July 18, 1961 A. HAMMER 2,992,596

FLOATING CHAMBER

Filed July 28, 1959

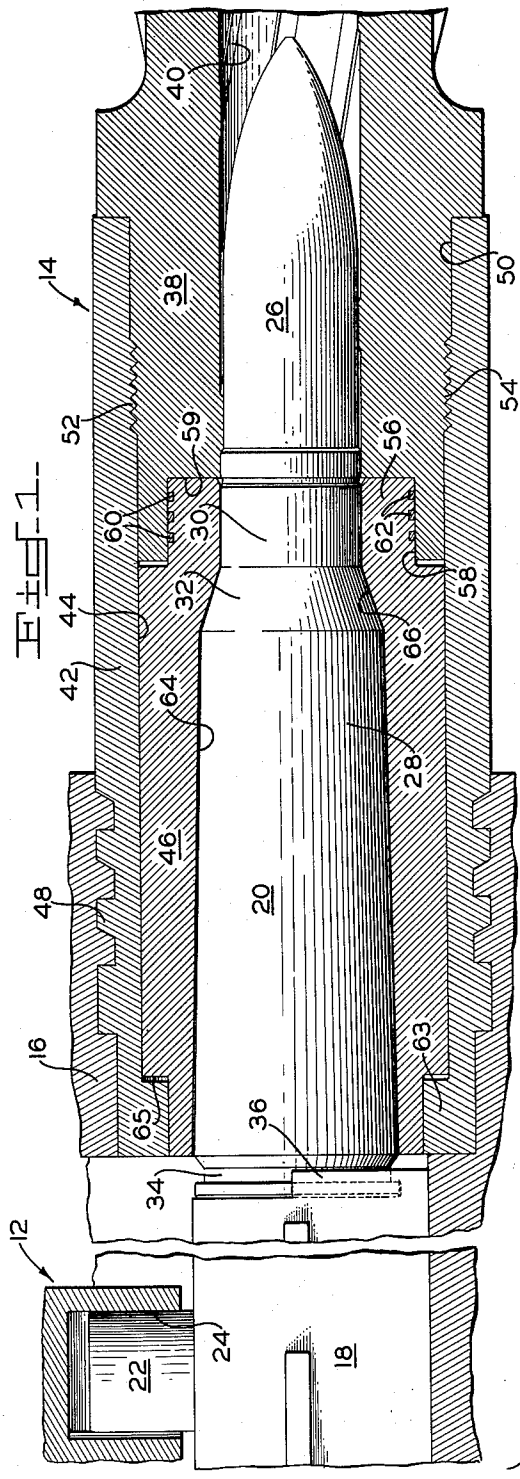


FIG. 3

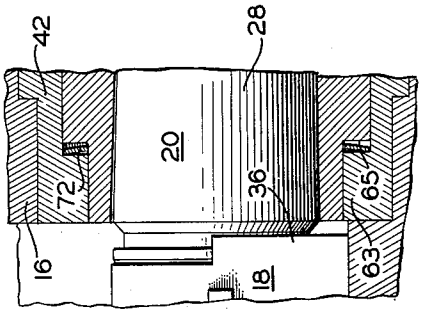
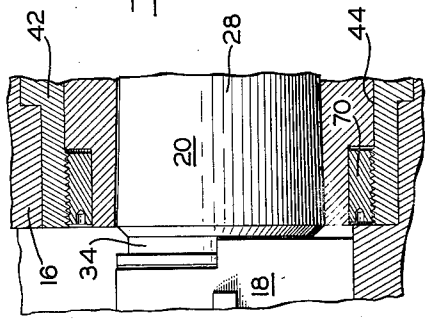


FIG. 2



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FLOATING CHAMBER

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The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment of any royalty thereon.

This invention relates to automatic firearm barrels and more particularly to those barrels in which the chambers are formed in separate members which are mounted to the barrel for axial movement relative thereto.

It is a well known fact that the lengths of cartridge cases and the chambers therefor may vary in aggregate as much as .050 of an inch through the tolerances permitted in the manufacture thereof because of practicality. This wide variation produces a problem which is met at the present time by adjusting the headspaces in the firearms to the mean of the extreme permitted dimensions. Those cases which are above the average in length are accommodated to the adjusted mean headspace by crush-up whereby the cases are deformed between the bases and shoulders thereof by the bolt when going into battery position. Those cases which are shorter than the average are, on the other hand, spaced from the chamber walls at time of discharge.

This solution is obviously not satisfactory because crush-up absorbs considerable energy from the bolt at the end of the recoil travel thereof so if the firearm is transiently underpowered the bolt is unable to go home to battery and stoppage occurs. Moreover, while crush-up is possible with cases made from brass it would not be practically possible if the cases were made from steel. Whereby, steel cases and the chambers therefor require special designs. Further, it oftentimes happens that the space between the walls of the chambers and the cases which are below average in size is so great that the cases are stretched far beyond the elastic limits and therefore cannot spring back from contact with the chamber walls when the discharge pressure is released. In such stretched cases, elastic flowback does not react soon enough to free the cases in time for extraction so that extraction is difficult with the extractor oftentimes rupturing the cases which are gripped too tight by the chamber walls, to cause stoppage of the gun and sometimes critical damage thereto.

It is the principal object of this invention to provide a firearm barrel in which the chamber is formed according to the dimensions of the maximum sized cartridges to be fired therein so that none of the cartridges need be crushed up by the bolt when going into battery with the adverse effects produced in the cases of smaller permitted dimensions by discharge in the maximum sized chamber being overcome by forming the chamber in a separate member which is slidingly mounted to the barrel for free reciprocation and is disposed for cooperation with the cartridge chambered therein to provide a time delay before separation of the fired case from the chamber by the bolt carried extractor and thereby permit plastic flowback and a reduction of heat in the fired case to facilitate the extraction thereof.

It is an additional object of this invention to provide for firearm barrels a floating chamber member having an axial movement therein which is approximately one-half the distance between the minimum and maximum tolerable lengths of the cartridge to be fired in the chamber with such chamber member being provided with a chamber which conforms to the dimensions of the maximum

sized case when the chamber member is in the foremost position thereof.

It is another object of this invention to provide such a floating chamber member whereby a sufficient time delay is introduced during the initial recoil movement of the case by the extractor to permit the initiation of elastic flowback in the case and a reduction in the temperature thereof so that the case is readily removed from the chamber by the extractor.

It is a further object of this invention to provide such a floating chamber whereby when a cartridge is rammed thereinto by the bolt a portion of the impact energy of the cartridge is absorbed by the floating chamber to reduce the energy to be absorbed by the barrel.

The specific nature of the invention as well as other objects and advantages thereof will clearly appear from a description of a preferred embodiment as shown in the accompanying drawings in which:

FIG. 1 is a longitudinal cross-sectioned view of a portion of a Gatling type automatic firearm showing a maximum size cartridge in a maximum size chamber;

FIG. 2 is a view similar to FIG. 1, but showing adjustable means for controlling the limits of the axial movement of the chamber member; and

FIG. 3 is another view similar to FIG. 1, but showing a spring type washer installed between the chamber member and retainer.

Shown in FIG. 1 is a portion of an automatic firearm of the multi-barrel Gatling type, which portion includes a receiver **12**, a barrel assembly **14** which is one of the multi-barrel group mounted for rotation in a cage **16**, and a bolt **18** which is the one associated with the illustrated one of the barrel assemblies. Bolt **18** is reciprocably mounted in cage **16** for moving a cartridge **20** into barrel assembly **14** and extracting the fired case therefrom and is actuated to and from battery position during rotation of the cage through the cooperation of a rotary follower **22** mounted to the bolt with a cam path **24** in receiver **12**.

Cartridge **20** includes a projectile **26** and a case **28** which is of conventional design with a neck portion **30** for engaging the projectile and an annular tapered shoulder **32** leading thereto. An extractor groove **34** extends around the base of case **26** for releasable engagement by an extractor **36** disposed at the front end of bolt **18** to axially position cartridge **20** relative to barrel assembly **14** for insertion thereinto and to extract case **28** therefrom after discharge.

Barrel assembly **14** includes a tube **38** with a rifled bore **40**, a cylindrical retainer **42** which is provided with an axial hole **44** therethrough and is fixedly mounted to the end of the tube, and a chamber member **46** slidingly disposed in such hole. The outside diameter of retainer **42** is approximately the same as that of the forwardly adjacent portion of tube **38** and provided on the outside of the retainer are conventional lugs **48** which cooperate with mating lugs in cage **16** for releasably securing barrel assembly **14** thereto. The rear end of tube **38** is reduced as noted at **50** to a diameter slightly larger than that of hole **44** so that retainer **42** is joinable to such reduced diameter portion by shrink fit. A threaded portion **52** in hole **44** has cooperating engagement with a threaded portion **54** on reduced diameter portion **50**, when retainer **42** is thermally expanded, to assist in securing the retainer to tube **38**.

Hole **44** is cylindrical in configuration and is disposed concentric to bore **40**. Chamber member **46** is also cylindrical in configuration and has a diameter approximately the same as hole **44** so as to fit slidably therein with a minimum of possible radial displacement. The front end of chamber member **46** is reduced in diameter to form a piston portion **56** which is slidably receivable by a cylin-

der 58 counterbored into tube 38 from the rear end thereof. Cylinder 58 is terminated by an end wall 59. Annular grooves 60 are provided around piston 56 for the mounting of sealing rings 62 to prevent the escapement of gas thereby.

An integral annular flange 63 reduces the diameter of the rear end of hole 44 and the exterior diameter of chamber member 46 is reduced at the rear end to that of the inside diameter of the flange so as to be slidingly received thereby with such reduced diameter portion of member 46 forming an annular abutment wall 65 contactable with the front side of the flange.

Provided in chamber member 46 is a chamber 64 for receiving case 28 and such chamber has a configuration conforming to that of the case to include a shoulder 66 corresponding to shoulder 32 of the case. The length of chamber member 46 is determined by the length of the particular case 28 as neck portion 30 should not extend beyond the front end of the chamber member so as to be unsupported during discharge and thereby cause a bell mouth deformation which would interfere with the extraction of the case.

The forward position of chamber member 46 in hole 44 is determined by the contact of the front end of piston 56 with end 59 of cylinder 58 and the rearward position of such chamber member is determined by the contact of abutment wall 65 with flange 63. The forward position of chamber member 46 is to be located so that chamber 64 will receive a case 28 of maximum length without crush-up by bolt 18 when going into battery. Thus, case 28, if desired, may be made either from brass or steel. The distance which chamber member 46 is permitted to move between the forward and rearward positions thereof is one-half the distance between the minimum and maximum longitudinal dimensions permitted in the manufacture of case 28; i.e., if the difference is .040 of an inch the chamber member should have .020 of an inch of axial movement.

As noted in FIG. 2, if it is desirable to have the rearward position of chamber member 46 adjustably controlled, a nut 70 can be threadably installed in the rear end of hole 44 instead of flange 63 with the pitch of the mounting threads being predetermined so that the nut can be selectively positioned in the hole to selectively limit the axial movement of the chamber member.

Also, if found desirable, a spring washer 72 of conventional design may be provided between flange 63 and abutment wall 65, as noted in FIG. 3, to permit resiliently restrained movement of the chamber member beyond the predetermined free movement thereof when the cases 28 grip the wall of chamber 64 especially tight and thereby extend the time delay to provide a longer period for a reduction in the dimensions of the cases by elastic flowback and reduction of temperature therein.

When the firearm incorporating the present invention is operating, the cartridges 20 rapidly discharged thereby have a wide range of dimensions ranging between the minimum and maximum tolerable limits. Those cartridges 20 having maximum dimensions will be readily accommodated in chamber 64 because when rammed thereinto by bolt 18 such maximum size cartridges will contactably move chamber member 46 to the forward position thereof and, as has been noted before, the chamber is designed to receive the maximum dimension cases when the chamber member is in the forward position thereof.

When the cases 28 are below maximum dimensions, chamber member 46 prior to the firing of the chambered cartridge 20 may be disposed anywhere within the position of contact with the case and the forward position, but during discharge of the chambered cartridge the chamber member is actuated to the forward position thereof by the forward expansion of the shoulders 32 through the pressure of the discharge gases. Thus, chamber member 46 is positively located in the forward position thereof when extraction is inaugurated regardless of the dimensions of case 28 to assure full travel of the chamber member in barrel assembly 14. The time taken for chamber member 46 to travel between the forward and rearward positions thereof with case 28 while such case is being pulled rearwardly by extractor 36 introduces a time delay during which period elastic flowback in case 28 has time to be initiated and a portion of the heat dissipated therefrom to reduce the dimensions of the case and thereby facilitate extraction from chamber 64.

It is obvious that a terrific amount of impact energy is transferred to the breech end of a barrel when a conventional cartridge is chambered therein and it is not infrequent to have the barrels crack under the stresses of such impact energy. However, in barrel assembly 14, a portion of any impact energy produced during the chambering of cartridge 20 in the barrel assembly is partially absorbed by chamber member 46 with the absorption being determined by the magnitude of the coefficient of restitution. Thus, less energy has to be absorbed by tube 38 than by those conventional barrels having integral chambers.

From the foregoing, it is clearly apparent that there is provided herein a barrel assembly which permits the use of either brass or steel cartridges, which facilitates the extraction of fired cases therefrom, and which reduces the amount of impact energy to be absorbed by the tube.

Although a particular embodiment of the invention has been described in detail herein, it is evident that many variations may be devised within the spirit and scope thereof and the following claims are intended to include such variations.

I claim:

1. In a firearm for the discharge of cartridges having cases variable in dimensions between minimum and maximum tolerable limits, the combination including a barrel assembly, a bolt reciprocably mounted adjacent the breech end of said barrel assembly for ramming successive ones of the cartridges into said barrel assembly during counterrecoil movement and extracting the fired cases therefrom during recoil movement, said barrel assembly including a retainer and a chamber member adapted for receiving the cases having the maximum tolerable dimensions without crush-up by said bolt, means for slidingly mounting said chamber member in said barrel assembly to sufficiently delay the extraction of the fired cases from the chamber member during initial recoil movement of said bolt, to permit plastic flowback and contraction from dissipation of heat in the fired cases which are below the maximum tolerable dimensions, for facilitating extraction thereof from said chamber member and thereby permit the use of a chamber having the size of the maximum dimensioned cases, and spring means mounted between said chamber member and said retainer for prolonging the period of the time delay to permit a longer period for plastic flowback and heat dissipation in the fired case before the extraction thereof.

2. The combination as defined in claim 1 and including means for adjusting the amount of the sliding movement of said chamber member to vary the period of the time delay.

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