THE AUXILIARY BARREL

BY LOYE MILLER

THERE has been much shifting of emphasis in the study of Vertebrate Zoology since I embarked upon it (even though crudely) more than sixty years ago. Still, the collecting of specimens in the field is not an obsolete procedure by any means.

Scarcely a week passes that I do not have inquiry from some graduate student regarding equipment for shooting birds, reptiles or small mammals. Their problem is still a real one. Expert machinists are expensive to employ and they lack familiarity with the problem; hence the present day "do it yourself" slogan might well be brought into play. Adult education classes in night schools at many localities offer facilities and training in the use of power tools. I "learned by doing" forty years ago. Why not try it? These suggestions are offered, therefore, to the novice.

My earliest efforts to avoid the "half-load" for standard-bore shot guns were directed toward the shot pistol (Miller, 1893;1915), a device that still has a very definite function (Schmidt, 1951). Quite a number of shot pistols have been put into circulation for my colleagues and students. They are of great importance to the herpetologist and to the man who "travels light." The auxiliary barrel, however, is the most serviceable device for the serious collector who is working in country with a diversified fauna. A fairly large bore double-barreled shotgun with a .38 caliber (or .410 gauge) and a .22 caliber auxiliary barrel make up a good general armament. Even a few shells loaded with a solid slug to represent the opposite "end of the spectrum" may properly be added to the list.

My first "aux", acquired in 1894, was made by taking one of the brass shells of my 16 gauge gun, boring out the anvil at the base, thrusting in a 10 in. length of brass tubing with an inside diameter of .375 in. and then pouring melted lead into the shell around it. The device was pretty crude and tended to "shoot loose" after a while but it survived many thousands of rounds of firing and was used fully four times to the large barrel's once.

My next effort at improvement (with accent on the effort) was to drill lengthwise through 10 inches of Ford axle with a long-shanked 3/8-in. drill, then remove excess metal beyond the chamber. Automobile axles nowadays are made of "sterner stuff" so commercial *cold roll* steel or even "Duralumin" is employed for our purpose though duralumin is a bit "tricky" to bore after the first inch of penetration. The total length also has been reduced to less than 6 inches for .38 auxes in 16 bore guns. Duralumin and brass have been abandoned because they bruise too easily if dropped.

Ejectors were fitted into the first dozen or so of the .38 and .410 auxes

which I made but the practice was abandoned after proper methods of chambering were developed. The exploded shell is easily plucked out with the thumb and middle finger nails if the chamber is right and is free from fouling.

This museum has standardized its equipment as 16 bore guns with .38 and .22 caliber auxes. At the present moment we are able to buy and stock "Shelby Seamless Steel Tubing" in proper diameters and bore so that it will ream and polish to .38 and .22 calibers. The proper length tube is then "sweated" into a steel block of proper size for the gun chamber. In the final reaming of .38 or .410 pistol barrels the reamer used has the ultimate 1/4 inch of the point tapered by 10 one-thousandths of an inch. This permits leaving a choke of .005 to .010 inches in the bore, a matter of great importance in the shot pistol.

The initial boring. Boring for a center fire cartridge is a relatively simple procedure. The stock selected must be of diameter sufficient to allow for the maximum diameter of rim at the breech. Cut off the desired length of stock rod, true up the ends, center each end with precision and clamp the work in a lathe dog. Select a twist drill at least 1/32 in. smaller than the desired bore. (Better still, select two drills 1/16 in. and 1/32 in. smaller than the bore and bore twice). The standard twist drill can easily be extended by drilling and tapping the shank and screwing in the desired length of drill rod of proper size.

Place the drill in the lathe chuck, bring the work against the drill point, bring the tail stock center up against the opposite end and tighten slightly. Rest the tail of the lathe-dog against the tool carriage and start the lathe slowly, keeping up gentle pressure by feeding in the tail stock screw. After the drill has gotten properly started the lathe speed may be stepped up, but in a long boring there is a tendency to heat up and the drill binds in the hole. A little patience is a good investment. Use plenty of cutting oil. Withdraw and remove chips frequently especially during the first cut. If your drill is properly ground, with the two lips of equal length and angle, it will follow through straight to the tail stock center. (Don't run too far and cut off the tip of that center). A poorly ground drill results in much grief and a discarded piece of work. Repeat with the second drill and follow with a six-fluted reamer tapered at the tip as suggested above and you will have a fairly smooth bore. A piece of 1/4-in. birch dowel, spiral-wrapped with a strip of crocus cloth, will give the final polish.

Boring for the .22 caliber introduces a new factor. A rim-fire cartridge must be struck by a center-fire firing pin. Theoretically the bore should be off center by 1/2 the diameter of the cartridge—i.e. .125 in. (This offset however could not be used in making a .22 aux for a .410 shotgun.) By trial and error I learned that an offset of .080 in. failed to fire, one .090 inches generally fired but one .100 inches was certain if the firing pin were exactly centered (Fig. 1). Too great an offset brings the pin too

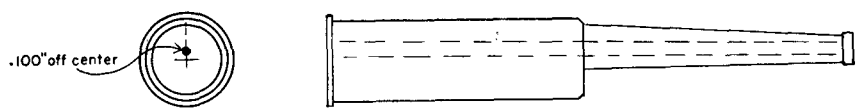

FIG. 1. Ground plan for .22 caliber auxiliary barrel for 16 gauge shotgun. Drawing by Lois C. Stone.

abruptly against the steel block, and one gun with which I had experience tore off the rim of the aux because of its too-powerful hammer springs. The rim gradually yielded with the repeated shocks.

In drilling for a .22 aux the procedure is much the same as for the .38 caliber, except that the offset must be accurately determined and must be on the same radius at each end of the work. This is accomplished readily by using the cross feed screw of the tool carriage which is graduated in thousandths of an inch. Bring a sharp-pointed cutting tool to the exact center, then retract exactly .100 inches and cut a very slight groove. Any point on this circle will have the proper offset. Drag the point lightly across the end and then along the side of the work. Reverse the work in the chuck, continue the fine scratch along the side, then across the face and to the exact center. Retract the cross feed exactly .100 in. and cut a shallow circle: Where the radius scratch intersects this circle determines your point. You then have points on opposite ends of the work that represent the ends of the drilling axis which is parallel to the center axis and .100 in. from it. Place one of these points against the drill and the other against the tail stock center, then proceed with drilling as described above.

In drilling for a .22 aux for .410 gun, a little "fudging" is done in order to leave more supporting metal where the aux tube extends beyond the .410 chamber. The muzzle center is not offset. Theoretically this is all wrong, but practically we find just as good patterns resulting, probably for the following reason: after the charge leaves the aux muzzle the gases confined within the gun bore "shepherd the shot" all the way to the gun muzzle. A little eccentricity at the breech seems to be of minor importance.

Removing excess metal.—Replace the chuck with a face plate and active center. With a lathe-dog the work can then be made to rotate on the axis of its bore between the active center and the tail stock center and against the cutting point. The barrel of the aux, beyond the block, can thus be reduced to the desired thickness and taper. It is wise to leave a slight collar at the muzzle of the aux for the following reasons: (1) it reduces danger of denting the muzzle; (2) it sets up vortex currents in the gas that might otherwise be carried back to the gun chamber. Any deposit of unburned carbon would then tend to form near the muzzle of the aux, thus reducing any tendency to fouling that might cause the aux to stick in the gun chamber.

Chambering the aux. Herein lies the potential source of greatest grief—the stuck shell that has to be rammed out with a stick. The chamber must be extremely smooth and should fit the shell snugly enough so that the brass shell cannot expand beyond the limit of its elasticity and yet will slip out when heated by the discharge.

For the .22 chamber I finally obtained and modified a special chambering reamer for .22 "Long rifle" barrels. This is a six-fluted reamer with a 7/32-in. pilot. The proximal shoulder was cut back sufficiently to allow penetration of the cutting flutes farther into the bore and accommodate the full length of the discharged shot shell. Since modifying the reamer we have had no trouble.

TABLE 1

DRILL AND REAMER SIZES FOR MAKING AUXILIARY BARRELS

Caliber	1st drill	2nd drill	Bore reamer	Chamber reamer
.22	3/16 = .1875 in.	13/64 = .203 in.	7/32 = .2187 in.	Special .227, piloted
.38	21/64 = .328	11/32 = .3475	3/8 = .375	3/8 expansion reamer
.410	3/8 = .375	25/64 = .390	13/32 = .406	13/32 expansion reamer

At this museum we use brass .38 shells retrieved, in part, from the pistol ranges of the police department. Shells are reloaded indefinitely and are "sized" before each reload. A 3/8-in. expanding reamer is used in chambering the auxes. By repeated cut and trial a very nice fit can be accomplished.

In .410 chambers we use stock paper shells. These give less trouble and I have gotten by with a 15/32-in. six-fluted reamer, though a little juggling may be called for on account of the variable brass base of the shells. A 15/32-in. expanding reamer will do this trick—if you have one.

Countersinking the chamber.—The cartridge must be countersunk into the aux a distance equal to the thickness of its rim in order that the breech may be closed.

If you install an ejector, this recessing is best done with a piloted counter bore of proper size (if you have one). The simpler procedure as finally adopted here is as follows: grip the aux in the chuck nearly up to the rim. By using a round-nosed cutting point held at right angles to the aux breech and carefully manipulating the cross and the longitudinal feeds, you can make a shallow open basin in the breech surface that will fully seat the cartridge and also allow room for the finger and thumb nails to pluck out the exploded shell.

If your chambering has been properly done and the aux accurately fitted to your gun you will have a serviceable item of equipment that, if protected from fouling, should give carefree service—until you lose it.

The values given in tables 1 and 2 may be of assistance.

TABLE 2
APPROXIMATE CHAMBER SIZES IN SHOTGUNS

Gauge	Rim diameter	Tapers from — to	
12 ga.	.900 in.	.804 in.	.800 in.
16 ga.	.810	.740	.730
20 ga.	.750	.694	.687
.410 ga.	.530	.474	.468

THE SHOT PISTOL

The shot pistol presents a dual problem. Making a smooth-bore barrel involves no great modification of parts of the above discussion. The main problem is to obtain a lock and stock that is rim fire for .22 or center fire for .38 and which has a cylinder long enough to accommodate the desired cartridge.

If you are in a position to purchase a new gun, follow your own taste. Iver-Johnson Company makes a .22 caliber target revolver with six-inch barrel that is designed for standard "Long-rifle" ammunition. By ordering from the factory they will provide at the same price, the barrel before the rifling grooves are cut. For short range collecting this needs no modification.

If the barrel is unscrewed and replaced with a nine-inch barrel, the range is greatly extended. A 9-inch choke bore for .38 caliber or 12-inch for .410 gauge will make an excellent collecting pistol. If the barrel will not unscrew,

cut it off to a stub, drill it out with a drill smaller than the outside diameter of the new barrel, turn down the outside of the new barrel to the proper size and distance so that it slips into the stub and stops against a square shoulder. This reduced part of the shot barrel is then sweated into the stub snug up to the shoulder. If your machining has been done accurately, the junction is scarcely discernible.

A great variety of pistols, old and new, have thus been converted to peaceful function for the ornithologist or the herpetologist.

Literature Cited

Miller, L.
1893 A taxidermist's gun. *Ornith. and Oöl.*, 18(7):99.
1915 A convenient collecting gun. *Condor*, 17:226–228.
Schmidt, K. P.
1951 The Hunter lizard pistol. *Copeia*, 1951:305.

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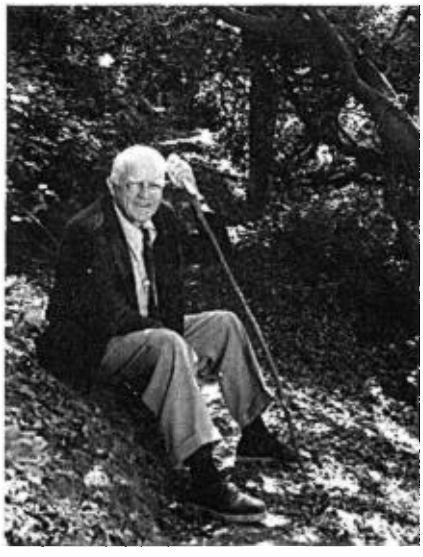
NEW LIFE MEMBER



Loye Miller, Professor of Biology, Emeritus, at the University of California at Los Angeles, is noted for his contributions to three areas of activity, vertebrate natural history, avian paleontology, and the teaching of biology. A legion of his former students refer to him affectionately as "Padre." Professor Miller, a Fellow of the American Ornithologists' Union, took his Ph.D. in paleontology at the University of California in 1912. Since that time he has investigated a variety of topics ranging from natural history of pelagic birds to territoriality in owls. A rich chronicle of his experiences as a naturalist is recorded in his book "Lifelong Boyhood," published in 1951. For the past several years, Professor Miller has lived in the home of his son, Alden H. Miller, in Berkeley and has maintained an office in the Museum of Vertebrate Zoology.