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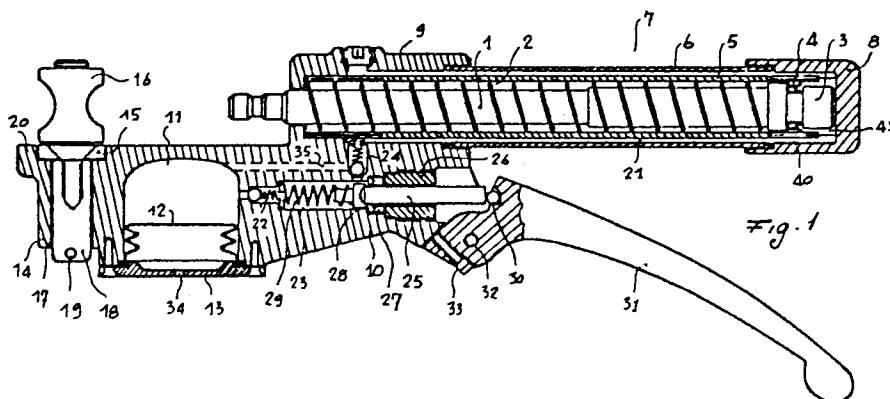
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I-20129 Milano(IT)(54) **Hydraulic transmission tube bending device that can be operated with a single hand.**

(57) Hand operable hydraulic transmission tube bending device whose matrix-die holding bar (1) is moved by a fluid (oil) through a hydraulic pump. The reservoir (11) of the fluid is formed directly in the arm (14), on which the support (15) of counterdies - (16) is installed, one of the walls of said reservoir being sealingly deformable. The pump, the conduits, the reservoir and the chamber in which the matrix-die holding bar slides form a closed circuit, the fluid arriving from the pump to the head (3) of the matrix-die holding bar through a conduit that is formed in the fixed part of the handle and which builds up the outer part of the handle (7) and is concentric with the cylinder (5) in which said bar slides.



Hydraulic transmission tube bending device that can be operated with a single hand

In the specific field of tube bending systems, devices are known that can be manually operated with anchoring to holders, such as stands, clamps and similar support points.

Tube bending devices are known as well that have more moderate dimensions, can be operated with a single hand, which are used in special cases, as it is common knowledge among the users, for example to bend tubes on place during their installation.

Both the anchorable-type devices and the portable-type devices that can be operated with a single hand can, generally speaking, be of two kinds, that is those driven by a mechanical transmission and those having a hydraulic transmission.

The present invention refers to the tube bending devices that can be operated with a single hand and having a hydraulic transmission.

The presently known equipment of the aforementioned kind have actually considerable drawbacks, essentially resulting from the fact that they are conceived as a simple lower-size model of equipment that can be used with a fixed point of support.

For instance, the known devices are heavy and require a considerable physical strength for their operation, the almost continuous use of same thus becoming very fatiguing; they are cumbersome, thereby making their use difficult and sometimes even impossible; they are not easily grasped and their training causes problems, especially in particular rooms and conditions, as is common knowledge among the specific operators, and, last but not least, to realize them a complicated manufacture is required, which is therefore expensive both from the point of view of building and from the point of view of maintenance.

Moreover, the dimensions being equal, they do not permit to bend tubes having a certain resistance, like rubber-lined steel tubes.

Finally, they are conceived in such a way that they do not allow to speed up work beyond a certain limit.

It is the object of the present invention to strongly reduce the aforementioned drawbacks, thus providing a device that satisfies the needs.

To better explain it, the invention is illustrated in the accompanying drawing, in which:

Fig. 1 shows a lengthwise sectional view of an embodiment displaying the various items;

Fig. 2 is a detail view of the discharge system, or, more precisely, the oil back-flow system.

In Fig. 1 reference numeral 1 denotes a matrix-die holding bar; 2 a return item, like a spring; 3 the inner head of bar 1, which is provided with a

sealing gasket 4 and can slide within cylinder 5. Still in Fig. 1 reference numeral 6 denotes the outer body of the handle 7, which comprises a tubular item concentric with 5 and having its two ends firmly connected with sleeve 8 and body 9 of the device, which body is manufactured as a unit construction with the remaining lower part, which is generally denoted by 10.

Reference numeral 11 denotes a cavity obtained in the lower part of the body 10 and forming an oil reservoir; 12 denotes an elastic bellows type membrane, for example a rubber membrane or a membrane made of plastics or other suitable material, which is sealingly locked in its position by means of the rigid washer 13.

Reference numeral 14 denotes the support, also obtained in the lower part of reference 10, of item 15 which holds the counterdies 16, said support being provided with a hole 17, a perpendicular hole, in which the cylindrical shank 18 of item 15 is nested, said shank being provided with stop 19, like a movable ball inserted with a spring, which prevents the shank 18 from being unintentionally removed, and consequently item 15, which item 15 remains therefore in place, its rotation being moreover prevented by shoulder 20 and respective counter shoulder. With such a lay-out, changing the die-holding assembly with another one suited to new needs is very simplified and easy.

Reference numeral 21 denotes a gap between items 5 and 6 which is provided to let the fluid (oil) flow in both directions, that is in the working stroke of the device, when bar 1 is moved forward, and in the release stroke, when the oil flows back thus allowing the withdrawal of bar 1 under the action of spring 2 after the work has been completed.

Reference numeral 22 denotes a check valve, for example of the ball type, that allows oil to flow from reservoir 11 to chamber 23 whilst 24 denotes a second check valve, which also consists in a ball that is pressed against a sealing seat by a spring and allows oil to flow from said chamber 23 to the gap chamber 21. Said gap 21 is hydraulically connected with valve chamber of valve 24 and, by means of passage ways 40, with the chamber 43, said passage ways 40 being made in lengthwise direction within the blind-bottom sleeve 8 in correspondence with the threaded part of cylinder 5 on which the sleeve is screwed.

Reference numeral 25 denotes a plunger that can freely slide axially within a cylindrical guiding bush 26 which has on its end facing chamber 23, an annular gasket 27 that seals plunger 25.

In a pendant seat 28 formed in the head of plunger 25 a dolly spring 29 is engaged which is

compression-loaded to allow afterwards the return, said spring finding reaction on an abutment formed at the end of chamber 23.

Reference numeral 30 denotes a ball that is interposed between the head of the plunger 25 and the lever arm 31, said lever arm having its fulcrum on pivot 32.

Reference numeral 33 denotes a stopping screw that is threaded on the body of lever 31 and abuts on the pump body 10 with its head, said spring being provided for the purpose of presetting the useful stroke of the lever 31.

Reference numeral 34 denotes a vent hole and 35 denotes a pipe to the oil reservoir 11, through said pipe 35 said oil being discharged on back-flow.

Of said pipe 35 it is well visible in Fig. 2 the arrangement of mouth 42 with reference to the axes of chamber 23 and of item 5, ball 41 keeping the passage way 36, connecting chamber 21 with pipe 35, closed.

Said passage orifice 36 is closed by a cock 37 that comprises an outer handwheel 38, which can be operated by hand, with threaded rod 39 the smaller head of which sealingly presses ball 41 against the corresponding orifice of conduit 36 by sliding coaxially with same when the handwheel 38 is turned and lets on the contrary the orifice of passage way 36 free when the handwheel 38 is turned in the opposite direction.

The working mode is as follows.

The device is grasped with a single hand holding it on the cylindrical body 7 and the lever 31.

By previously calibrating the position of the stopping screw 33 it is possible to adjust and secure the position of lever 31 relative to the fixed part 7 of the handle thereby adapting it to the dimensions of the hand that operates it.

When the operator pulls the lever 31 towards 7, plunger 25, onto which acts the annular sealing gasket 27, is pushed and slides within the cylinder 23, and said chamber being filled with oil the penetration of said plunger inside said chamber causes the delivery valve to be opened and a quantity of oil equal to the volume of the part of the plunger that has penetrated into the cylinder to pass in gap 21.

Indeed said oil finds the stopcock 37 closed and is therefore constrained to enter the gap 21 and then the chamber 43 where it acts upon the head of piston 3, which has a larger diameter than plunger 25, causing it to move forward against the resistance of spring 2, and the matrix-die holding bar 1 to move forward with it for a first stretch.

Next the operator releases the lever 31 thus causing plunger 25 to be brought back to its initial position by the thrust of spring 29, that had been loaded during the previous delivery phase, and,

due, to the difference of applied pressure, the return valve 24 is closed whilst valve 22 is opened, thus allowing the oil to flow from reservoir 11 to cylinder 23. The lowered volume of oil inside the reservoir 11 is compensated by the deformation of membrane 12 on the outer surface of which the atmosphere pressure acts through hole 34.

Chamber 23 is then filled with new oil, thereby restoring the original conditions for a new pumping cycle.

Every pumping cycle causes then the bar 1 to move forward on which there is installed a matrix-die the dimensions of which are suitable for the tube to be bent; thus the matrix-die approaches step by step the corresponding counter-dies 16 and causes the interposed tube to be progressively bent.

For bar 1 to be retracted it will be enough to open the cock 37 that opens the hydraulic connection between chamber 43 and return pipe 35 through gap 21.

The counteracting force of spring 2 causes bar 1 to automatically move back into item 5 while pushing the oil from chamber 43 to the reservoir, and in the meantime membrane 12 is deformed and will assume the maximum capacity position when all oil will have flowed back into the reservoir.

The invention attains all the intended objects and allows moreover, the total length being equal, to realize larger radius bendings because the working stroke that the matrix-die holding bar 1 permits is much longer; such an advantage is rather remarkable too because it permits to attain in a substantial way larger radii than can be attained by means of the presently known tube bending devices of the type under discussion.

This brings into effect also the possibility of bending tubes having a larger diameter than it was previously possible because such tubes, just due to their diameter, require much larger radius bends under penalty of obtaining defective bends, tube crushes, wrinkling and other defects that are well known to the field specialists.

Claims

1. A hydraulic transmission tube bending device that can be operated with a single hand, the matrix-die holding bar of which is moved by the action of a fluid (oil) which is displaced by a hydraulic pump that is an integral part of the device, characterised in that the hydraulic pump has its longitudinal axis parallelly arranged with reference to the fixed part (7) of the handle and is placed, on said part of the handle, on the same side on which there are the matrix-die and the counter-dies, the reservoir (11) of the fluid (oil) being formed directly

in the arm (14), or plate, one which the support - (15) of counterdies (16) is installed, on of the walls of said reservoir, preferentially the bottom, being capable of being sealingly deformed, like a bellows-like device that is elastic or elastically can be deformed, or a membrane (12), the pump, the conduits, the reservoir and the chamber in which the matrix-die holding bar slides forming a closed circuit, the fluid (oil) arriving from the pump to the head (3) of the matrix-die holding bar through a conduit that is formed in the fixed part of the handle (7) and is obtained with a tubular element - (6) that also builds the outer part of (7) and is concentric with the cylinder (5) in which the matrix-die holding bar (1) slides, said tubular element (6) being sealingly anchored on the unit construction body (10) and closed on the back by a blind sleeve (8) which in turn is sealingly anchored on said tubular element (6).

2. A device as claimed in claim 1, characterised in that the pump is actuated by means of the movable part (3), which is lever-like, of the handle, said lever-like part being placed under the fixed part (7) of the handle itself, both the fixed and the movable part being within a single hand's reach, the lever-like part's position being adjustable

relative to the fixed one by means of a pusher (33), like a screw that is used to push against the unit construction body.

3. A device as claimed in claim 1 characterised in that the membrane, or bellows, (12) that can be elastically deformed and makes the movable wall and that seals the reservoir (11) of which it is a wall is in communication with the external air and is nested in the reservoir, of which reservoir it is a protection, the open base of said bellows being closed by another protection element (13) like a washer, in said washer being formed at least an opening (34), like a through-hole, that is the passage way that connects the membrane with the external air.

4. A device as claimed in claim 1, characterised in that the support (15) of the counter-dies - (16) is centrally provided with at least an extension (18) that is nested with a corresponding housing perpendicularly formed within the arm, or plate, on which the support itself is installed, said support being engaged against rotating and sliding out by suitable locking devices, like a shoulder (20) and a counter-shoulder and a stop (19) comprising a ball that is elastically held in place.

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