Dec. 10, 1957 H. W. YOUNG 2,815,602

BARREL CHAMBER FOR CARTRIDGES OF DIFFERENT LENGTH

Filed Feb. 23, 1954

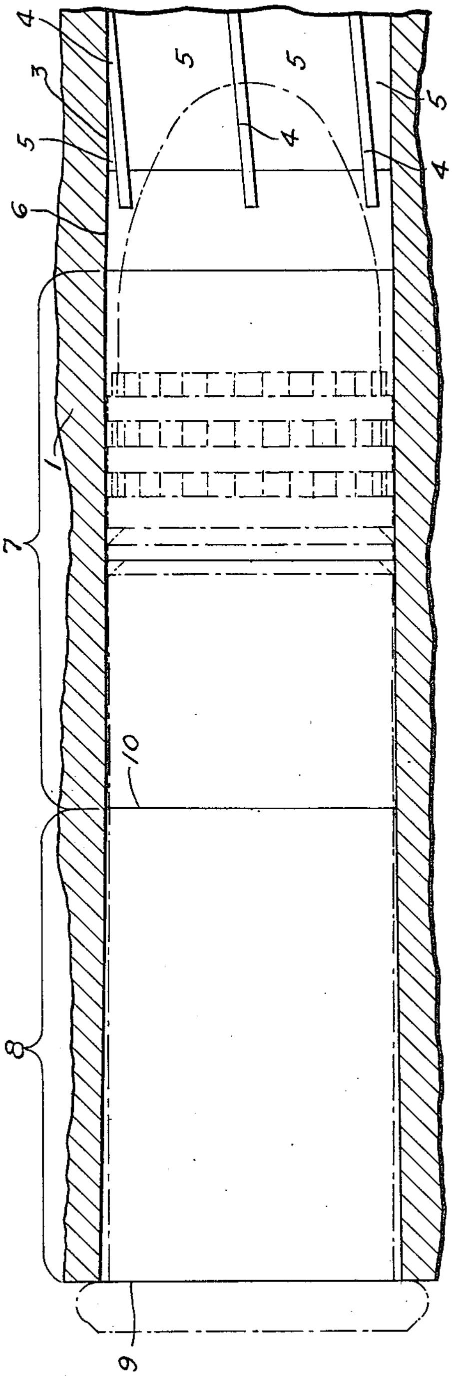

Fig.1

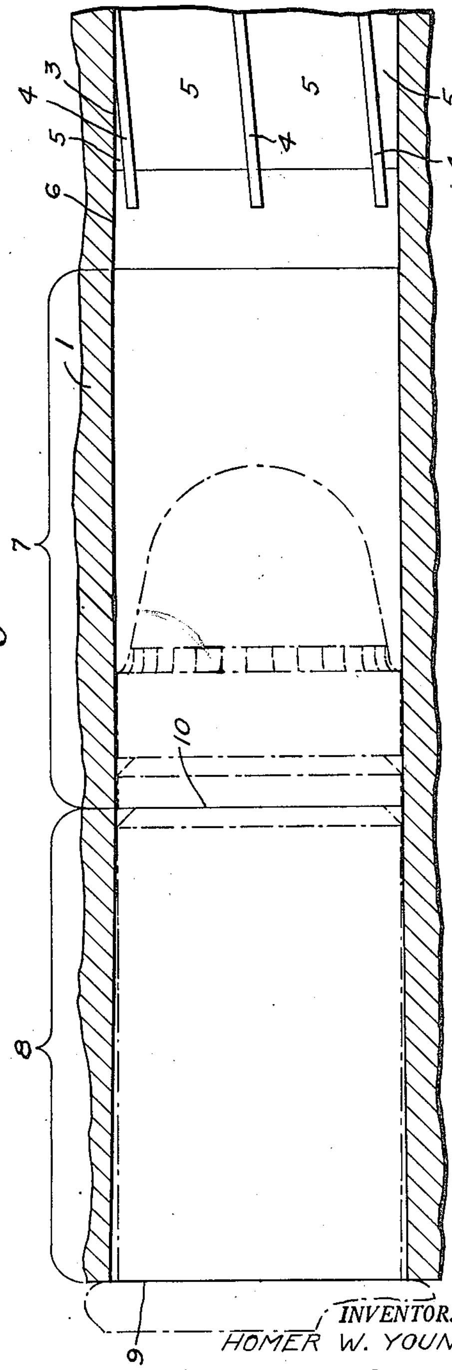

Fig.2

INVENTOR.
HOMER W. YOUNG

BY [signature]
John H. Lewis Jr.
ATTORNEYS

2,815,602

BARREL CHAMBER FOR CARTRIDGES OF DIFFERENT LENGTH

Homer W. Young, Ilion, N. Y., assignor to Remington Arms Company, Inc., Bridgeport, Conn., a corporation of Delaware

Application February 23, 1954, Serial No. 411,829

4 Claims. (Cl. 42—76)

This invention relates to autoloading small arms and has particular reference to an arm of that type which is actuated by a blow-back breech block.

Particularly in .22 caliber, blow-back actuated autoloading arms have been relatively common but until quite recently all such arms produced have been adapted to use only the single cartridge for which they were particularly designed. For example, an arm designed for the .22 short cartridge could be used with that cartridge only and not with .22 long or .22 long rifle cartridges. The so-called "floating chamber" developed by David M. Williams and shown in various Williams patents, particularly as shown in Patent No. 2,336,146, made it possible to produce for the first time a .22 caliber autoloading arm capable of use interchangeably with any of the three cartridges referred to above and an arm developed from that shown in the patent has enjoyed marked commercial success. The "floating chamber" is, however, an expensive component to manufacture and fit, it must be fairly loosely fitted so that it does not improve the accuracy of an arm in which it is used, and it is rather difficult to remove for the occasional cleaning which would maintain its functioning at highest levels or permit tighter fitting.

It is an object of this invention to provide an autoloading rifle of the blow-back type which can function with cartridges of different length and power such as the three common cartridges for .22 rifles and which does not require the "floating chamber."

Another object is to secure maximum accuracy and dependability from a blow-back autoloading rifle.

It will be realized that accuracy is to a considerable extent dependent upon the manner in which the throat of the chamber presents the bullet to the rifled section of the barrel. Target rifles have been consistently provided with "tight" chambers which closely fit both the cartridge case and the bullet, supporting the bullet immediately adjacent the end of the rifled section of the barrel, and maintaining the full length of both bullet and cartridge case in coaxial relation to the rifled section of the barrel.

The feeding and extraction requirements of an autoloading arm of the blow-back type preclude the use of such "tight" chambers and the usual practice has been to form a tapered chamber which was large enough at the rear end for easy entrance of a cartridge and which, by reason of the taper, facilitated extraction. While such tapered chambers could be designed to function fairly well with a single type of cartridge, they functioned poorly with cartridges of other types. Thus, with a chamber defined by straight tapered walls of the proper dimensions for a .22 long rifle cartridge, it would be found that the .22 short cartridge was inadequately supported, producing inferior accuracy and tending to permit gas to blow back around the cartridge case, while the effect of gas leakage often so reduces the available blow-back force as to prevent autoloading operation.

I have found that I can secure superior functioning by the employment of a chamber defined by tapers of different degree. My preferred chamber has a mouth portion which is large enough to permit easy feeding yet not so large as to result in burst cartridge cases. For the length of the shortest cartridge case which is to be employed therein, the chamber wall tapers rather sharply to a diameter such that the mouth of the short case and the bullet seated therein will be supported concentrically with the barrel. Forward of this point, the chamber tapers only slightly, if at all, and forms a comparatively tight chamber for longer cartridge cases which extend into this region. Obviously, the bullet in either length of cartridge case is well and coaxially supported prior to its entrance into the rifled section of the barrel.

In addition to the effect upon ease of feeding and accuracy, already referred to, I derive an important benefit from this chamber in that a short case has a sufficiently tight fit at its mouth to effect obturation and to derive the maximum blow-back force from the explosion of the propellent therein, but the sharply tapered rear section of the chamber frees the cartridge case after only a slight axial movement and imposes a minimum of frictional restraint thereon. A longer cartridge case, however, extends for a substantial distance into the tight, nearly cylindrical front portion of the chamber and, although the full chamber pressure is acting to blow the cartridge case out of the chamber, that same pressure is also acting to expand the cartridge case into tight continuous engagement with the chamber. As a result, the blowing back of the cartridge case is impeded by the maximum frictional engagement with at least all of that portion of the chamber forward of the point of transition in the rate of taper. This action tends to a material extent to equalize the blow-back force exerted on the bolt by the short low-powered cartridge cases and by the longer higher powered cartridge cases.

In any autoloading rifle the short time available makes cartridge handling, both in feeding and in extraction and ejection, a difficult problem. With cartridges of different length these problems are more serious and lack of equality in the blow-back force, and bolt velocity determined thereby, creates further complications. To the extent that any improvement tends to produce equalization of blow-back force, in spite of variations in cartridges, the functioning of a universal cartridge autoloader is improved in all respects.

With the aid of a medium weight bolt and appropriate bolt return spring, the force equalizing action of my improved chamber is sufficiently effective that I can secure consistently reliable operation in all functions of an autoloading rifle with .22 caliber cartridges ranging from short to long rifle high velocity.

The exact nature of my improved chamber as well as other objects and advantages thereof will become more apparent from consideration of the following specification referring to the attached drawing in which:

Fig. 1 is a partial longitudinal sectional view of a .22 caliber rifle barrel having a chamber constructed in accordance with my invention, a .22 caliber long rifle cartridge case being shown therein in dotted lines. This view is substantially ten times actual size. Chamber dimensions are minimum with a tolerance of +.001" and cartridge dimensions are about minimum also.

Fig. 2 is a view similar to Fig. 1 with a .22 caliber short cartridge case outlined in dotted lines. Scale and dimensional tolerances are the same as in Fig. 1.

Referring to the drawing by characters of reference, it will be seen that I have illustrated a portion of the breech end of a rifle barrel 1. This barrel includes the usual axial bore 3 in which there are provided alternating spiral lands 4 and grooves 5 to impart rotation to a bullet.

The chamber with which this invention is concerned comprises a throat section 6 leading gradually into the rifled bore, a front section 7 and a breech section 8. As seen by a comparison of Figs. 1 and 2, the transition between the breech section 8 and the front section 7 occurs in an annular zone 10 substantially coincident with the mouth of the shortest cartridge case to be chambered. The body of any longer cartridge case extends into the front section 7 of the chamber.

To insure that the cartridge case mouth and bullet of the short cartridges are accurately and coaxially supported relative to the bore 3, I prefer to have the chamber fit fairly closely in and forwardly of the annular zone 10 at the mouth of the short case. The diameter of the chamber at the mouth of a short case of any caliber should not be substantially more than .0015" greater than the maximum specified diameter of the cartridge case at that point referring to the standardized dimensions specified by the Sporting Arms and Ammunition Makers Institute. Preferably, the fit is much closer. For example, the Institute specification for maximum diameter at the mouth of a .22 short cartridge is .2260" and Remington Arms Company, Inc., for another example, sets its commercial specification for maximum diameter of the cartridge at .2258" measured at the same point. Chamber diameter in the annular zone 10 embracing the mouth of the short cartridge should not exceed these diameters by more than about .0015" and preferably by not more than about .0005". For the .22 short I prefer to establish a minimum chamber diameter at this point of .2263" and allow a tolerance of +.001". Actually, if the chamber forward of this point were cylindrical the best functioning could be obtained if chamber diameter at this point was exactly the same as maximum cartridge diameter.

From a functional standpoint, it would be desirable to have the front section 7 of the chamber cylindrical and of the same diameter as the maximum cartridge case which might be used therein. However, as a matter of control in machining the chamber and to permit regrinding of chamber reamers, it is preferable to form this front section of the chamber with a slight taper. This taper may range from zero for a cylindrical section to a maximum of about .002" reduction in diameter per inch of chamber length. I prefer to utilize a taper of about .0015" reduction in diameter per inch of length of the taper. The taper in this section, as noted in the preceding paragraph, influences the diameter at the mouth of the short cartridge cases, for the longer cartridge cases usually have the same mouth diameter as the short cases. Thus, if the chamber fits closely upon the mouth of a short case and the front section tapers at a fast rate, it will be necessary in chambering a long case to slightly swage or reduce the diameter of the bullet and of the mouth of the long case.

The range of diameters and tapers used as examples above have been established as satisfactory considering normal variations in cartridges, etc. and provide adequate support and gas sealing for a short cartridge case of minimum dimensions without constricting or swaging a long cartridge case of maximum dimensions to an undesirable or dangerous degree.

The breech section 8 of the chamber or that portion thereof to the rear of the mouth of the short cartridge cases is less critical than the front section. The maximum diameter at the breech end 9 of the chamber is probably that fixed by the ability of a loosely supported cartridge case to resist bursting under the effect of internal pressure. A minimum diameter at the breech end 9 of the chamber is determined by two considerations, one being the desirability of a funnel-like mouth which will facilitate feeding of cartridges in an automatic arm and the other being the need to have sufficient taper to release the grip of the chamber on a fired cartridge case with slight longitudinal movement thereof and facilitate extraction of fired cases. Of these two considerations the first probably requires a wider chamber mouth than the second. Using as a reference base the diameter at the mouth of the short cartridge case established with the limits noted above, I have found that the taper of the chamber to the rear of the annular zone 10 may be within a range of about .0075" to .02" increase in diameter per inch of length along the chamber. I prefer to use a taper of about .018" per inch. Within these limits I have had good results in regard to feeding and extraction and have not suffered burst cartridge cases with ammunition loaded in cartridge cases of normal strength and metallurgical characteristics.

In considering the functioning of my improved chamber, it will be noted that the full bearing band portion of the short bullet, as shown in Fig. 2, is received in the tight front section 7 of the chamber, and is thereby positioned for accurate entry into the rifled section of the barrel. The mouth of the short cartridge case is closely embraced by the chamber and within the ranges of tolerances used as examples herein readily expands to seal the gas within the chamber and prevent the rearward escape of gas around the cartridge case. Thus, full power is available to start the blow-back operation, but with the tapered wall only slight rearward movement of the short cartridge case is required to completely free the cartridge case from frictional restraint by the wall of the chamber. Extraction is therefore readily completed by residual gas pressure in the chamber and the bolt will have a length of stroke essential to the operation of an autoloading arm.

A longer cartridge case, for example, the .22 L. R., extends forwardly a substantial distance into the front section 7 of the chamber. Obviously, the support and centering of the bullet, and the completeness of the gas seal at the mouth of the cartridge will be better than in the case of the shorter cartridge to the extent that the front section of the chamber is tapered. With regard to extraction, the longer cartridge case is for a considerable fraction of its length tightly encased in the cylindrical, or nearly cylindrical, front section of the chamber. Gas pressure acting within the cartridge case expands this portion of the cartridge case into tight frictional engagement with the wall of the chamber. As a result, until after the internal pressure has dropped well below peak levels, the blow-back force acting upon the bolt head is materially diminished by frictional drag upon the walls of the chamber, and the amount of that drag is proportional to the internal pressure developed by charges of different power and to the straightness of the front portion of the chamber, a cylindrical front portion developing maximum drag.

As has been noted above, the problem of feeding cartridges to an autoloading arm makes it desirable to employ a funnel-like chamber having a relatively large diameter at the mouth, the maximum being set by the resistance of cartridge cases to bursting from internal pressure. Obviously, since the chamber must present a bullet to the rifling, the dimensions of the rifled section of the bore fix the diameter of the front end of the chamber. It has been suggested that a single straight taper between the two diameters so selected would suffice for the purposes of my invention.

I have made comparative tests with a chamber formed according to this invention in .22 caliber utilizing .22 short cartridges and .22 long rifle cartridges. Retests of the same components, after the chamber had been reamed out to provide a single straight taper without modification of the diameters at the two ends of the chamber were also conducted. These tests established that in the dual taper chamber according to this invention the long rifle cartridge imparted substantially less force to the blow-back bolt than in the single taper chamber, apparently because of the retarding action of the frictional grip of the chamber upon the mouth portion of the cartridge case. The short cartridge, on the other hand, when fired in the dual taper chamber imparted materially greater blow-back force to the bolt than when fired in a straight taper chamber, apparently because the poorer gas seal at the mouth of the short case in the single taper chamber allowed gas leakage which reduced the available gas pressure tending to cause blow-back, and because the increased taper of the rear section permitted easier extraction. Gas leakage has been further evidenced by the fact that short cartridge cases after firing in the single taper chamber were not permanently expanded at the mouth and by excessive breech flash accompanying their firing. In both cases accuracy was significantly improved in a dual taper chamber by comparison with single taper and, as would be expected, the effect upon accuracy was most apparent with the short cartridge.

Although I have shown and described my invention with quite specific examples of its application in one caliber, I consider that the principles extend to any other caliber where a similar problem exists. Accordingly, I wish it to be understood that I consider my invention to be limited only as described in the claims appended hereto.

I claim:

1. For use in a blow-back autoloading firearm employing cartridges having substantially straight cylindrical bodies of varying length and loaded with charges of varying power, a barrel chamber in which said cartridges are fired, said chamber being formed to define a reference circle embracing the mouth of the shortest cartridge case to be used therein with sufficient tightness to secure obturation and prevent substantial gas leakage thereby, a front section extending forwardly from said reference circle in a single continuous taper for a distance at least equal to the additional length of the longest cartridge to be used, said front section being constricted to a diameter between the diameter of said reference circle and the mouth diameter of said longest cartridge case, and a breech section extending rearwardly from said reference circle in a single continuous straight taper, said breech section flaring outwardly at a rate of taper between .0075 inch and .02 inch increase in diameter per inch of chamber length.

2. For use in a blow-back autoloading firearm employing cartridges having substantially cylindrical bodies of varying length and loaded with charges of varying power, a barrel chamber in which said cartridges are to be fired, said chamber being formed to define an annular zone embracing the mouth of the shortest cartridge to be fired therein with sufficient tightness to secure obturation and to prevent gas from blowing thereby, a front section extending forwardly from said zone for a distance at least equal to the additional length of the longest cartridge to

be fired therein, said front section being tapered inwardly at a rate between zero and about .002 inch reduction in diameter per inch of length, and a breech section extending rearwardly from said zone, said breech section flaring outwardly from said zone at a rate between about .0075 inch and .02 inch increase in diameter per inch of chamber length.

3. For use in a blow-back autoloading firearm employing cartridges having substantially cylindrical bodies of various lengths and loaded with charges of varying power, a barrel chamber in which said cartridges are fired, said chamber being formed to define an annular zone embracing the mouth of the shortest cartridge to be fired therein and exceeding the maximum specified diameter of said shortest cartridge at its mouth by not substantially more than .0015 inch, a front section extending forwardly from said annular zone for a distance at least equal to the additional length of the longest cartridge to be fired therein, said front section being constricted at a rate of taper between zero and about .002 inch reduction in diameter per inch of chamber length, and a breech section extending rearwardly from said annular zone, said breech section flaring outwardly from said annular zone at a rate between about .0075 inch and .02 inch increase in diameter per inch of chamber length.

4. For use in a blow-back autoloading firearm employing .22 caliber short, long and long rifle cartridges, a barrel chamber in which said cartridges are fired, said chamber being formed to define an annular zone embracing the mouth of the .22 short cartridge case and having a diameter in said annular zone not substantially more than .0015 inch greater than the maximum specified diameter of the mouth of the loaded .22 short cartridge case, a front section extending forwardly from said annular zone at least to a point corresponding to the mouth of the .22 long rifle cartridge case, said front section being constricted at a rate of taper between zero and about .002 inch reduction in diameter per inch of chamber length, and a breech section extending rearwardly from said annular zone, said breech section flaring outwardly from said annular zone at a rate between about .0075 inch and .02 inch increase in diameter per inch of chamber length.

References Cited in the file of this patent

UNITED STATES PATENTS

290,738	Brown	Dec. 25, 1883
338,192	Rubin	Mar. 16, 1886
1,552,864	Methlin	Sept. 8, 1925
1,659,625	Cowan	Feb. 21, 1928

FOREIGN PATENTS

212,862	Germany	Aug. 11, 1909
739,852	Germany	Oct. 30, 1943