

July 27, 1937.

W. CAMBEIS

2,088,131

MEANS FOR EXPANDING HOLLOW BODIES

Filed Feb. 17, 1934

2 Sheets-Sheet 1

Fig. 1.

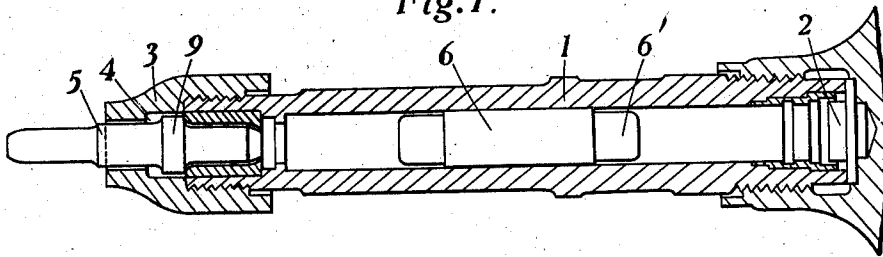


Fig. 2.

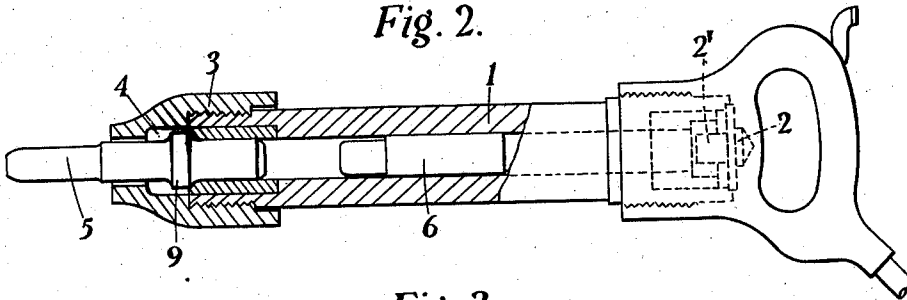


Fig. 3.

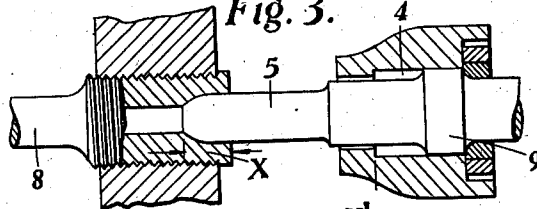


Fig. 4.

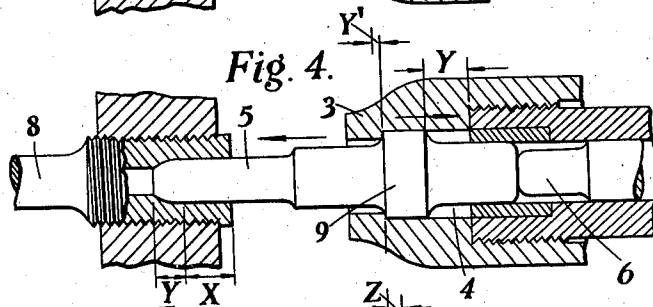
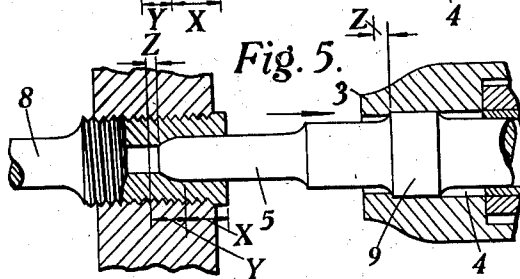


Fig. 5.



INVENTOR
Walter Cambeis
BY S. Loral.
ATTORNEY

July 27, 1937.

W. CAMBEIS

2,088,131

MEANS FOR EXPANDING HOLLOW BODIES

Filed Feb. 17, 1934

2 Sheets-Sheet 2

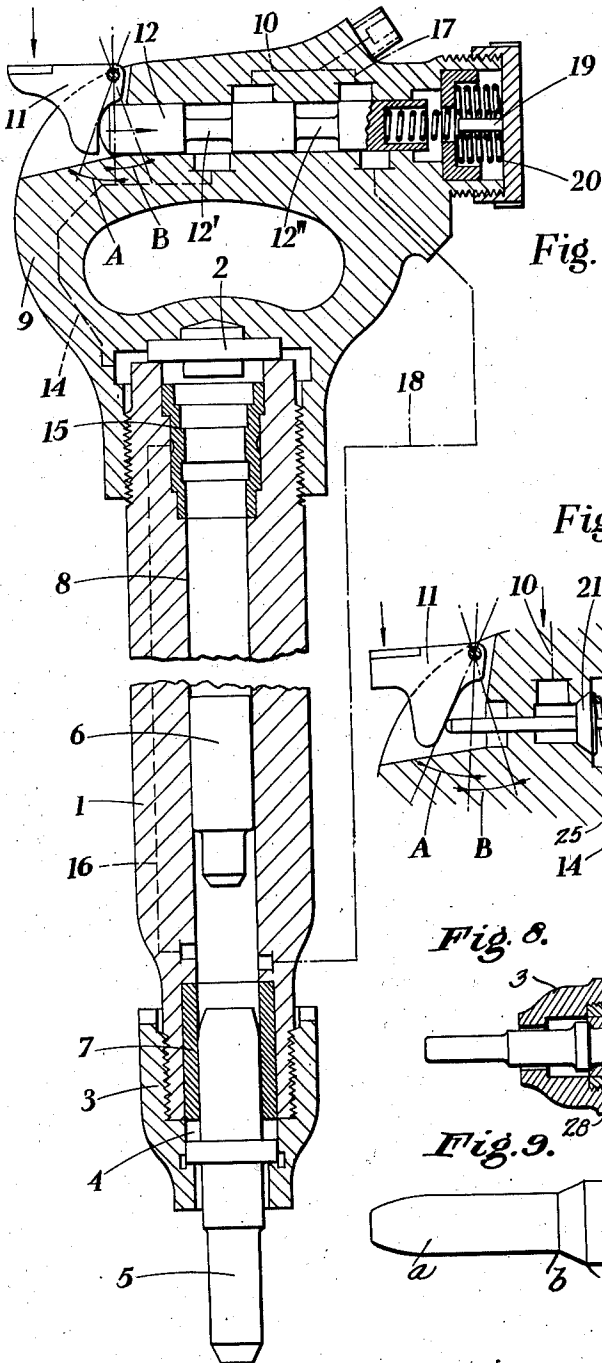


Fig. 6.

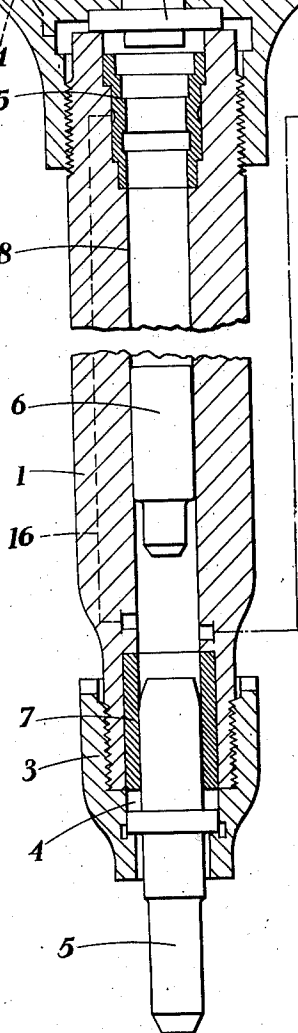


Fig. 7.

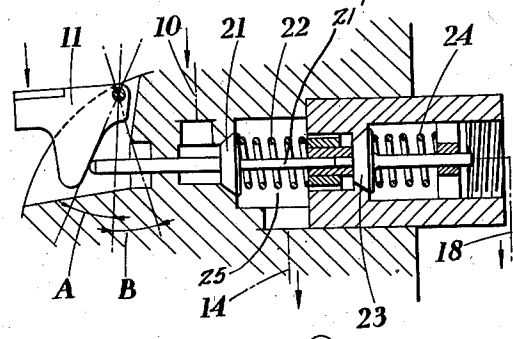


Fig. 8.

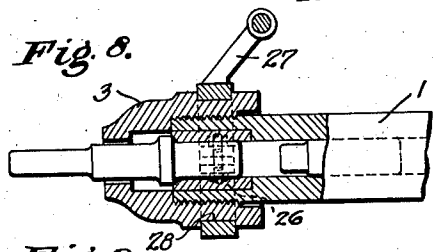
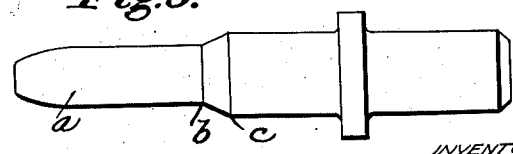


Fig. 9.



INVENTOR
Walter Cambeis
BY S. Loral
ATTORNEY

UNITED STATES PATENT OFFICE

2,088,131

MEANS FOR EXPANDING HOLLOW BODIES

Walter Cambeis, Kassel, Germany

Application February 17, 1934, Serial No. 711,683
In Germany February 20, 1933

10 Claims. (Cl. 153—79)

The present invention relates to means for expanding hollow bodies, more particularly the stay bolts of the fire boxes of locomotives, or for improving and facilitating the working of boring, breaking and like hammers, by the stepwise progressive driving in of a mandrel, core, hammer or like member by the aid of a pressure-air operated percussive driving tool or hammer, into suitable cavities of a bolt or like member.

In the art of expanding hollow bodies by means of a normal, single action controlled pressure air hammer or percussive tool, it is well-known to drive one or more mandrels into corresponding cavities of a hollow body or a not previously prepared material. At the end of the driving operation the mandrel must be removed from the cavity by means of a separate tool. Attempts have been made to loosen the mandrel after each stroke of the driving hammer, for instance by causing a spring tensioned during the expanding operation to act upon a counter surface of the mandrel. The object of this arrangement was to prevent the mandrel from becoming too tightly jammed in the cavity and also to prevent the hollow body from becoming excessively elongated during the driving operation.

This known method has the following disadvantages: Firstly, a separate lining member must be interposed between the mandrel and the hammer used for driving in the mandrel, and secondly, vibrations caused by the continuously changing tensioning and de-tensioning of the spring, are transmitted upon the operator manipulating the hammer, said vibrations imposing an almost intolerable strain upon the operator. Moreover, a considerable amount of power is consumed by the interposition of the lining member, so that the loosening of the mandrel does not take place in a reliable and perfect manner.

According to the invention, loosening of the mandrel or like member is attained without the use of a tension spring, by the employment of a muff or sleeve which engages the mandrel and is firmly connected with the hammer or percussive tool. The driving piston or striker of the hammer transmits upon its return to the rear dead centre its energy of motion to an impact receiving plate and through the latter and the casing of the hammer to the muff or sleeve and to the mandrel engaged by the muff or sleeve. Any normal pressure air operated hammer with single control action can be utilized for carrying out the invention, it only being necessary for the purpose of adapting the hammer or percussive tool to provide the hammer casing at the rear end of the cylinder

with an impact receiving plate and to provide at the front end of the hammer a muff or sleeve adapted to engage the mandrel, said muff or sleeve being for instance in the form a screw cap screwed upon the front end of the hammer casing. The impact receiving plate is securely fixed between the cover of the casing containing the grip or handle, and the casing proper. The muff serving for loosening the mandrel or core is provided with an interior recess within which a collar of the mandrel or like member can move longitudinally by a limited amount.

After the mandrel or like member has been completely driven into the cavity of the hollow body to be expanded or into an unprepared material, the hammer together with the muff fixed thereto is drawn back until the muff bears upon the collar of the mandrel. During further striking operations of the hammer, the forward blow of the piston or striker of the hammer is reduced or entirely cancelled by the increase of the air buffer between the mandrel and the striker. During the return movement of the striker or piston in the casing of the hammer, the striker or piston transmits its energy of motion to the impact receiving plate fixed in the hammer casing and to the muff fixedly connected with the casing, the result being that the mandrel is rapidly withdrawn entirely from the cavity.

In order to increase the number of blows or the force exerted by the hammer during the loosening or withdrawing operation, it is advisable to provide in addition to the normal control already provided at the rear dead centre of the cylinder, a further control associated with the main air admission. This additional control serves for supplying an additional regulable amount of pressure air to the space in front of the piston or striker of the hammer or to the space in front of the collar of the mandrel within the recess of the muff, and is so associated or coupled with the normal control member that the additional air supply is opened only after the main supply has been fully opened. The two associated or coupled control members may be operated by a single operating lever or like member, and the times at which the various air conduits are opened are preferably indicated upon the exterior of the hammer.

The muff or sleeve engaging the mandrel may be connected in a manner known per se either by a bayonet joint or by screws with the front end portion of the hammer casing and it may be provided with a turnable hand grip. This hand grip facilitates the holding of the hammer in

the required correct axial position and it also facilitates the pulling back of the hammer before the final removal of the mandrel from the hollow body or other material.

5 Another feature of the invention consists in providing the mandrel or hammer actuated by the percussive tool at the rear end of the driving surface which penetrates into the hollow body or other material, with a rearwardly flaring conical surface, the angle of which is steeper than
10 the angle of the forward driving or penetrating surface of the mandrel. This arrangement facilitates the loosening or withdrawal of the mandrel after the completion of the expanding operation, particularly in cases in which the cavity
15 of the body to be expanded is very long or in cases in which the body to be expanded is of considerable strength. By the driving in of the steeper conical portion of the mandrel, the whole
20 bore of the body to be expanded is temporarily and elastically expanded and consequently the mandrel can be easily released or removed from the hollow body or material acted upon by the mandrel. It is not essential that the steeper conical
25 portion of the mandrel be an exact cone, but it is essential that the inclination of that additional portion should correspond at least to the angle of friction obtaining between the mandrel and the hollow body or other material expanded by the mandrel.
30

The accompanying drawings show by way of example an apparatus suitable for carrying out the improved method.

35 Fig. 1 is an axial section through a pneumatic hammer, the handle portion of the hammer being partly broken off.

Fig. 2 is an elevation partly in section of a pneumatic hammer,

40 Figs. 3 to 5 show in section the front portion of the pneumatic hammer and a portion of an expandible stay bolt acted upon by the hammer in three different stages of the operation.

45 Fig. 6 shows a pneumatic hammer according to the invention provided with an additional air control.

Fig. 7 shows a modified construction of the additional air control.

50 Fig. 8 is a detail section through the front end of the pneumatic hammer showing a hand grip turnable about the axis of the hammer and

Fig. 9 shows in elevation an improved construction of the mandrel.

In all the figures 1 indicates a pneumatic hammer more particularly the casing of the hammer, 2 designates an impact receiving plate fixed
55 in the rear end of the bore of the hammer, 3 is a muff or sleeve fixed at the front end of the hammer and provided with an internal recess 4. 5 indicates a mandrel or core to be driven into
60 a tubular body or other material to be expanded, and 6 indicates the piston or striker which is reciprocated within the hammer.

In the construction shown in Fig. 1, the striker 6 is provided at its rear end with a reduced portion 6' which co-operates with the impact receiving plate 2. In the construction according
65 to Fig. 2, the striker 6 has no reduced rear portion, but the impact receiving plate 2 has a reduced portion 2' co-operating with the striker.

70 In the stage of the operation illustrated by Fig. 3 the mandrel 5 has been already driven into a stay bolt 8 of a locomotive by an amount x . In the stage illustrated by Fig. 4, the mandrel 5 has been further driven into the bolt 8 by the
75 striker 6 by a further amount y in the direction

of the arrow, the collar 9 of the mandrel reaching in this position a front shoulder of the recessed portion 4. By the reaction of the blow the hammer itself has moved by an amount y' backwards, that is, in a direction opposite to the
5 direction of the movement of the mandrel 5. In the last stage illustrated in Fig. 5, the mandrel 5 has been withdrawn in the direction of the arrow by an amount z which is shown to a somewhat exaggerated scale, and has thereby been
10 loosened within the stay bolt 8.

In Fig. 6, 11 indicates a control lever for controlling, for instance, the pressure air supply of the hammer. 12, 12' and 12'' are control members for controlling the pressure air supply
15 conduits 10, 14, 17, 18. 15 indicates the usual pressure air control valve for supplying the working medium through conduits 16 to the space in front of the piston or striker 6. 19 and 20 indicate
20 springs for returning the control members 12, 12' etc. to their rest positions, whilst A and B indicate the angles through which the control lever 11 is turned or depressed for obtaining normal or additional pressure air supply.

The mode of operation of the tool is as follows:
25

The admission of the pressure air which moves the striker 6 up and down, is effected in known manner, via conduit 10 arranged on the hammer hand grip 9, which leads to the control member
30 12 actuated by means of the lever 11. From the control member the pressure air passes through conduit 14 to an air reversing gear 15 (only diagrammatically indicated) of known kind, from
35 which the air passes according to the position of the gear, either into the space under the impact plate 2 behind the striker 6 or through conduit 16 into the space in front of the mandrel 5 and behind the striker 6. The valve gear 15
40 is known per se and does not form part of the invention. The control device 12 which is shown in Fig. 6 in fully closing position, is so constructed that during the first part of its opening movement, only normal pressure air supply is opened,
45 whilst during the second part of this movement the conduit for the supply of additional fresh air is opened. By turning the lever 11 through the angle A, the pressure air supply 10 is first connected via recesses 12' of the control device
50 12 with the conduit 14; during further movement of the lever 11 through the angle B the connection between conduit 10 and conduit 14 is maintained and an additional connection between a branch 17 of the conduit 10 and a conduit 18
55 is produced through a second recess 12'' of the control device 12. The conduit 18 opens into the space between the striker 6 and mandrel 5 in the proximity of the socket 7 and represents the path of the additional pressure air which may be admitted in front of the striker 6 either when it is
60 desired to withdraw the mandrel from the work-piece (stay bolt), the mandrel 5 then assuming, relatively to the hammer casing 1, the position shown in Fig. 6, or when it is desired to increase the number of blows of the striker 6 and the
65 driving energy of the tool. By the employment of two springs 19 and 20 of which the spring 20 responds only on opening up the supply of additional pressure air, the operator manipulating the pneumatic hammer receives an indication
70 upon depressing the lever 11 that the first part of the control operation, that is, the opening of the normal pressure air supply, is completed and that following thereon the additional fresh air supply is being opened.
75

Fig. 7 shows a somewhat modified valve control which is again operated in a similar manner, that is, on compressing the lever 11 through the angle A, a valve 21 forced by a spring 22 upon its seat, is first raised and a connection is established between the conduits 10 and 14. During further depression of the lever 11 through angle B, the second valve 23 loaded by spring 24 is lifted from its seat by means of a projection 21' of the valve 21, and the additional pressure air path to the conduit 18 from the conduit 10 is opened, as the conduit 18 is connected to the space 25 behind the valve 21.

It is obvious that the means for supplying additional pressure air can be easily applied to old pressure air hammers, particularly if the conduit 18 is constructed as an external hose conduit. With new hammers, the conduit is preferably either completely or partly arranged in the hammer casing 1 and the hand grip 9.

In Fig. 8, 27 indicates a hand grip which is rotatably mounted in a groove 28 of the muff 3 and can be fixed in position by means of screws 26.

In Fig. 9 is shown a mandrel having a normal driving or expanding surface *a-b* which may be cylindrical, conical or parabola shaped. Adjacent to this normal driving or expanding surface there is provided a steeper surface *b-c*.

As previously stated, the described tool may be used not only for expanding the stay bolts, but may also be used for working boring, breaking and like hammers.

It may be pointed out that the invention is applicable to the driving in of boring hammers and drilling tools. In this application of the invention, the material acted upon is unprepared, that is, it does not consist of a metallic hollow body to be expanded, the workpiece acted upon by the pneumatic hammer being rock or other material to be drilled. The striker acts, in these cases, directly upon a hammer or drilling tool. The hammer or drilling tool is after each blow slightly loosened in the material to be drilled.

I claim:

1. In a pneumatic tool for expanding hollow bodies, more particularly stay bolts of fire boxes of locomotives, of the type in which the admission of pressure air to the striker is controlled by a single automatic slide valve located at the top of the hammer casing and actuated by the striker, the sub-combination of: a hammer casing; a mandrel located in the front end of said casing and provided with a collar; a muff fixedly connected to the front end of the hammer casing engaging said mandrel and having a recess within which said mandrel has a limited longitudinal movement; a striker adapted to reciprocate in said cylinder casing and to act upon the mandrel; means for admitting pressure air to the striker; a single automatic slide valve for controlling said means located at the top of the hammer casing and actuated by the striker and an impact plate fixed at the rear dead centre of the casing adapted to co-operate with the striker at the end of the return stroke of the latter, substantially as described.

2. In a pneumatic tool for expanding hollow bodies, more particularly stay bolts of fire boxes of locomotives, of the type in which the admission of pressure air to the striker is controlled by a single automatic slide valve located at the top of the hammer casing and actuated by the striker, the sub-combination of: a hammer casing; a mandrel located in the front end of said casing and provided with a collar; a muff fixedly con-

nected to the front end of the hammer casing engaging said mandrel and having a recess within which said mandrel has a limited longitudinal movement; a striker adapted to reciprocate in said cylinder casing and to act upon the mandrel; means for admitting pressure air to the striker; a single automatic slide valve for controlling said means located at the top of the hammer casing and actuated by the striker; an impact plate fixed at the rear dead centre of the casing adapted to co-operate with the striker at the end of the return stroke of the latter; a main pressure medium supply control; and an additional pressure medium supply control associated with said main pressure medium supply control, so as to come into action only after the main pressure medium supply has been fully opened, substantially as described.

3. In a pneumatic tool for expanding hollow bodies, more particularly stay bolts of fire boxes of locomotives, of the type in which the admission of pressure air to the striker is controlled by a single automatic slide valve located at the top of the hammer casing and actuated by the striker, the sub-combination of: a hammer casing; a mandrel located in the front end of said casing and provided with a collar; a muff fixedly connected to the front end of the hammer casing engaging said mandrel and having a recess within which said mandrel has a limited longitudinal movement; a striker adapted to reciprocate in said cylinder casing and to act upon the mandrel; means for admitting pressure air to the striker; a single automatic slide valve for controlling said means located at the top of the hammer casing and actuated by the striker; an impact plate fixed at the rear dead centre of the casing adapted to co-operate with the striker at the end of the return stroke of the latter; a main pressure medium supply control; an additional pressure medium supply control associated with said main pressure medium supply control, so as to come into action only after the main pressure medium supply has been fully opened; and a pressure medium supply conduit controlled by said additional control, said conduit opening in front of the striker, substantially as described.

4. In a pneumatic tool for expanding hollow bodies, more particularly stay bolts of fire boxes of locomotives, of the type in which the admission of pressure air to the striker is controlled by a single automatic slide valve located at the top of the hammer casing and actuated by the striker, the sub-combination of: a hammer casing; a mandrel located in the front end of said casing and provided with a collar; a muff fixedly connected to the front end of the hammer casing engaging said mandrel and having a recess within which said mandrel has a limited longitudinal movement; a striker adapted to reciprocate in said hammer casing and to act upon the mandrel; means for admitting pressure air to the striker; a single automatic slide valve for controlling said means located at the top of the hammer casing and actuated by the striker; an impact plate fixed at the rear dead centre of the casing adapted to co-operate with the striker at the end of the return stroke of the latter; a main pressure medium supply control; an additional pressure medium supply control associated with said main pressure medium supply control, so as to come into action only after the main pressure medium supply has been fully opened; and a pressure medium supply conduit controlled by said additional control, said conduit opening into the recess of the muff, substantially as described.

5. In a pneumatic tool for expanding hollow bodies, more particularly stay bolts of fire boxes of locomotives, of the type in which the admission of pressure air to the striker is controlled by a single automatic slide valve located at the top of the hammer casing and actuated by the striker, the sub-combination of: a hammer casing; a mandrel located in the front end of said casing and provided with a collar; a muff fixedly connected to the front end of the hammer casing engaging said mandrel and having a recess within which said mandrel has a limited longitudinal movement; a striker adapted to reciprocate in said hammer casing and to act upon the mandrel; means for admitting pressure air to the striker; a single automatic slide valve for controlling said means located at the top of the hammer casing and actuated by the striker; an impact plate fixed at the rear dead centre of the casing adapted to co-operate with the striker at the end of the return stroke of the latter; a main pressure medium supply control; an additional pressure medium supply control associated with said main pressure medium supply control, so as to come into action only after the main pressure medium supply has been fully opened; and a common manually operable member for operating both the main and the additional air control, substantially as described.

6. In a pneumatic tool for expanding hollow bodies, more particularly stay bolts of fire boxes of locomotives, of the type in which the admission of pressure air to the striker is controlled by a single automatic slide valve located at the top of the hammer casing and actuated by the striker, the sub-combination of: a hammer casing; a mandrel located in the front end of said casing and provided with a collar; a muff fixedly connected to the front end of the hammer casing engaging said mandrel and having a recess within which said mandrel has a limited longitudinal movement; a striker adapted to reciprocate in said hammer casing and to act upon the mandrel; means for admitting pressure air to the striker; a single automatic slide valve for controlling said means located at the top of the hammer casing and actuated by the striker; an impact plate fixed at the rear dead centre of the casing adapted to co-operate with the striker at the end of the return stroke of the latter; a main pressure medium supply control; an additional pressure medium supply control associated with said main pressure medium supply control, so as to come into action only after the main pressure medium supply has been fully opened; and a common manually operable member for operating both the main and the additional air control, said common manually operable member consisting of an outwardly visible lever.

7. In a pneumatic tool for expanding hollow bodies, more particularly stay bolts of fire boxes of locomotives, of the type in which the admission of pressure air to the striker is controlled by a single automatic slide valve located at the top of the hammer casing and actuated by the striker, the sub-combination of: a hammer casing; a mandrel located in the front end of said casing and provided with a collar; a muff fixedly connected to the front end of the hammer casing engaging said mandrel and having a recess within which said mandrel has a limited longitudinal movement; a striker adapted to reciprocate in said cylinder casing and to act upon the mandrel; means for admitting pressure air to the striker; a single automatic slide valve for controlling said means located at the top of the hammer casing

and actuated by the striker; and an impact plate fixed at the rear dead centre of the casing adapted to co-operate with the striker at the end of the return stroke of the latter, said muff being detachably connected to the front end of the casing and being provided with a turnable hand grip, said hand grip serving for holding the hammer and for withdrawing the hammer in the longitudinal direction.

8. In a pneumatic tool for expanding hollow bodies, more particularly stay bolts of fire boxes of locomotives, of the type in which the admission of pressure air to the striker is controlled by a single automatic slide valve located at the top of the hammer casing and actuated by the striker, the sub-combination of: a hammer casing; a mandrel located in the front end of said casing and provided with a collar; a muff fixedly connected to the front end of the hammer casing engaging said mandrel and having a recess within which said mandrel has a limited longitudinal movement; a striker adapted to reciprocate in said cylinder casing and to act upon the mandrel; means for admitting pressure air to the striker; a single automatic slide valve for controlling said means located at the top of the hammer casing and actuated by the striker; and an impact plate fixed at the rear dead centre of the casing adapted to co-operate with the striker at the end of the return stroke of the latter, said muff being detachably connected to the front end of the casing and being provided with a turnable hand grip, said hand grip being adjustable upon the muff or upon the hammer casing and fixable in any adjusted position, substantially as described.

9. In a pneumatic tool for expanding hollow bodies, more particularly stay bolts of fire boxes of locomotives, of the type in which the admission of pressure air to the striker is controlled by a single automatic slide valve located at the top of the hammer casing and actuated by the striker, the sub-combination of: a hammer casing; a mandrel located in the front end of said casing and provided with a collar; a muff fixedly connected to the front end of the hammer casing engaging said mandrel and having a recess within which said mandrel has a limited longitudinal movement; a striker adapted to reciprocate in said cylinder casing and to act upon the mandrel; means for admitting pressure air to the striker; a single automatic slide valve for controlling said means located at the top of the hammer casing and actuated by the striker; and an impact plate fixed at the rear dead centre of the casing adapted to co-operate with the striker at the end of the return stroke of the latter, said mandrel having at the end of its normal operative surface an operative surface inclined at a steeper angle, for the purpose of imparting to the hollow body at the end of the expanding operation a temporary elastic expansion and thereby facilitate withdrawal of the mandrel.

10. In a pneumatic tool for expanding hollow bodies, more particularly stay bolts of fire boxes of locomotives, of the type in which the admission of pressure air to the striker is controlled by a single automatic slide valve located at the top of the hammer casing and actuated by the striker, the sub-combination of: a hammer casing; a mandrel located in the front end of said casing and provided with a collar; a muff fixedly connected to the front end of the hammer casing engaging said mandrel and having a recess within which said mandrel has a limited longitudinal movement; a striker adapted to reciprocate in said cylinder casing and to act upon the mandrel;

means for admitting pressure air to the striker; a single automatic slide valve for controlling said means located at the top of the hammer casing and actuated by the striker; and an impact plate fixed at the rear dead centre of the casing adapted to co-operate with the striker at the end of the return stroke of the latter, said mandrel having at the end of its normal operative surface an operative surface inclined at a steeper angle, for

the purpose of imparting to the hollow body at the end of the expanding operation a temporary elastic expansion and thereby facilitating withdrawal of the mandrel, the angle of said additional operative surface of the mandrel being at least equal to the angle of friction obtaining between the mandrel and the body to be expanded, substantially as described.

WALTER CAMBEIS.