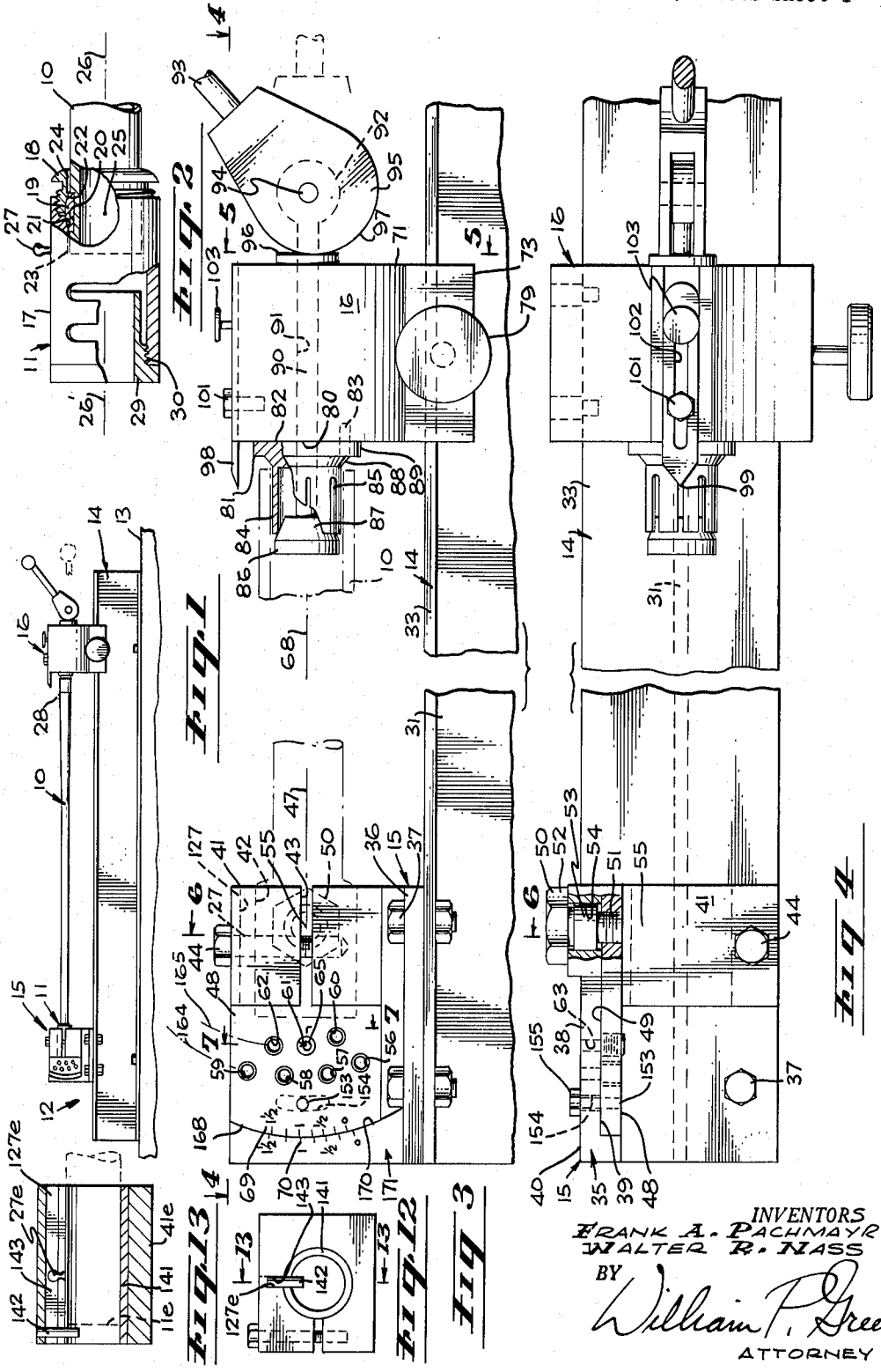
June 21, 1966 F. A. PACHMAYR ETAL 3,257,108

MOUNTING OF GUN MUZZLE DEVICES

Filed July 10, 1962 2 Sheets-Sheet 1



INVENTORS
FRANK A. PACHMAYR
WALTER R. MASS
BY
William P. Green
ATTORNEY

June 21, 1966 F. A. PACHMAYR ETAL 3,257,108

MOUNTING OF GUN MUZZLE DEVICES

Filed July 10, 1962 2 Sheets-Sheet 2

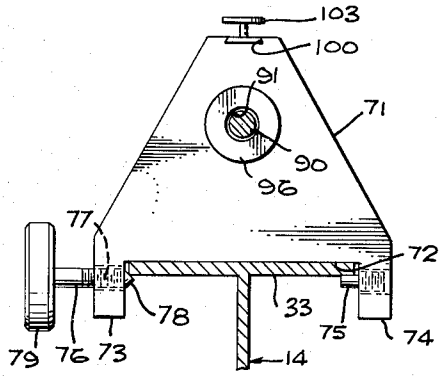


Fig. 5

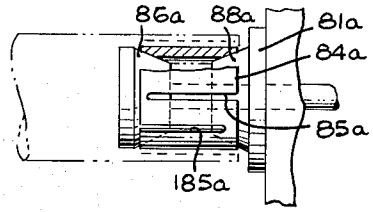


Fig. 8

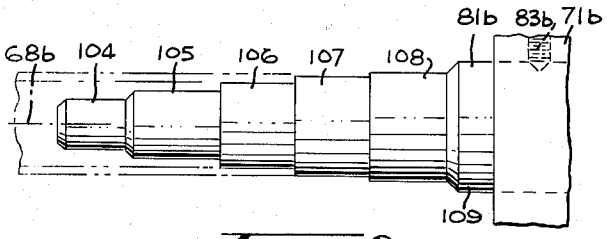


Fig. 9

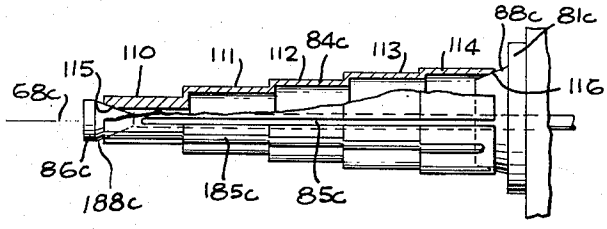
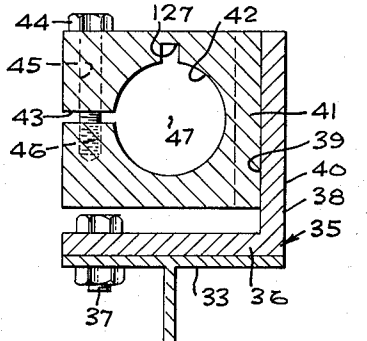


Fig. 10

Fig. 6



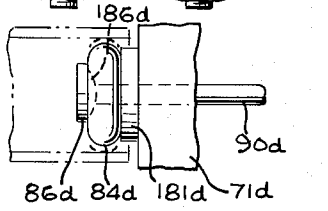


Fig. 11

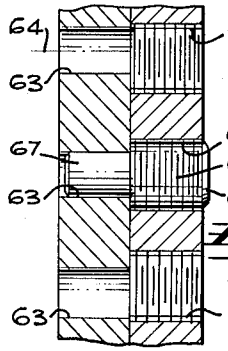


Fig. 7

INVENTORS
FRANK A. PACHMAYR
WALTER R. HASS
BY
William P. Green
ATTORNEY

United States Patent Office 3,257,108 Patented June 21, 1966

3,257,108

MOUNTING OF GUN MUZZLE DEVICES

Frank A. Pachmayr, Culver City, and Walter R. Nass, Escondido, Calif., assignors to Firearm Accessories, Inc., Los Angeles, Calif., a corporation of California

Filed July 10, 1962, Ser. No. 208,732
19 Claims. (Cl. 269—45)

This invention relates to improved apparatus for mounting a muzzle device, such as a shot gun choke, on the forward end of a gun barrel.

The attachment of a choke device or the like to a gun barrel alters the aiming characteristics of the gun in a manner requiring compensation for this change. For one thing, the muzzle attachment normally reduces the recoil of the gun, and because of this reduction in recoil tends to cause the gun to hit a target slightly lower than if no muzzle device were present. Further, since the muzzle device is of a diameter somewhat larger than the rest of the barrel, the application of the attachment to the barrel usually requires elevation of the forward sight of the gun, and for this reason also the gun may hit a target slightly low with respect to the sighting line.

To compensate for the above discussed tendency of a gun having a muzzle attachment to shoot low, it has been found desirable to mount such muzzle attachments in positions of slight angularity with respect to the main axis of the gun barrel. More particularly, the muzzle attachment is so mounted as to be aimed slightly upwardly, preferably at an angle between about 0 degrees and 1½ degrees. The general object of the present invention is to provide apparatus for thus mounting a muzzle attachment at a predetermined very accurately measurable slight upward angle with respect to a gun barrel, to effect the desired compensation for the change in aiming characteristics of the gun resulting from the application of the muzzle attachment to the barrel. In a device embodying the invention, the muzzle attachment and gun barrel are firmly held in the desired positions of relative angularity, while a rigid connection is made between the two units. This connection may be effected in any desired manner, but for maximum simplicity is preferably attained by merely applying a strong bonding cement, such as an epoxy cement, to the attachment and gun barrel, and allowing this cement to dry to a hardened condition while the attachment is held in the proper position of angularity with respect to the gun barrel.

Certain specific features of novelty have to do with the preferred mounting of the unit which holds the muzzle attachment in a manner such that this unit is shiftable between two or more positions of different angularity, in order that the attachment may be connected to a gun barrel in any of various different settings. Preferably, the unit for holding the muzzle attachment is mounted for pivotal movement between these different settings, and may be rigidly locked in any desired setting. For locking the unit in its different positions, I may utilize one or more screws, pins or other locking elements adapted to fit into mating apertures within the attachment holding unit and a coacting mounting structure, and serving to secure the unit in different settings when the locking element is received within the different sets of apertures. The rear end of the gun barrel may be accurately located by engagement with a positioning structure, which may consist of a part projecting into and closely interfitting with the rear end of the barrel. For effecting tight engagement of this locating structure with the gun barrel, I may form the structure to be expansible radially outwardly into tight gripping engagement with the inner surface of the barrel. In certain forms of the invention, the expansible unit takes the

form of a longitudinally slit radially expansible sleeve, adapted to be expanded by a suitable cam type axially movable mandrel. In another form of the invention, the expansible unit may be an elastomeric ring adapted to expand radially upon the application of axial compressive forces thereto. It is also contemplated that the locating structure for engaging the rear end of the barrel may have portions of several different diameters, for engaging and locating any of several different sizes of gun barrels.

The above and other 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 side view of a first form of the invention;

FIG. 2 is a side view of the forward end of the gun barrel and muzzle attachment of FIG. 1;

FIG. 3 is an enlarged fragmentary representation of the apparatus of FIG. 1;

FIG. 4 is a fragmentary view taken on line **4—4** of FIG. 3;

FIG. 5 is a fragmentary vertical section taken on line **5—5** of FIG. 3;

FIG. 6 is a vertical section taken on line **6—6** of FIG. 3;

FIG. 7 is a greatly enlarged fragmentary section taken on the generally vertical arcuate line designated **7—7** in FIG. 3;

FIGS. 8, 9, 10 and 11 represent four variational types of devices for holding the rear or chamber end of the gun barrel in the present apparatus;

FIG. 12 is a view similar to a portion of FIG. 6, showing a different form of muzzle device holder; and

FIG. 13 is a section taken on line **13—13** of FIG. 12.

Referring first to FIG. 1, I have represented at **10** a conventional gun barrel, to which there is to be applied a muzzle attachment **11**. The attachment and barrel are secured in desired positions of slight angularity with respect to one another by means of a device **12** constructed in accordance with the invention, and typically mounted on a table or other support surface represented at **13**. The apparatus **12** includes a base rail or mounting part **14**, a unit **15** for receiving and holding the muzzle attachment **11**, and a second unit **16** for engaging and locating the rear end of the gun barrel **10**.

While it is to be understood that any of numerous different types of muzzle attachments may be connected to a gun barrel by the apparatus of the invention, there is typically illustrated in FIG. 2 one form of muzzle device which may be used, this device being shown for the purpose of representing broadly the manner in which the muzzle device may be received about the front of the gun barrel. In the FIG. 2 arrangement, the muzzle device **11** consists of a main tubular body **17**, to the rear portion of which there is threadedly connected a securing ring **18**, for retaining the choke device in a fixed axial position relative to a ring **19** received within an annular groove **20** formed in the end portion of gun barrel **10**. Ring **19** may be formed of two semicircular sections, and may have the externally rounded cross-section illustrated in FIG. 2, for engagement at opposite axial sides by correspondingly curved annular surfaces **21** and **22** of parts **17** and **18**.

At locations forwardly of and rearwardly of ring **19**, the external surface of barrel **10** has a slight clearance (at **23** and **24**) from the inner surfaces of parts **17** and **18**, to allow for slight universal adjusting movement of muzzle device **11** relative to barrel **10** about a center **25** lying on the axis **26** of barrel **10**. To facilitate such limited adjusting movement of the muzzle device, the curved surfaces **21** and **22** of parts **17** and **18**, and the engaged external surface of ring **19**, may all be of spherical curvature, about

the discussed center 25. The clearance spaces 23 and 24 are of sufficient size to allow adjustment of the muzzle device to a position in which the axis 26' of the muzzle device is disposed at the proper angle with respect to barrel axis 26 to effect the compensation which is required as a result of the presence of the muzzle device on the barrel. The usual forward sight 27 is of course mounted on the muzzle device, for coaction with the rear sight 28 on the rear portion of the barrel, in aiming the gun. At its forward end, the part 17 of the muzzle device may carry a choke tube typically represented at 29, for controlling the pattern of the shot fired by the gun, with tube 29 being suitably secured to part 17, as by a threaded connection at 30.

The rail or mounting member 14 may take the form of a horizontally elongated rigid metal "I" beam, having the cross-section represented in FIG. 6. More particularly, this member 14 may have a vertical web portion 31, formed integrally with a bottom horizontal planar cross piece or flange 32, and a top horizontal planar cross piece or flange 33. Bottom flange 32 may be rigidly secured to the supporting table or structure 13, as by bolts represented at 34 in FIG. 6, while the units 15 and 16 are mounted to upper flange or plate 33.

Referring now to FIGS. 3, 4 and 6, the unit 15 for holding muzzle attachment 11 may include a first bracket section 35, having a horizontal bottom flange 36 which is secured by bolts 37 to the upper side of top plate 33 of part 14. At one of the edges of bottom flange 36, part 35 has an integral upstanding flange 38, whose inner and outer parallel surfaces 39 and 40 lie in vertical planes which extend parallel to, but are offset laterally from, the vertical plane of central web 31 of rail 14. Adjacent the inner surface 39 of flange 38, there is mounted a block or section 41 containing a cylindrical passage 42 of a normal diameter which is only slightly larger than the diameter of the outer cylindrical surface of the muzzle attachment, to receive and effectively locate the attachment within block 41. An axially extending groove 127 is provided in the undersurface of the top portion of block 41, of a width to exactly receive and closely confine forward sight 27 of the muzzle device, and thereby locate the sight in a precisely upwardly pointing position. At the side of block 41 which faces away from flange 38, the material of this block may be interrupted by a horizontal slit or gap 43, with the vertical height of this gap being variable by means of a screw 44, to tighten the wall of passage 42 against and about the muzzle device. Screw 44 has an upper head bearing downwardly against the top surface of block 41, and extends downwardly through an unthreaded bore 45 in the upper part of block 41, with the lower end of the screw being threadedly connected into the bottom part of block 41 at 46, so that tightening of screw 44 within bore 46 causes the upper head of the screw to pull downwardly on the upper portion of block 41, and reduce the height of gap 43, thereby restricting passage 42 to a diameter corresponding to the outside diameter of the muzzle attachment. Block 41 may be formed of a material, such as metal, which is essentially rigid, but has a capacity for some resilient deformability, between a normal condition in which passage 42 has a diameter slightly greater than the outside diameter of the muzzle attachment, to easily receive that attachment, and a reduced diameter condition in which the passage 42 is at least as small as the outside diameter of the muzzle attachment, and tightly grips that attachment. The axis of passage 42 is designated 47, and of course coincides with axis 26' of the muzzle attachment when the attachment is received within passage 42. Block 41 has, adjacent surface 39, a vertical flange portion 48, and has a vertical planar side surface 49 abutting against and slidably engaging surface 39 of flange 38. Surface 49 is retained in abutting engagement with surface 39 by means of a pivot screw 50, whose end portion 51 is threadedly connected into block 41 (FIG. 4), and whose enlarged head 52 abuts against the outer side flange 38. Cylindrical portion 53 of screw 50 is journalled within a correspondingly dimensioned cylindrical bore 54 formed in flange 38, to mount block 41 and its integral flange portion 48 for pivotal movement relative to flange 38 about a horizontal axis 55 extending perpendicular to vertical surfaces 39 and 49, and extending perpendicular to and intersecting axis 47 of passage 42. The threaded portion 51 of screw 50 is a sufficiently tight fit within the coacting threaded opening in part 41 to retain the screw in fixed relation relative to part 41, and the engagement of head 50 with the outer side of flange 38 is sufficiently loose to allow the discussed pivotal movement of part 41, while still retaining surfaces 39 and 40 at all times in abutting engagement. Also, a second screw 153 may be threaded into wall 48 and extended through and be movable within an arcuate slot 154 in flange 38, and have a head 155 slidably engaging this flange to assist screw 53 in holding flanges 38 and 48 together.

Flange portion 48 of part 41 contains a number of threaded openings 56 through 62 (typically six such openings), whose axes may extend parallel to axis 55, and which may typically be arranged along two arcuate lines 164 and 165 centered about axis 55. For coaction with these openings 56 through 62, the flange portion 38 of part 35 has cylindrical bores 63 which may also be located along the same two arcuate lines 164 and 165 with respect to axis 55, and which are spaced approximately in correspondence with the different apertures 56 through 62. The axes 64 of openings 63, like the axes of the threaded openings 56 through 62, are parallel to pivotal axis 55. For locking the block 41 in any desired pivotal position, there is provided a lock element 65 (FIG. 7), having a threaded portion 66 engageable within any of the different threaded openings 56 through 62, and having a reduced diameter cylindrical portion 67 of a size corresponding to bores 63, and receivable therein. Thus, when the pin or element 65 is received within any one of the threaded openings 56 through 62, and projects into the corresponding bore 63, the pin 65 acts to securely lock block 41 in a corresponding predetermined position of angularity with respect to the later to be discussed horizontal axis 68 of barrel holding unit 16. This axis 68 with which axis 26 (FIG. 2) of the gun barrel coincides when the latter is held in the apparatus, intersects the previously mentioned axis 47 of passage 42 (axis 26' of the muzzle device) at the location of transverse pivotal axis 55 (and axis 25 of FIG. 2).

The various bores 63 are spaced apart slightly differently than are the various threaded openings 56 through 62, in a relation such that, in any one setting of block 42, pin 65 is receivable in locking relation within only one of the threaded openings and the associated opening 63. When the pin is received within the first threaded opening 56, and the associated aperture 63, this may typically serve to lock block 41 in a position in which its axis 47 coincides exactly with barrel axis 68, so that the muzzle device is exactly aligned with the barrel. When the locking pin is received within opening 57, muzzle device axis 47 may be disposed at an upward angle of one-fourth of a degree relative to axis 68 of the barrel. Similarly, upward inclinations of one-half degree, three-quarters degree, one degree, one and one-fourth degree and one and one-half degree may be attained by connection of locking pin 65 into threaded openings 58, 59, 60, 61 and 62 respectively. For indicating the setting of block 41, the flange portion 48 of block 41 may have an arcuate edge 168 having markings 69 coacting with marking 70 on an arcuate edge 170 of a portion 171 of flange 38. In any of the various settings of block 41, only one of the markings 69 will exactly coincide with one of the markings 70, with the angularity being indicated in degrees adjacent that pair of coinciding markings.

The unit 16 for engaging and locating the rear or cham-

ber end of barrel **10** may include a rigid typically level body member **71**, which may have the essentially triangular cross-section represented in FIG. 5. The undersurface **72** (FIG. 5) of body part **71** may be planar, and slidably engage the upper surface of top flange **33** of part **14**. At opposite sides of flange **33**, body part **71** may have two spaced parallel depending flanges **73** and **74**, to confine flange **33** between these flanges **73** and **74** in a manner allowing shifting movement of part **71** along the upper surface of flange **33** only in a direction parallel to barrel axis **68**. The flange **74** may carry a pin **75** engageable with the undersurface of flange **33** to hold one side of body **71** against upward movement from flange **33**. At the opposite side of flange **33**, depending flange **73** may carry a locking screw **76**, which is threadedly connected at **77** into flange **73**, and which has a tapered end portion **78** adapted to be tightened inwardly against the underside of flange **33** in a manner frictionally locking block **71** in any desired setting relative to member **14**. Screw **76** may have a knurled knob **79** for facilitating the tightening and loosening of the set screw.

At its side which faces toward the muzzle attachment holding unit **15**, block **71** has a vertical planar surface **80**, disposed transversely of axis **68**. Against this surface, there is mounted a barrel locating part **81**, having a flat surface **82** engaging surface **80**, and having a locating pin **83** received within a coacting recess in block **71** to locate part **81** relative to block **71**. The element **81** forms a tubular sleeve **84** projecting toward unit **15**, and centered about axis **68**. Sleeve **84** has a series of circularly spaced parallel longitudinally or axially extending slits **85**, and is formed of a resilient material (such as spring steel) allowing outward expansion of the sleeve to an increased diameter for gripping the inner surface of barrel **10**. The free end of sleeve **84** is expansible outwardly in this manner by means of an expanding mandrel **86**, having a conical tapering surface **87** engaging the inner side of the free end of the sleeve, and acting to expand the sleeve outwardly in response to rightward movement of mandrel **86** (as viewed in FIG. 3) along axis **68**. Between sleeve portion **84** of part **81**, and surface **80**, the part **81** may externally have a tapering conical surface **88** and a short cylindrical surface **89**.

For actuation of mandrel **86** axially, this part may be rigidly carried by a reduced diameter stem **90**, which extends through and is slidable within a bore **91** formed within block **71**, and which has an end portion **92** pivotally connected to a cam actuating lever **93** by a pin **94**. As will be apparent, the lever **93** has a camming portion **95**, which may be bifurcated to engage a pressure plate **96** at both sides of stem **90**, with element **95** having camming surfaces **97** at both of these sides whose radius with respect to the pivotal axis varies in a manner such that actuation of lever **93** between the full line position of FIG. 1 and the broken line position of that figure acts to pull mandrel **86** to the right, as viewed in FIG. 3, and to thereby expand sleeve **84** outwardly into tight essentially annular gripping engagement with the inner wall of the rear end portion of barrel **10**. For assisting in properly locating sight **28** of the gun barrel **10** in a directly upwardly facing position, box **71** may carry an indicator or indexing element **98** (FIGS. 3 and 4), having a pointer end **99** which should directly overlie and directly align with sight **28** when barrel **10** is turned to a properly oriented position. Element **98** may be mounted for sliding movement parallel to axis **68**, by mounting element **98** slidably within a dovetail shaped recess or groove **100** in the upper surface of block **71**, with the sliding movement of part **98** typically being limited by means of a screw **101** whose head engages the upper side of part **98** and whose shank extends downwardly through an elongated slot **102** in part **98** and is connected threadedly into block **71**. A handle **103** may be formed on part **98**, for actuating it between its different settings.

To now describe the complete process of securing a muzzle attachment to a gun barrel utilizing the apparatus of FIGS. 1 through 7, assume that it is desired to mount the choke device **11** of FIG. 2 on shotgun barrel **10**, with the axis **26'** along which shot is directed by choke **11** being disposed at a slight angle of one and one-fourth degrees relative to axis **26** of the shotgun barrel. In this case, block **41** is pivoted about axis **55** to the position represented in FIG. 3, in which locking pin **65** may be, and is, screwed into threaded opening **61**, with the unthreaded end portion **67** of the lock pin being received within the corresponding aperture **63** in flange **38**, to positively lock block **41** in the one and one-fourth degree setting. This setting is indicated by the fact that the two markings opposite the number one and one-fourth coincide, whereas the other markings **69** and **70** do not coincide.

Next, the operator may insert muzzle device **11** into passage **42** of block **41**, with the outer cylindrical surface of the muzzle device being engaged and centered by the wall of passage **42**, and with pivotal axis **25** of the muzzle device (FIG. 2) coinciding with pivotal axis **55** of block **41**, and axis **26** of the muzzle device (which is also the center about which the external cylindrical surface of the muzzle device is formed) coinciding with axis **47** of passage **42**. Sight **27** on the muzzle device is received within slot **127** in the upper portion of block **41**, to retain the sight in a proper upwardly directed setting. Screw **44** may then be tightened, to securely clamp the muzzle device in a properly centered and oriented position within block **41**, so that the device is very accurately located in the desired one and one-half degree angular position relative to axis **68**.

The barrel **10** may be inserted into the muzzle device either prior to or after attachment of the muzzle device into block **41**. Rings **18** and **19** are secured in the positions of FIG. 2, to attach the muzzle device and barrel together, and a suitable bonding cement, preferably a very hard setting epoxy resin, may be applied to the inner surfaces of parts **17**, **18** and **19**, and the external surfaces of parts **10** and **19**, preferably filling the annular clearance spaces **23** and **24**, so that as soon as the cement has set, the muzzle device will be rigidly and permanently retained in the proper slightly angular position relative to the barrel.

Before the epoxy resin or other cement has had an opportunity to set, the operator slides block **71** forwardly (to the left in FIG. 3) far enough to cause sleeve **84** to extend into the chamber end of barrel **10**, as to the FIG. 3 setting, following which the barrel may be turned if necessary to properly align sight **28** with index element **98** in a manner locating the sight portion of the barrel at exactly the proper upwardly directed position. The operator locks block **71** in position by means of screw **76**, and then may swing lever **93** downwardly from the full line position of FIG. 1 to the broken line FIG. 1 position, to expand sleeve **84** outwardly against the barrel and locate it precisely relative to block **71**. The cement is then hardened while the apparatus holds the muzzle attachment and barrel in the discussed slightly angular relative positions. If desired, the cement may be an air-drying type of bonding compound, but preferably it is a thermosetting resin (such as the previously mentioned epoxy resin), which is cured by baking the resin for an appropriate period, say for example for a period of two hours at 250° Fahrenheit, in the case of an epoxy resin. If necessary, the entire mounting rail **14** and all of the carried parts may be bodily transported into a curing oven during the resin curing period. After the resin is set, the barrel and muzzle attachment may be removed from the apparatus and the installation process is complete.

FIG. 8 illustrates a variational form of the invention, which may be considered as identical with that of FIGS. 1 through 7 except as to the manner of construction of the barrel gripping expansible sleeve or collet **84*a***, and the coacting parts. In this arrangement, the sleeve has a first set of circularly spaced slits **85*a*** extending into the

material of the sleeve from one of its ends, and has a second set of slits **185***a* extending into the material of the sleeve from its opposite end, so that both ends of the sleeve may be expanded radially against the resilience of the sleeve material. Mandrel **86***a* is actuable rightwardly in the same manner as mandrel **86** of FIG. 3, to expand the left end of the sleeve, while the right end of the sleeve is simultaneously engaged by a correspondingly tapering frustro-conical projection **88***a* formed on a part **81***a* corresponding to part **81** of FIG. 3. Thus, instead of the right end of the sleeve being rigidly attached to part **81***a*, in correspondence with the FIG. 3 arrangement, this right end of the sleeve engages tapered surface **88***a*, and is expansible radially by that surface upon rightward actuation of the mandrel. If desired, the ends of the sleeve may have tapered surfaces shaped in correspondence with the engaged tapered surfaces of parts **86***a* and **81***a*, to facilitate the camming action. The FIG. 8 arrangement acts to locate the right end of the gun barrel somewhat more effectively than in FIG. 3, by virtue of the fact that the sleeve **84***a* tends to expand uniformly along its entire length, rather than only a one end.

FIG. 9 shows an arrangement in which there is substituted for the part **81** of FIG. 3 a rigid element **81***b*, which may be rigidly retained within a block **71***b* (corresponding to block **71** of FIG. 3) by a set screw represented at **83***b*. Part **81***b* may have a series of externally cylindrical portions **104**, **105**, **106**, **107**, **108** and **109**, all centered about an axis **68***b* corresponding to axis **68** of FIG. 3, and of different diameters corresponding to the internal diameters of the rear portions of a series of different sizes of gun barrels. When using this arrangement, the block **71***b* is merely actuated to the left far enough to move the appropriate one of the cylindrical portions **104**, **105**, **106**, **107**, **108** or **109** into engagement with the inner surface of the rear end portion of the gun barrel, to locate the barrel in properly centered position about axis **68***b*.

In the FIG. 10 arrangement, there is provided a resiliently expanasible sleeve or collet **84***c*, corresponding to sleeve **84***a* of FIG. 8, except that the sleeve has a series of portions **110**, **111**, **112**, **113** and **114** which are externally cylindrical and of progressively increasing diameter, all being centered about the main axis **68***c* of the device, for engaging and gripping different sizes of gun barrels (as discussed in connection with FIG. 9). The expanding mandrel **86***c* engages the reduced diameter end of collet **84***c*, while the opposite end is engageable with a frustro-conical surface **88***c* on a part **81***c* corresponding to parts **81** and **81***a* of FIGS. 3 and 8 respectively. As in FIG. 8, sleeve **84***c* has two sets of longitudinal slits **85***c* and **185***c* extending into the material of the sleeve from opposite ends thereof, and alternating about the circular extent of the sleeve. The surfaces **115** and **116** which engage cam surfaces **88***c* and **188***c* may be tapered in correspondence with the engaged cam surfaces. In using the FIG. 10 device, the sleeve **84***c* is first inserted into the gun barrel to a position in which the proper one of the surfaces **110**, **111**, etc. is received within and substantially engages the inner end portion of the barrel, following which element **86***c* is actuated to the right, as viewed in FIG. 10, to expand the sleeve **84***c* outwardly into tight gripping engagement with the barrel. Since slits **85***c* and **185***c* extend into the sleeve from its opposite ends, and extend along almost the entire length of the sleeve, the sleeve expands radially along substantially its entire length upon actuation of mandrel **86***a*.

FIG. 11 represents another form of the invention, in which there is substituted for the sleeve **84** of FIG. 3, a disk or ring **84***d* of rubber or other elastomeric material, which may normally be slightly undersized with respect to the particular size of barrel **10***d* with which the device is to be used, but which disk **84***d* is adapted to be expanded against its own resilience radially outwardly into tight gripping engagement with the inner surface of the gun barrel. For effecting such expansion, the right side of disk **84***d* may abut against a part **181***d*. corresponding to part **81** of FIG. 3, and mounted on the face of a block **71***d* corresponding to part **71** of FIG. 3. The opposite side of disk or ring **84***d* may be engaged by a member **86***d* which is carried by a stem **90***d* adapted to be actuated to the right by a cam lever such as that shown at **93** in the first form of the invention. The surface of part **86***d* which engages element **84***d* may be convexly curved, as represented at **186***d*, to maximize the extent to which element **84***d* is expanded outwardly upon rightward movement of element **86***d* relative to part **81***d*. The broken lines at the periphery of element **84***d* in FIG. 11 represent the position to which this part is expanded upon rightward actuation of parts **86***d*. As will be apparent, the part **84***d* may have a central opening through which stem **90***d* extends, to allow projection of that stem to a position for connection to an actuating lever.

FIGS. 12 and 13 represent a slightly altered form of muzzle device holder **41***e*, which may be used in connection with different sizes of adapter rings **141** for adapting the holder to receive muzzle devices of different gauges. Specifically, each adapter **141** may take the form of a sleeve which is received within body **41***e* and is keyed in position by reception of a pin **142**, carried at the forward end of body **41***e*, within an axial slit **143** in the sleeve. This slit also enables sleeve **141** to constrict and expand with body **41***e*. The reduced caliber muzzle device **11***e* is positioned within sleeve **141** behind pin **142**, with sight **27***e* projecting upwardly through slit **143** and into recess **127***e*. Any number of adapters of different internal diameters may of course be provided for use with different muzzle devices, or the holder **41***e* may be used without any adapter for maximum size muzzle devices.

We claim:

1. Apparatus for holding a gun muzzle attachment and a gun barrel having a muzzle end and a firing chamber end while said attachment is being secured to the barrel, said apparatus including a support, a first fixture mounted to said support and constructed and positioned to engage and accurately locate said firing chamber end of the gun barrel, and a second fixture mounted to said support for holding and accurately positioning said muzzle attachment at said muzzle end of the barrel, said second fixture being constructed to hold said attachment in almost exact axial alignment with the muzzle end of a barrel held by said first fixture but at a predetermined very slight upward angle relative thereto as the barrel and attachment are secured together, to compensate for the presence of the muzzle attachment in aiming, there being means for indicating precisely when said second fixture and attachment are at said predetermined very slight angle to the muzzle end of the barrel.

2. Apparatus for holding a gun muzzle attachment and a gun barrel having a muzzle end and a firing chamber end while said attachment is being secured to the barrel, said apparatus including a support, a first fixture mounted to said support and constructed and positioned to engage and accurately locate said firing chamber end of the gun barrel, and a second fixture mounted to said support for holding and accurately positioning said muzzle attachment at said muzzle end of the barrel, said first fixture including a projection projecting essentially toward said second fixture and constructed to extend into and fit closely within and thereby position said firing chamber end of the barrel, said second fixture being constructed to hold said attachment in almost exact axial alignment with a barrel held by said first fixture but at a predetermined very slight upward angle relative thereto as the barrel and attachment are secured together, to compensate for the presence of the muzzle attachment in aiming.

3. Apparatus for holding a gun muzzle attachment and a gun barrel having a muzzle end and a firing chamber end while said attachment is being secured to the barrel, said apparatus including a support, a first fixture mounted to said support and constructed and positioned to engage

and accurately locate said firing chamber end of the gun barrel, and a second fixture mounted to said support for holding and accurately positioning said muzzle attachment at said muzzle end of the barrel, said first fixture including an expansible projection projecting essentially toward said second fixture and constructed to extend into and expand radially outwardly into tight gripping engagement with and thereby position said firing chamber end of the barrel.

4. Apparatus for holding a gun muzzle attachment and a gun barrel having a muzzle end and a firing chamber end while said attachment is being secured to the barrel, said apparatus including a support, a first fixture mounted to said support and constructed and positioned to engage and accurately locate said firing chamber end of the gun barrel, and a second fixture mounted to said support for holding and accurately positioning said muzzle attachment at said muzzle end of the barrel, said second fixture being constructed to hold said attachment in almost exact axial alignment with a barrel held by said first fixture but at a predetermined very slight upward angle relative thereto as the barrel and attachment are secured together, to compensate for the presence of the muzzle attachment in aiming, said first fixture including a sleeve projecting essentially toward said second fixture and adapted to project into and fit closely within and thereby position said firing chamber end of the barrel, an axially movable mandrel for expanding said sleeve, and means for actuating said mandrel axially.

5. Apparatus for holding a gun muzzle attachment and a gun barrel having a muzzle end and a firing chamber end while said attachment is being secured to the barrel, said apparatus including a support, a first fixture mounted to said support and constructed and positioned to engage and accurately locate said firing chamber end of the gun barrel, and a second fixture mounted to said support for holding and accurately positioning said muzzle attachment at said muzzle end of the barrel, said second fixture being constructed to hold said attachment in almost exact axial alignment with a barrel held by said first fixture but at a predetermined very slight upward angle relative thereto as the barrel and attachment are secured together, to compensate for the presence of the muzzle attachment in aiming, said first fixture including a sleeve projecting essentially toward said second fixture and adapted to project into and fit closely within and thereby position said firing chamber end of the barrel, an axially movable mandrel for expanding said sleeve, a swinging lever having a cam portion operable to shift said mandrel axially in a sleeve expanding direction upon swinging movement of said lever, and means mounting said lever for swinging movement.

6. Apparatus for holding a gun muzzle attachment and a gun barrel having a muzzle end and a firing chamber end while said attachment is being secured to the barrel, said apparatus including a support, a first fixture mounted to said support and constructed and positioned to engage and accurately locate said firing chamber end of the gun barrel, a second fixture mounted to said support for holding and accurately positioning said muzzle attachment at said muzzle end of the barrel, said second fixture being constructed to hold said attachment in almost exact axial alignment with the muzzle end of a barrel held by said first fixture but at a predetermined very slight upward angle relative thereto as the barrel and attachment are secured together, to compensate for the presence of the muzzle attachment in aiming, a mounting structure mounting said second fixture for movement between a plurality of positions for holding said attachment at a plurality of different very slight angles with respect to the muzzle end of said barrel, and means for indicating precisely when said second fixture and attachment are at said different very slight angles to the barrel.

7. Apparatus for holding a gun muzzle attachment and a gun barrel having a muzzle end and a firing chamber end while said attachment is being secured to the barrel, said apparatus including a support, a first fixture mounted to said support and constructed and positioned to engage and accurately locate said firing chamber end of the gun barrel, and a second fixture mounted to said support for holding and accurately positioning said muzzle attachment at said muzzle end of the barrel, said second fixture being constructed to hold said attachment in almost exact axial alignment with a barrel held by said first fixture but at a predetermined very slight upward angle relative thereto as the barrel and attachment are secured together, to compensate for the presence of the muzzle attachment in aiming, there being means for indicating precisely when said second fixture and attachment are at said predetermined very slight angle to the barrel, said second fixture including a structure containing a recess for receiving said attachment and opening essentially toward said first fixture and being tightenable radially inwardly against said attachment, and means for releasably tightening said structure against said attachment.

8. Apparatus for holding a gun muzzle attachment and a gun barrel having a muzzle end and a firing chamber end while said attachment is being secured to the barrel, said apparatus including a support, a first fixture mounted to said support and constructed and positioned to engage and accurately locate said firing chamber end of the gun barrel, and a second fixture mounted to said support for holding and accurately positioning said muzzle attachment at said muzzle end of the barrel, said second fixture being constructed to hold said attachment in almost exact axial alignment with a barrel held by said first fixture but at a predetermined very slight upward angle relative thereto as the barrel and attachment are secured together, to compensate for the presence of the muzzle attachment in aiming, there being means for indicating precisely when said second fixture and attachment are at said predetermined very slight angle to the barrel, said second fixture including a structure containing a recess for receiving said attachment and opening essentially toward said first fixture, and said structure being interrupted at one side in a relation enabling said structure to be tightened radially inwardly against said attachment, and a screw for releasably tightening said structure against said attachment.

9. Apparatus for holding a gun muzzle attachment and a gun barrel having a muzzle end and a firing chamber end while said attachment is being secured to the barrel, said apparatus including a support, a first fixture mounted to said support and constructed and positioned to engage and accurately locate said firing chamber end of the gun barrel, and a second fixture mounted to said support for holding and accurately positioning said muzzle attachment at said muzzle end of the barrel, said first fixture including a projection projecting essentially toward said second fixture and constructed to extend into and fit closely within and thereby position said firing chamber end of the barrel, said second fixture being constructed to hold said attachment in almost exact axial alignment with a barrel held by said first fixture but at predetermined very slight upward angle relative thereto as the barrel and attachment are secured together, to compensate for the presence of the muzzle attachment in aiming, said projection having different axially aligned portions of a plurality of different diameters for selectively engaging and fitting closely within and thereby accurately locating barrels of different diameters.

10. Apparatus for holding a gun muzzle attachment and a gun barrel having a muzzle end and a firing chamber end while said attachment is being secured to the barrel, said apparatus including a support, a first fixture mounted to said support and constructed and positioned to engage and accurately locate said firing chamber end of the gun barrel, and a second fixture mounted to said support for holding and accurately positioning said muzzle attachment at said muzzle end of the barrel, said

second fixture being constructed to hold said attachment in almost exact axial alignment with a barrel held by said first fixture but at a predetermined very slight upward angle relative thereto as the barrel and attachment are secured together, to compensate for the present of the muzzle attachment in aiming, there being means for indicating precisely when said second fixture and attachment are at said predetermined very slight angle to the barrel, said first fixture having an indicator element positioned to indicate when the barrel has been turned about its axis to a predetermined proper setting with respect to said first fixture.

11. Apparatus for holding a gun muzzle attachment and a gun barrel having a muzzle end and a firing chamber end while said attachment is being secured to the barrel, said apparatus including a support, a first fixture mounted to said support and constructed and positioned to engage and accurately locate said firing chamber end of the gun barrel, a second fixture mounted to said support and for holding and accurately positioning said muzzle attachment at said muzzle end of the barrel, said second fixture being constructed to hold said attachment in almost exact axial alignment with a barrel held by said first fixture but at a predetermined very slight upward angle relative thereto as the barrel and attachment are secured together, to compensate for the presence of the muzzle attachment in aiming, there being means for indicating precisely when said second fixture and attachment are at said predetermined very slight angle to the barrel, and means mounting one of said fixtures to said support for adjusting movement toward and away from the other fixture.

12. Apparatus for holding a gun muzzle attachment and a gun barrel having a muzzle end and a firing chamber end while said attachment is being secured to the barrel, said apparatus including a first fixture constructed and positioned to engage and accurately locate said firing chamber end of the gun barrel, a second fixture for holding and accurately positioning said muzzle attachment at said muzzle end of the barrel, said first fixture including a projection projecting essentially toward said second fixture and constructed to extend into and fit closely within and thereby position said firing chamber end of the barrel, said second fixture being constructed to hold said attachment in almost exact axial alignment with a barrel held by said first fixture but at a predetermined very slight upward angle relative thereto as the barrel and attachment are secured together, to compensate for the presence of the muzzle attachment in aiming, said second fixture containing a recess for receiving said attachment and opening toward said projection and being tightenable, against said attachment, a support carrying both of said fixtures, and means mounting one of said fixtures to said support for a movement relatively toward and away from the other.

13. Apparatus for holding a muzzle attachment and a gun barrel having a muzzle end and a firing chamber end while said attachment is being secured to the barrel, said apparatus including an elongated support, a first fixture mounted to said support toward a first end thereof and constructed and positioned to engage and accurately locate said firing chamber end of the gun barrel, and a second fixture mounted to said support toward a second end thereof for holding and accurately positioning said muzzle attachment at said muzzle end of the barrel, said first fixture including a projection projecting essentially toward said second fixture and constructed to extend into and be expanded tightly against and thereby accurately position said firing chamber end of the barrel, means for expanding said projection against the barrel, said second fixture containing a passage for receiving said attachment and opening toward said projection and being tightenable radially inwardly against the attachment, means for tightening said second fixture, a pivotal connection mounting said second fixture for slight pivotal movement relative to said support and said first fixture between a plurality of different positions in which said passage and an attachment therein are disposed in almost exact alignment with said projection and a barrel held thereby but at a plurality of different predetermined very slight upward angles, in the order of 0 to 2 degrees, relative thereto, and means for securing said second fixture in said different angular positions.

14. Apparatus for holding a muzzle attachment and a gun barrel having a muzzle end and a firing chamber end while said attachment is being secured to the barrel, said apparatus including an elongated support, a first fixture mounted to said support toward a first end thereof and constructed and positioned to engage and accurately locate said firing chamber end of the gun barrel, and a second fixture mounted to said support toward a second end thereof for holding and accurately positioning said muzzle attachment at said muzzle end of the barrel, said first fixture including a projection projecting essentially toward said second fixture and constructed to extend into and be expanded tightly against and thereby accurately position said firing chamber end of the barrel, an axially movable mandrel in said projection operable by axial movement to expand said projection, a swinging lever having a cam portion for actuating said mandrel axially, said second fixture containing a passage for receiving said attachment and opening toward said projection and being tightenable radially inwardly against the attachment, means for tightening said second fixture, a pivotal connection mounting said second fixture for slight pivotal movement relative to said support and said first fixture between a plurality of different positions in which said passage and an attachment therein are disposed in almost exact alignment with said projection and a barrel held thereby but at a plurality of different predetermined very slight upward angles, in the order of 0 to 2 degrees relative thereto, means for securing said second fixture in said different angular positions, means mounting one of said fixtures for movement along said support toward and away from the other fixture and to a plurality of different positions, and means for securing said one fixture in any of said different positions.

15. Apparatus for holding a muzzle attachment and a gun barrel having a muzzle end and a firing chamber end while said attachment is being secured to the barrel, said apparatus including an elongated support, a mounting part carried by said support, a first fixture mounted to said mounting part and constructed and positioned to engage and accurately locate said firing chamber end of the gun barrel, and a second fixture mounted to said support toward a second end thereof for holding and accurately positioning said muzzle attachment at said muzzle end of the barrel, said first fixture including a projection carried by said mounting part and projecting essentially toward said second fixture and having an externally essentially arcuately curved surface constructed to extend into and be expanded tightly against and thereby accurately position said firing chamber end of the barrel, an axially movable mandrel mounted to said mounting part for axial movement relative thereto and operable to expand said projection by said axial movement, a lever mounted to said mounting part for swinging movement and connected to said mandrel to actuate it, a cam carried by said lever and exerting force against said mounting part toward said second fixture in a relation to actuate the mandrel axially, said second fixture containing a passage for receiving said attachment and opening toward said projection and being tightenable radially inwardly against the attachment, means for tightening said second fixture, a pivotal connection mounting said second fixture for slight pivotal movement relative to said support and said first fixture between a plurality of different positions in which said passage and an attachment therein are disposed in almost exact alignment with said projection and a barrel held thereby but

at a plurality of different predetermined very slight upward angles, in the order of 0 to 2 degrees, relative thereto, means for securing said second fixture in said different angular positions, and a sliding connection mounting said mounting part for sliding movement toward and away from said second fixture and including means for securing said mounting part in different positions along said support.

16. Apparatus for holding a muzzle attachment of a gun barrel having a muzzle end and a firing chamber end while said attachment is being secured to the barrel, and apparatus including an elongated support, a mounting part carried by said support, a first fixture mounted to said mounting part and constructed and positioned to engage and accurately locate said firing chamber end of the gun barrel, and a second fixture mounted to said support toward a second end thereof for holding and accurately positioning said muzzle attachment at said muzzle end of the barrel, said first fixture including a projection in the form of an axially split expansible sleeve carried by said mounting part and projecting essentially toward said second fixture and having an externally essentially arcuately curved surface constructed to extend into and be expanded tightly against and thereby accurately position said firing chamber end of the barrel, an axially movable mandrel mounted to said mounting part for axial movement relative thereto and operable to expand said projection by said axial movement, to a lever mounted to said mounting part for swinging movement and connected to said mandrel to actuate it, a cam carried by said lever and exerting force against said mounting part toward said second fixture in a relation to actuate the mandrel axially, said second fixture containing a passage for receiving said attachment and opening toward said projection and being tightenable radially inwardly against the attachment, a screw for tightening said second fixture, a carrier part mounted to said support and movably carrying said second fixture, a pivotal connection mounting said second fixture to said carrier part for slight pivotal movement relative to said carrier part and said support and said first fixture between a plurality of different positions in which said passage and an attachment therein are disposed in almost exact alignment with said projection and a barrel held thereby but at a plurality of different predetermined very slight upward angles, in the order of 0 to 2 degrees, relative thereto, said carrier part and said second fixture containing a plurality of sets of apertures adopted to register in said different pivotal positions of the second fixture, threaded pin means receivable within said registering apertures to releasably lock said second fixture in said different positions, and a sliding connection mounting said mounting part for sliding movement toward and away from said second fixture and including means for securing said mounting part in different positions along said support.

17. Apparatus for holding a gun muzzle attachment and a gun barrel having a muzzle end and a firing chamber end while said attachment is being secured to the barrel, said apparatus including a support, a first fixture mounted to said support and constructed and positioned to engage and accurately locate said firing chamber end of the gun barrel, and a second fixture mounted to said support for holding and accurately positioning said muzzle attachment at said muzzle end of the barrel, said second fixture being constructed to hold said attachment in almost exact axial alignment with a barrel held by said first fixture but at a predetermined very slight upward angle relative thereto as the barrel and attachment are secured together, to compensate for the presence of the muzzle attachment in aiming, said second fixture containing a passage for receiving said attachment and being tightenable radially inwardly against the attachment, and said second fixture containing a localized recess extending radially outwardly thereinto from said passage at the upper side thereof and adapted to receive a sight on the attachment to properly locate the sight relative to said barrel.

18. Apparatus for holding a gun muzzle attachment and a gun barrel having a muzzle end and a firing chamber end while said attachment is being secure to the barrel, said apparatus including a support, a first fixture mounted to said support and constructed and positioned to engage and accurately locate said firing chamber end of the gun barrel, and a second fixture mounted to said support for holding and accurately positioning said muzzle attachment at said muzzle end of the barrel, said second fixture being constructed to hold said attachment in almost exact axial alignment with a barrel held by said first fixture but at a predetermined very slight upward angle relative thereto as the barrel and attachment are secured together, to compensate for the presence of the muzzle attachment in aiming, there being an indicator device on said first fixture for indicating the proper rotary positioning of the barrel, and means mounting said indicator device for shifting movement relative to the fixture between active and retracted positions.

19. Apparatus for holding a gun muzzle attachment and a gun barrel having a muzzle end and a firing chamber end while said attachment is being secured to the barrel, said apparatus including a support a first fixture mounted to said support and constructed and positioned to engage and accurately locate said firing chamber end of the gun barrel, and a second fixture mounted to said support for holding and accurately positioning said muzzle attachment at said muzzle end of the barrel, said second fixture being constructed to hold said attachment in almsot exact axial alignment with a barrel held by said first fixture but at a predetermined very slight upward angle relative thereto as the barrel and attachment are secured together, to compensate for the presence of the muzzle attachment in aiming, said second fixture containing a passage for receiving said attachment and being tightenable radially inwardly against the attachment, said second fixture containing a localized recess extending radially outwardly thereinto from said passage at the upper side thereof and adapted to receive a sight on the attachment to properly locate the sight relative to said barrel, and there being a sleeve removably receivable in the said passage to adapt the second fixture for different size muzzle attachments and containing an opening for passing said sight of an attachment therethrough into said localized recess, and interfitting keying means on said second fixture and said sleeve for retaining the latter in a predetermined proper rotary orientation.

References Cited by the Examiner

UNITED STATES PATENTS

402,108	4/1889	Ries.	
1,368,683	2/1921	Anderson	269—130
2,226,078	12/1940	Spahn	113—103 X
2,227,443	1/1941	Denner	269—52
2,497,943	2/1950	Ingwer	269—69
2,662,266	12/1953	Powell et al.	29—1.1
2,731,712	1/1956	Laux	269—82 X
2,767,676	10/1956	Johnson et al.	113—103
2,767,677	10/1956	Johnson et al.	269—52 X
2,853,771	9/1958	Melville	113—102 X
2,853,773	9/1958	Darasko	113—103 X

FOREIGN PATENTS

952,484	11/1956	Germany.

ROBERT C. RIORDON, *Primary Examiner.*

BROUGHTON G. DURHAM, *Examiner.*

T. E. BEALL, JR., F. J. POWERS, B. S. MOWRY, *Assistant Examiners.*