

Oct. 18, 1949.

G. E. HUTCHINSON

2,484,998

MEANS FOR CONTROLLING SHOT PATTERNS

Filed June 26, 1946

2 Sheets-Sheet 1

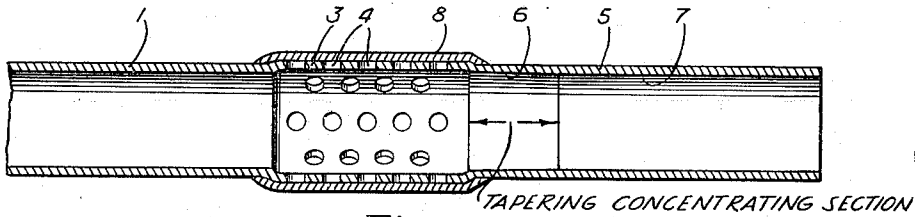


Fig. 1

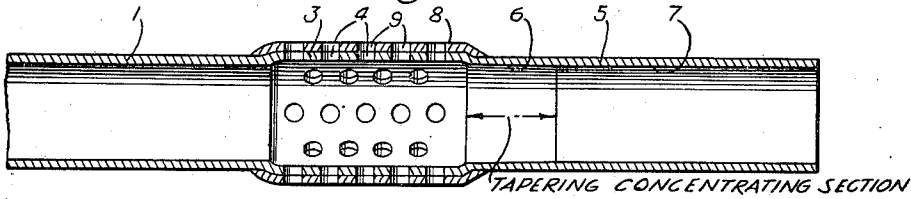


Fig. 2

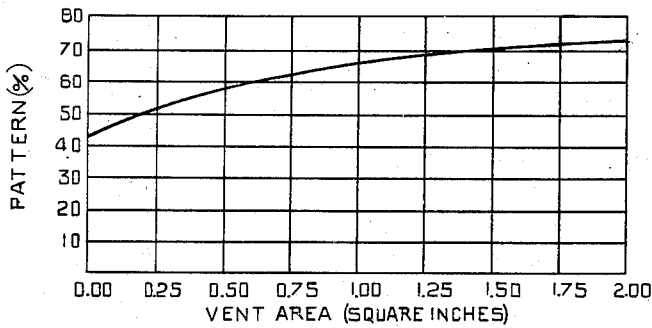


Fig. 3

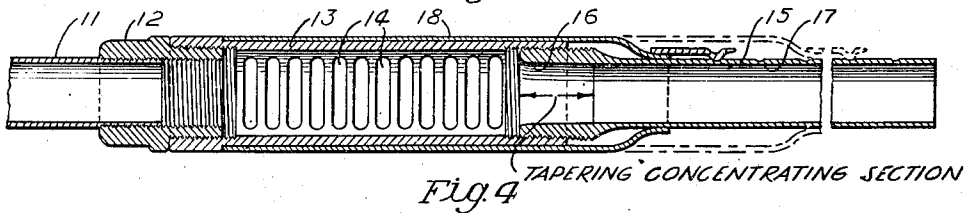


Fig. 4

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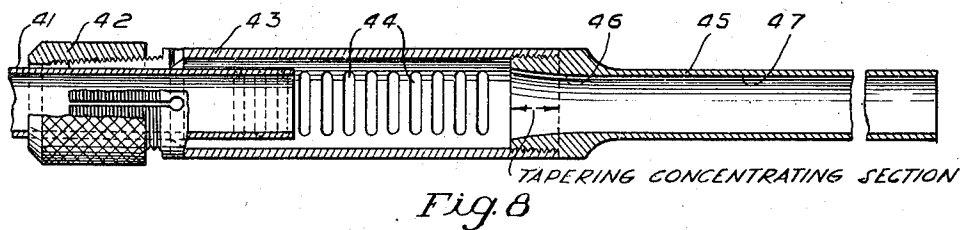
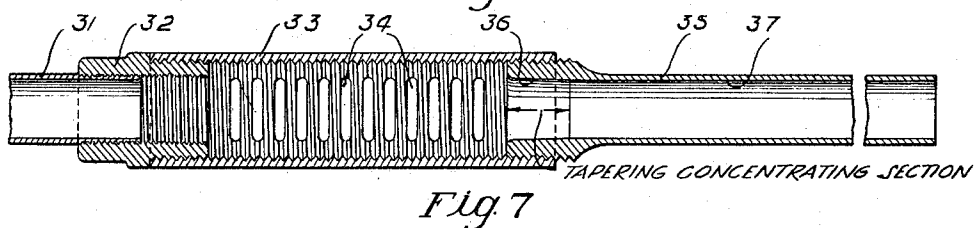
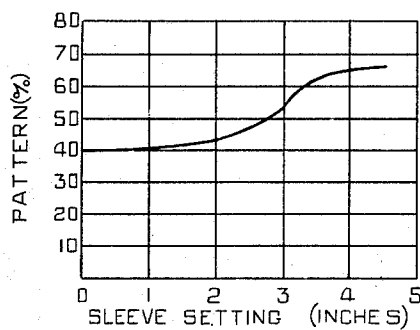
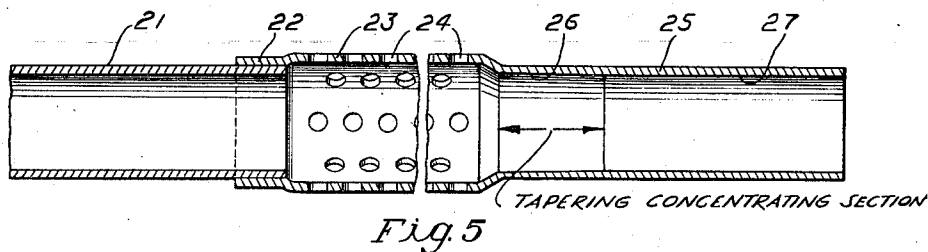
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MEANS FOR CONTROLLING SHOT PATTERNS

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,484,998

MEANS FOR CONTROLLING SHOT PATTERNS

Gilbert E. Hutchinson, Bridgeport, Conn., assignor to Remington Arms Company, Inc., Bridgeport, Conn., a corporation of Delaware

Application June 26, 1946, Serial No. 679,550

11 Claims. (Cl. 42-79)

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This invention relates to an improved method of controlling the pattern of the shot projected by a shotgun and to apparatus which may be applied to any shotgun to produce any desired concentration of pattern.

Different uses to which a shotgun may be put naturally require different pattern characteristics. For example, swiftly moving upland game at short range, pheasants, grouse in heavy timber, or the clay targets in the shoot game "Skeet," require comparatively open or widespread patterns. Such patterns are necessary because even the most expert shots have difficulty in taking exact aim under such conditions and the range is generally so short that a concentrated pattern would be highly destructive to game. While the disintegration of a "Skeet" target into black dust by a highly concentrated pattern may be regarded by the expert as a sporting and highly satisfying test of his skill, the same effect upon game is tragic and wasteful. At the other end of the scale, handicap trap shooting and the shooting of ducks and geese require relatively concentrated patterns. These are long range sports and if the gunner is to be given an even break in such tests of his marksmanship, he must be assured that, at the effective range, his pattern is still sufficiently concentrated to operate effectively upon any target within the pattern area.

The pattern of a shot charge is usually expressed in terms of arbitrary designations such as full choke, modified choke, improved cylinder, and the like. These terms may be defined by reference to a percentage figure which indicates the proportion of the total number of pellets in the charge which strike within the area encompassed by a thirty-inch circle on a target at a range of 40 yards. The normal range of requirements extends from an open or cylinder pattern which will place about 40% of the pellets in the thirty-inch circle at 40 yards to a full choke or close pattern in which about 70% of the pellets fall within the same circle.

In the fixed and variable pattern control devices of the prior art, the approach to the problem has been by way of constricting a short section of the barrel adjacent the muzzle. According to various theories of choke action, the constriction applies to the pellets a velocity component directed toward the barrel axis which opposes and at least to some extent overcomes their natural tendency to diverge from that axis due to various causes. Another theory of choke action is based upon the idea that the wad column

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is momentarily retarded by the choke and is therefore unable to act upon the base of the unsupported shot string after emergence from the muzzle and exert an upsetting action thereon.

Regardless of the theory involved, it has been the practice to produce more concentrated patterns by the use of muzzle sections constricted to a diameter less than that of the rest of the barrel. Since the entire range of constriction diameters between a normal 12-gauge true cylinder barrel and a full choke barrel of the same gauge is about 0.035 inch, and since the pattern variation is not directly proportional to constriction, it may be seen that conventional methods of pattern control must be operated at extremely close tolerances.

It is the object of this invention to provide a means of pattern control which is operable throughout the range of desirable patterns and in which the critical factor may be readily and predictably controlled.

It is a further object of this invention to provide effective, positive means of variable pattern control which will permit a single gun to be used for all types of shooting.

An additional object of this invention is the production of an effective pattern control device having a recoil equalizing feature.

The accomplishment of these objectives has been made possible by studies based upon the principle that when a shot charge passes through a choke with a relatively long constriction, the charge configuration (and hence the pattern) can be altered by varying the amount of powder gas escape to the rear of the constricted section. The extent of gas escape can be readily controlled by the provision of escape vents of variable area which will permit the gas to escape from behind the wad column. Such principles may, of course, be utilized in the design of barrels for any predetermined pattern or for the design of adjustable pattern control devices applicable to any gun.

The exact nature of the invention as well as other objects and advantages thereof will become apparent from consideration of embodiments thereof described in the following specification and shown in the accompanying drawings in which:

Fig. 1 is a longitudinal sectional view through a rudimentary form of the invention adjusted to produce cylinder patterns.

Fig. 2 is a similar view with the invention adjusted to produce full choke patterns.

Fig. 3 is a graph in which vent areas for the

form shown in Fig. 1 are plotted against pattern percentages.

Fig. 4 is a longitudinal sectional view through another embodiment of the device shown in Fig. 1.

Fig. 5 is a longitudinal sectional view through a rudimentary form of a modification of the invention, the control being adjusted for a full choke pattern.

Fig. 6 is a graph in which sleeve settings of the modification shown in Fig. 5 are plotted against pattern percentages.

Figs. 7 and 8 are longitudinal sectional views through slightly different physical embodiments of the modification illustrated in Fig. 5.

Figs. 1 and 2 illustrate the invention in a form simplified for discussion purposes to little more than bare essentials. Referring thereto by characters of reference, it may be seen that there is illustrated a cylinder barrel 1 which is formed with a recessed section 3 in which there are vents 4. The recessed section is followed by an integral choke tube 5 having a throat 6 tapered at substantially the usual choke angle and a constricted section 7 of preferably not less than 6 inches in length and preferably of not greater inside diameter than the cylinder bored barrel. The constricted section may be cylindrical or it may flare slightly but in the latter event must not flare to an extent which will prevent the wad column from maintaining control over the escape of gas. Rotatably mounted on the recessed section is the control sleeve 8 having vents 9 which may be rotated into registry with the vents 4 or may be positioned through an intermediate range to a second extreme position in which the solid portions of the sleeve completely close the vents 4. The first extreme position is that shown in Fig. 2, wherein all vents are open, and the second extreme position is that shown in Fig. 1, wherein all vents are closed. In the intermediate ranges the degree of opening of the partially exposed vents is directly controlled by the rotation of the sleeve.

As shown in Fig. 3, a vent area of 0.00 square inches (corresponding to the position of Fig. 1) yields a pattern between 40% and 45%. This pattern will qualify as a good cylinder pattern. At this setting of the device, the shot column emerges from the cylinder section of the barrel, may spread slightly in the recessed section, and may be reconstricted in the choke throat. Under closed vent conditions, the wad column is under acceleration as it passes through the constricted tube and by engagement with the base of the shot string recompacts the shot into a sufficiently solid body to allow the upsetting action just beyond the muzzle which is characteristic of cylinder patterns. Unless the constricted section of the choke tube is of substantial length, it will not be possible for the acceleration of the wad column to recompact the shot string adequately for true cylinder proportions. Six inches appears to be about the minimum length at which an adequately open cylinder pattern may be achieved, while from 7½ to 8 inches seems to be better if such a length can be utilized without appearing disproportionately long or exerting an undesirable effect on gun balance or feel.

The maximum internal diameter of the cylindrical constricted section is of some importance in that a diameter materially larger than that of the cylinder barrel will produce inadequate reconstriction for a desirable full choke pattern and there may be sufficient gas leakage to prevent

adequate reacceleration of the wad column to effect the desired recompacting for a cylinder pattern. Thus, a substantially greater inside diameter than that of the barrel may have an undesirable effect at both ends of the scale of patterns. The inside diameter of the vented section is not critical so long as it equals or exceeds the diameter of the barrel.

Regardless of whether or not the theories expressed above or to be expressed in regard to operational principles are correct, it has been definitely established that a construction of this type, adjusted as shown in Fig. 1, will produce adequate cylinder patterns. It has likewise been established that the position of the sleeve shown in Fig. 2 will produce close patterns of normal or better than normal full choke proportions and that intermediate settings will produce intermediate patterns.

In the position shown in Fig. 2, all vents are open and as shown by the graph of Fig. 3, a vent area of approximately 1.5 square inches corresponds to the conventional full choke or 70% pattern. By the use of increased vent areas, some small additional improvement in the field of extra full choke patterns may be obtained. As will be noted, the curve in this region is substantially flat.

With this setting of the device, the shot string emerges from the cylinder section of the barrel proper and those portions of the charge having a relatively great spreading tendency may contact the choke throat and be realigned in the final constricted section. The major difference, however, between this setting and that previously discussed and shown in Fig. 1, is that the propelling gases are relatively free to escape through the vents. Thus, the propelling force behind the wad column is largely dissipated and retardation of the wad column by the choke throat will effectively prevent the recompacting of the shot string into cylinder pattern configuration. The maximum concentration of pattern which may be obtained in this manner will be obtained when the vent area is adequate to relieve enough of the gas to completely prevent the wad column from recontacting the base of the shot string.

The intermediate settings, as shown by the graph, produce intermediate patterns. It may be noted, for example, that the change from a 70% or full choke pattern to a 60% or modified choke pattern may be made by varying the vent area from about 1.5 square inches to about .70 square inch. With the conventional chokes, this theoretical variation in pattern would have been accomplished by a change in constriction diameter of about .015 inch and the exact value would have been quite critical. Because of the non-linear characteristic of these control methods, the change between the more open patterns would have been much more critical. Obviously, an area of more than three quarters of a square inch is a much more readily controllable factor, from a manufacturing or field adjustment point of view, than a diametral change of a few thousandths of an inch.

Fig. 4 shows an embodiment of the invention designed as an attachment for an existing gun. While its principle of operation is identical, its construction is slightly different. This embodiment is designed to be threadably or otherwise securely attached to the muzzle of a cylinder bored barrel 11. Threadably attached to a connector 12 and extending forwardly therefrom is the vent tube 13 provided with a plurality of

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vents 14. The forward end of the vent tube has a threaded connection with a choke tube 15 which is bored internally to provide a conventional choke throat 16 and a constricted portion 17 of not more than barrel diameter. Slidably received on the exterior of the vent tube is a control sleeve 18 which may be moved longitudinally thereon and retained in the desired position by any suitable detent means to regulate the number of the vents 14 which are exposed and free to discharge gas.

This embodiment functions exactly as do those previously described. Briefly, the shot string emerges from the muzzle of the barrel, may expand slightly in the vented section, is realigned by the choke throat, and, if the vents are closed, is recompact by the wad column to issue as a cylinder pattern shot string. If the vents are all open, the same sequence is followed but there is no recompacting action of the wad column and the shot string will issue with the elongated conformation essential to a close or full choke pattern.

The modified form of the invention illustrated in Figs. 5 through 8 combines with those principles previously discussed herein the effect which is the subject of a copending patent application of Walter L. Finlay, entitled "Firearms," Serial Number 586,303, filed April 3, 1945.

Fig. 5 illustrates the essentials of this form of the invention in a simplified form adequate for discussion of the principles of operation. Referring to that figure by characters of reference, it will be seen that a cylinder barrel 21 has slidably received on its exterior surface a sleeve 22 which is shown integral with a vent tube 23 provided with a plurality of vents 24. Leading forward from the vent tube is the choke tube 25 bored internally with substantially a conventional full choke taper 26 which terminates at the rear end of an elongated constriction 27, preferably not less than 6 inches in length and preferably of no greater diameter than the inside diameter of the barrel 21. The dimensions of the choke tube are subject to the same limitations as the modification previously discussed.

Adjustment of this modification is very simply achieved by longitudinal movement of the sleeve 22 on the barrel 21. Such movement, to the rear, for example, simultaneously reduces the effective area of the gas vents and shortens the length of the recessed section in which the shot string is not restrained against lateral spreading. The latter effect is that discussed in the copending patent application above identified, and for purposes of pattern control these effects are additive in nature.

The functioning of this modification is, in general, the same as that of the modification first discussed. The charge emerges from the cylinder barrel, expands in the vented section, and is re-constricted by the choke throat. The amount of expansion and hence the amount of reconstruction necessary to bring the charge back to bore diameter are functions of the length of the recessed section as discussed in the copending application referred to herein. With all of the vents open and with the maximum length of recessed section, the wad column will not have sufficient driving force to recompact the charge in the choke tube and the shot string will issue in the elongated form essential to the production of a full choke or close pattern. With rearward settings of the sleeve, the vent area is progressively reduced as the length of the recessed section is reduced. Thus, there is less opportunity

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for the charge to expand, the realignment will therefore be less severe, and there will be higher gas pressure to act upon the wad column and force it to recompact the charge into the shorter configuration characteristic of the more open patterns. In a completely rearward position, there is no opportunity either for expansion of the charge or for the escape of gas. The shot string, therefore, behaves exactly as it would in a true cylinder barrel.

Fig. 6 shows in graphic form the effect of varying sleeve settings in inches upon pattern percentages. Again using as an example the amount of adjustment necessary to change from a full choke or 70% pattern to a modified or 60% pattern, it will be noted that the change is in the neighborhood of one inch, and that the range of conventional patterns spreads over approximately four and one-half inches. Obviously, with this wide range, dimensional control of the sleeve setting, either in the factory or the field, becomes a relatively simple proposition. This modification produces slightly more open cylinder patterns than that previously discussed unless the vented section of the first modification is so proportioned that there is but little opportunity for expansion of the shot charge. When much expansion is permitted in the vented section, it may require a constriction length of from 8 inches to 10 inches to entirely overcome the effect of realignment in the choke throat. The full choke or close pattern capabilities of this modification are substantially identical with those already discussed.

Fig. 7 shows a physical embodiment of this modification designed for attachment to any existing firearm. Referring to the drawing by characters of reference, there will be seen a cylinder barrel 31 or a choked barrel which has been cut off behind the choke to produce a cylinder barrel. Threadably attached to the muzzle is a connector 32 which has threadably secured thereon a vent tube 33 provided with vents 34. The vent tube is internally threaded for its entire length and receives therein the externally threaded choke tube 35 provided with a choke throat 36 and an elongated constricted section 37 preferably at least 6 inches in length and preferably of an internal diameter not greater than that of the barrel.

Obviously, the adjustment of this model is achieved by screwing the choke tube into the vent tube. In this way, there are effected simultaneous reductions in vent area and length of recessed section.

The embodiment shown in Fig. 8 provides different means for making the adjustment but is in all functional aspects the equivalent of the previously discussed embodiments of this modification. Shown in Fig. 8 is a true cylinder barrel 41 on which there is slidably received a connector bushing 42. Threadably attached to the bushing is the vent tube 43 which has vents 44 formed therein. The vent tube, in turn, furnishes a mounting for the choke tube 45 which may be threadably or otherwise attached. The choke tube is bored to provide a choke throat 46 and an elongated constricted section 47 of preferably at least 6 inches in length and of the same inside diameter or slightly less than that of the cylinder bored barrel 41. Obviously, sliding the bushing longitudinally on the barrel will vary the area of the vents directly exposed to gas escaping from the muzzle of the barrel and at the same time the effective length of the recessed

section with results the same as those already discussed. Any vents to the rear of the muzzle of the barrel are not directly exposed to escaping gas and their effectiveness is so greatly reduced that for practical purposes they may be disregarded.

It will be noted that this modification presents a greater effective barrel length when set for full choke patterns which are primarily useful at long ranges. Thus, an important boost is given to accuracy at the range where accuracy is a most important factor.

It may also be noted that either of the modifications provides the greatest vent area and hence the greatest recoil reduction when set in full choke position. Since it is the usual practice to utilize long range, high velocity shot shells for those targets which are best adapted to full choke targets, this invention provides for an equalization of recoil between, for example, a long range duck load and a relatively low-powered, short range "Skeet" load. This effect is of considerable utility with automatic shot-guns which are generally recoil operated and require special adjustments to compensate for the varying recoil effects of various special purpose loads.

The discussion herein has been little concerned with design details and it is not intended that the invention described herein shall be limited to any particular mechanical embodiment shown. Likewise, although certain theories of operation have been set forth, it is not intended that this invention be limited thereby. The basic construction and the results achieved thereby have been set forth and are demonstrably consistent regardless of the correctness of the theory. It is intended that this invention is to be considered as limited only as required by the scope of the claims appended hereto.

I claim:

1. In combination with a shotgun barrel, an elongated choke section substantially coaxial with the barrel and supported forwardly thereof, said choke section comprising a forwardly and inwardly tapering choke throat which merges at its forward end into an elongated tubular section not substantially less than six inches in length and of an inside diameter not substantially less than the least diameter of said choke throat and not substantially greater than the inside diameter of said barrel; and gas vent means of adjustable area discharging laterally from between said barrel and the forward end of said choke section.

2. In combination with a shotgun barrel, an elongated choke section substantially coaxial with and forward of said barrel and supported forwardly thereof, said choke section comprising a forwardly and inwardly tapering choke throat which merges at its forward end into an elongated tubular section not substantially less than six inches in length and of an inside diameter not substantially less than the least diameter of said choke throat and not substantially greater than the inside diameter of said barrel; gas vent means discharging laterally from said barrel and said choke section; and adjustable means to regulate the degree of opening of said vents.

3. In combination with a shotgun barrel, a tubular member mounted on said barrel and provided with gas vents; adjustable means to control the degree of opening of said vents; and an elongated choke tube mounted in substantially coaxial relation to the barrel immediately forward of said tubular member, said choke tube comprising a forwardly and inwardly tapering

choke throat which merges at its forward end into a tubular section not substantially less than six inches in length and of an inside diameter not substantially greater than the inside diameter of said barrel and not substantially less than the least diameter of said choke throat.

4. In combination with a shotgun barrel, a tubular member mounted on said barrel and defining a chamber surrounding the muzzle of the barrel; gas vents in the tubular member; adjustable means to control the open area of said vents; and an elongated choke tube mounted on and extending forwardly from said tubular member in substantially coaxial relation to the barrel, said choke tube comprising a forwardly and inwardly tapering choke throat which merges at its forward end into a tubular section not substantially less than six inches in length and not substantially greater in inside diameter than said barrel and not substantially less in inside diameter than the least diameter of the choke throat.

5. In combination with a shotgun barrel, a tubular member mounted on said barrel and defining a chamber surrounding the muzzle of said barrel; gas vents in said tubular member; adjustable means to obstruct the passage of gas through said vents; and a choke tube mounted on and extending forwardly from said member in axial alignment with said barrel, said choke tube having a forwardly and inwardly tapering choke throat which merges at its forward, small end, into a tubular section not substantially less than six inches in length and of an inside diameter not substantially greater than the inside diameter of said barrel and not substantially less than the least diameter of said choke throat.

6. In combination with a shotgun barrel, a member defining a tubular chamber aligned with and supported by said barrel; gas vent means in the walls of said member; adjustable means to enable the exposure of a desired area of said vent means; and a choke tube mounted on said member in alignment said choke tube comprising a forwardly and inwardly tapering choke throat which merges at its forward, small end, into a cylindrical tubular section at least six inches in length and having an inside diameter not substantially greater than the inside diameter of said barrel and not substantially less than the least diameter of said choke throat.

7. In combination with a shotgun barrel, a tubular member mounted on said barrel and extending forwardly from the muzzle thereof; gas vent means in the tubular member; sleeve valve means adjustably mounted on the tubular member to control the exposed area of said vents; and an elongated choke tube mounted on said tubular member and extending forwardly therefrom, said choke tube comprising a forwardly and inwardly tapering choke throat which merges at its forward end into a tubular section not substantially less than six inches in length and having an inside diameter not substantially greater than the inside diameter of the barrel and not substantially less than the least diameter of the choke throat.

8. In combination with a shotgun barrel, a member defining an enlarged tubular chamber aligned with said barrel and of adjustable length forward of the end of said barrel; gas vent means in the wall of said member, said gas vent means being progressively reduced in exposed area as the length of said tubular chamber is reduced; and an elongated choke tube mounted forward of said tubular member in substantially coaxial re-

lation to said barrel, said choke tube comprising a forwardly and inwardly tapering choke throat which merges at its forward end into a tubular section not substantially less than six inches in length and having an inside diameter not substantially greater than the inside diameter of the barrel and not substantially less than the least diameter of said tapering choke throat.

9. In combination with a shotgun barrel, a member defining an enlarged tubular chamber aligned with said barrel so constructed and arranged that the length of said chamber forward of the end of the barrel may be adjusted; gas vent means formed in the wall of said member; means to progressively reduce the exposed area of said vents as the length of the chamber is reduced; and a choke tube having a forwardly and inwardly tapering choke throat merging into a constricted cylindrical bore mounted on and extending forwardly from said member in alignment with said barrel, the cylindrical bore of said choke tube being not less than six inches in length and of an inside diameter not substantially greater than the inside diameter of said barrel and not substantially less than the least diameter of said tapering choke throat.

10. In a construction for controlling the pattern of a shot charge propelled through a shotgun barrel by the action of a confined gaseous medium acting upon the rear face of said charge, the combination of a concentrating means for gradually reducing the diametral dimension of said moving shot charge, tubular means positioned adjacent said concentrating means in the direction of travel of said shot charge arranged to maintain the diametral dimension of said shot charge substantially constant at a dimension not substantially greater than the least diameter of said concentrating means for a distance not substantially less than six inches, and venting means for controlling the extent to which said gaseous medium maintains pressure on the rear face of

said shot charge while said charge is traversing said tubular means.

11. In a construction for controlling the pattern of a shot charge propelled through a shotgun barrel by the action of a confined gaseous medium acting upon the rear face of said charge, the combination of a concentrating means for gradually reducing the diametral dimension of said moving shot charge, tubular means positioned adjacent said concentrating means in the direction of travel of said shot charge arranged to maintain the diametral dimension of said shot charge substantially constant at a dimension not substantially greater than the least diameter of said concentrating means for a distance not substantially less than six inches, and adjustable venting means for controlling the extent to which said gaseous medium maintains pressure on the rear face of said shot charge while said charge is traversing said tubular means.

GILBERT E. HUTCHINSON.

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Certificate of Correction

Patent No. 2,484,998

October 18, 1949

GILBERT E. HUTCHINSON

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows:

Column 1, line 10, for the word "shoot" read *shooting*; column 2, line 31, for "short" read *shot*;

and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 14th day of February, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.

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