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[54] GUN-TYPE DEVICE FOR MECHANICAL ASSEMBLY WORK UTILIZING ENERGY OF EXPLOSION

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[58] **Field of Search** 60/261; 91/399, 416, 462, 235, 91/23

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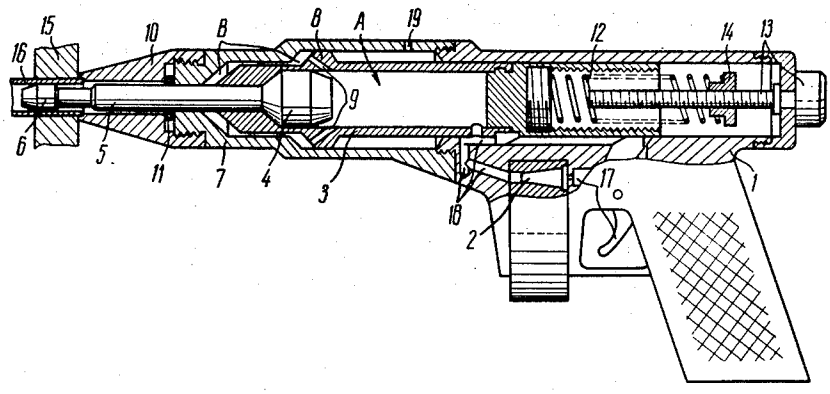
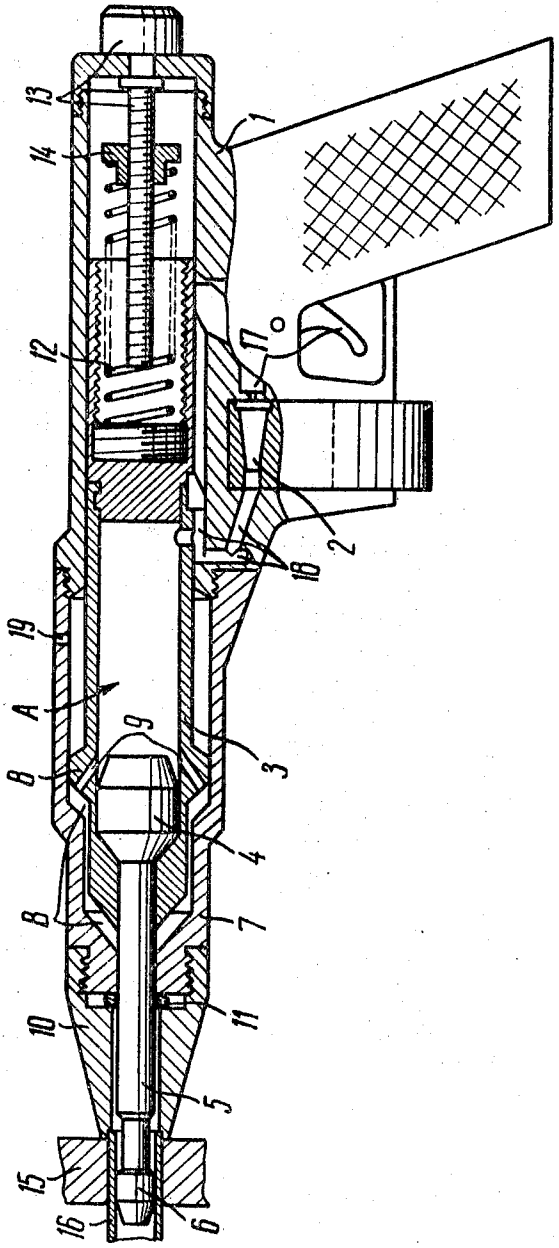
[57] **ABSTRACT**

A gun-type device for mechanical assembly work utilizing the energy of explosion.

The device comprises a second barrel secured on the body around the first barrel, the latter being installed with a provision for axial movement and has a circular projection functioning as a piston while the first barrel is moving in the second one, and has channels which intercommunicate the spaces of both barrels and are located at the side of the circular projection facing the rod so that at the end of the forward stroke of the piston with the working tool the compressed gases flow from the space of the first barrel into that of the second one as a result of which the first barrel moves and returns the piston with the tool to the initial position.

1 Claims, 1 Drawing Figure

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GUN-TYPE DEVICE FOR MECHANICAL ASSEMBLY WORK UTILIZING ENERGY OF EXPLOSION

The present invention relates to devices for mechanical assembly work and more specifically it relates to the gun-type devices for mechanical assembly work, utilizing the energy of explosion.

The invention can be used most effectively for the assembly of tubular heat exchangers.

Known in the art are the gun-type devices for mechanical assembly work using the energy of explosion.

These devices comprise a body with an explosion chamber which communicates with a barrel accommodating a piston with the rod, the latter carrying the working tool.

The working tool is selected to suit the work in hand; thus, riveting is done with a striker.

Acted upon by the compressed gases produced by the explosion in the explosion chamber, the piston with the working tool makes a forward (working) stroke. For returning the piston to the initial position, the known devices are provided with a return spring installed between the barrel and the piston at the side of the rod.

However, experience shows that the mechanical assembly work, particularly expansion of tubes, punching and calibration of holes demands that the energy required for the return stroke of the piston with the working tool and the speed of this stroke should be approximately equal to the energy spent on the working stroke of the piston with the tool and to the speed of this stroke. Hence, the return springs which pull the piston back to the initial position should be sufficiently powerful. However, the provision of such springs in the known devices results in spending a considerable portion of the energy of explosion during the piston working stroke on compressing the spring.

As a result, the speed of the piston working stroke drops with the increased resistance of the spring and this drop of speed, in turn, impairs the accuracy of machining and the surface finish of the workpieces. Besides, it should be borne in mind that operation of springs at a pulsating duty, particularly at the initial instant of explosion and accelerated movement of the piston with the tool, causes rapid fatigue wear of the springs.

An object of the present invention resides in eliminating the aforesaid disadvantage.

Another important object of the present invention resides in providing a gun-type device for mechanical assembly work utilizing the energy of explosion wherein the piston with the rod carrying the working tool would make the return stroke only due to the energy of explosion.

Still another important object of the present invention is to provide the aforementioned device which would be reliable and easy to operate.

Still another no less important object of the present invention is to provide the aforementioned device which would have a broader field of application than the known devices of the same type.

In accordance with these and other objects, the body of the claimed device, according to the invention, is provided with a second barrel fitted around the first barrel, the latter being installed with a provision for axial movement and having a circular projection serving as a piston while the first barrel slides in the second one, and having channels which communicate the spaces of both barrels and are located at the side of the circular projection facing the rod so that at the end of the working stroke of the piston with the tool, the compressed gases flow from the space of the first barrel into that of the second one as a result of which the first barrel moves and returns the piston with the tool to the initial position.

Owing to such an arrangement of the claimed device the piston with the rod carrying the working tool makes the return stroke only due to the energy of explosion, without any auxiliary devices which steps up considerably the operational reliability of the device and ensures better convenience in operation as compared with the known devices of the same type.

Besides, the claimed device has a wider field of application than the known devices of the same type.

Now the invention will be described in detail by way of example with reference to the accompanying drawing (in which a longitudinal section of the claimed device is given).

The claimed gun-type device for mechanical assembly work utilizing the energy of explosion comprises a body **1** with an explosion chamber **2**, a first barrel **3** with space. A communicating with the explosion chamber **2** and a piston **4** with rod **5** carrying the working tool **6**, said piston being located in said space A.

According to the invention, secured on the body **1** is a second barrel **7** fitting around the first barrel **3** which is installed in the body with a provision for axial movement, its outer surface has a circular projection **8** functioning as a piston while the first barrel **3** moves in the second barrel **7** and which has channels **9** which intercommunicate the spaces of both barrels. These channels are located at the side of the circular projection **8** facing the rod **5** so that at the end of the working stroke of the piston **4**, space A of the barrel **3** communicating with the explosion chamber **2** is also in communication with space B of the barrel **7**.

The barrel **7** is secured on the body **1** by means of a screw joint for easier assembly and disassembly of the device.

At the side of the rod **5**, the barrel **7** has a removable centering bushing **10**. Located between the barrel **7** and said bushing is a circular retainer **11** for holding the rod **5** together with the piston **4** in the initial (extreme right) position.

The barrel **3** is loaded on the body **1** by a compression spring **12** one end of which bears against the blind end of the barrel, the other end bearing against the stop **14** which is adjusted by screw **13**.

The compression spring **12** is intended to return the barrel **3** to the initial position. Adjustment of the force of compression of the spring **12** makes it possible to change the length of the working stroke of the piston **4** which, in turn, allows the striking force of the working tool to be changed to suit the work in hand at one and the same explosive charge, i.e., at the same energy of explosion.

Now we shall consider an example of using the claimed device for expanding tubes in the tube plates by the use of mandrels.

In this case the working tool **6** of the device is a mandrel secured to the rod **5** by any one of the known methods. In the present example, the rod **5** is made integral with the mandrel.

The rod **5** with piston **4** is held in the initial position by means of the circular retainer **11**. At this moment the piston **4** occupies the extreme right position in space A of the barrel **3**.

Then an explosive charge is placed into the explosion chamber **2** and the device is aligned with relation to the tube **16** which is to be expanded in the tube plate **15**. For this purpose the bushing **10** is put against the end of the tube **16** protruding from the tube plate **15**.

Then the explosive charge is ignited in the explosion chamber **2** by means of a trigger mechanism **17** which is well known to those skilled in the art and is not, therefore, dealt with in the present description. The compressed gases produced by the explosion flow from the chamber **2** through channels **18** into space A of the barrel **3** and move the piston **4** with the rod **5** and mandrel to the extreme left position; it means that the piston has made a forward (working) stroke in space A of the barrel **3**.

The mandrel expands the tube **16** in the hole of the tube plate **15**.

At the end of the forward stroke of the piston **4**, space A of the barrel **3** communicating with the explosion chamber **2** is also put in communication with space B of the barrel **7** through the channels **9**. The compressed gases pass through these channels from space A of the barrel **3** into space B of the barrel **7** and, acting upon the circular projection **8** of the barrel **3**, move the latter axially, compressing the spring **12**. The piston **4** with the rod **5** and the mandrel return to the initial (extreme right) position and are held there by the circular retainer **11** interacting with the rod.

Then the compressed gases are exhausted into the atmosphere through the channel **19** from space B of the barrel **7**, the barrel **3** moving in space B of the barrel **7** being returned by the spring **12** to the initial position.

Then the entire operating cycle is repeated.

Thus, in the claimed device, the piston with the rod carrying the working tool makes the return stroke also under the effect of the compressed gases produced by the explosion which guarantees a high reliability of the device and facilitates its operation.

Besides, thanks to its design, the device according to the invention has a wide field of application since it can be used not only for riveting and marking but also for piercing of holes, expansion of tubes with mandrels with a high accuracy and surface finish, i.e., for such operations which call for high speeds and power of both the forward and return strokes of the piston with the rod and the working tool.

What we claim is:

1. A gun-type device for mechanical assembly work utilizing the energy of explosion which comprises: a body with explosion chamber; a barrel with a space communicating with said explosion chamber, said barrel being installed in said body with a provision for axial movement; a piston accommodated in the space of said first barrel; a rod of said piston carrying a working tool at the end; a second barrel secured on said body around said first barrel; said first barrel has a circular projection functioning as a piston while said first barrel is moving in the space of said second barrel and has channels intercommunicating the spaces of both barrels and located at the side of said circular projection facing said rod so that at the end of the forward stroke of said piston with the rod carrying the working tool the compressed gases flow from the space of said first barrel into the space of said second barrel, as a result of which said first barrel moves and returns said piston with rod and working tool to the initial position.

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