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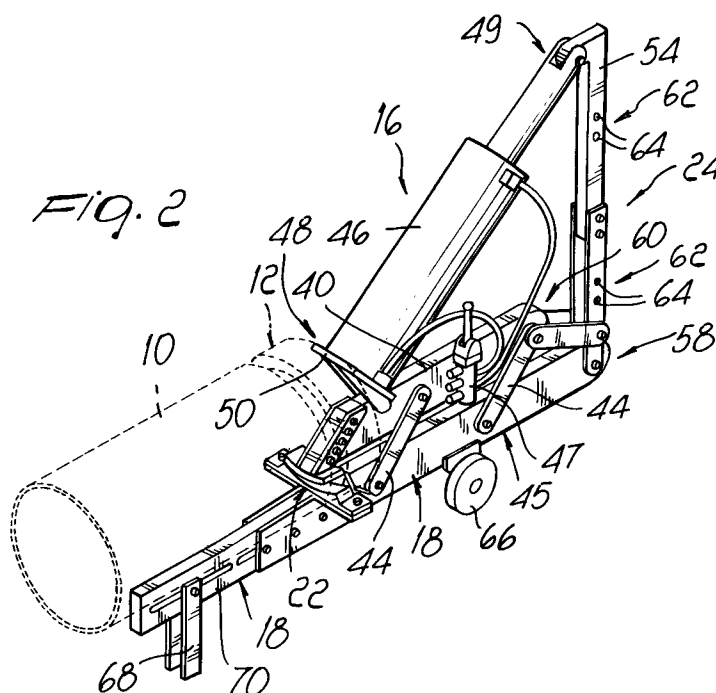
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Modiano, Josif, Pisanty & Staub,
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W-8000 München 5 (DE)(54) **Apparatus and method for repairing containers.**

(57) An apparatus (16) and a method for repairing metal containers (10) which are provided with a cylindrical base portion (12) to support the container (10) in a free-standing position. The apparatus (16)

includes means (20) for securing the container (10) in position while repairing same and vice means (22) which acts on the deformed cylindrical base (12) without the necessity of removing same.

**EP 0 546 478 A1**

FIELD OF THE INVENTION

The present invention relates to the repair of metal containers of the sort having a cylindrical base configured to support the container in a free-standing position on a surface.

BACKGROUND OF THE INVENTION

Containers, such as refillable metal canisters used for containing a fluid, such as liquid petroleum gas, typically have generally cylindrical bodies to which is attached a generally circular base. In some instances, the base has a shallow, cylindrical configuration, one side of the base being integrally formed with, or connected to, the main body of the container, the other side of the base having an annular rim formed therewith. The container is typically constructed so as to be free-standing on the annular rim of the base. The base, together with the generally cylindrical shape of the container, also enable automated handling of the container for purposes of refilling.

It is also usual for manual handling, particularly of a heavy, refillable, gas canister, to involve rolling thereof, via its base rim, on a hard floor surface, between a delivery truck, for example, and a selected installation location. The base is also used for predetermined positioning of the container on a conveyor belt for refilling.

Mechanical integrity of the base of the container is thus of paramount importance in terms of automated handling, including refilling, manual handling, and free-standing installation thereof. Damage to the base, such as may occur by accidental dropping of a container from a truck to a hard pavement surface, for example, may prevent the container being rolled on its base rim, as described above. Free-standing installation of a damaged container may also be problematic, as it may no longer be possible to stand the container on its base. Such damage may further prevent automated handling of the container.

Conventionally, so as to return a container with a damaged base to a usable condition, the base is cut away from the remainder of the container and a new base is welded thereto. In the case of a container for a highly inflammable fluid, such as L.P. gas, the container has to be emptied of its contents, prior to replacement of the damaged base. Subsequent to the repair, the container is refilled.

Described in U.S. Patent No. 4,802,272, entitled PROCESS OF REFURBISHING CONTAINERS, is a method of repairing 55 gallon drums, the bottom of the drum being torched off and a new bottom being welded on.

It will be appreciated by persons skilled in the art that, the above-described method of repairing a container with a damaged base is slow and cumbersome, and thus costly.

The following references are noted as disclosing containers and methods of manufacture thereof, and associated art:

U.S. Patent No. 1,084,115 entitled METHOD FOR MAKING CONTAINERS FOR GAS AND THE LIKE;

U.S. Patent No. 2,175,411 entitled METHOD OF RECONSTRUCTION DRUMS;

U.S. Patent No. 2,408,596 entitled METHOD OF FORMING CYLINDER ENDS;

U.S. Patent No. 2,541,065 entitled HIGH PRESSURE CONTAINER;

U.S. Patent No. 2,280,501 entitled CONTAINER FOR FLUIDS UNDER PRESSURE;

U.S. Patent No. 2,799,318 entitled METHODS AND APPARATUS FOR REMOVING DENTS FROM CONTOURED OBJECTS;

U.S. Patent No. 2,943,386 entitled METHODS OF RECONDITIONING DRUMS;

U.S. Patent No. 3,505,722 entitled RECONDITIONABLE CONTAINER;

U.S. Patent No. 3,771,345 entitled END FORMING STATION FOR METALLIC BODY FORMERS AND THE LIKE;

U.S. Patent No. 3,889,835 entitled ONE-PIECE PRESSURE CONTAINER;

U.S. Patent No. 3,948,073 entitled APPARATUS AND METHOD OF METAL FORMING;

U.S. Patent No. 4,134,354 entitled METHOD OF MAKING A CONTAINER;

U.S. Patent No. 4,320,848 entitled DEEP DRAWN AND IRONED PRESSURE VESSEL HAVING SELECTIVELY CONTROLLED SIDE-WALL THICKNESSES;

U.S. Patent No. 4,372,143 entitled APPARATUS FOR FORMING A DOMED BOTTOM IN A CAN BODY;

U.S. Patent No. 4,493,201 entitled METHOD OF MAKING A METAL BOTTLE FOR EXOTIC GASES UNDER PRESSURE;

U.S. Patent No. 4,541,265 entitled PROCESS FOR FORMING A DEEP DRAWN AND IRONED PRESSURE VESSEL HAVING SELECTIVELY CONTROLLED SIDE-WALL THICKNESSES;

U.S. Patent No. 4,589,270 entitled HYDRAULIC BOTTOM FORMER;

U.S. Patent No. 4,599,886 entitled MANUFACTURE OF METAL CONTAINERS;

U.S. Patent No. 4,609,118 entitled CONVEX TYPE BOTTOM WITH A BEARING RIM FOR BOTTLES FOR INDUSTRIAL GASES OBTAINED BY MEANS OF HOT FORGING FROM A STEEL BILLET;

U.S. Patent No. 4,685,322 entitled METHOD

OF FORMING A DRAWN AND REDRAWN CONTAINER BODY;

U.S. Patent No. 4,723,433 entitled METHOD AND APPARATUS FOR DOMING CAN BOTTOMS;

U.S. Patent No. 4,732,031 entitled METHOD OF FORMING A DEEP-DRAWN AND IRONED CONTAINER;

U.S. Patent No. 4,790,169 entitled APPARATUS FOR DOMING CAN BOTTOMS;

U.S. Patent No. 4,826,382 entitled METHOD AND APPARATUS FOR FORMING CONTAINER WITH PROFILED BOTTOM; and

U.S. Patent No. 4,909,393 entitled CONTAINER RECONFIGURING SYSTEM.

SUMMARY OF THE INVENTION

The present invention seeks to provide apparatus and a method for repairing cylindrical base portions of metal containers, overcoming disadvantages of known art.

An additional aim of the invention is to provide apparatus for repairing L.P. gas containers, constructed to enable repair of the containers by unskilled persons.

It is yet a further aim of the invention to provide apparatus for repairing L.P. gas containers, which may be conveniently operated at a conventional L.P. gas refilling station.

There is provided, therefore, in accordance with the present invention, apparatus for repairing a mechanically deformed cylindrical base of a container, wherein the base has a side wall, including vise apparatus defining vise surfaces having predetermined complimentary configurations; apparatus for positioning the container such that a portion of the deformed side wall of the container base is disposed intermediate the vise surfaces; and apparatus for selectably forcing the vise surfaces together so as to press the portion of the side wall disposed therebetween into a desired configuration.

Additionally in accordance with the invention, and the cylindrical base has a generally rounded side wall portion defining a pair of generally curved, parallel edges, one of the edges being attached to the remainder of the container and another edge having attached thereto a transverse rim portion, the apparatus for forcing includes apparatus for forcing the vise surfaces together includes apparatus for moving the vise surfaces together in a direction transverse to both the side wall portion and the transverse rim portion, typically at about 45° thereto, so as to force both the side wall portion and the transverse rim portion into a desired configuration.

Further in accordance with the invention, the vise apparatus includes a first vise portion rigidly mounted onto a base; and a second movable vise

portion, mounted onto the apparatus for forcing, the apparatus for forcing being operative, in a first mode, to move the second member into pressing engagement with the first vise portion, and being further operative, in the second mode, to move the second vise portion out of engagement with the first vise portion.

Additionally in accordance with the invention, the apparatus for forcing includes apparatus for rigidly mounting the second vise portion; force generation apparatus; and force transmission apparatus, including a plurality of rigid, hinged together members, for transmitting a force generated by the force generation apparatus to the apparatus for rigidly mounting, thereby transmitting the force to the second vise portion.

Further in accordance with the invention, the force generation apparatus includes apparatus for generating a force of a first magnitude, and the force transmission apparatus includes force magnification apparatus for increasing the force provided by the force generation apparatus from the first magnitude to a second magnitude greater than the first magnitude by a known multiplication factor.

In accordance with a further embodiment of the invention, there is also provided a method of repairing a mechanically deformed cylindrical base, having side wall and rim portions, of a container including the steps of positioning the container such that a portion of the base of the container is disposed intermediate a pair of vise portions having respective vise surfaces having complimentary predetermined configurations; and forcing the pair of vise portions together so as to press the portion of the base disposed therebetween into a desired configuration.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated more fully from the following detailed description, taken in conjunction with the drawings, in which:

Figs. 1A and 1B are isometric views of containers having respective damaged and repaired cylindrical base portions;

Fig. 2 is an isometric view of apparatus for repairing damaged container bases in accordance with the present invention;

Fig. 3 is a schematic side view illustration of the apparatus of Fig. 2 in use;

Fig. 4A is an enlarged side sectional view of the complimentary vise portions of the apparatus of Figs. 2 and 3 in a closed position; and

Fig. 4B is an enlarged sectional view of the vise portions illustrated in Fig. 4A, perpendicular to the view illustrated in Fig. 4A and taken along line 4B-4B therein.

DETAILED DESCRIPTION OF THE INVENTION

Referring to Figs. 1A and 1B, there are illustrated isometric views of a portion of a metal container, referenced 10, having a cylindrical base 12 consisting of a cylindrical side wall 13 and an annular rim 14, arranged typically at right angles to each other. The base 12, in general, and the rim 14, in particular, are used for supporting the container 10 in a free-standing upright position on a hard floor surface (not shown). Container 10 may be any type of refillable metal container used for free standing storage of fluids, although a particular use may be the storage of fluids such as L.P. gas, for example.

As described in the Background Of The Invention, the mechanical integrity of the base 12 is of paramount importance both in handling container 10, during refilling and distribution thereof, and in enabling safe free-standing of the container at an installation location.

In Fig. 1A, the base 12 of the illustrated container 10 is damaged and the container is thus not usable without replacement or repair of the base 12, so as to provide an undamaged base as illustrated in Fig. 1B. Conventionally, the base of the container may be torched off and replaced with a new base. This procedure is costly and requires prior emptying of the container, and it would thus be preferable to effect an inexpensive repair to the base while it is still attached to the container.

Referring now to Figs. 2 and 3, there is provided apparatus, referenced generally 16, for repairing a base portion of a container such as illustrated in Fig. 1A, constructed and operative in accordance with a preferred embodiment of the invention. Apparatus 16 is constructed so as to enable rapid, easy and safe repair of the base of a refillable metal container, of the variety described above in conjunction with Figs. 1A and 1B, while the base is still attached to the remainder of the container and without requiring prior emptying thereof, in accordance with a method of the invention.

Apparatus 16 includes a chassis 18 which defines a container support portion, referenced generally 20, vise apparatus 22 (also illustrated in Figs. 4A and 4B), for engaging and imparting a predetermined configuration to a damaged container base, and apparatus 24, mounted on to a base portion of chassis 18, for operating the vise apparatus 22.

The vise apparatus 22 typically includes first and second vise portions, respectively referenced 26 and 28, having respective opposing surfaces having complimentary configurations which, when apparatus 24 is operated, are forced together, preferably at an angle of about 45°, thereby pressing a portion of a damaged container base located be-

tween the vise portions, into a predetermined configuration.

As shown in Figs. 1A and 1B, the side wall 13 of base 12 of the container 10 defines a pair of generally curved, parallel edges, respectively referenced 30 and 32. Edge 30 being attached to the main portion of the container and edge 32 having attached thereto, typically at right angles, annular rim 14.

With reference once again to Fig. 3, first vise portion 26 is mounted onto chassis 18 in a predetermined, fixed position, and as illustrated also in Fig. 4A, includes a primary, vise member 27, and a transverse, generally upright secondary vise member 34 mounted so as to abut primary vise member 27, thereby serving as a stop for annular rim 14 when container 10 is positioned on support portion 20 of chassis 18.

As illustrated particularly in Fig. 4A, primary vise member 27 defines a first support surface 36', which, in the present example, has a generally convex configuration, as shown in Fig. 4B. Secondary vise member 34 defines a second support surface 38' which, in the present example, is a generally planar surface abutting and perpendicular to first support surface 36'. First and second support surfaces 36' and 38' are arranged to respectively support portions of the side wall and of the annular rim of the container base.

Further according to the present embodiment, second vise portion 28 defines a first pressing surface 36'', which, in the present example, has a generally concave configuration, as shown in Fig. 4B, of a radius similar to that of first support surface 36'. Second vise portion 28 further defines a second pressing surface 38'' (Fig. 4A) which, in the present example, is a generally planar surface abutting and perpendicular to first pressing surface 36''.

As illustrated in Figs. 3 - 4B, the respective first and second pressing surfaces 36'' and 38'' have an overall configuration complimentary to the overall configuration of first and second support surfaces 36' and 38', and are arranged to engage intervening portions of the side wall and of the annular rim of the container base when apparatus 24 (Figs. 2 and 3) is operated, as described below.

Referring now to Figs. 2 and 3, apparatus 24 includes a rigid beam 40 having an end portion 42 (Fig. 3) for rigidly mounting second vise portion 28; a plurality of parallel, transverse link members 44 for mounting beam 40 onto a rear portion 45 of chassis 18; force generation apparatus 46 mounted, at a first end 48, onto a support flange 50 hingedly connected at location 52 (Fig. 3) to rigid beam 40, and further hingedly connected, via a second end 49, a rear member 54 and an additional link member 56, to a rear end 58 of chassis

18 and to a rear portion 60 of rigid beam 40. Force generation apparatus 46 is any suitable e.g. hydraulic or pneumatic actuation means, capable of generating a force of the magnitude described below.

In a preferred embodiment of the invention, force generation apparatus is pneumatic actuation means such as may be operated, via valve apparatus 47, by any suitable standard compressor.

As illustrated in Fig. 3, operation of force generation apparatus 46 is operative, in a first mode of operation, to move second vise portion 28 toward first vise portion 26, at an angle of, for example, 45°, with respect to surfaces 36' and 38', from an open position (shown in solid outline) to a closed position (shown in broken outline), and, in a second mode of operation, to move second vise portion 28 away from first vise portion 26, thereby opening vise apparatus 22. The general directions of movement of second vise portion 28 relative to first vise portion 26 are indicated in Figs. 3 and 4A by arrows 29 and 31.

It will be appreciated that the force required to repair the side wall and rim of a container base by pressing them between the vise portions will vary according to the shape of the container base, the amount of damage to the base, the precise material from which the base is made, and the wall thickness of the base. In order to cover a range of different types of container base, a typical pressing force provided by apparatus 16 via second vise portion 28 is in the exemplary range 10 - 15 tons.

Accordingly, rear member 54 of apparatus 24 acts as a lever arm, such that it serves not simply to transmit a force applied thereto via second end 49 of the force generation apparatus 46 but, also, to multiply the force provided by generation apparatus 46 by a known factor. Therefore, depending on the precise length of rear member 54, a force of approximately 20 tons can be applied via second vise portion 28 by generation of a much smaller force, such as corresponds to a pressure of about 8 atmospheres.

As illustrated in Figs. 2 and 3, rear member 54 is made of a number of rigid sections 62, attached via bolted connections. A plurality of additional bolt holes 64 are provided in sections 62 so as to enable adjustment of the length of rear member 54, and, consequently, adjustment of the factor by which the force applied to rear member 54 by force generation apparatus 46 is to be increased.

According to a preferred embodiment of the invention, apparatus 16 is made for travel along a floor surface, so as to be easily movable from one location to another. Accordingly, chassis 18 is mounted onto wheels or rollers 66 (only one of which is seen in Figs. 2 and 3), there also being provided a support leg 68 in association with sup-

port portion 20 of the chassis 18, thereby permitting a stable, and generally horizontal positioning of apparatus 16 at a selected location.

So as to facilitate travel of apparatus 16 from one location to another more easily, and so as also to facilitate the stable positioning of a container on support portion 20, support portion 20 typically includes a telescopically adjustable support member 70, whose position relative to the remainder of chassis 18 may be locked by tightening of bolts 72.

In summary, therefore, repair of a container having a base such as described above in conjunction with Fig. 1A, may be carried out, by use of apparatus 16 of the present invention, as follows:

Initially, apparatus 24 is operated so as to open vise apparatus 22 so as to permit positioning of a container having a damaged base on support portion 20 and such that rim 14 of the container base abuts second support surface 38', ensuring that at least a portion of the deformed cylindrical base of the container is disposed intermediate vise portions 26 and 28.

Subsequently, apparatus 24 is operated in a first mode so as to force second vise portion 28 toward first vise portion 26, in the direction indicated by arrow 29 (Figs. 3 and 4A) so as to press both the respective portions of the side wall 13 and of the annular rim 14 disposed between the vise portions, into a desired configuration. Thereafter, apparatus 24 is operated in a second mode, to move second vise portion 28 away from first vise portion 26, in a direction indicated by arrow 31 (Figs. 3 and 4A) thereby permitting removal of the repaired container from apparatus 16.

If a larger portion of the container base than that which can be accommodated between vise portions 26 and 28 is damaged, the container can be rotated so as to position a further damaged portion of the base between the vise portions, and the above-described process is repeated.

It will be appreciated that the above-described repair process by use of the apparatus 10 of the invention does not require the use of skilled labor.

It will also be appreciated by persons skilled in the art that, the present invention is not limited to what has been described hereinabove, by way of example. The scope of the invention is limited, rather, solely by the claims, which follow:

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. Apparatus for repairing a mechanically deformed cylindrical base of a container, wherein the base has at least a side wall, comprising:
 - vise means defining vise surfaces having predetermined complimentary configurations; 5
 - means, associated with said vise means, for positioning the container such that at least a portion of side wall of the deformed cylindrical base of the container is disposed intermediate said vise surfaces; and 10
 - means for selectably forcing said vise surfaces together so as to press the portion of the side wall disposed therebetween into a desired configuration. 15
2. Apparatus according to claim 1, and wherein the base has a generally rounded side wall portion defining a pair of generally curved, parallel edges, one of the edges being attached to the remainder of the container and another edge having attached thereto a transverse rim portion, and wherein said means for forcing comprises means for forcing said vise surfaces together comprises means for moving said vise surfaces together in a direction transverse to both the side wall portion and the transverse rim portion, so as to force both the side wall portion and the transverse rim portion into a desired configuration. 20 25 30
3. Apparatus according to claim 2, and wherein said means for forcing said vise surfaces together comprises means for forcing said vise surfaces together at an angle of approximately 45° relative to said vise surfaces. 35
4. Apparatus according to any of claims 1 - 3, and wherein said means for positioning comprises container support means positioned adjacent to said means for forcing. 40
5. Apparatus according to claim 4, and wherein said means for supporting includes base means, and said vise means comprises:
 - a first vise portion rigidly mounted onto said base means; and 45
 - a second, movable vise portion, mounted onto said means for forcing, said means for forcing being operative, in a first mode, to move said second member into pressing engagement with said first vise portion, and being further operative, in said second mode, to move said second vise portion out of engagement with said first vise portion. 50 55
6. Apparatus according to claim 5, and wherein said means for forcing comprises:
 - means for rigidly mounting said second vise portion; 5
 - force generation means; and
 - force transmission means, including a plurality of rigid, hinged together members, for transmitting a force generated by said force generation means to said means for rigidly mounting, thereby transmitting the force to said second vise portion.
7. Apparatus according to claim 6, and wherein said force generation means comprises means for generating a force of a first magnitude, and said force transmission means comprised force magnification means for increasing the force provided by said force generation means from said first magnitude to a second magnitude greater than said first magnitude by a known multiplication factor.
8. Apparatus according to claim 7, and wherein said plurality of hinged together members comprises a plurality of hinged links which may be selectably connected together so as to adjust said multiplication factor to a preselected multiplication factor.
9. Apparatus according to any of claims 6 - 8, and wherein said force generation means comprises pneumatic means.
10. Apparatus according to any of claims 6 - 8, and wherein said force generation means comprises hydraulic means.
11. Apparatus according to any of the preceding claims, and also comprising a chassis for supporting said vise means, said means for positioning, and said means for selectably forcing.
12. Apparatus according to claim 11, and when said chassis includes wheeled means for enabling selectable movement of said apparatus along a travel surface.
13. A method of repairing a mechanically deformed cylindrical base of a container, wherein the base has at least a side wall, comprising the following steps:
 - positioning the container such that at least a portion of the side wall of the deformed cylindrical base of the container is disposed intermediate a pair of vise portions having respective vise surfaces having complimentary predetermined configurations; and
 - forcing the pair of vise portions together so

as to press the portion of the cylindrical side wall disposed therebetween into a desired configuration.

14. A method according to claim 13, and wherein the container base has a generally rounded side wall portion defining a pair of generally curved, parallel edges, one of the edges being attached to the remainder of the container and another edge having attached thereto a transverse rim portion, and wherein said step of forcing the pair of vise portions comprises moving the vise portions together in a direction transverse to both the side wall portion and the transverse rim portion, so as to force both the side wall portion and the transverse rim portion into a desired configuration.

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15. A method according to claim 14, and wherein said step of forcing the pair of vise portions together comprises the step of forcing the pair of pair vise portions together at an angle of approximately 45° relative to the vise surfaces.

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16. A method according to any of claims 13 - 15, and wherein one of the vise portions is in a stationary position and said step of forcing comprises the steps of:

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 - generating a force; and
 - transmitting the force to other of the vise portions, thereby causing movement thereof relative to the stationary vise portion.

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17. A method according to claim 16, and wherein said step of generating a force comprises the step of generating a force of a first magnitude, and said step of transmitting the force comprises the step of increasing the force from said first magnitude to a second magnitude greater than said first magnitude by a known multiplication factor.

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18. Apparatus substantially as illustrated and described hereinabove.

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19. Apparatus substantially as illustrated in any of the drawings.
20. A method substantially as illustrated and described hereinabove.

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21. A method substantially as illustrated in any of the drawings.

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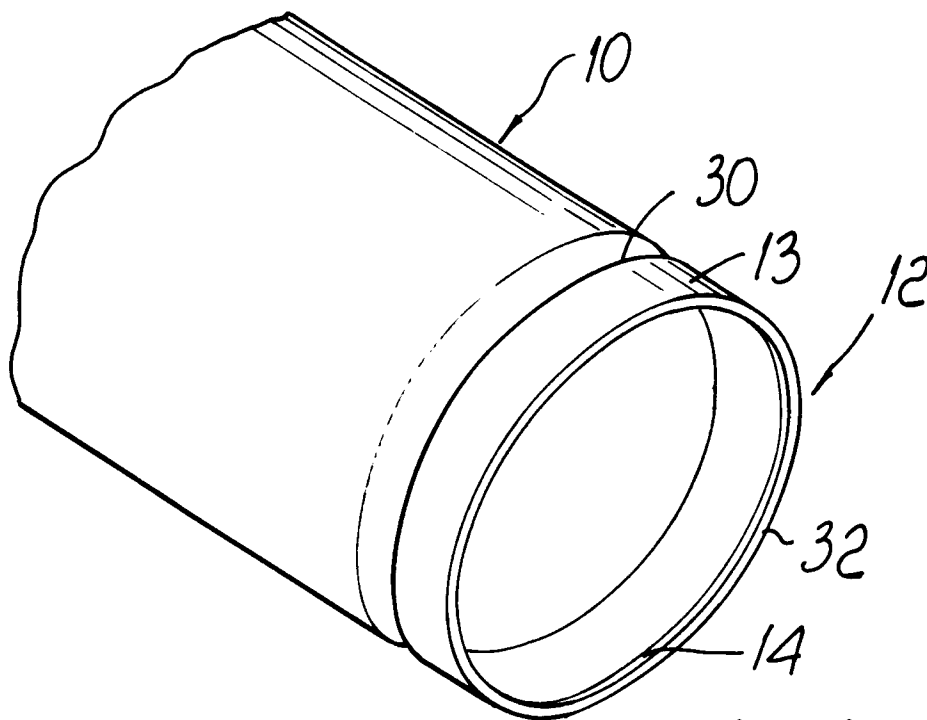


FIG. 1B

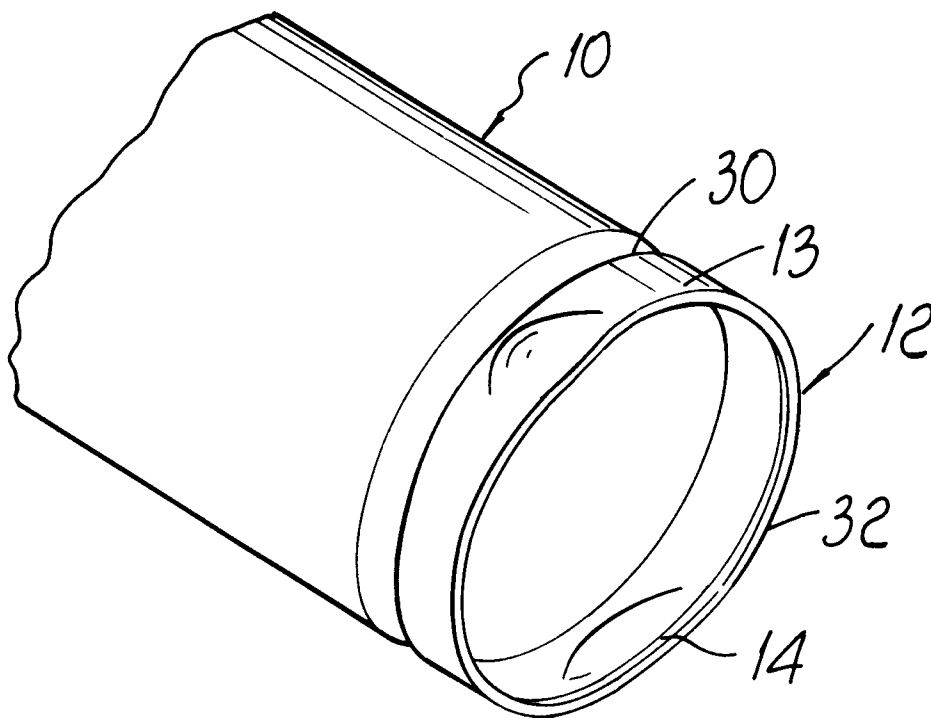
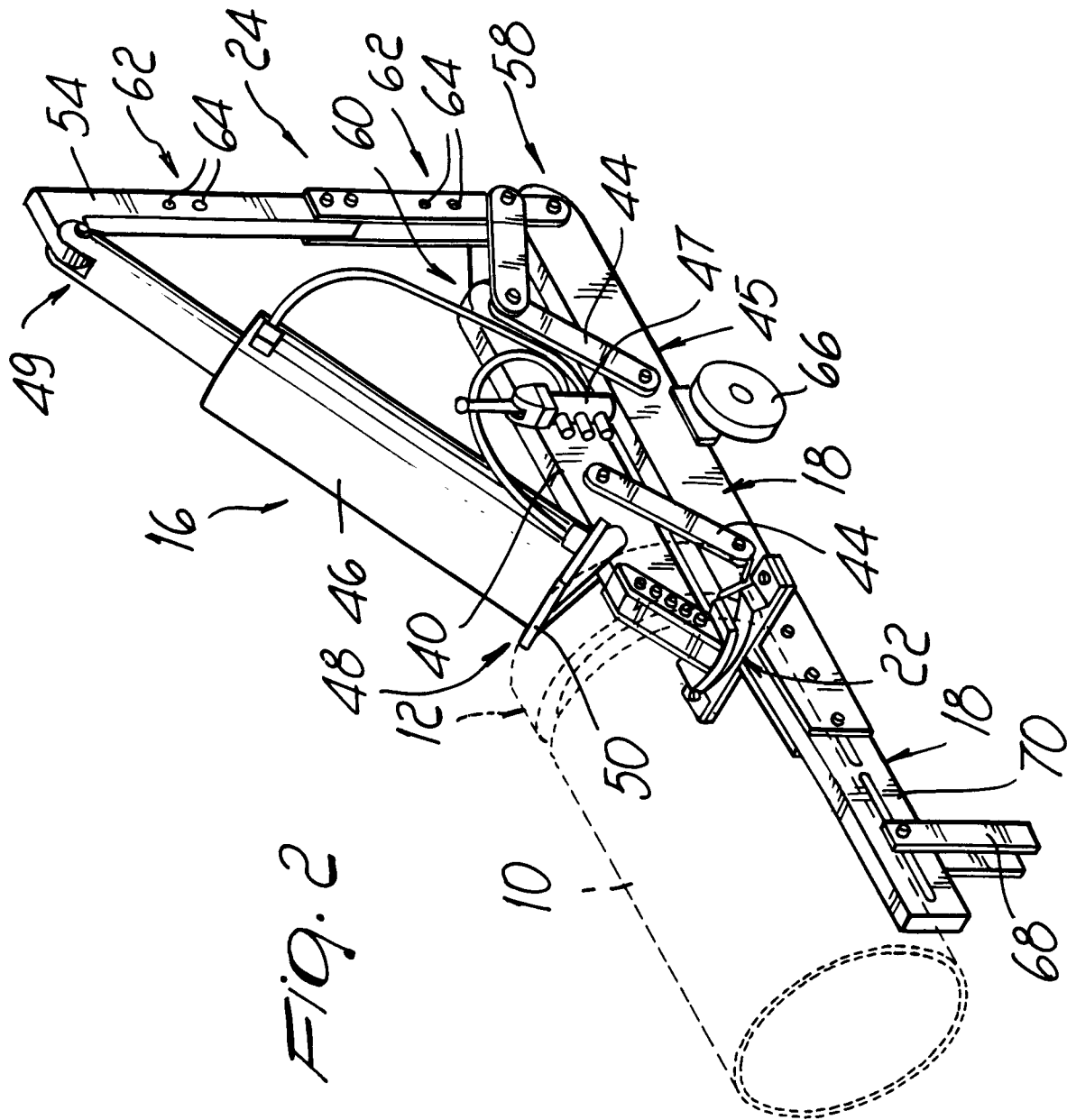
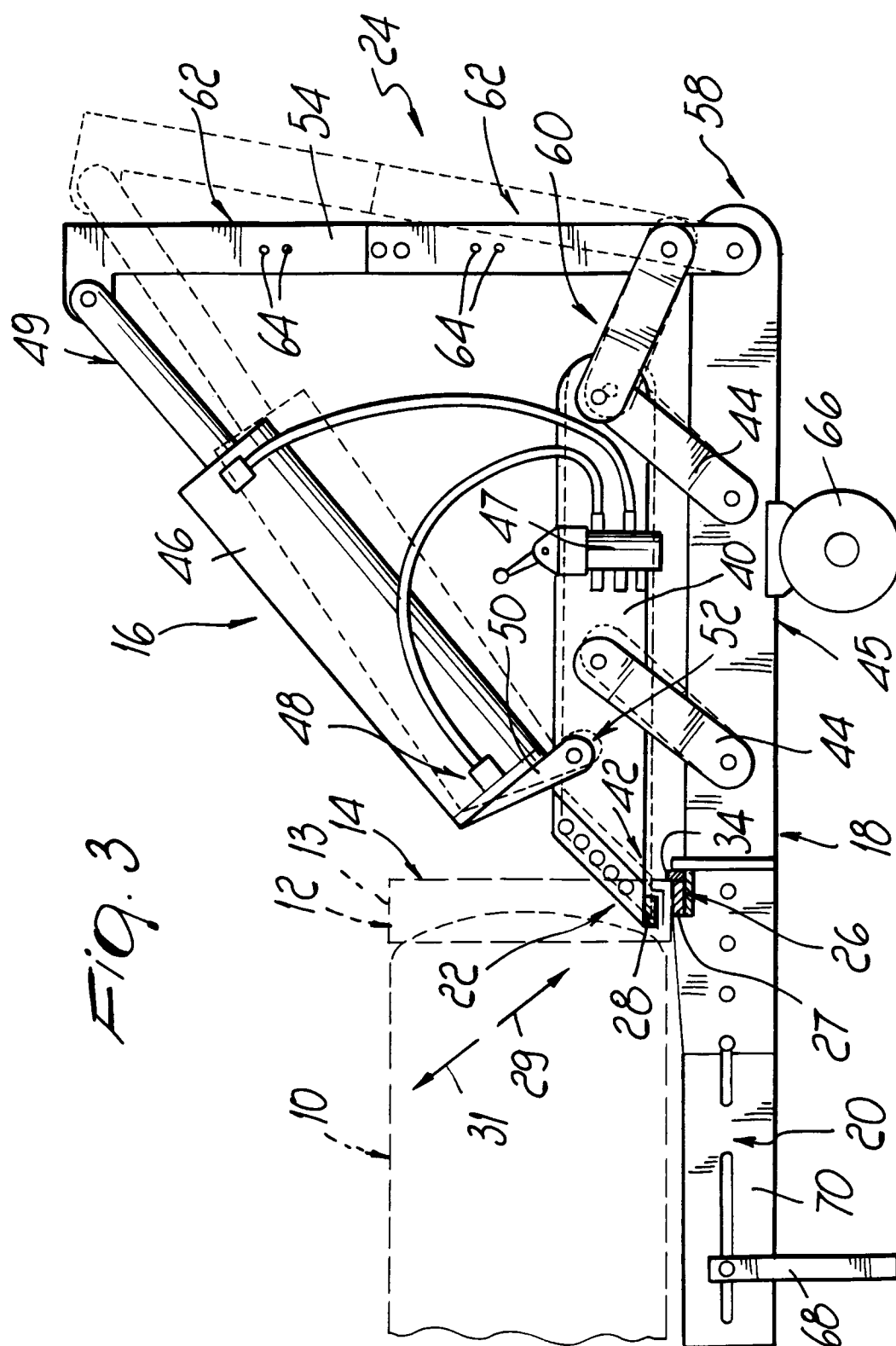
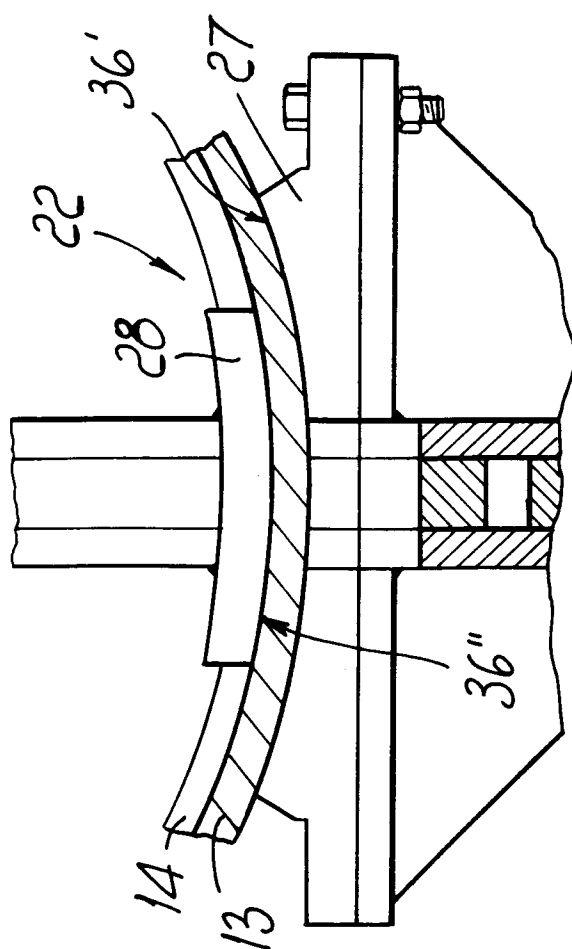
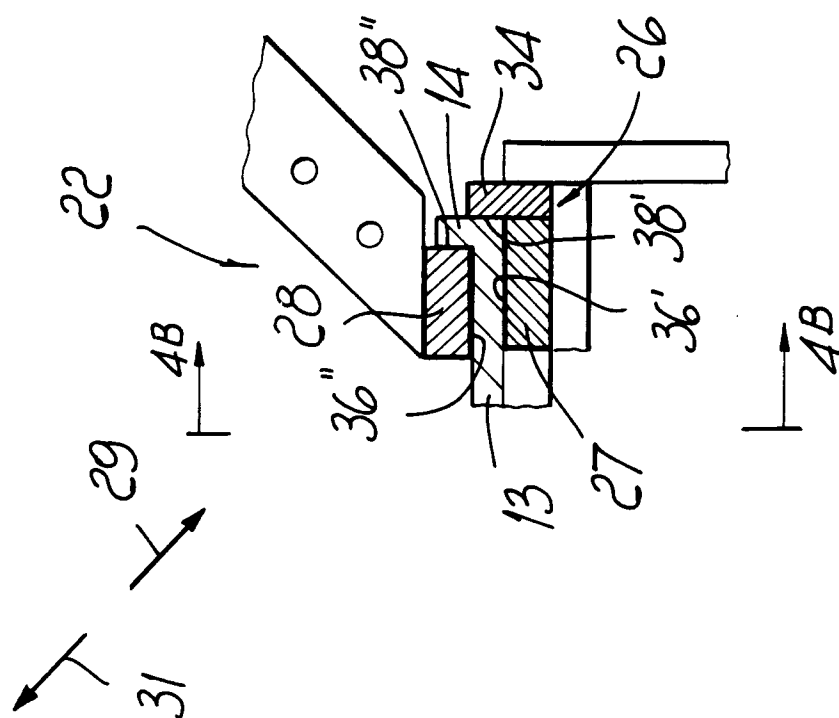


FIG. 1A









European Patent
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EUROPEAN SEARCH REPORT

Application Number

EP 92 12 0749

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.5)
X	EP-A-0 377 219 (DTM DRUCKLUFTTECHNIK) * figures 1,6 *	1-21	B21D1/08
A	EP-A-0 119 141 (JACQUES MAXEL)		
A	FR-A-1 600 724 (MENDÈS)		
A	GB-A-535 304 (WALDE)		
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B21D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 16 MARCH 1993	Examiner RIS M.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			