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(72) Inventors:  
• **Smith, Daniel Robin**  
**Castle Bromwich, Birmingham B36 9DG (GB)**  
• **Clarke, Derek Stephen**  
**Sutton Coldfield B76 1YT (GB)**  
• **Morris, Stephen**  
**Sutton Coldfield B76 2UT (GB)**

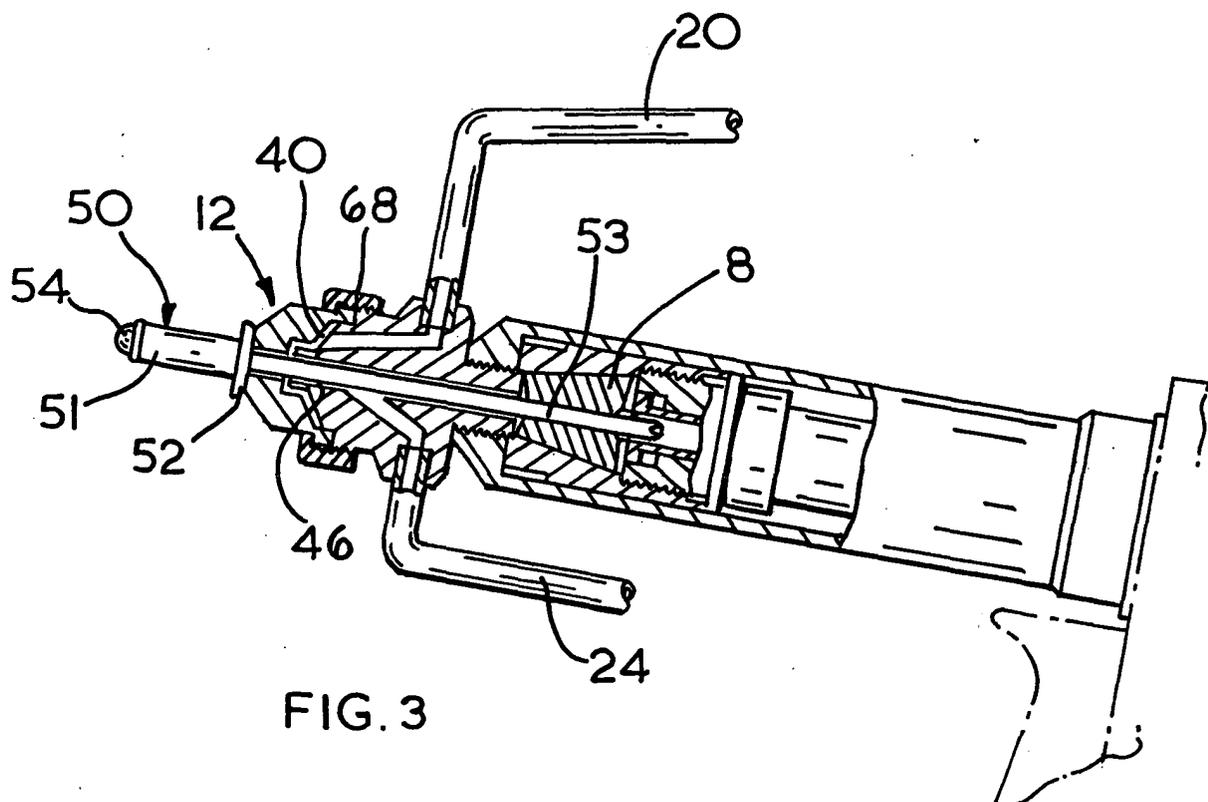
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(71) Applicant: **Newfrey LLC**  
**Newark, Delaware 19711 (US)**

(74) Representative: **Haar, Lucas H., Dipl.-Ing. et al**  
**Patentanwälte Haar & Schwarz-Haar,**  
**Lessingstrasse 3**  
**61231 Bad Nauheim (DE)**

(54) **Painting of blind rivets**

(57) A setting tool for setting a blind rivet (50) incorporating a paint delivery system (40, 20, 24) in a nosepiece (12) of such tool for applying paint from the rivet setting tool to the flange (52) of the blind rivet during setting.



**FIG. 3**

## Description

**[0001]** This invention relates to a tool and method for applying paint to the flange of blind rivets, and particularly to a tool and method for applying paint to the flange of blind rivets using a rivet setting tool.

**[0002]** A blind rivet typically comprises an outer tubular shell with a flange at one end, and a mandrel having a stem and a means for engaging part of the remote end of the shell. The means for engaging part of the remote end of the shell is at one end of the stem and may be, for example, a radially enlarged head at one end of the stem, or a screw-threaded portion on one end of the stem. The rivet shell is generally positioned in the aligned apertures of two application pieces to be joined with the flange of the shell on the operator side, and the mandrel stem extending into the tubular shell so that its enlarged head is on the blind side of the application pieces. During the rivet setting process, the flange of the rivet shell is generally supported by a setting tool, and the stem of the mandrel is subjected to tensile loading by jaws within the tool which grip the mandrel and pull it into the tool. The mandrel is thereby pulled through the shell of the rivet until the radially enlarged head engages part of the remote end of the shell, causing the remote end of the shell to collapse and move into contact with the blind side of the application pieces. The rivet therefore holds the application pieces between its shell-flange on the front side of the application pieces, and the collapsed portion on the blind side of the application pieces.

**[0003]** There are many applications where it is aesthetically and/or functionally desirable to apply paints or coatings to the flange of the blind rivet. As examples where painted rivets are desired there may be mentioned rivets to secure vehicle number plates to road vehicles, external exposed fixings in whitened goods such as washing machines or refrigerators, external fixings in computer cabinets or in electrical control gear. Many other applications where a painted rivet would be desirable would be known to the man skilled in the art.

**[0004]** Methods are known for painting rivets, the method selected depending on the nature of the rivet, and specifically depending on whether it is an open-end rivet or a closed-end rivet.

**[0005]** An open-ended rivet typically comprises a tubular shell open at both ends with a flange extending radially outwardly from one open end. This is generally used in combination with a mandrel comprising a stem and an enlarged head; the head being pulled into contact with the non flanged open end of the shell to collapse it to set the rivet. Such rivets therefore comprise separate shell and mandrel parts. It is known to paint the shell part only of such open-ended rivets by barrel spray painting or by coating in rotating barrels. The painted rivet shells can then be assembled with the unpainted mandrels. It is advantageous that the mandrels remain unpainted since during the setting process they

are gripped by the installation tool jaws, and any paint on their surface can be scraped off and eventually clog the jaw teeth, or block other parts of the tool, necessitating frequent tool cleaning.

**[0006]** While barrel spray painting or coating is an efficacious method of painting open-ended rivets, both methods do require at least 30,000 rivets as a batch quantity for consistent and acceptable coating. For smaller quantities the residues from the batch needs to be scrapped or retained in stock, perhaps only to be scrapped later. Where smaller quantities are needed it is also known to mount each rivet in a card or a plate individually and then hand spray the flanges from an aerosol can. This is obviously time inefficient, and leads to inconsistent covering.

**[0007]** Other problems occur with barrel-sprayed or barrel-coated open-ended rivet shells where the assembled rivets are worked after assembly and prior to setting. Such working may be required, for example, to provide a multigrip type of blind rivet. A multi-grip type of blind rivet has multi-necked portions along the length of its which collapse in a cottage loaf type configuration within the apertures of the application pieces on setting, to provide multiple gripping of the pieces. The multi-necked portions are typically produced by rolling or grooving after assembly of the mandrel in the shell. Such rolling or grooving of the shell can cause damage to any painted surface on the rivet body and the flange unless the rolling machine is precisely set. Moreover the paint generally adheres to the working rollers and the paint debris often attaches itself to the rolled rivets. All have to be cleaned frequently which entails additional costs.

**[0008]** Closed end rivets typically comprise a tubular shell, which is closed at one end, and open at the other end with a flange extending radially outward from the open end. The mandrel may be screw threaded to engage a mating thread within the shell, or may comprise an enlarged head, the mandrel being pre-assembled within the shell and then the shell deformed around the mandrel head so that on setting the head can engage part of the remote end of the shell to cause it to collapse. All closed-end rivets, by virtue of the manufacturing process, are finally heat treated after assembly of the shell with the mandrel. Any previously painted surface would be damaged by the heat treatment process, which means that closed end rivets must be painted after the assembly of the shell with the mandrel. Thus for closed end rivets it is not possible to paint the shell parts only prior to assembly with the mandrel. Therefore the usual known procedure for painting closed-end rivets is to barrel spray or coat closed-end blind rivets after assembly of the shell and mandrel (and after post assembly working if applicable). This disadvantageously means that not only the shell but also the mandrel is painted, and during subsequent setting the paint may be scraped off by the setting tool, resulting in clogging of the tool and necessitating frequent setting tool clean-

ing, or alternatively scraping of the mandrel stems with a separate tool prior to setting. Closed end rivets that have been barrel spray painted or coated also suffer from the problem of batch quantities, already referred to with respect to the open-end blind rivets.

**[0009]** We have discovered a new tool and method for applying paint to the flange of a blind rivet. The tool and method can be used to apply paint to the flange of both open-end and closed end rivets.

**[0010]** A first aspect of the present invention provides a tool for setting a blind rivet in an aperture in one or more application pieces, the blind rivet comprising a flanged shell, and the tool incorporating means for supplying paint to the flange of the shell during the rivet setting process.

**[0011]** The advantage of the tool of the present invention is that it allows the rivet shell flanges to be painted on setting. Therefore for open-ended rivets there is no need to paint the rivet shells prior to assembly, either in large batch operations or individually at great expense and the problems of post-assembly working do not apply since the painting is carried out after setting of the rivet. For closed-end rivets there is no need for setting tool cleaning or the need to scrape the mandrel stems prior to setting, and as for open-ended rivets there is no need for large batch painting operations.

**[0012]** With respect to the tool it is preferable that the tool comprises a pressurised air inlet port. Preferably the air inlet port is in communication with one or more pressurised air supply lines, preferably two or three or even more pressurised air supply lines (depending on the preferred embodiment), referred to in this specification as first, second and third pressurised air supply lines. Whilst it is possible for a single pressurised air inlet port to be in communication with each of the pressurised air supply lines, where more than one is present, it is preferred that multiple air inlet ports could be included to feed the pressurised air supply lines.

**[0013]** In several preferred embodiments according to the invention a first pressurised air supply line supplies pressurised air passing from the said air inlet port in order to activate the rivet setting process.

**[0014]** In one preferred embodiment pressurised air passes from an air inlet port along a second pressurised air supply line to the paint delivery means to pressurise delivery of the paint. Preferably the same inlet port feeds a first supply line that activates rivet setting and the said second air supply line pressurising the paint delivery. Thus according to this preferred embodiment the tool can both set a rivet and pressurise paint delivery using the same pressurised air inlet port.

Preferably the paint delivery means comprises a paint supply line, and especially preferably pressurised air passes along the second pressurised air supply line to pressurise the paint supply line.

**[0015]** In a preferred design the tool is arranged so that air passes from the air inlet port simultaneously to the first and second pressurised air supply lines. This

simultaneous passage is preferably initiated by an operator, for example by depression of a trigger.

**[0016]** In a preferred structural design of the tool it comprises a nosepiece for supporting the flange of the rivet shell against the application piece, or one of the application pieces, the nosepiece also comprising at least part of the said paint delivery means. Usually the nosepiece will contain only part and not all of the said paint delivery means, since a paint supply line, which also forms part of the paint delivery means, will if present usually extend from the nosepiece.

**[0017]** In one particular embodiment the paint delivery means comprises a paint spray.

**[0018]** In order to deliver the paint the tool typically comprises a paint outlet. Where the tool design incorporates a nosepiece the paint outlet will preferably be in the nosepiece. In a particular embodiment the paint delivery means comprises a paint chamber, including a paint outlet, the paint chamber being located within the nosepiece. Preferably the paint chamber and preferably also the paint outlet are annular.

**[0019]** As noted above the tool may in some preferred embodiments comprise three pressurised air supply lines. In this case the arrangement is preferably such that pressurised air passes from an air inlet port along the third pressurised air supply line to a region adjacent a paint outlet. The preferred purpose of this third air supply line is to act to spray paint at the paint outlet. The arrangement is preferably such that the spray is in the direction of the rivet shell. Preferably pressurised air from the third supply line atomises paint at the paint outlet to provide a pulse of paint spray onto the rivet flange at the same time as the rivet setting process.

In an especially preferred embodiment where two or more pressurised air supply lines are present, the air preferably passes simultaneously from the air inlet port to any combination of the first second and third pressurised air supply lines.

**[0020]** A particular tool design, which allows paint spraying to be achieved, comprises a nosepiece that comprises an air chamber, which is in communication with the third pressurised air supply line. This air chamber is preferably generally cylindrical, and is preferably used in combination with an annular paint chamber and air chamber within paint chamber. In this case the second pressurised air supply line pressurises paint to the paint chamber, and the third pressurised air supply line supplies pressurised air to the cylindrical air chamber surrounding the paint causing the paint to be atomised and sprayed out from the nosepiece.

**[0021]** In a different embodiment the paint delivery means comprises a paint pad, preferably instead of a paint spray. Where a paint supply line is present, this preferably feeds into the paint pad, generally via a paint chamber. Where a paint pad is used in place of a paint spray, no third pressurised air supply line is required to apply the paint. Where the tool design includes a nosepiece the paint pad is preferably contained in the nose-

piece. Preferably the paint pad is charged with predetermined amount of paint on rivet setting. This is generally achieved by the second pressurised air line pressurising the paint supply line for a short duration of time, by depression of a trigger for a short period of time thereby supplying a predetermined amount of paint. This short time air pressurisation of the second pressurised air supply line is preferably simultaneous with a pulse of pressurised air supplied via a first supply line to cause rivet set, preferably activated by depression of a common trigger.

**[0022]** Where the tool design incorporates a nose-piece, this nosepiece preferably comprises a tip portion and a body portion, removably secured to each other. In tools incorporating a paint spray the paint chamber is preferably contained within the tip portion of the nose-piece, and similarly in tools incorporating a paint pad, the pad is preferably in the tip portion of the nosepiece. This arrangement permits easy cleaning. Preferably the tool and nosepiece design are arranged so that interchangeable tips (paint spray or paint pad) can be applied to a common tool body.

**[0023]** In another embodiment in which the tool comprises a paint supply line and a third pressurised air supply line the tool also comprises a valve. This valve is preferably movable from a first position in which it closes the third pressurised air supply line and opens the paint supply line to a second position in which it opens the third pressurised air supply line and closes the paint supply line.

**[0024]** In this design the third pressurised air supply line preferably supplies pressurised air to a region adjacent to the outlet of the paint supply line. In one embodiment the movement of the valve to its said first position is achieved during the rivet setting process by pulling of the mandrel stem of the rivet through the shell of the rivet. In this position the paint supply line is open, and if there is a paint outlet the paint will be at that outlet. However the paint will not be delivered to the rivet shell since the air supply is closed so there is no air to spray the paint. In this design, it is especially preferred that the tool incorporates a biasing means such as a spring, so that on rivet setting, when the mandrel of the rivet breaks and no longer holds the valve in its first position, then the biasing means acts to move the valve to its said second position. In this second position the air supply line is open. Therefore momentarily the air supply is able to spray the small amount of paint at the outlet. Then as the spring continues to move the valve the paint outlet shuts so no more paint is delivered. This preferred embodiment therefore acts to deliver a set small quantity of paint. This is unlike other embodiments previously described, where the amount of paint delivered typically depends on the length of time the supply lines are activated by an operator, usually by trigger depression.

**[0025]** The present invention also provides a method comprising setting a flanged blind rivet in an aperture in one or more application pieces and simultaneously

painting the flange of the blind rivet. In a preferred method the same tool is used to set the rivet and paint the flange of the rivet. Preferably the tool used is a tool according to the present invention.

Embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, wherein:

Figure 1 is a side view, partly in section of a first embodiment of combined rivet setting installation tool and rivet flange painting tool according to the present invention;

Figure 2 is an enlarged side view, partly in section, of the nosepiece of Figure 1;

Figure 3 is a side view of part of the tool of Figures 1 and 2, with a rivet in the installation tool prior to rivet setting;

Figure 4 shows the tool and rivet of Figure 3 immediately after rivet setting;

Figure 5 is a side view of part of a second embodiment of a combined rivet setting tool and rivet flange painting tool according to the present invention;

Figure 6 is side view of the nose piece part of a third embodiment of a combined rivet setting tool and rivet flange painting tool according to the present invention;

Figure 7 is the same view as Figure 6, but with a rivet in place prior to setting;

Figure 8 is the same view as Figure 7, showing the rivet during the setting process; and

Figure 9 is the same view as Figures 7 and 8, showing the rivet at the end of the setting process as paint spraying occurs.

**[0026]** Referring now to the drawings the Figures show a tool 1 suitable for setting a blind rivet 50 (Figure 3) into aligned apertures in two application pieces 62, 64 (Figure 4) to be joined. The rivet comprises a tubular shell 51 having a flange 52 at the front operator side and a mandrel 53 that is pulled through the tubular shell in order to set the rivet shell (figure 3). According to the embodiments shown in the drawings paint is either sprayed onto the rivet shell flange as shown in the first embodiment (Figures 1-4) and the third embodiment (Figures 6-9), or is applied by a paint pad as shown in the second embodiment (Figure 5).

**[0027]** Looking at Figure 1, it will be apparent to the skilled man that the rivet setting and flange painting tool 1 contains many features common to known rivet setting tools. In particular it has a general structure comprising housing made up of three parts: a handle portion 2, a pressure intensification portion 4 beneath the handle portion 2, and an upper barrel portion 6 extending across the top of the handle portion 2. The barrel portion 6 comprises a nosepiece 12 that, during the rivet setting process, abuts the flange of the rivet shell (not shown in Figure 1) in order to maintain tight abutment between the shell flange and the apertured application pieces in

which it is being installed. The barrel portion 6 contains jaws 8 which are arranged to grip the mandrel 53 of a rivet, and pull it into the body of the upper portion of the tool housing, thereby moving it relative to the rivet shell in order to set the rivet. The gripping and pulling action of the rivet mandrel by the jaws 8 of the tool 1 is air pressure activated, as explained in more detail below, and the action is initiated by depression of a trigger 10, which is located in the handle portion 4 of the tool housing.

**[0028]** Within the barrel portion 6, jaws 8 are connected via a piston rod 14 to a piston 9, the combination 8, 14, 9 being movable within the barrel portion 6 of the tool when pressure activated. Jaws 8, piston rod 14 and piston 9 move as a unit.

**[0029]** The pressure intensification portion 4 of the housing of tool 1 contains a chamber 22 which itself comprises an upper chamber 17 and a lower chamber 19, the two chambers being separated by a piston plate 27. Piston plate 27 seals across the entire cross-section of the pressure vessel 22 and is connected to a piston rod 29 which is seated in a hollow channel 31 passing through the handle portion into communication with the barrel portion 6 of the tool 1.

**[0030]** The lower chamber 19 of the pressure vessel 22 is in communication via air supply line 23 to a pressurised air inlet at a port 21 (disposed behind the tool as shown in Figure 1 and adjacent the valve 25), whereby entry of the pressurised air into the air inlet and hence into the chamber 19 is controlled by a valve 25.

**[0031]** Valve 25 can be opened by depression of trigger 10 by an operator, allowing pressurised air to pass via supply line 23 to the lower chamber 19 of the pressure vessel 22. The supply line 23 provides a first pressurised air supply line of the tool. When pressurised air passes along supply line 23 it causes piston plate 27 and hence piston rod 29 to move upwards. This upward movement in turn causes fluid pressure to increase in the barrel portion 6 of the tool 1 and hence piston 9, resulting in an increase of pressure on the end plate of the piston 9 moving it to the right when viewed in Figure 1. This movement causes jaws 8 to clamp around the rivet mandrel stem, and the jaws also to move to the right, pulling the mandrel 53 through the rivet shell 51, and consequently setting the rivet. At the maximum tensile load the rivet mandrel stem 53 breaks (see Figure 4).

**[0032]** On release of trigger 10 by the operator, spring 33, located between valve 25 and trigger 10, acts to return the trigger 10 to its pre-depressed position and valve 25 closes. The pressurised air supply is thereby redirected by the position of valve 25 so that air is admitted to the upper portion of the chamber 17 to cause piston plate 27 to lower and, consequently, piston 9, rod 14 and jaws 8 move to the left (as viewed in Figure 1) and the jaws 8 open to release the previously clamped, and now broken-off, mandrel stem portion 53, which is then discarded.

**[0033]** It will be appreciated that where reference is

made to upward movement and lowering this refers to the orientation of tool shown in the Figures, but that it would be possible to use the tool in any orientation.

**[0034]** In addition to the features described above for setting the rivet, which are standard for known rivet setting tools, the tool 1 of Figure 1 also comprises various features which operate to paint the flange of the rivet shell during the setting process. In the embodiment shown in this Figure the nosepiece 12 operates not only as a means to maintain tight abutment between the rivet shell flange and the application pieces, but also as a paint spray nozzle. The nosepiece 12 contains a central passageway 16, through which the rivet mandrel is pulled during setting. This passageway 16 acts as an outlet for the paint spray from the end of the nosepiece 12 once the mandrel stem 53 has broken (Figure 4).

**[0035]** Referring additionally to Figure 2, paint is supplied to the nosepiece via paint supply line 20 from a paint reservoir (not shown, but to the right of Figure 1). In the absence of any other pressurising features the paint reservoir supplies paint at atmospheric pressure. A liquid shut-off valve 32 is provided in the paint supply line 20.

**[0036]** When trigger 10 is depressed to set the rivet it opens valve 25 which supplies pressurised air not only to air supply line 23 to set the rivet as previously described, but also to pressurised air supply lines 24 and 26. These supply lines provide the third and second pressurised air supply lines respectively of the invention as defined by the claims of the present invention. Air supply line 24 delivers pressurised air directly into the nosepiece portion 12 of the tool, the pressure being controlled by pressure regulator 34, which is in supply line 24. In addition air supply line 26 delivers pressurised air to the paint supply line 20 via branch air line 26. The junction between the paint supply line 20 and the branch air line 26 is controlled by both a non return valve 28 (to prevent paint clogging the air supply line 26) and by a pressure regulator 30.

**[0037]** Whilst the embodiments shown in the figures show the paint supply line 20 and pressurised air supply lines 24 and 26 externally mounted for clarity of description, it should be appreciated in practice that such supply lines will be built into the tool structure. Additionally, while the preferred embodiment discusses the use of air pressurised air lines for delivering pressurised air, the present invention is not restricted to the use of pressurised air but is equally applicable to use with any inert or non corrosive gas (all of which known gasses are considered to be defined by use of the term "air" within the present description and claims).

**[0038]** Referring especially to Figure 2 the nosepiece 12 comprises two parts, tip part 12' and a body part 12", the two parts being held together by a screw threaded cap 68. Prior to depression of the trigger 10, paint is supplied to the nosepiece 12 at atmospheric pressure via a series of inlets 36. These are contained in the body part 12" of the nosepiece 12. The series of inlets 36 are reg-

ularly spaced around the nosepiece 12. Only one inlet 36 is marked, but in general there would be between one and six paint inlets 36 into the nosepiece 12. The paint passes through inlets 36, via passages 38 to an annular paint chamber 40. The paint chamber 40 is in the tip part 12' of the nosepiece 12 and is positioned in communication with the inlets 36 when the cap 68 secures the two parts 12' and 12" together. The chamber 40 surrounds the passageway 16 passing through nosepiece 12. The chamber 40, being within the tip portion 12' of the nosepiece 12 is easily removable for cleaning. The paint is stored in the chamber 40 until its release is activated during the rivet setting process. When released the paint will exit the chamber 40 via an annulus 42 within the chamber 40, the annular exit 42 being directed radially inwardly of the tool. Generally, the size of the annulus 42 is appropriate so that the surface tension of the paint is sufficient to restrain such paint from flowing out of the annulus at atmospheric pressure and, since both supply lines 24 and 20 are not pressurised when the trigger 10 is not activated then there is no pulse or jet of air released through passageway 16 to effectively pull the paint from the annular paint chamber 40 as no vacuum is created by air flowing past the gap 41. The paint release process is described in more detail below with reference to Figures 3 and 4.

**[0039]** Also shown in Figure 2 is a series of air inlets 44 from air supply line 24, which connect to an air chamber 46. Air chamber 46 forms part of the passageway 16 passing through the nosepiece 12. The air chamber 46 is generally cylindrical, is located within the annular paint chamber 40, and has a diameter larger than that of the rivet mandrel, which during the setting process will pass through it. There will generally be one to six air inlets 44 each connected via a passageway 46 regularly spaced around the nosepiece 12, although only one is shown in the Figure for clarity. The air inlets 44 supply air directly to the air chamber 46 when the trigger 10 is depressed by an operator and valve 25 consequently opened.

**[0040]** Referring now to Figure 3, this shows a rivet 50 inserted in the installation tool 1 ready for setting. The rivet comprises a cylindrical shell 51 with a radially directed flange 52 at one end. The flange 52 is positioned and supported by the end of the nosepiece 12 of the rivet setting tool 1. The rivet 50 also comprises a mandrel comprising a stem 53 and an enlarged head 54. The rivet stem 53 passes through the rivet shell 51. The stem 53 of the rivet mandrel is shown inserted into the passageway 16 in the nosepiece 12 of the tool, having passed through the cylindrical air chamber 46 and the annular paint chamber 40 in the nosepiece 12. The free end of the mandrel stem 53 is received within the jaws 8 of the tool 1. In this position the tool 1 is at rest with no air under pressure being allowed into the tool and therefore both air supply line 24 and paint supply line 22 and 20 are at normal atmospheric pressure.

**[0041]** As is conventional for such rivet setting tools,

at rest, the jaws are biased into the position shown in Figures 1 through 3 so as to engage with the main body part 12" of the nose piece 12 which, as seen in Figure 4 has an inner conical protrusion 112 which co-operates with the inclined end surfaces 108 (figure 4) of the jaws 8 which, under such biasing force serves to effect a cam force pushing the jaws apart slightly to allow the mandrel to be received therein (as shown in Figure 3). When the rivet tool is activated so as to displace the jaws from left to right (as previously described, and achieved by operation of switch 10), the jaws are displaced out of engagement with this surface 112 and, in a conventional manner, are compressed by engagement with the inclined collar 114 so as to compressively engage with the mandrel stem 53 in a standard manner which will not need be described in detail herein as it forms standard blind rivet setting tool operation.

**[0042]** Referring now to Figure 4, and additionally again to Figure 1, when the trigger 10 is depressed valve 25 opens and pressurised air is delivered simultaneously to air supply lines 23, 24 and 26. The pressurised air supply along line 23 activates the conventional rivet setting process as described earlier causing the rivet to set and the rivet mandrel stem 53 to break. The pressurised air supplied along line 26 pressurises the paint supply line 20 so that paint is fed into the paint chamber 40 and exits via the annulus 42 of the paint chamber 40. The pressurised air supplied simultaneously along supply line 24 directly to the nosepiece 12 passes through passageways 44 into the air chamber 46. This pressurised air therefore acts directly on the exiting paint. The paint that is exiting annulus 42 is thereby atomised by the pressurised air supply from the air outlet chamber 46. The atomised paint streams from the end of the nosepiece 12 onto the rivet flange 52 (figure 4).

**[0043]** Paint will flow during the rivet setting process and will continue until the trigger 10 is released. This means that the operator controls the amount of paint supplied. In general the operator will release the trigger as soon as the rivet sets. As soon as the trigger 10 is released to return the pulling jaws 8 to the rest position to await the next rivet, the air pressure ceases and the paint flow along line 20 and the direct air flow to the nosepiece stops and the paint spray process stops. In Figure 4, the setting process has just completed, the mandrel stem 53 has broken, and the nosepiece 12 has moved away from the rivet shell flange 52.

**[0044]** Figure 5 shows part of a tool 1' according to a second embodiment of the present invention. The only variation from the tool 1 of the first embodiment shown in Figure 1 is in the design of the nosepiece 12, and therefore only this part of the tool 1' is shown. In this embodiment the paint spray of the Figure 1 embodiment is replaced by a paint pad 60, and there is no direct supply of pressurised air to the nosepiece and no air chamber contained within the nosepiece 12, i.e. supply line 24, supply passageways 44 and air chamber 46 of Figures 1-4 embodiment are missing. As before paint is

supplied along paint supply line 20, being pressurised by pressurised air supply line 26 when the tool trigger 10 (see Figure 1) is depressed. As before there is a non return valve 28 at the junction of the paint supply line 20 and the pressurised air supply line 26, and there is a paint cut-off valve 32, and a pressure regulating valve 30 either side of the non return valve 28. Paint is fed into the nosepiece 12 of the tool 1' through inlets 36 and via passageways 38 to an annular paint chamber 40'. As in the previous embodiment the annular paint chamber 40' has an annular outlet 42', but in this case the annular outlet 42' faces outwardly towards the rivet end of the nosepiece 12 and not radially inward as in the previous embodiment. The annular outlet 42' opens directly onto, and is in contact with the paint pad 60 which is located at the end of the nosepiece 12.

**[0045]** As in the first embodiment the nosepiece 12 comprises two parts, a main body portion 12" containing the paint supply passageways 38 and a tip portion 12'" containing the paint chamber 40' and the paint pad 60. The two parts 12" and 12'" are held together by screw cap 68 as in the first embodiment. Main body portion 12' of the nosepiece 12 is identical in the first embodiment and the second embodiment. Only the tip portion (12' in the first embodiment, and 12'" in the second embodiment) is different. Therefore the tool can be simply converted between operation according to the first embodiment and operation according to the second embodiment simply interchanging the tip portions 12' and 12'".

**[0046]** The Figure 5 embodiment can be used with the same type of rivet shown in Figure 3. In operation, when the trigger 10 is depressed a pulse of pressurised air from the air inlet passes not only along supply line 23 to set the rivet, as previously described, but also along supply line 26, which communicates with paint supply line 20. Therefore a pulse of pressurised air is supplied to the paint supply line 20 (see Figure 1), each time a rivet is set. Thus each time a rivet is set the porous paint pad 60 is recharged with a small amount of paint ready for application to the next rivet. As the rivet is inserted into the tool 11 the stem 53 of the mandrel passes through the porous paint pad 60 and the flange 52 of the rivet seats on the porous paint pad 60 during which time and with the action of a load being applied axially paint is transferred to the rivet shell flange 52.

**[0047]** As noted above each rivet set charges the porous paint pad 60 ready for application to the next rivet flange. When starting a setting and painting operation, the paint pad 60 must be initially charged with paint for painting the first rivet flange. This is achieved by brief depression of trigger 10 of the tool without the rivet in place.

**[0048]** Figures 6 to 9 show part of a third embodiment of tool according to the invention. Each of these Figures shows a nosepiece 12 attached to the end of the barrel portion 6 of a tool that is otherwise identical to that shown in Figure 1. Unlike in the earlier Figures, in each of Figures 6-9 the paint supply line 20 is shown entering

nosepiece 12 from below, and the air supply line 24 is shown entering the nosepiece 12 from above. Although only one paint line 20 and one air supply line 24 is shown in the Figures, there may be up to six of each of these inlets entering the nosepiece 12.

**[0049]** Referring first to Figure 6, nosepiece 12 comprises two parts, a first main body part 12" and a tip portion 12#' which is itself a screw cap fit over the main body 12" of nosepiece 12. The main body portion 12" of the nose piece 12 contains air inlet 24 which is in communication via passageways 44 with the outward end of the main body portion 12" of the nosepiece 12. The tip portion 12#' of the nosepiece 12 contains the end of paint line 20, and also contains air passageways 84, which are arranged so that at some time they are in communication with the passageways 44 in the main body portion 12" of the nosepiece 12. This is described in more detail below.

**[0050]** Contained within the nosepiece 12 is a spool valve 70. This can move axially relative to the nosepiece 12. It is inserted into the nosepiece prior to screw attachment of the respective parts 12", 12#' of the nosepiece 12. The movable spool valve 70 comprises a seal 74 to seal it to the main portion 12" of the nosepiece 12, and a seal 76 to seal it to tip portion 12#' of the nosepiece 12. The spool valve 70 can move axially relative to the nosepiece 12 in both directions. It moves to the right of the Figures when the rivet is being set (Figure 8), and moves to the left of the Figures under the action of compression spring 78 prior to rivet setting (Figures 6 and 7), and immediately after mandrel breakage during the rivet setting process.

**[0051]** In the position shown in Figures 6 and 7, prior to rivet setting, the movable spool valve 70 is moved to its extreme left position by the compression spring 78. In this position a seal is formed at 80 between a front sloping face of the movable spool 70 and a corresponding inwardly sloping face of the tip portion 12#' of the nosepiece 12. Therefore any paint supplied via paint supply line 20 to the nosepiece, either at atmospheric or higher pressure can not exit the nosepiece, and no paint delivery can be achieved.

**[0052]** Figure 7 is similar to Figure 6, but shows the rivet 50 in place, and the jaws 8 of the tool gripping the mandrel stem 53.

**[0053]** Figure 8 shows the rivet 50 in the process of being set. This is achieved as in the previous embodiments by depression of trigger 10 (Figure 1). As before, trigger depression simultaneously supplies pressurised air to supply line 23 to activate the setting process, and simultaneously to paint supply line 20 (via branch line 26, and directly to air supply line 24 feeding into the nosepiece 12. However, as shown in Figure 8 in the setting process the action of the pulling force on the rivet mandrel stem acts to compress spring 78 so that a rearwardly sloping face of the movable spool 70 seals against a correspondingly sloping face on the main body 12' of the nosepiece 12 providing a seal at a point 82.

This seal 82 effectively blocks communication between the air passageway 44 in the main portion 12" of the nosepiece 12 and the air passageway 84 through the tip portion 12# of the nosepiece 12.

**[0054]** As shown in Figure 8, the movable spool valve 70 is in its extreme right position, and a chamber 86 contained within the end of the tip 12# of the nosepiece 12 in communication with the paint supply line 20 is filled with paint. However since the air supply line 24 is sealed at 82 as explained above there can be no paint spray delivery since there is no communication with the direct air supply line 24, and hence nothing to atomise and spray the delivered paint. Momentarily, paint flows out of the end of the chamber 86 since the paint line 20 will be pressurised until the mandrel 53 breaks and the spool 70 returns to the front. It is at this time when air is admitted to exit 84 and atomises the paint.

**[0055]** As shown in Figure 9, as the rivet sets, and the mandrel stem 53 of the rivet 50 breaks, the force on the compression spring is released and the spring is therefore free to move forward (i.e. to the left of the Figure) opening air passageway 44 to be in communication with the passageway 84, but simultaneously closing paint chamber 86, and blocking further supply of paint. (In the Figure the movable spool 70 is shown immediately prior to its left movement). Thus air is delivered to spray the small amount of paint contained in the chamber 86, and thus a predetermined supply of paint is sprayed onto the rivet shell flange 52. The sprayed paint is referenced 90. Hence this design uses a movable spool to deliver a metered quantity of paint to the rivet shell flange. This is in contrast to the earlier embodiments in which continued depression of trigger 10 would supply paint continually as a spray (embodiment 1) or to charge the paint pad (embodiment 2), and which embodiments depend on the operator to stop trigger depression once the rivet is set in order to control the amount of paint supplied.

## Claims

1. A tool for setting a blind rivet in an aperture in one or more application pieces, the blind rivet comprising a flanged shell, and the tool incorporating means for delivering paint to the flange of the shell during the rivet setting process.
2. A tool according to claim 1, wherein the setting tool comprises a pressurised air inlet port.
3. A tool according to claim 2, wherein the tool comprises a first pressurised air supply line, and pressurised air passes from the said air inlet port along the first pressurised air supply line to activate the rivet setting process.
4. A tool according to claim 2 or 3, wherein the tool comprises a second pressurised air supply line, and pressurised air passes from the said air inlet port along the second pressurised air supply line to the paint delivery means to pressurise delivery of the paint.
5. A tool according to any preceding claim, wherein the paint delivery means comprises a paint supply line.
6. A tool according to claim 5 when dependent on claim 4, wherein the pressurised air passes along the second pressurised air supply line to pressurise the paint supply line.
7. A tool according to any preceding claim, wherein the tool comprises an air inlet port according to claim 2, a first pressurised air supply line according to claim 3 and a second pressurised air line according to claim 4, wherein air passes from the air inlet port simultaneously to the said first and second pressurised air supply lines.
8. A tool according to any preceding claim, comprising a nosepiece for supporting the flange of the rivet shell against the application piece, or one of the application pieces, the nosepiece also comprising at least part of the said paint delivery means.
9. A tool according to any preceding claim, wherein the paint delivery means comprises a paint spray.
10. A tool according to any preceding claim, wherein the tool comprises a paint outlet.
11. A tool according to claim 10, wherein the tool comprises a nosepiece, and wherein the paint outlet is located within the nosepiece.
12. A tool according to claim 11, wherein the paint delivery means comprises a paint chamber, including the said paint outlet, the paint chamber being located within the nosepiece.
13. A tool according to any of claims 10-12, wherein the tool comprises an air inlet port and also a third pressurised air supply line, and pressurised air passes from the said air inlet port along the third pressurised air supply line to a region adjacent the paint outlet.
14. A tool according to claim 13 wherein the tool comprises an air inlet port according to claim 2, a first pressurised air supply line according to claim 3 and a second pressurised air line according to claim 4, wherein pressurised air passes simultaneously from the air inlet port to any combination of the first second and third pressurised air supply lines.

15. A tool according to claim 13 or 14, wherein pressurised air from the third supply line atomises paint at the paint outlet to provide a pulse of paint spray onto the rivet flange at the same time as the rivet setting process. 5
16. A tool according to any of claims 13-15, wherein the tool comprises a nosepiece that comprises an air chamber which is in communication with the third pressurised air supply line. 10
17. A tool according to claim 13, wherein the air chamber is generally cylindrical.
18. A tool according to any of claims 1-8, or 10-12, wherein the paint delivery means comprises a paint pad. 15
19. A tool according to claim 18, wherein the paint delivery means also comprises a paint supply line according to claim 5 and wherein the paint supply line feeds into the paint pad. 20
20. A tool according to claim 18 or 19, wherein the tool comprises a nosepiece according to claim 8 or any claim dependent thereon, wherein the paint pad is contained in the nosepiece. 25
21. A tool according to any of claims 18-20, wherein the paint pad is charged with predetermined amount of paint on rivet setting. 30
22. A tool according to any preceding claim, wherein the tool comprises a nosepiece according to claim 8 or 20 or any claim dependent thereon, whereon the nosepiece comprises a tip portion and a body portion, removably secured to each other 35
23. A tool according to any of claims 1-17 or claim 22, the tool comprising a paint supply line according to claim 5 or any claim dependent thereon, a third pressurised air supply line according to claim 13 or any claim dependent thereon, and a valve movable from a first position in which it closes the third pressurised air supply line and opens the paint supply line to a second position in which it opens the third pressurised air supply line and closes the paint supply line. 40 45
24. A tool according to claim 23, wherein the third pressurised air supply line supplies pressurised air to a region adjacent to the paint outlet. 50
25. A tool according to claim 23 or 24, wherein during the rivet setting process a mandrel of the rivet is pulled through the shell of the rivet by the tool, and this mandrel pulling action also act to move the valve to its said first position. 55
26. A tool according to claim 25, wherein on setting the mandrel of the rivet breaks, and on mandrel breaking a biasing means acts to move the valve to its said second position.
27. A tool according to claim 26, wherein the biasing means is a compression spring.
28. A method comprising setting a flanged blind rivet in an aperture in one or more application pieces and simultaneously painting the flange of the blind rivet.
29. A method according to claim 28, wherein the same tool is used to set the rivet and paint the flange of the rivet.
30. A method according to claim 29, wherein the tool is a tool according to any of claims 1-26.
31. A tool or method substantially as hereinbefore described with reference to the accompanying drawings.





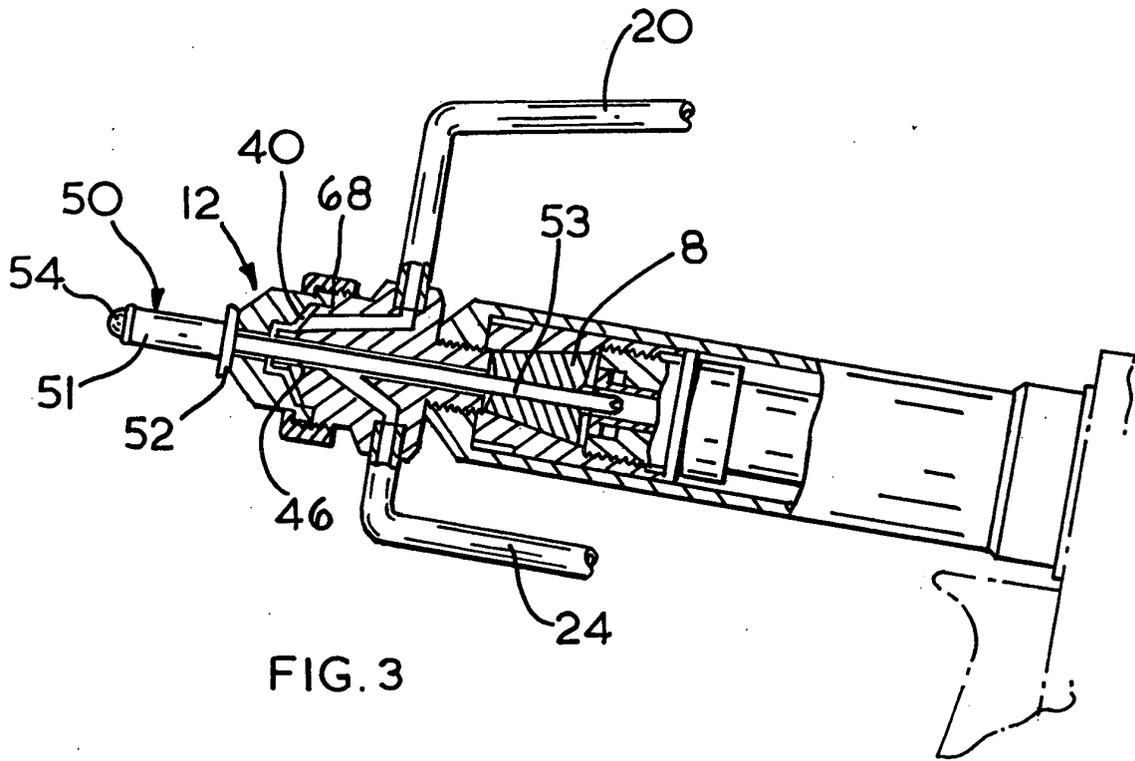


FIG. 3

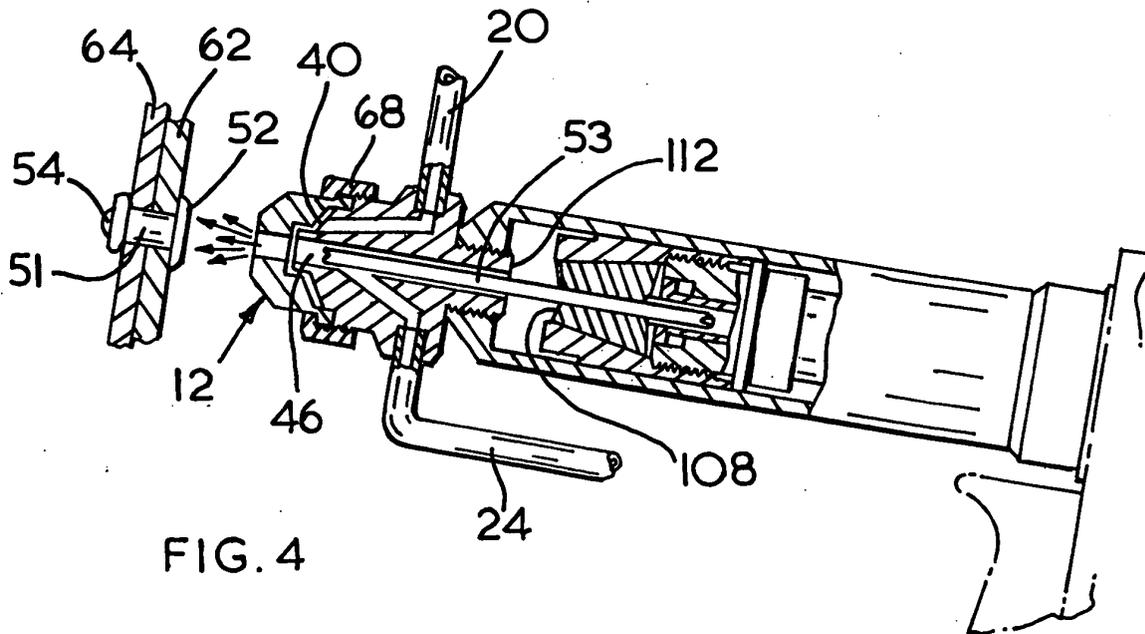


FIG. 4

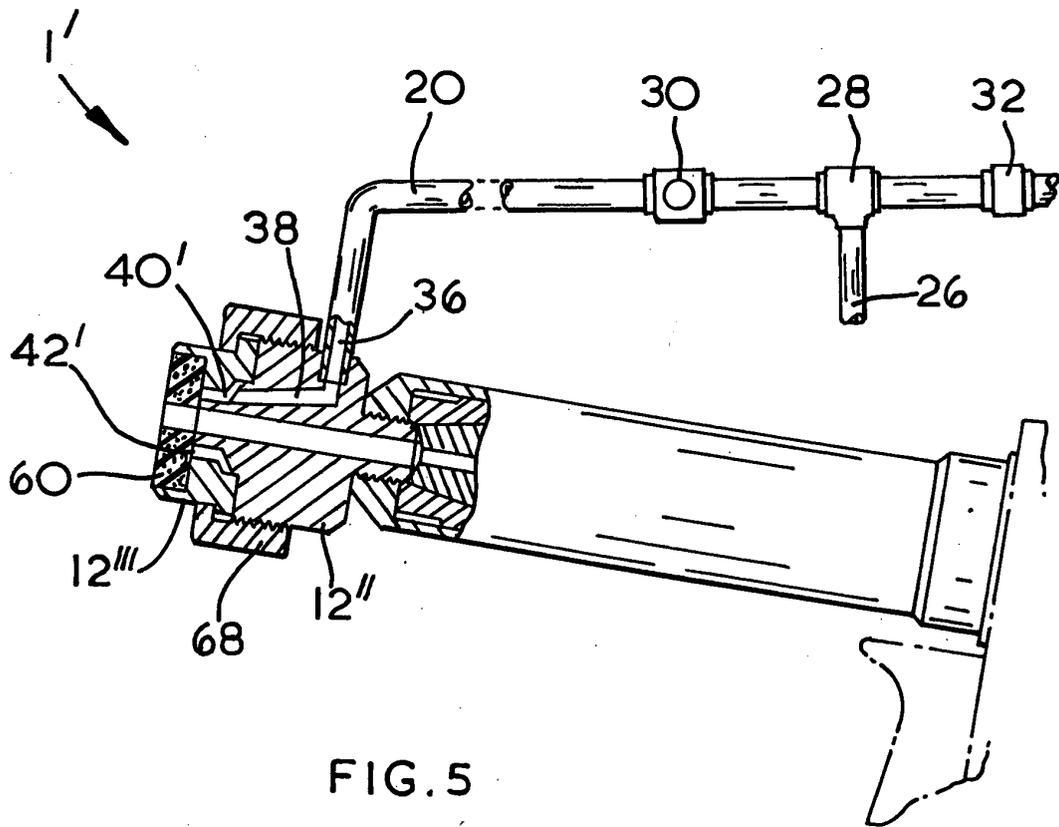


FIG. 5

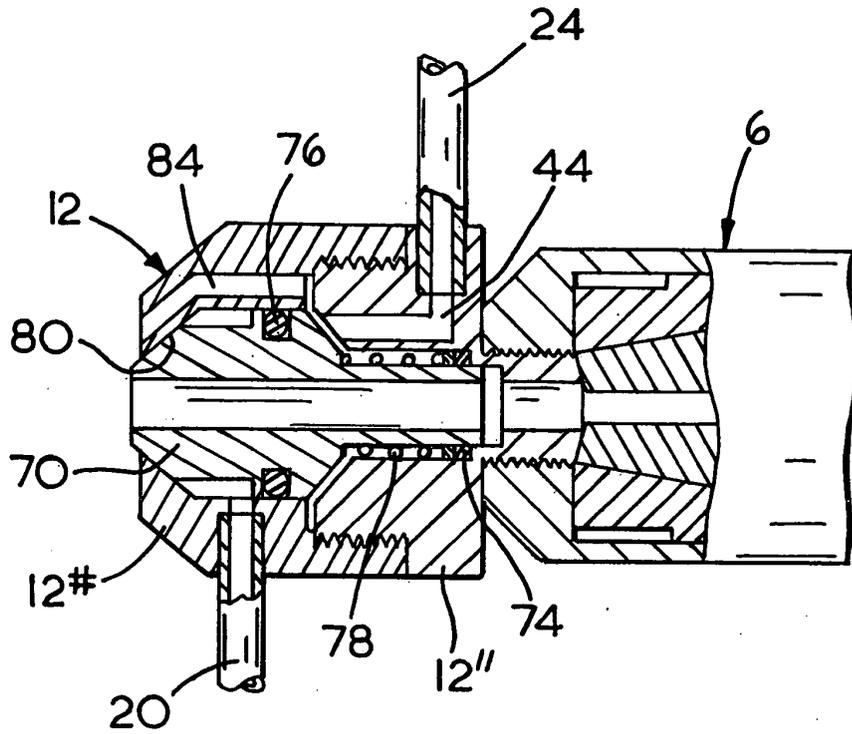


FIG. 6

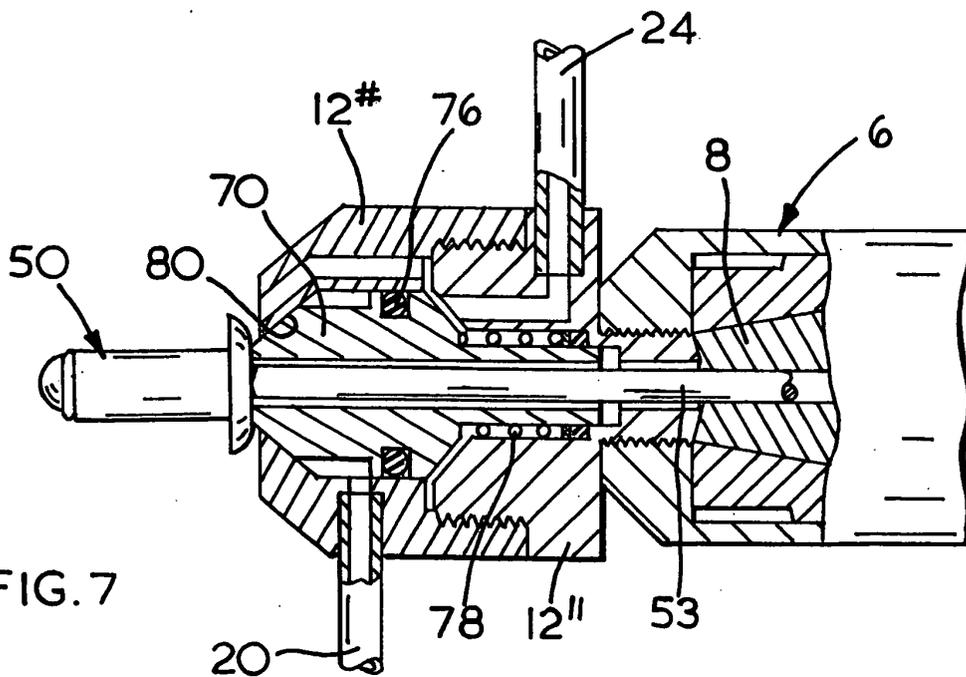


FIG. 7

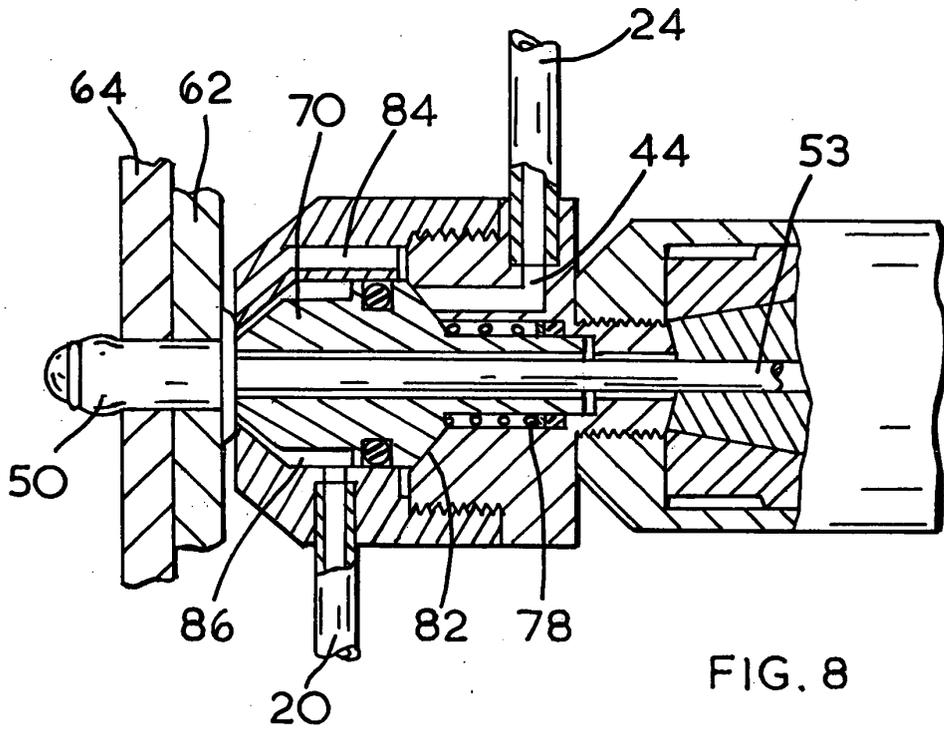


FIG. 8

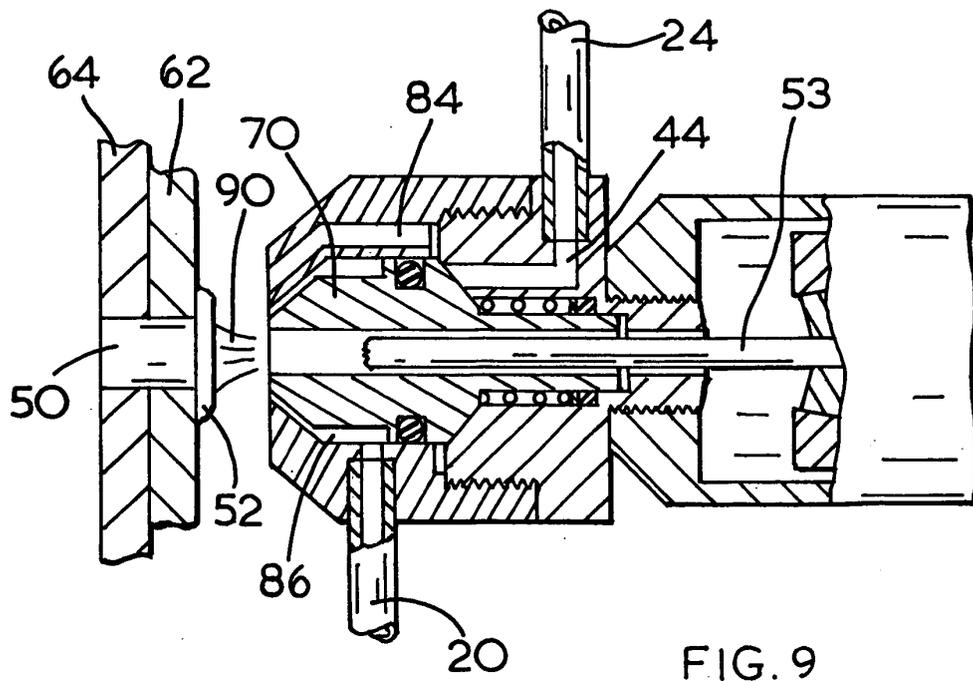


FIG. 9



European Patent  
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EUROPEAN SEARCH REPORT

Application Number  
EP 03 01 0725

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	DE 198 47 738 A (DAIMLER CHRYSLER AG) 24 February 2000 (2000-02-24) * claim 1; figure 1 * ---	1,28	B21J15/10 B05B7/06 B21J15/22 B21J15/04
A	US 6 149 356 A (CHU GEORGE ET AL) 21 November 2000 (2000-11-21) * column 3, line 66 - column 4, line 18; figures 13-19 * ---	1,28	
A	DE 43 20 282 A (DORNIER LUFTFAHRT) 22 December 1994 (1994-12-22) * column 2, line 3-26; figure 1 * -----	1,28	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B21J B05B B05C B25B
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
MUNICH		8 July 2003	Augé, M
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**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 03 01 0725

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
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08-07-2003

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
DE 19847738	A	24-02-2000	DE 19847738 A1	24-02-2000
US 6149356	A	21-11-2000	NONE	
DE 4320282	A	22-12-1994	DE 4320282 A1	22-12-1994

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82