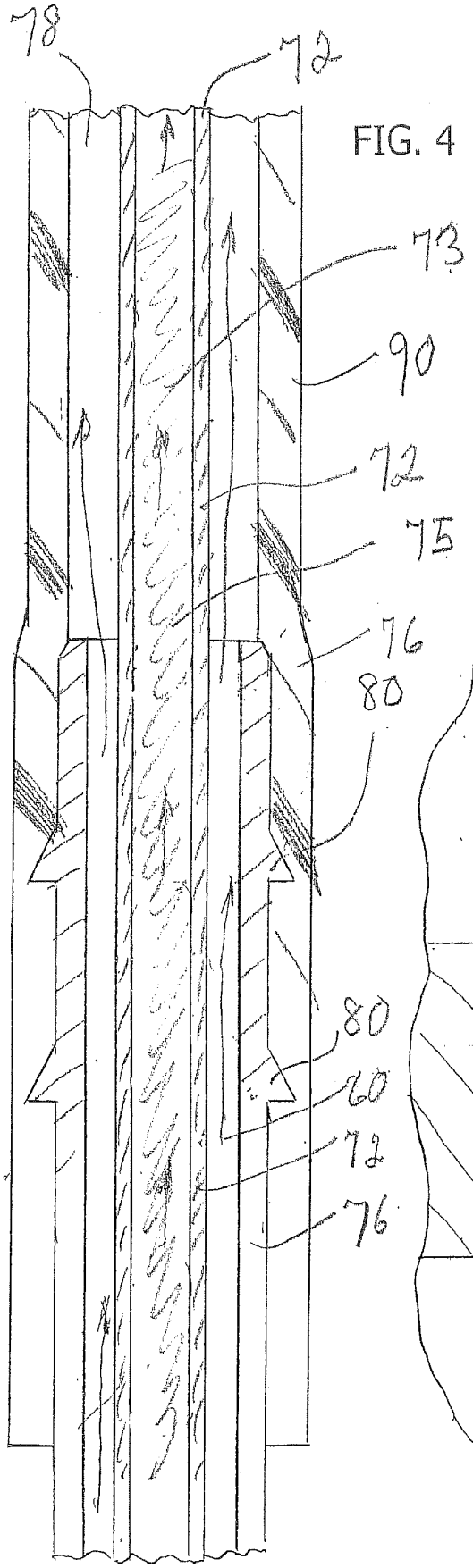


FIG. 4

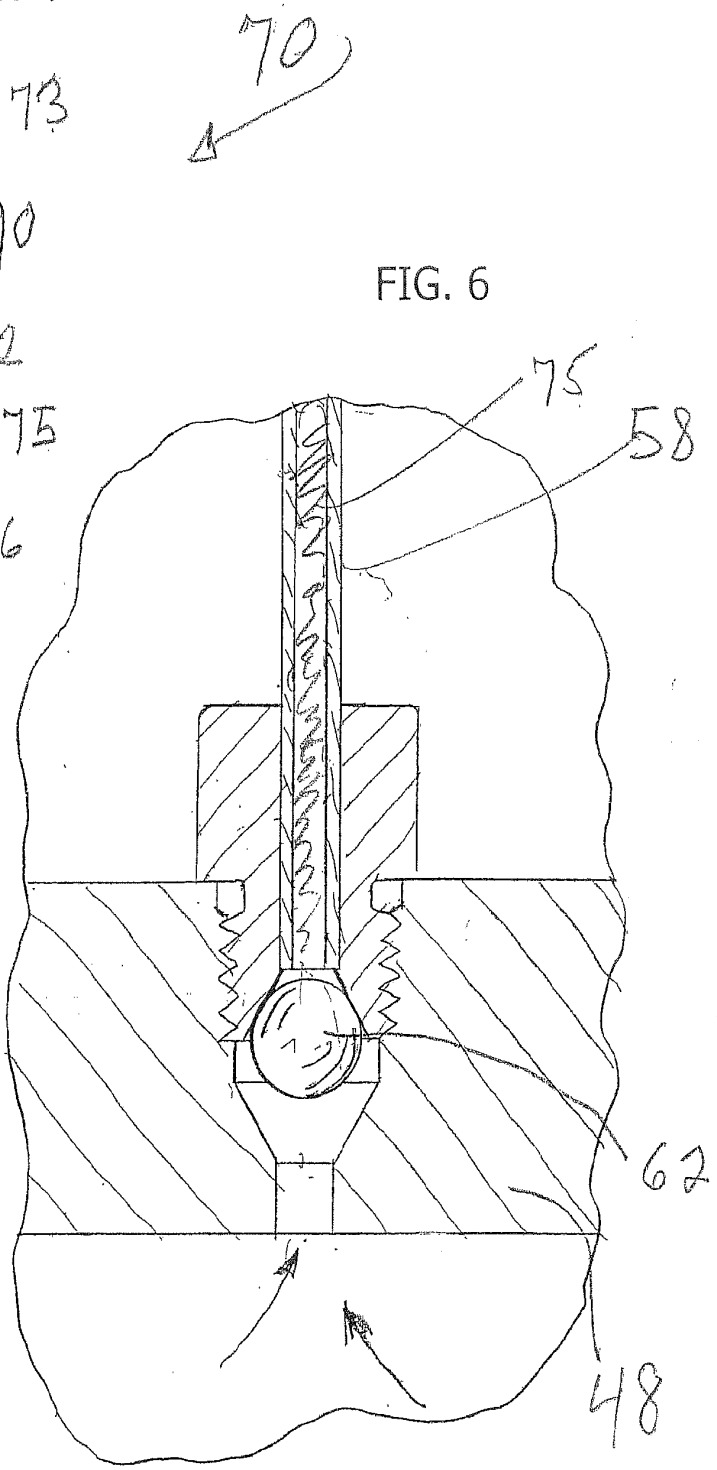


FIG. 6

FIG. 5A

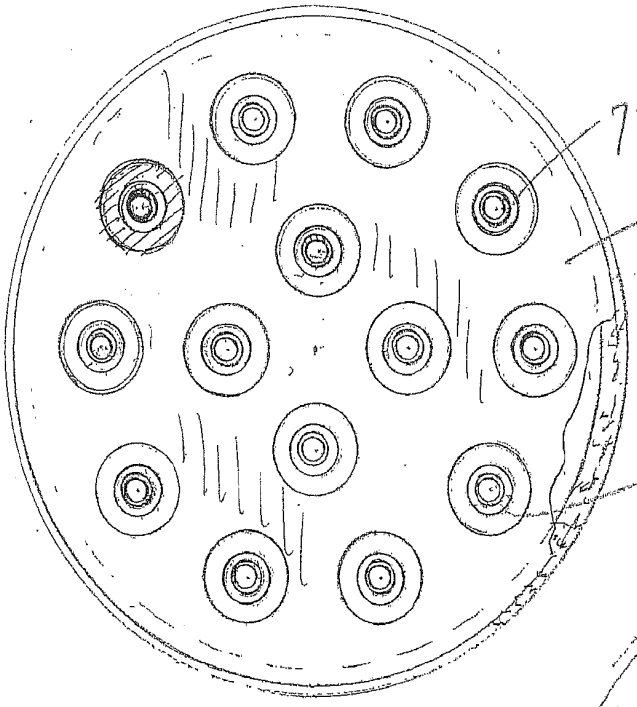
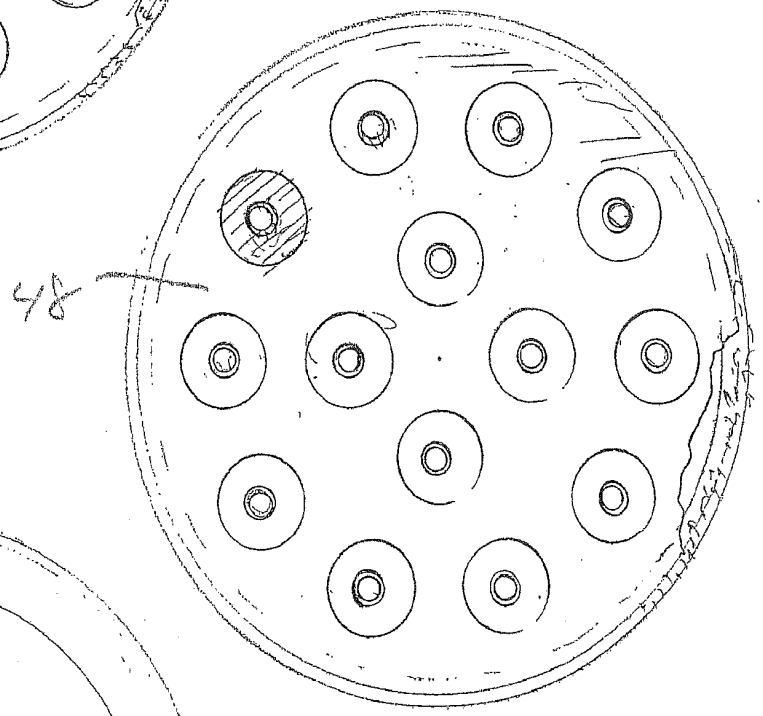


FIG. 5B



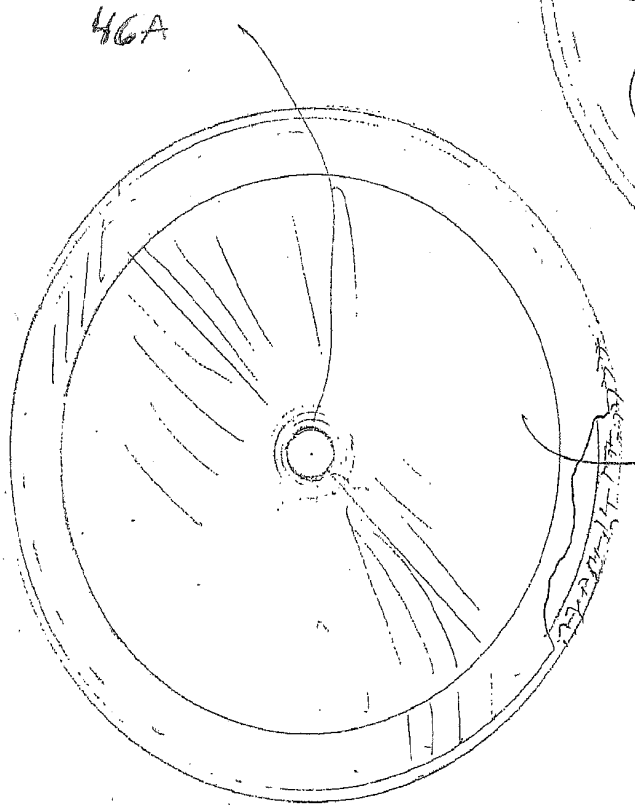


FIG. 5C

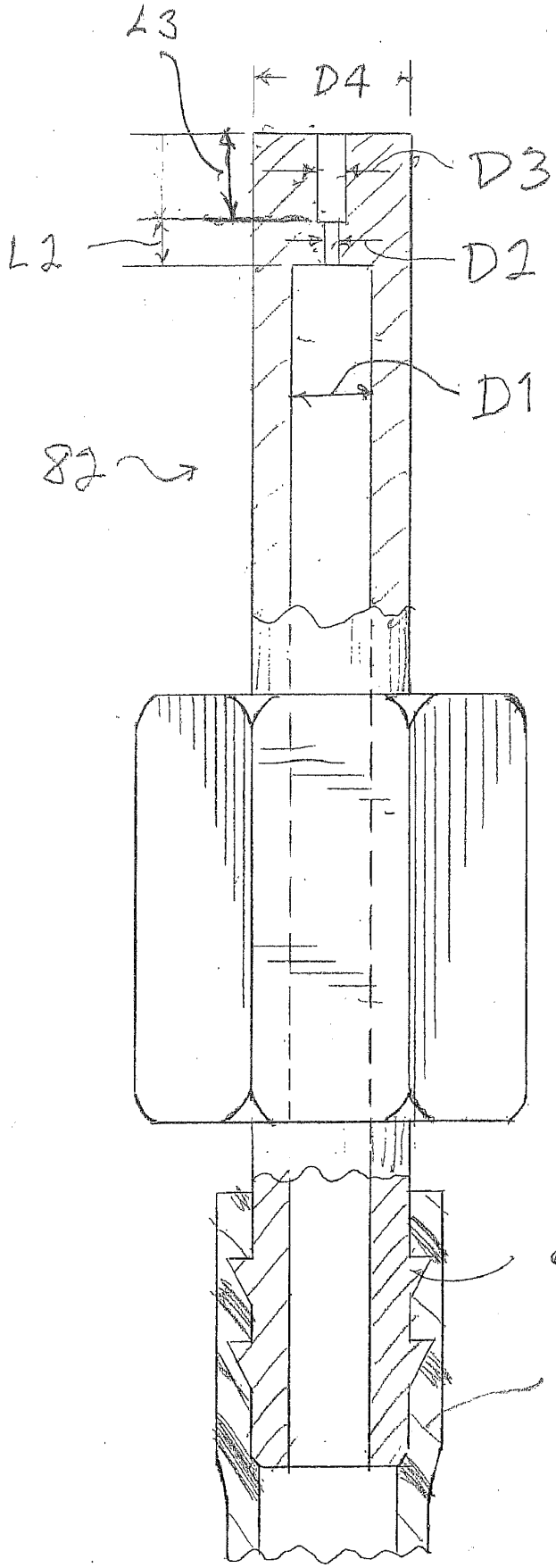


FIG. 7

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

- US 61919184 A **[0001]**
- EP 0427047 A1 **[0012]**
- DE 2040770 A1 **[0013]**
- GB 1218324 A **[0013]**