Dec. 15, 1953 E. B. POWELL ET AL 2,662,266

METHOD AND APPARATUS FOR ATTACHING MUZZLE DEVICES TO GUNS

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Fig. 1.

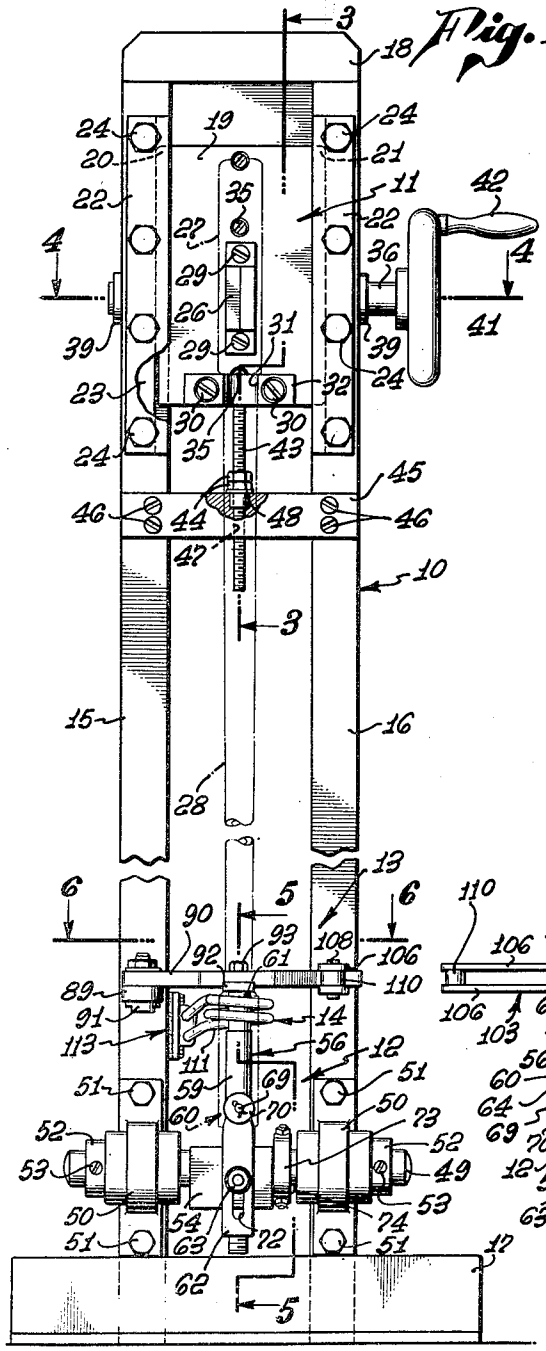
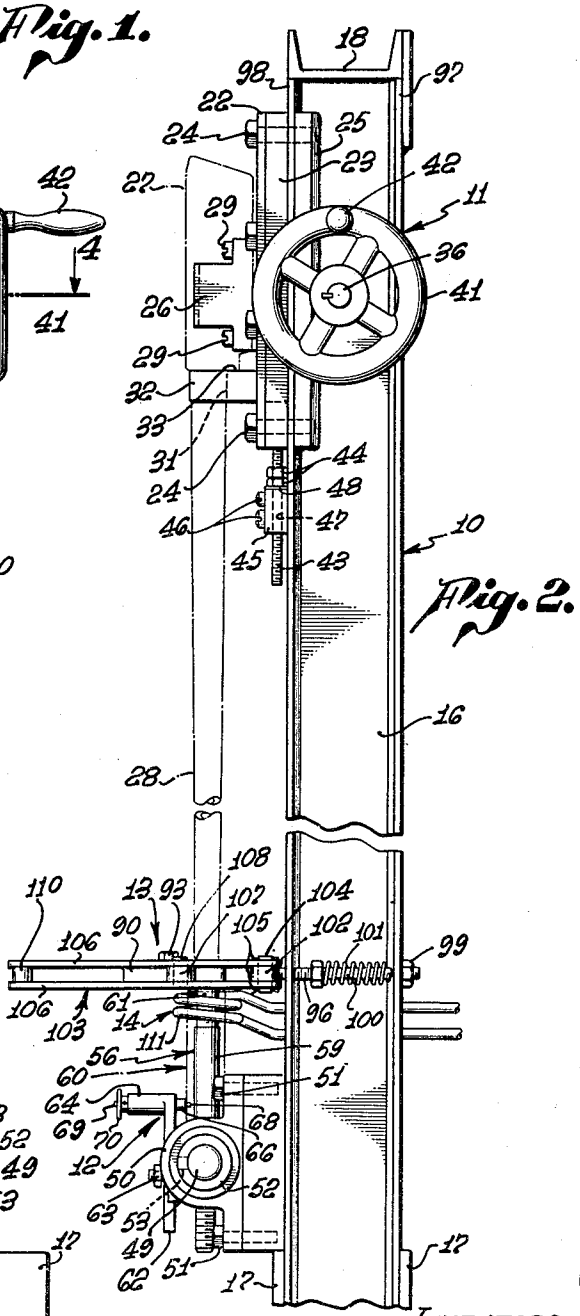


Fig. 2.



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Fig. 3.

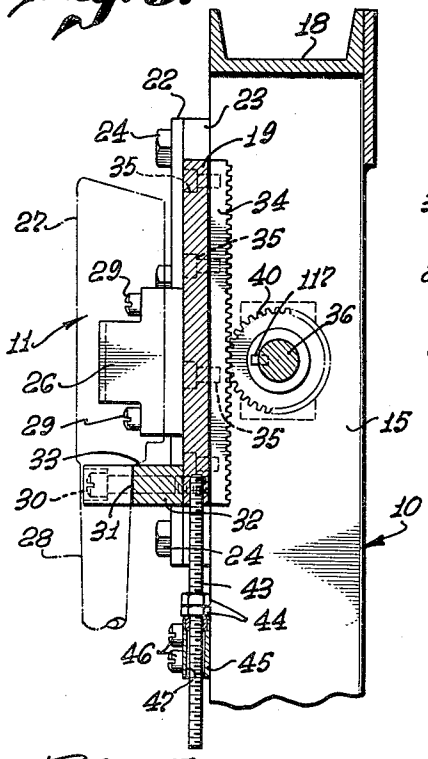


Fig. 4.

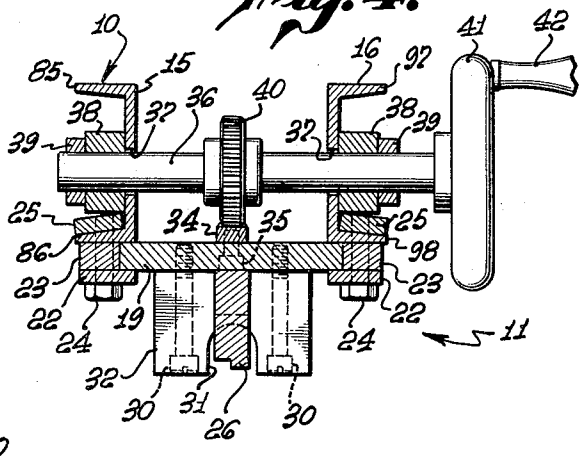


Fig. 5.

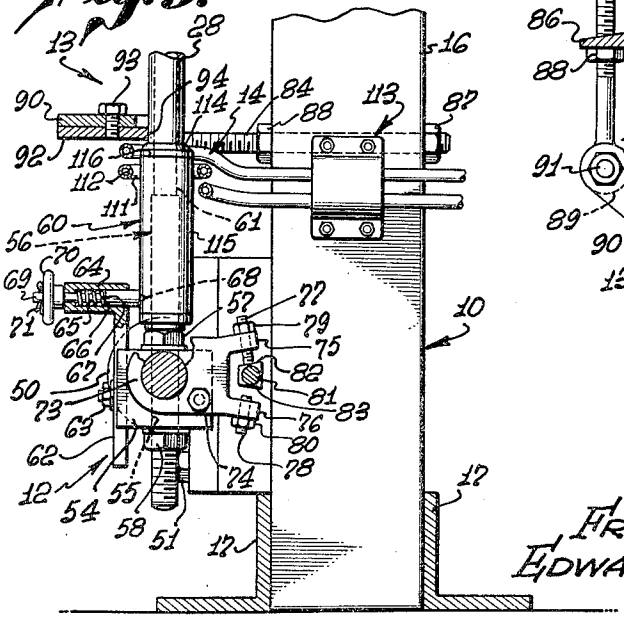
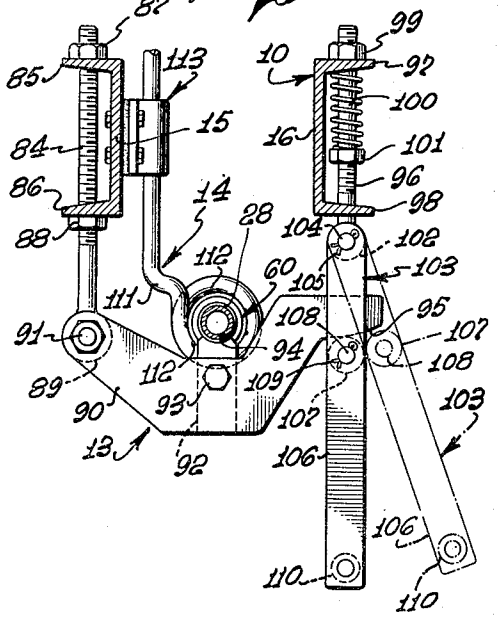


Fig. 6.



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METHOD AND APPARATUS FOR ATTACHING MUZZLE DEVICES TO GUNS

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11 Claims. (Cl. 29—1.1)

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This invention relates generally to improved apparatus and methods for attaching muzzle devices to gun barrels.

In attaching a muzzle device to a shot gun barrel according to conventional methods, it is very difficult to assure correct alinement of the barrel and device when first secured together, and it is thus usually necessary to bend the gun muzzle to a certain extent after attachment of the device to correct for any slight misalinement. Further, if the muzzle device is of a larger external diameter than the gun barrel, as is usually the case, it is necessary to bend the barrel slightly upwardly to correct for the sighting error introduced by the resultant elevation of the forward gun sights. Thus, the complete application of a muzzle device has, in the past, been a rather laborious time consuming operation, and has generally proved very expensive.

A major object of the present invention is to provide apparatus and methods for installing such muzzle attachments in a manner greatly reducing the time required for application and positively assuring accurate alinement of the attachment with respect to the gun muzzle. In accordance with the invention, certain of these results are achieved by the employment of means for maintaining the muzzle end of a barrel and a muzzle attachment in predetermined relation during the formation of a fused bond. This may be effected by use of a locating arbor, in conjunction with other locating means, adapted to extend through a muzzle device and into the muzzle end of a gun for maintaining them in axial alinement. A second locating and mounting element may be employed for retaining the opposite or receiver end of the barrel in a predetermined location.

We provide also novel heating means disposed adjacent the engaging portions of the barrel and muzzle attachment and especially adapted to locally heat the barrel for simultaneously effecting either or both of the dual purposes of fusing bonding material for securing the two parts together and conditioning the barrel for a subsequent bending operation. A bending unit may then be brought into engagement with the heated barrel near the muzzle attachment to slightly bend the muzzle while still maintaining the attachment and muzzle end of the gun in the desired predetermined axially alined relation. Preferably, the heating means extends about the gun barrel and attachment and may take the form of an annular electrical induction coil adapted to serve also as a cooling unit. The mounting or locating apparatus is desirably operable to axially retract a gun barrel from within the heating unit after the attaching process to permit its removal from the apparatus.

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The apparatus disclosed herein is particularly adapted for assuring that the bending of the barrel can take place only in the desired direction and to a predetermined optimum extent. Such control is preferably effected by the employment of a shaft carrying the previously described locating arbor for movement in a single plane, in conjunction with means for limiting the permitted rotation of the shaft to thus limit the bending of the barrel.

The above and further features and objects of the present invention will be better understood from the following detailed description of the typical embodiment illustrated in the accompanying drawings, in which:

Fig. 1 is a front elevation of the attaching apparatus, with the gun barrel and muzzle attachment illustrated in dot-dash lines;

Fig. 2 is a side elevation of the apparatus shown in Fig. 1;

Fig. 3 is an enlarged fragmentary vertical section through the upper locating apparatus and taken on line 3—3 of Fig. 1;

Fig. 4 is an enlarged fragmentary horizontal section taken on line 4—4 of Fig. 1;

Fig. 5 is an enlarged fragmentary vertical section through the lower locating and bending apparatus taken on line 5—5 of Fig. 1; and

Fig. 6 is an enlarged fragmentary horizontal section showing the bending apparatus and taken on line 6—6 of Fig. 1.

Referring first to Figs. 1 and 2, the illustrated apparatus is carried by framework 10, and comprises essentially an upper locating or mounting assembly generally indicated at 11, a lower mounting assembly 12, bending unit 13, and heating coil 14. Framework 10 includes a pair of spaced vertically extending channel members 15 and 16, secured together at their lower ends and maintained in upstanding condition by a pair of angle irons 17. A shorter channel member 18 extends horizontally between the upper ends of members 15 and 16 to form a rigid frame structure.

Upper mounting assembly 11 includes a vertical sliding plate 19 disposed at the outside of channels 15 and 16 and overlapping the outer surfaces of channel flanges 86 and 98 at 20 and 21. As best seen in Fig. 4, gibs or retaining plates 22 engage the outer surface of plate 19 at either side to retain it against the channel flanges and thus form a pair of guiding recesses within which the plate is vertically slidable. Gibs 22 are spaced from their respective channels a distance approximately equal to the thickness of the sliding plate by spacers 23, the gibs and spacers being retained in the illustrated positions by bolts 24, which extend through the channel flanges to threadedly engage clamping plates 25.

On its outer surface, the sliding plate removably carries a locating block 26 especially designed to correspond in configuration to the internal recess of receiver 27 of gun barrel 28. The locating block is removably secured to the plate by screws 29, to permit ready interchangeability of blocks having unlike shapes corresponding to the receivers of different makes of guns. At the lower end of its outer surface, plate 19 carries a horizontally disposed outwardly projecting support 32, removably secured to the plate, as by bolts 30, and having a recess 31 within which the gun barrel is receivable. As will be understood, with the barrel and receiver mounted to the illustrated apparatus, the lower extremity of receiver 27 engages support 32 at 33 to vertically locate the barrel.

Extending vertically along the inner surface of plate 19 is a toothed rack 34 secured to the plate as by bolts 35. Shaft 36 extends through openings 37 in channels 15 and 16, and is rotatably supported by bearings 38, which are carried by the respective channels in any convenient manner. Thrust sleeves 39 are secured to the shaft outwardly of the bearings to retain the shaft against lateral displacement. At a central location, shaft 36 carries gear 40, keyed to the shaft at 117 and engageable with rack 34 to control the vertical position of sliding plate 19. At one end, shaft 36 carries control wheel 41, which may have a control handle 42. Thus, clockwise rotation of wheel 41 as seen in Fig. 2 rotates shaft 36 and gear 40 to displace rack 34 and plate 19 upwardly and effect upward axial retraction of barrel 28.

Depending elongated stud 43 is threadedly receivable within an opening in the lower end of plate 19, and carries, beneath the plate, a pair of stop nuts 44. Stop plate 45 (see Fig. 1) extends between the outer surfaces of channel flanges 86 and 98 beneath the plate and its retaining gibs, and is secured to the flanges, as by bolts 46. Plate 45 has a central vertically extending opening 47, through which stud 43 extends, and at the upper end of which stop bushing 48 is contained. The lower one of the nuts 44 engages the upper surface of bushing 48 to limit downward displacement of plate 19, the limiting position being easily adjustable by movement of the nuts along the stud.

Lower mounting assembly 12 includes a transversely extending shaft 49 rotatably retained by bearings 50, which are secured to the forward flanges of channels 15 and 16 at their lower ends, as by bolts 51. Thrust collars 52 are carried by shaft 49 outwardly of the two bearings and may be rigidly secured to the shaft by set screws 53. These set screws permit lateral adjustment of shaft 49 to enable accurate alinement of the lower mounting assembly with the upper mounting assembly to thus assure accurate alinement of the muzzle attachment with respect to the gun barrel.

Shaft 49 has an enlarged central portion 54 of substantially rectangular configuration, having a radially extending transverse opening 55 (see Fig. 5) through which arbor 56 passes. Nuts 57 and 58 threadedly engage the arbor at opposite sides of enlarged portion 54 of the shaft to rigidly retain the arbor in perpendicularly extending relation to the shaft. The nuts permit regulation of the upwardly projecting extent of the arbor. Above its lower threaded portion, the arbor has a cylindrical portion 59 of an external diameter corresponding to the internal diameter of muzzle attachment 60 and thus adapted to retain the muzzle attachment in a predetermined position.

Upwardly beyond portion 59, the arbor presents a reduced diameter portion 61 of an external diameter corresponding to the internal diameter of gun barrel 28, and of a length permitting its reception within the lower end of the gun muzzle. With the gun barrel and muzzle attachment mounted on the apparatus as illustrated, the upper end of the arbor is approximately at the same elevation as the upper end of muzzle attachment 60. The arbor, by virtue of its two unlike external diameters, acts to positively retain the muzzle device and the muzzle end of barrel 28 in accurate axial alinement both before and during heating and bending of the barrel.

Bracket 62 is secured by bolt 63 to the outer surface of shaft enlargement 54, and extends upwardly to present a substantially horizontal barrel portion 64. This barrel portion has an internal bore 65 within which plunger 66 is slidably receivable. Coil spring 67 urges the plunger to the right, as seen in Figs. 2 and 5, in which position pin or projection 68 is receivable within the opening in the upper surface of muzzle device 60 provided for the forward gun sight. The pin thus serves to retain the muzzle device against rotation relative to the barrel. At its outer end, reduced diameter portion 69 of plunger 66 carries an operating knob 70, retained on the plunger as by cotter key 71. Knob 70 permits outward retraction of the plunger and its pin 68 to permit removal of the gun barrel and its attached muzzle device after the applying operation has been completed. Slot 72 in bracket 62 permits adjustment of the bracket relative to shaft 49 to allow use of the apparatus for applying various types of muzzle devices having differently located sight receiving openings.

At one side of enlargement 54, shaft 49 carries a stop element 73 (see Figs. 1 and 5), which is rigidly secured to the shaft enlargement, as by bolt 74, to rotate with the shaft in either direction. Stop 73 presents a pair of inwardly facing spaced arms 75 and 76 (see Fig. 5), having openings within which opposed studs 77 and 78 are threadedly received. Nuts 79 and 80 permit accurate adjustment and setting of the studs relative to their respective arms. Stop pin 81, which may have faces 82 and 83 angularly disposed for full contact with the inner ends of studs 77 and 78, projects from the base of bearing 50 to engage the studs and limit rotation of the shaft. Thus, the studs may be adjusted to accurately determine the amount of bending to which barrel 28 is subjected.

Bending unit 13, as best seen in Fig. 6, includes an eye bolt 84 extending through openings in flanges 85 and 86 of channel member 15, and is rigidly retained in predetermined relation to the channel member by nuts 87 and 88 at the sides of the flanges. Eye 89 of bolt 84 pivotally carries bending lever 90 by bolt or pin 91. Lever 90 carries a barrel engaging element 92, as by bolt 93, the element presenting an inner arcuate barrel engaging surface 94 of a diameter corresponding to the external diameter of barrel 28. At its free end, lever 90 presents an outer curved cam surface 95 against which bending pressure is exerted.

Eye bolt 96 passes through flanges 97 and 98 of channel 16, its outward displacement being limited by nut 99, and its inward displacement being resiliently restrained by coil spring 100 against which nut 101 bears. Eye 102 of bolt 96 pivotally carries operating arm assembly 103 by pin 104, which may be retained at either end by a cotter key 105. The arm assembly includes a

pair of spaced arms 106 having an intermediate roller 107 rotatably retained between them by pin 108. Similarly, a spacer 110 may be disposed between the outer ends of arms 106. As will be understood, leftward movement of arm assembly 103 causes roller 107 to engage cam surface 95 on lever 90 and thus effect inward bending movement of the bending lever. As best seen in Fig. 5, element 92 engages the barrel at a point immediately beyond muzzle attachment 60 and the reduced diameter portion 61 of the arbor.

Electrical induction heating coil 14 is formed of a limited number of turns of electrically conductive tubing 111. This tubing is connected at its ends to an electrical supply in known manner and is disposed about the barrel and muzzle attachment at their areas of engagement to locally heat them by inducing current flow within them. Tubing 111 presents a number of inwardly facing openings 112, and is thus adapted to act also as a cooling unit by passage of cooling air through the tubing and from these openings 112 onto the heated barrel and muzzle attachment. The heating coil is suitably supported from the framework, as by insulating support 113.

In using the apparatus, the muzzle attachment is first placed about arbor 56 in the illustrated position. Barrel 28 is then mounted as shown, with its muzzle end disposed about the upper end of the arbor and within the upper end of the muzzle attachment, and with receiver 27 about locating block 26 and above support 32. When thus mounted on the apparatus, the muzzle end of the barrel and the muzzle attachment are positively retained in axially alined positions.

During the mounting of the barrel and attachment, fusible bonding material is placed in a suitable position of engagement with both units to form a fused bond when heated. Preferably, a ring of bonding material is placed about the muzzle end of the barrel to engage the inner surface of the rearward portion of the muzzle attachment. If the rear portion of the attachment is formed in the usual manner, i. e. as a pair of sections including an adapter 114 receivable about the barrel and a forwardly extending cage portion 115 to be carried by the adapter, an additional ring of bonding material may be placed between the engaging surfaces of these two sections at 116 to be fused simultaneously with the attaching bonding material.

After the muzzle attachment and barrel have been mounted on the apparatus in the illustrated positions, heating element 14 is energized by supplying electrical energy to the opposite ends of tube 111 to locally heat the barrel, the attachment, and the two rings of bonding material. Such heating fuses the two rings of bonding material to form rigid connections between the barrel and adapter 114 and between the adapter and cage 115. The heating also effectively conditions that portion of the barrel immediately to the rear of the muzzle attachment for bending. After the bonding material has been fused and the barrel is locally heated enough to facilitate bending, arm assembly 103 is pivoted to the left as seen in Fig. 6 to engage cam surface 95 on lever 90 and cause inward movement of the lever. Such inward movement of lever 90 effects inward bending of the barrel by element 92 at a location immediately beyond the muzzle attachment and the reduced portion 61 of the arbor. Since shaft 49 can rotate only about a single axis, the arbor is positively retained for movement in a single inward direction, and thus no lateral bending can occur. During the fusing and bending processes, pin 68 retains the muzzle attachment in the correct rotative relation to barrel 28. Also, arbor 56 retains the attachment and the muzzle end of the gun, that is that portion of the muzzle within which its reduced diameter portion 61 is received, in axially alined relation. The enlarged portion 59 of the arbor assures correct alinement of the muzzle attachment, and the reduced diameter portion 61 assures identical axial alinement of the gun muzzle. The amount of bending is determined by engagement of stud 77 on stop 73 with surface 82 of pin 81, and thus may be accurately controlled.

After the bending operation has been completed, the electrical supply to the heating element is disconnected, and cooling air is forced into one end of the tube for passage out of openings 112 and onto the heated parts. Lever 90 is then pivoted out of engagement with the barrel, and pin 68 is withdrawn from the sight opening in the cage by outward movement of knob 70. Control wheel 41 may then be rotated by handle 42 in a clockwise direction as seen in Fig. 2 to move sliding plate 19 upwardly by virtue of gear 40 and rack 34. Such upward movement of the sliding plate retracts barrel 28 and the muzzle attachment axially or upwardly from within the annular heating element and from about arbor 56 to permit dismounting of the barrel from the apparatus.

We claim:

1. Apparatus for applying a muzzle attachment to a gun barrel, comprising a support, means for mounting the barrel and attachment to said support with said attachment in predetermined relation to the muzzle end of the barrel, heating means mounted in proximate relation to said barrel and attachment for locally heating them at an area of interengagement to simultaneously fuse bonding material disposed in said area and condition said barrel for bending, and a member movably mounted to the support for engaging and longitudinally bending said heated barrel to correct for sighting error while maintaining said attachment in said predetermined relation to said muzzle end of the barrel.

2. Apparatus for applying a muzzle attachment to a gun barrel, comprising a support, a shaft rotatably carried by said support, an arbor carried by said shaft and extending perpendicularly therefrom to extend through the attachment and into the muzzle end of the barrel to maintain said attachment and muzzle end in predetermined axially aligned relation, heating means mounted in proximate relation to said barrel and attachment for locally heating them at an area of interengagement to simultaneously fuse bonding material disposed in said area and condition said barrel for bending, and a member movably mounted to the support for engaging and longitudinally bending said heated barrel to correct for sighting error while maintaining said attachment in said predetermined relation to said muzzle end of the barrel, said shaft and arbor limiting the bending to a single predetermined direction.

3. Apparatus for applying a muzzle attachment to a gun barrel, comprising a support, means for mounting the barrel and attachment to said support, said mounting means including an arbor adapted to extend through the attachment and into the muzzle end of the barrel to maintain said attachment and muzzle end in predetermined axially aligned re-

lation, heating means mounted in proximate relation to said barrel and attachment for locally heating them at an area of interengagement to simultaneously fuse bonding material disposed in said area and condition said barrel for bending, and a member movably carried by said support for engaging the heated barrel immediately beyond the end of said arbor and longitudinally bending said barrel to correct for sighting error while maintaining said attachment in said predetermined relation to said muzzle end of the barrel.

4. Apparatus for applying a muzzle attachment to a gun barrel, comprising a support, means for mounting the barrel and attachment to said support with said attachment in predetermined relation to the muzzle end of the barrel, annular heating means extending about said barrel and attachment for locally heating them at an area of interengagement to simultaneously fuse bonding material disposed in said area and condition said barrel for bending, and a member movably mounted to the support for engaging and longitudinally bending said heated barrel to correct for sighting error while maintaining said attachment in said predetermined relation to said muzzle end of the barrel.

5. Apparatus for applying a muzzle attachment to a gun barrel, comprising a support, means for mounting the barrel and attachment to said support with said attachment in predetermined relation to the muzzle end of the barrel, an electrical induction coil extending about said barrel and attachment means mounted in proximate relation to said barrel and attachment for locally heating them at an area of interengagement to simultaneously fuse bonding material disposed in said area and condition said barrel for bending, and a member movably mounted to the support for engaging and longitudinally bending said heated barrel to correct for sighting error while maintaining said attachment in said predetermined relation to said muzzle end of the barrel.

6. Apparatus comprising a support, means for mounting a gun barrel and muzzle attachment to said support with said attachment in predetermined relation to the muzzle end of the barrel, said mounting means including a plate slidable relative to said support and axially of the barrel when mounted thereto, and including a locating block carried by said plate and receivable within the receiver of said gun barrel, means mounted in proximate relation to the barrel to locally heat said barrel in the vicinity of said attachment, a toothed rack carried by said plate, and a gear engageable with said rack and rotatable relative to said support to move said plate and block and thereby axially retract said barrel after said heating.

7. The method of applying a muzzle attachment to the barrel of a gun, including mounting the attachment in predetermined relation to the muzzle end of the gun with fusible bonding material disposed at an area of interengagement, locally heating said barrel in the vicinity of said attachment to simultaneously fuse said bonding material and condition said barrel for bending, and longitudinally bending the barrel in the heated area to correct for sighting error while maintaining said attachment in said predetermined relation to said muzzle end.

8. Apparatus for applying a muzzle attachment to a gun barrel, comprising a support to which the barrel and attachment may be mounted with the attachment substantially alined with the barrel, a heater mounted to the support for locally heating the barrel and attachment at an area of interengagement to simultaneously fuse bonding material disposed in said area and condition the barrel for bending, a member movably carried by the support for engaging and longitudinally bending the barrel, and means carried by the support for axially retracting the barrel away from the heater after said bending operation.

9. Apparatus for applying a muzzle attachment to a gun barrel, comprising a support, means for mounting the barrel and attachment to said support, said mounting means including an arbor adapted to extend through the attachment and into the muzzle end of the barrel to maintain said attachment and muzzle end in predetermined axially alined relation, heating means mounted in proximate relation to said barrel and attachment for locally heating them at an area of interengagement to simultaneously fuse bonding material disposed in said area and condition said barrel for bending, a member movably carried by said support for engaging the heated barrel immediately beyond the end of said arbor and longitudinally bending said barrel to correct for sighting error while maintaining said attachment in said predetermined relation to said muzzle end of the barrel, said mounting means including an element engaging a receiver end of said barrel and movable in a direction to axially retract the barrel from about said arbor and from said heating means, and means for moving said element to so retract the barrel.

10. Apparatus as recited in claim 9, including means mounting said arbor for swinging movement in accordance with said bending of the barrel.

11. Apparatus for applying a muzzle attachment to a gun barrel, comprising a support, a shaft rotatably carried by said support, an arbor carried by said shaft and extending perpendicularly therefrom to extend through the attachment and into the muzzle end of the barrel to maintain said attachment and muzzle end in predetermined axially alined relation, an annular heater element disposed about the barrel in proximate relation to the attachment for locally heating the barrel and attachment at an area of interengagement to simultaneously fuse bonding material disposed in said area and condition said barrel for bending, a member movably mounted to the support for engaging and longitudinally bending said heated barrel to correct for sighting error while maintaining said attachment in said predetermined relation to said muzzle end of the barrel, said shaft and arbor limiting the bending to a single predetermined direction, a stop limiting the extent of said swinging movement of the arbor, said mounting means including a block projecting transversely into a recess in a receiver end of the gun barrel and movable in a direction to axially retract the barrel from the arbor and heater element, and means for so moving the block.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,239,533	Spansel	Sept. 11, 1917
2,056,155	Brinkman	Oct. 6, 1936
2,496,950	Marcus et al.	Feb. 7, 1950