The Construction and Operation of the Air Gun

Vol 2 The Walking Stick Air Gun

G Baker
C Currie

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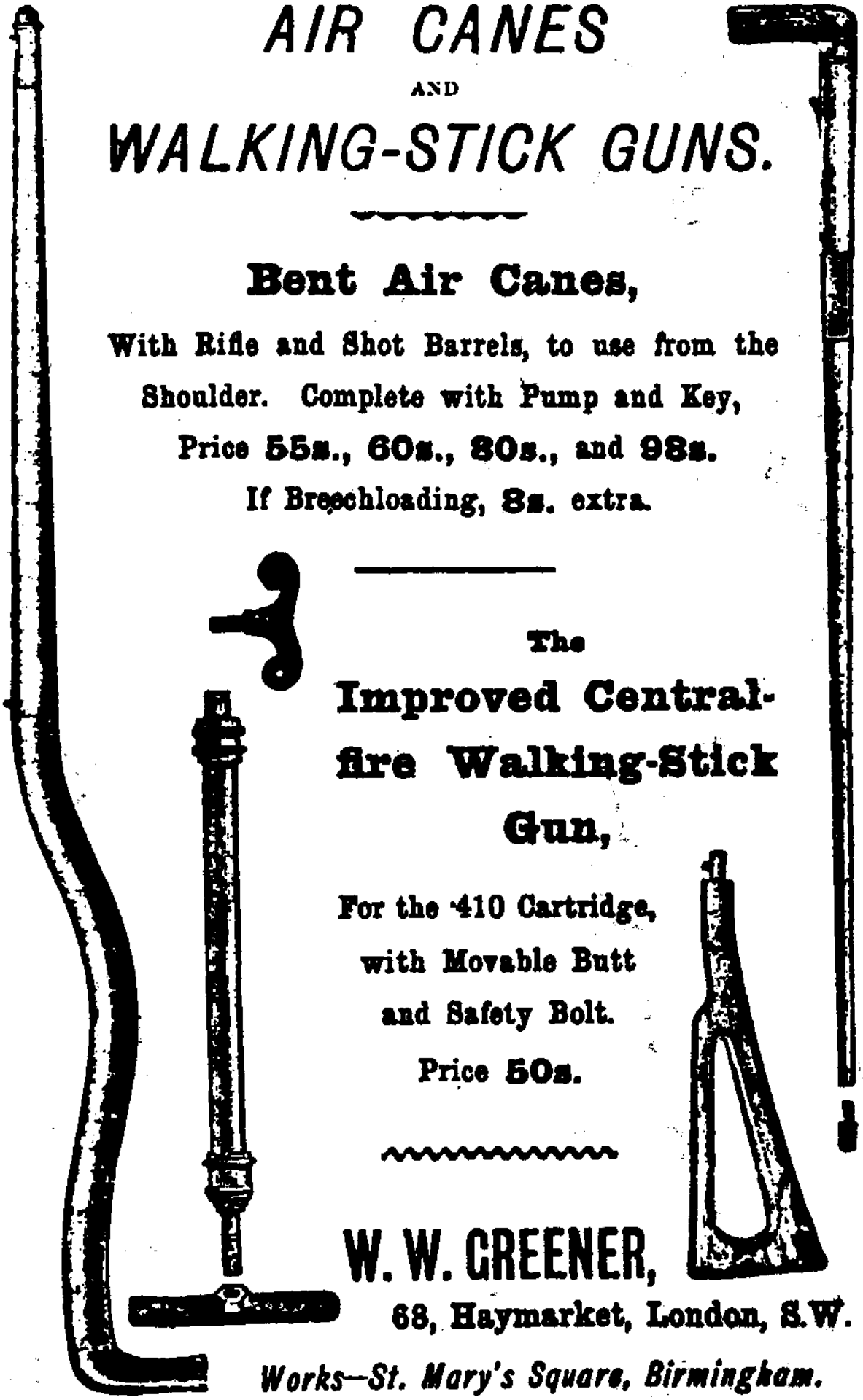
AIR CANES
AND
WALKING-STICK GUNS.



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ACKNOWLEDGEMENTS

The authors would like to thank everyone who helped to make this project possible. Special thanks to Ted Blackley, Malcolm Munslow, along with Tom Gaylord and Ron Sauls for their encouragement. Last but definitely not least, Mrs Crescencia Baker who was persuaded to demonstrate an aircane.

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INTRODUCTION

The subject of the second book in the series, is that most unusual device the walking stick airgun or aircane. Like many others, the authors were first introduced to them through the writings of Lesley Wesley and have retained a strong fascination for them ever since. Of course the concept of disguising a firearm or blade in a walking stick is not a novel one and the variations on this idea are legion. However, concealing something of the complexity of a pneumatic weapon within the constraints of a walking stick is a different concept altogether.
Given the aircane was both made and used in significant numbers during the Victorian period, it is suprising there is very little contemporary or subsequent documented history. Perhaps one reason the aircane has not attracted the academic attention that is its due, is that unlike a firearm its real interest is concealed behind a rather uninspiring exterior. No one however who removes the outer casing from an aircane can fail to be astonished by both the mechanical complexity and superlative Victorian workmanship that is revealed.

The format established with volume 1 has been followed in volume 2, with the main emphasis on how the aircane worked and how it was constructed. However, in view of the general lack of information on the subject, it was considered this scope should be expanded to include the following areas. Firstly, a discussion on the origins of the aircane with the authors comments. Secondly, a description of a contemporary proposed adjustable valve which to the authors best knowledge has never been previously evaluated. Finally, performance tests on a number of aircanes with a comparison of results. All the illustrations and dimensional information in this book were taken from original examples in the authors collection.

References

There are very few references on the subject of aircanes, however the following are probably the most informative.

Aircanes and Other Air Weapons (1850) by Reilly junior
Airguns and Other Pneumatic Arms by Arne Hoff
Airguns and Airpistols by L. Wesley
Airguns by Eldon G. Wolfe
Gas, Air and Spring Guns by W.H.B. Smith.

CONTENTS

THE AIRCANE

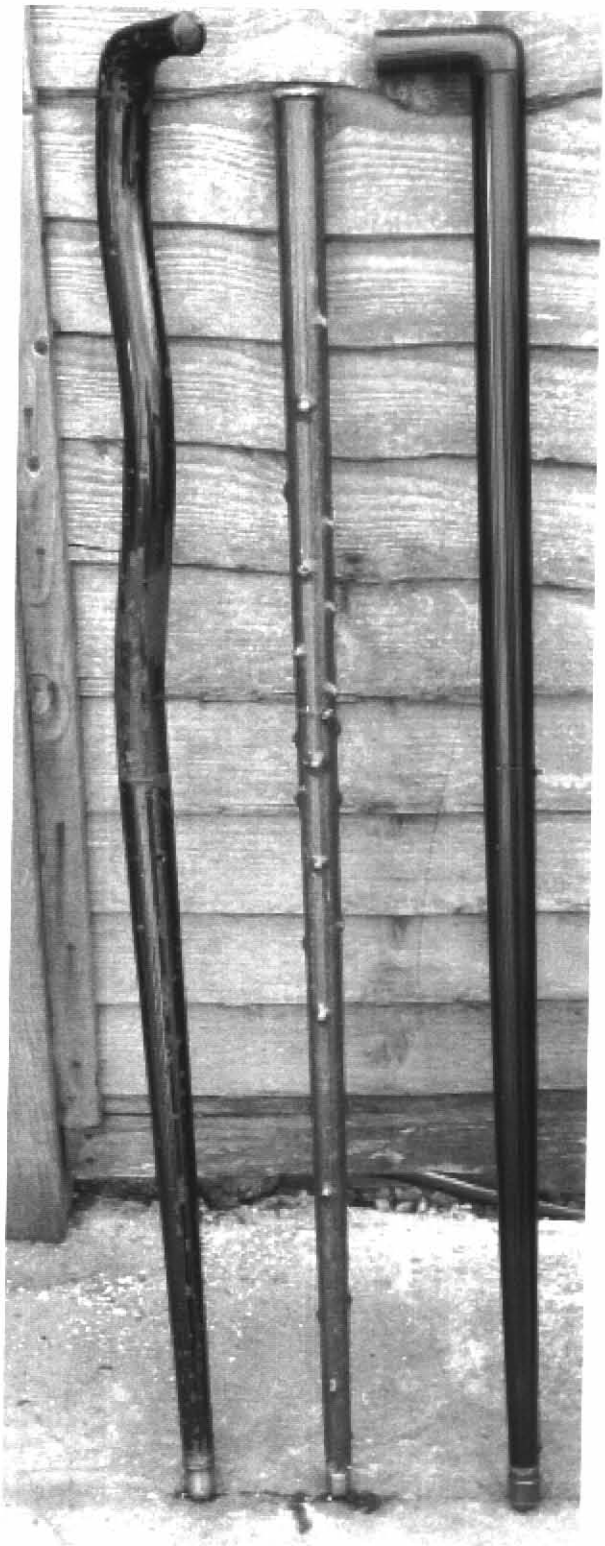
The walking stick airgun or aircane is one of the more curious developments of firearms history. Although mentioned in 1640, the earliest specimen known is in a Kremlin museum and attributed to Kolbe between 1740 and 1760. However, their real development and use took place in Great Britain from 1850 through to the Edwardian period. Given their extensive manufacture and use, it is perhaps surprising contemporary documented information on aircanes during this period is very scarce or virtually non-existent. Fortunately however, a small advertising pamphlet on their operation and manufacture by one of the major manufacturers of aircanes, E.G.Reilly has survived. This source although brief, possibly contains the most comprehensive contemporary description of aircane manufacture and operation available. Apart from a passing comment in Higsons book on the Bullet Crossbow in 1910 on the use of aircanes for rook shooting, the only other mention is by author Conan Doyle. In the Sherlock Holmes stories, his detailed description of a disguised walking stick air rifle used by the infamous Cl. Moran is probably based on the aircanes Doyle must have been familiar with during the period the stories were written.

Various explanations for their development and use have been touted, some of the most common being use by poachers, self defence or by naturalists for securing specimens. None of these explanations are really convincing as no working class poacher could possibly have afforded one, neither would it have been a sensible choice to carry for defence a loaded cocked aircane with all the hazard of an unprotected stud trigger. The case for use by naturalists is possibly the most viable; used as a shotgun with a charge of dust shot, they would have been very effective in acquiring undamaged specimens of small mammals and birds at short range.

However, this minority demand could not possibly account for the large numbers that were clearly being manufactured during this period. Most major gunmakers carried and advertised them as normal stock completely replacing the older style of butt and ball reservoir weapons. In fact they were still being listed in catalogues of the 1920's albeit as discontinued items.

Perhaps one explanation for their popularity was that for some purposes the aircane provided a viable alternative to the blackpowder firearms of the day. Its lack of flame, smoke and noise meant it could be used safely for amusement indoors by Country House shooting parties, for example when bad weather precluded normal shooting.

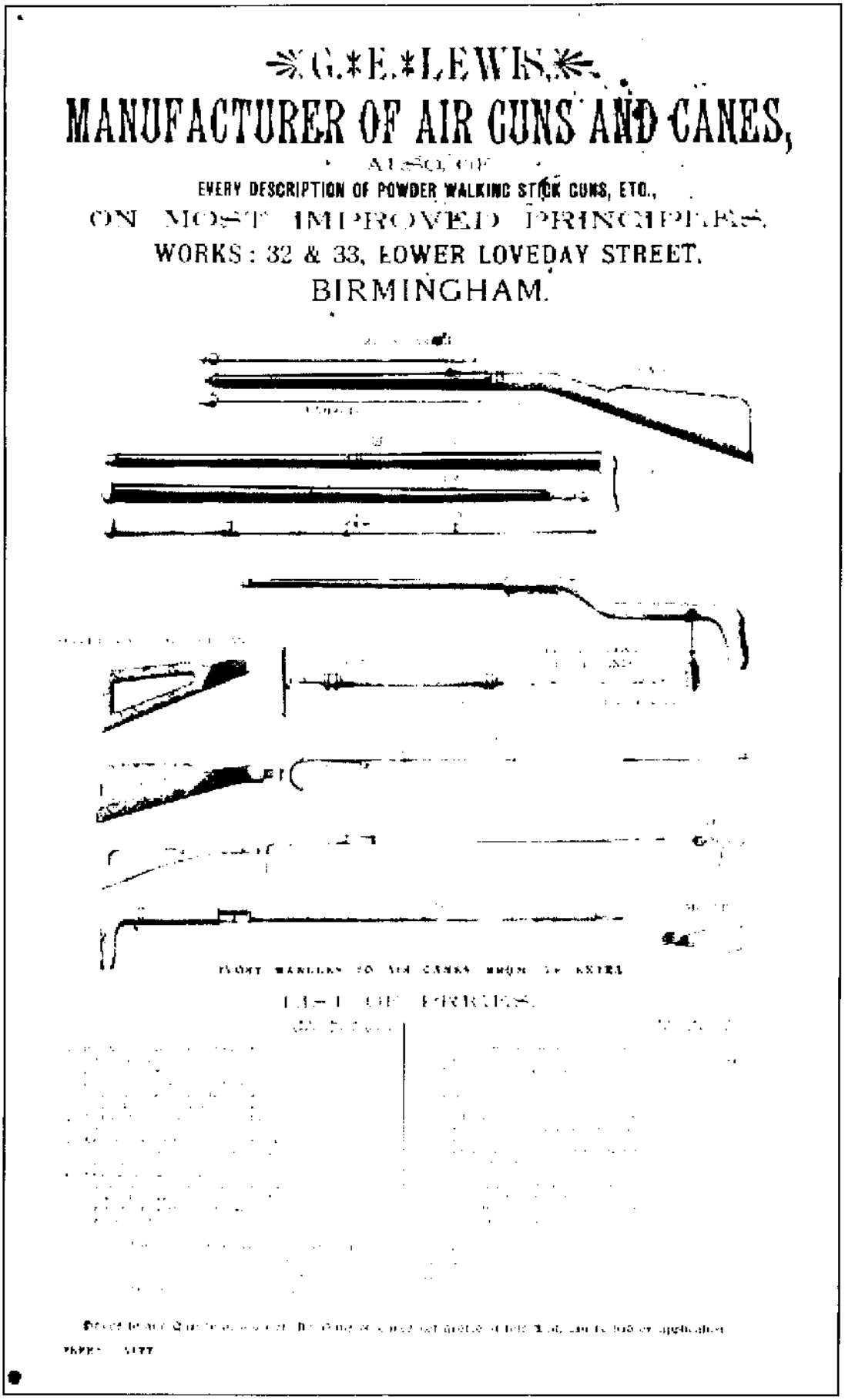
More importantly perhaps, the available evidence indicates the aircane filled a niche, prior to the introduction of the rook rifle as a rival to the bullet crossbow for rook shooting, as well as providing excellent sport with other small game.



They would also have appealed to the emerging prosperous Victorian middle class in the new suburbs, enabling them to conduct discreet informal pest/target shooting in their large gardens without the noise, dirt or dangers associated with firearms of the day. An additional factor of course could have been as our generation are fascinated with electronic novelties even more so were the Victorians with mechanical ones. The aircane certainly met this criteria and is still a source of interest and speculation to any modern firearms enthusiast who handles one.
Although many aircanes carry the names of major gunmakers of the period, these were probably mostly retailed rather than made by them. The most prolific manufacturers of aircanes were Edward Michael Reilly of London and James Townsend of Birmingham. The large numbers of surviving aircanes with the initials of either of these gentlemen marked on the lockplate, seems to confirm this. In its most basic form the aircane would have been supplied in a cloth bag, along with a hand charging pump, bullet mould and cocking key.
At the other extreme, if supplied by a prestigious gunmaker to a wealthy customer, it would be splendidly cased in leather or wood.

Muzzle loading cased aircane by Reilly

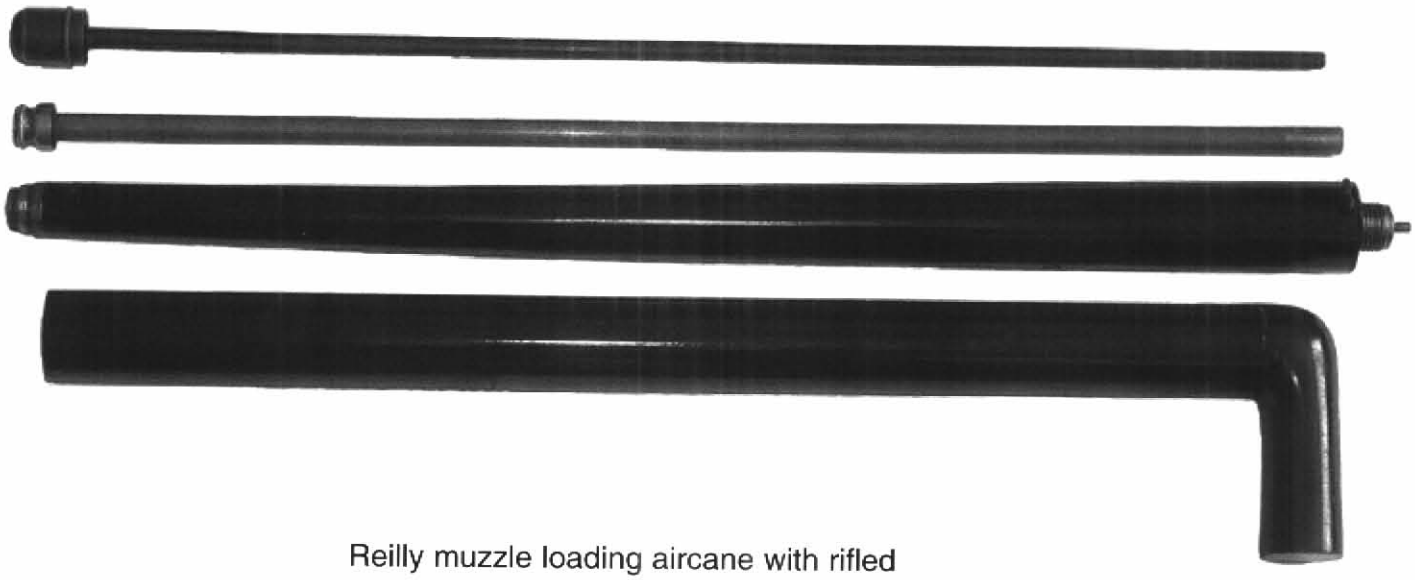
The case would also contain numerous accessories such as spare valve assemblies, removal tools, springs, wadcutter for shot and many other items.



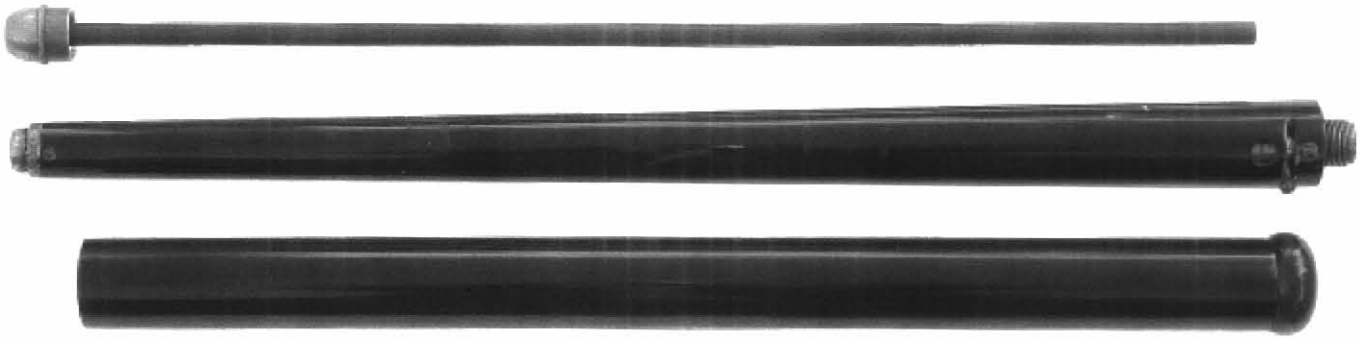
As this contemporary advert shows there was a fairly wide range of options available when purchasing an aircane.

Aircanes were made in a number of sizes determined by the measurement across the valve in the centre of the cane and these were 3/4 inch, 7/8 inch, 1 inch, 1- 1/8 inch, 1- 1/4 inch, the latter size being the one most commonly encountered. In his treatise on airguns, Reilly does give evidence of his manufacture of larger aircanes of 3/4 inch bore or 11gauge firing a 1-1/2 oz. ball, these were both extremely powerful and very cumbersome as borne out by the description of one in Wesleys book. However aircanes both below and above 1-1/4 inches are very rarely encountered and should be considered the exception rather than the norm.

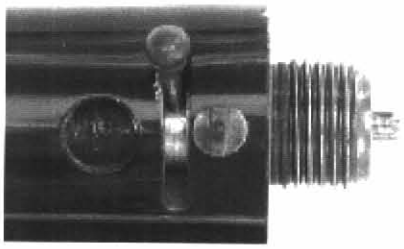
The most common surviving aircane is the muzzleloading straight cane 1-1/4 inches across ` valve, with a .32 calibre barrel contained in a .410 shot tube. If there ever was such a thing, this version is probably is the closest to being considered as the standard cane.
However as contemporary adverts indicate, there were a large variety of options on this basic design available.
Despite the number of options available, aircanes can be divided into two basic types: muzzleloading and breechloading. The latter is distinguished by invariably having a rifle barrel only in .36 calibre.



Reilly muzzle loading aircane with rifled liner.

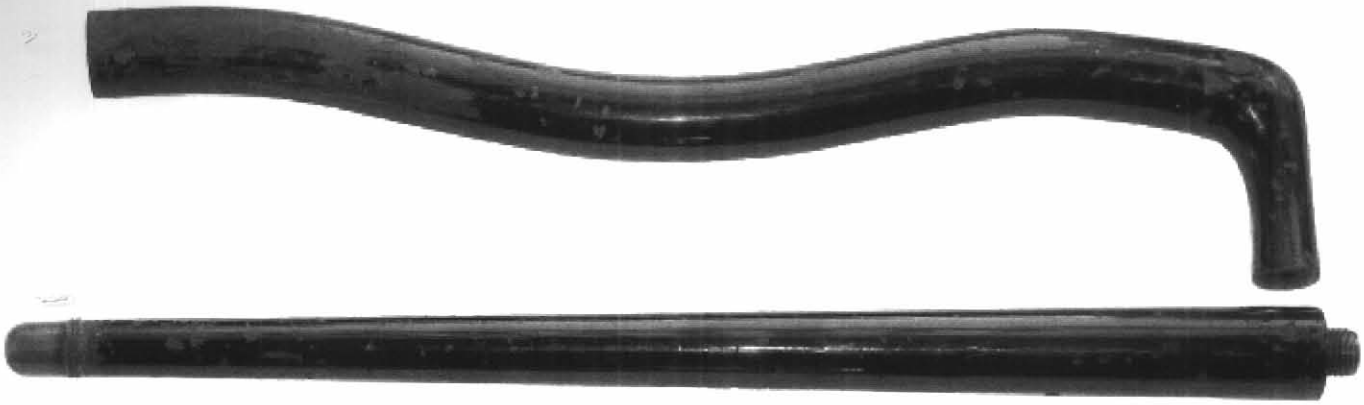


Breach loading aircane by Reilly with a .36 calibre rifled barrel.

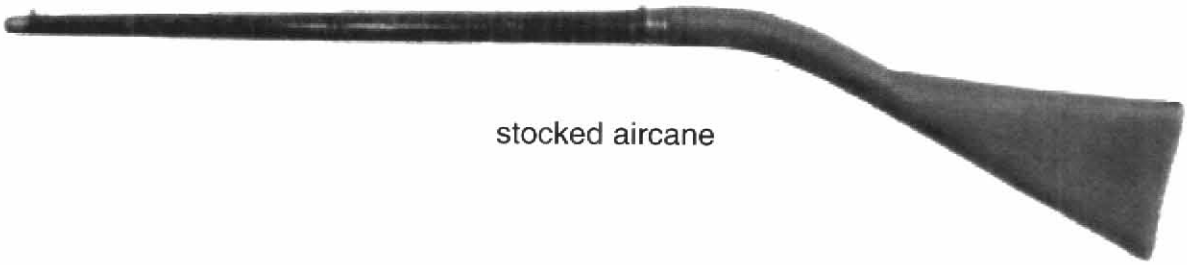


Close up of the breach showing the loading port and tap.

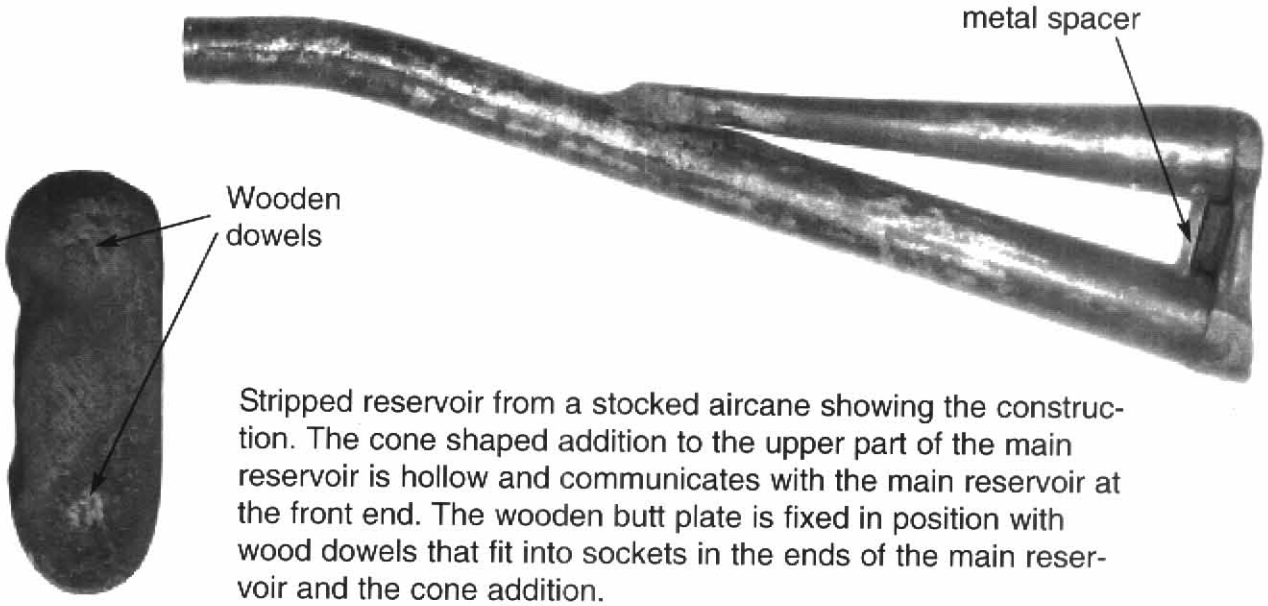
Muzzle loading aircane with cranked stock



Both types were available with cranked compression tubes to facilitate sighting, along with a version called the stocked cane, where the compression chamber was subsumed into an imitation gunstock. This was constructed by fitting a hollow cone shaped addition to the to compression tube, this was filled in with papier mache or plaster of paris and then covered with leather. They provided an increased reservoir capacity and gave the aircane more of a rifle appearance.



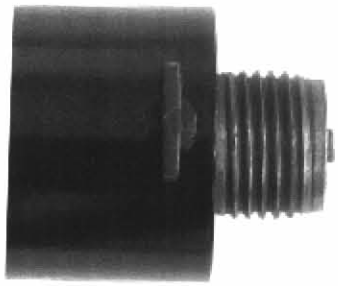
stocked aircane

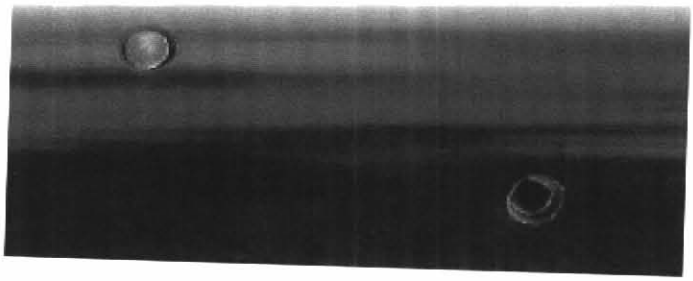


Stripped reservoir from a stocked aircane showing the construction. The cone shaped addition to the upper part of the main reservoir is hollow and communicates with the main reservoir at the front end. The wooden butt plate is fixed in position with wood dowels that fit into sockets in the ends of the main reservoir and the cone addition.

On first appearance, an aircane appears to be nothing more than a stoutly made walking stick, topped with a round knob of horn or ivory and tapering down to a thimble shaped brass tip. On closer inspection however, it will be seen that this is no ordinary walking stick, picking the cane up reveals it is made of metal and of some weight.

The lower tapering section will reveal at either extremity a tiny foresight and an equally small rearsight. Further down the section there are two small adjacent buttons one containing a square hole both flush with the body of the the cane.





If the cane is twisted between both hands it will unscrew into two virtually equal sections.

The thimble shaped brass tip can be unscrewed and withdrawn together with an attached wooden ramrod, revealing a brass sleeve with fine polygroove rifling, either 0.32 or 0.36 calibre. In the smaller calibre withdrawing this sleeve will generally expose a further 0.410 smooth bore barrel intended for shot.

The parallel upper section is the air reservoir that contains a threaded recess at the bottom of which the tip of the exhaust/inlet valve can just be seen.

Supplied with the cane would be a charging pump, cocking key and a bullet mould of appropriate calibre.

DIRECTIONS FOR USING

THE

IMPROVED AIR CANE GUNS.

To fill the Receiver with air, take the Butt or air reservoir, and screw it tightly to the pump or condenser, attach the treadle or foot piece, place your foot on the plate, grasp the Butt with the left hand, and place your right hand on the horn top of the Butt; or if pumping handles are used, the horn knob must be unscrewed and the handles substituted, draw up the piston as high as it will come, and then, with a sharp perpendicular blow, force it down till you hear the end of the piston strike the top of the pump; unless this is heard no air has passed into the reservoir. Repeat this motion until the condensation is complete. No rule can be given as to the quantity of air to be put in, as, in the first place, the reservoir should NEVER BE ENTIRELY EMPTIED; and in the next, it is not possible for one person, fairly, to put in too much air: therefore the pumping may be continued as long as any air can be got in. Occasionally it is best, on finishing to pump, draw back the piston rod of the pump, and pour in a small quantity of fine sperm or neats-foot oil at the hole at the side of the pump, and then force it in in the same manner as stated above for pumping air. Having filled the Butt with air, take off the pump and screw on the barrel. Unscrew and withdraw the ramrod, and put in a bullet. If the shot barrel is used, unscrew the rifle from the shot barrel put a **wadding first, then the charge of shot, and a wadding** over that. The charge of shot is three-eighths of an ounce, or the contents of the measure which is sent with each gun. Before commencing to shoot with shot, fill the Butt as full of air as it is possible to pump into it.

To cock the gun, put the key into the square hole at the side of the barrel, and turn it sharply to the right hand until the trigger flies out, with a click. The key must never be allowed to return till the trigger is drawn, otherwise the whole of the air, as well as the charge may be lost. The muzzle should be held upwards while in the act of cocking, to prevent accidents. The gun being loaded and cocked, the knob or hook is held between the finger and thumb of the right hand, the fore part of the stick lying on the left hand, with the thumb in a position to touch the trigger, and to be ready to press it when the sight has been taken.

To take sight, bring the knob or hook near the right eye, letting the elbow touch the right hand, and looking along the gun between the sights, having the bottom of the notch of the back sight, the front sight and the object in a line. The sights are adapted to a range of 25 or 30 yards.

Should any slight escape of air take place at the valve, it may generally be remedied by forcing in a little oil, and pumping as before described, and then snapping the gun a few times.

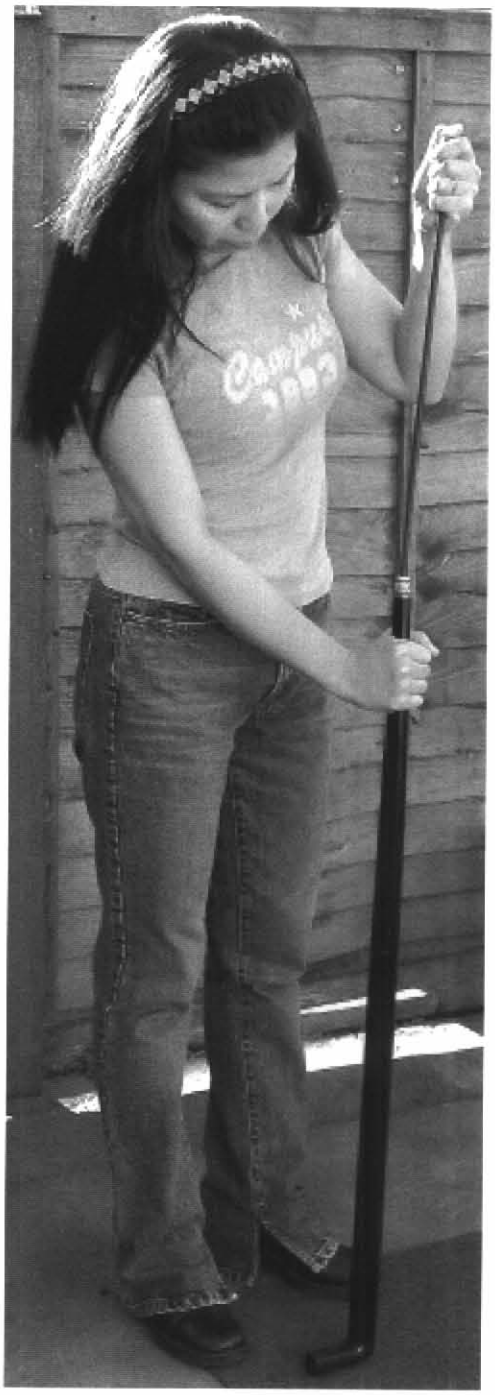
Every part of the gun and apparatus should be kept clean and free from grit or dust.

Some air should always be left in the receiver.

Cast the Bullets with soft Lead

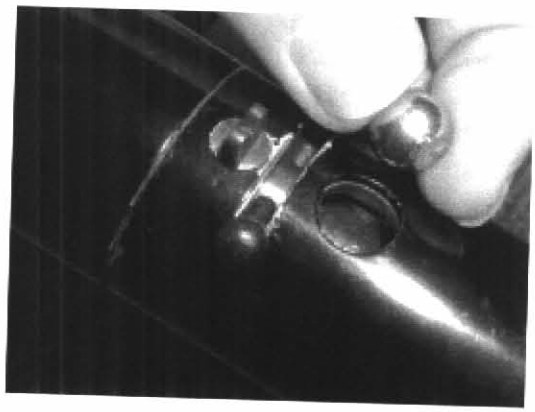
Operation of the aircane

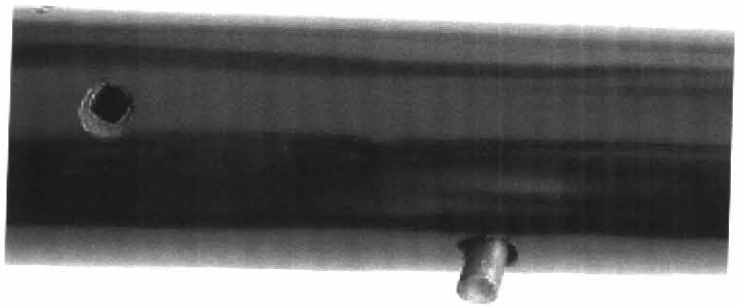
Firstly, screw the charging pump to the reservoir, place both feet on the cross bar attached to the pump piston rod and make a steady series of compression strokes until no further air can be forced into the reservoir.



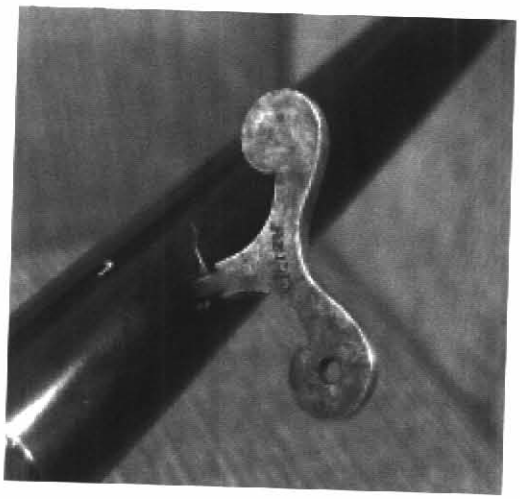
Remove the pump and screw both sections together. Unscrew and withdraw the thimble end with the attached ramrod, insert a ball cast from the supplied bullet mould and ram fully home.

In the case of a breechloading air-cane, the ball can be simply dropped in the rotary breech which is then closed.





Insert the cocking key in the button with the square shaped hole, then turn clockwise until the sear engages and the button trigger pops out.

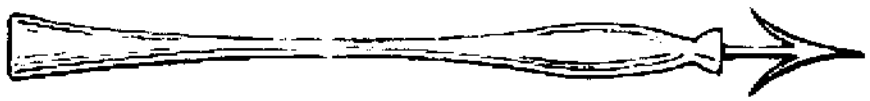


Due to the fact there is no recoil the knob on the end of the cane can be safely brought up to the cheek and the sights lined up. Press the button trigger between thumb and forefinger to discharge the ball. This process can be repeated for fifteen approximately equal shots until the power falls rapidly.

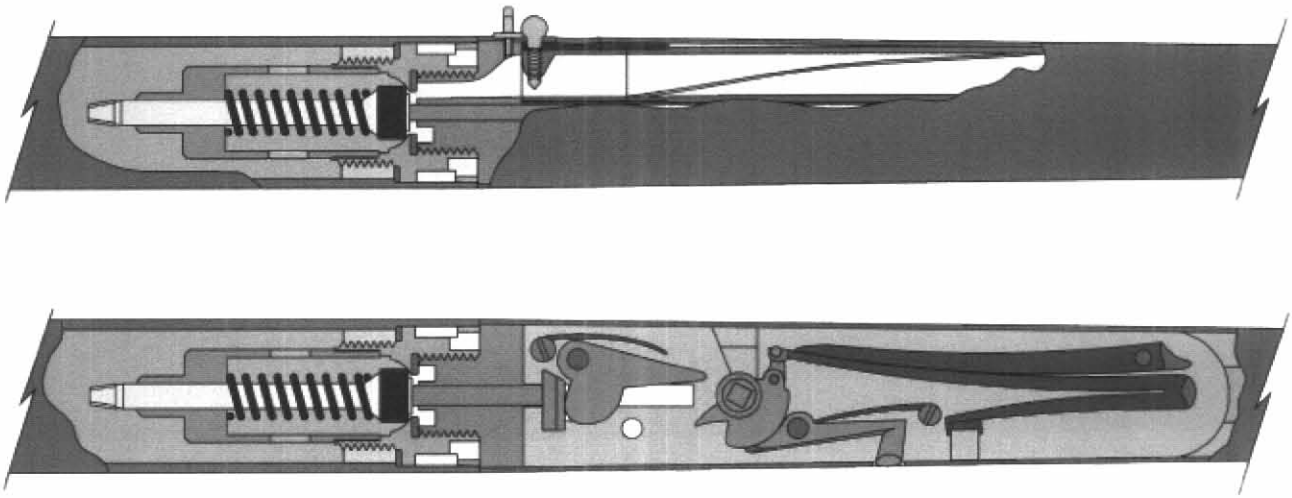
Although the aircane was a powerful weapon easily capable of taking most small game at distances over 50 metres, it was generally more effective at shorter ranges. This was due to a combination of the sights which were rudimentary in the extreme, along with the problem of the thumb movement entailed in pressing the button trigger, deflecting the aircane during discharge. Attempts were made to improve the first problem by fitting folding and other types of rear sight, however the second problem was really insoluble apart from anticipating the deflection by aiming off.

The most common projectile used in aircanes, was a round ball 0.32 or 0.36 calibre of pure lead cast from the mould usually supplied at purchase. Although some aircanes, usually breechloaders used a conventional bullet with the loading port elongated to receive them.
Fishing was another advertised use envisaged for which barbed harpoons fitted with wooden guidance shafts were supplied.
Although the problem of having to allow for the refraction of the water, as well as the normal need to aim off, would have required a real optimist to exchange a fishing rod for a aircane.

STEEL HARPOONS FOR AIR CANES.



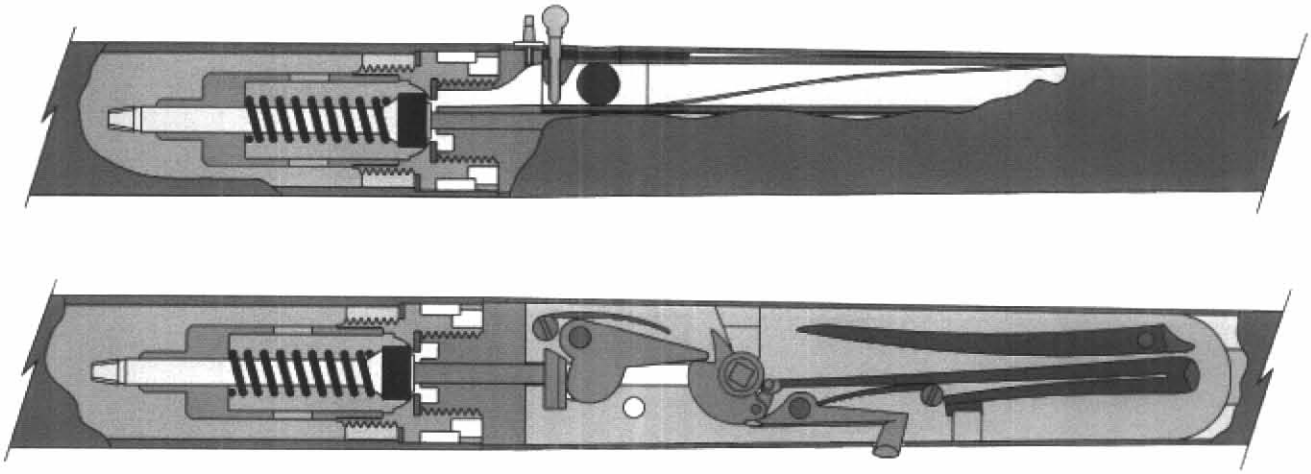
The mechanics of the aircane were very reliable, except for the valve system which was rather prone to leakage. Horn was the only suitable valve material available at this period, unfortunately it was susceptible to distortion in use if exposed to dirt or oil. When replaced with modern materials, the valve becomes very reliable and allows the reservoir to hold air for considerable periods.
The use of the aircane went into a steep decline after the turn of the 19th century, mainly due to the advent and availability of the cheap small calibre cartridge weapon.
There was no comparison between the cost of the aircane with its beautifully finished but complex mechanics with that of its simpler but cheaper cartridge rival. It is ironic however that at present this situation is being reversed, as in today's climate of severe restrictions on cartridge weapons, the pneumatic is again becoming the preferred choice for small game and pest control.
Although the aircane is considered by many authorities as a rather eccentric piece of Victoriana, it did represent an important benchmark. Previously the sporting pneumatic had been confined to a relatively small number of wealthy aristocrats, on the advent of the aircane an affordable sporting pneumatic made in large numbers was available to a larger section of the public. In fact it still presents a challenge to modern designers who have yet to produce a equivalent design that matches the aircane for power, compactness, and light weight.



Operation of the aircane lock

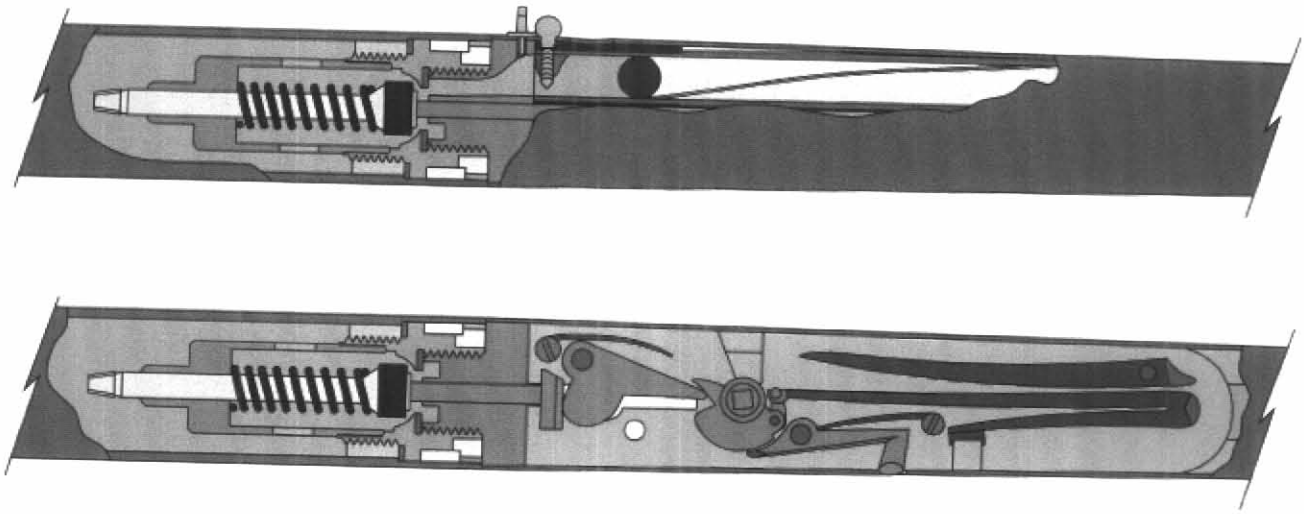
The following sequence of drawings indicates the principles of the working of the aircane lock. A breechloading version has been used for demonstration in this case but the principle applies to both types.

This view indicates the aircane lock in the rest position with the breech unloaded. The reservoir valve is fully closed under a charge of compressed air with the valve trip positioned by the trip spring resting lightly against the air release pin.



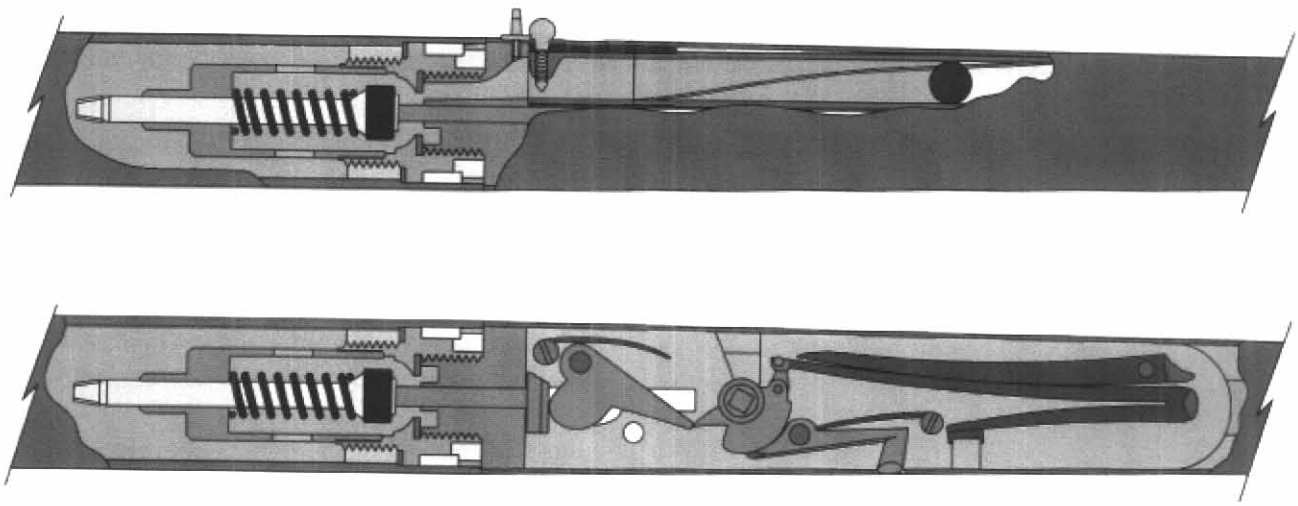
Loaded and cocked

Using the cocking key the tumbler is rotated against the mainspring pressure. The rotary motion of the tumbler captures the tail of the valve trip, whilst the sear engages and the button trigger is exposed. A ball is then inserted and the breech closed.



Discharging the lock

When the button trigger is pressed the sear releases the tumbler under mainspring pressure. The rotating tumbler forces the trip against the air release pin and opens the valve, allowing the compressed air to start driving the ball up the barrel

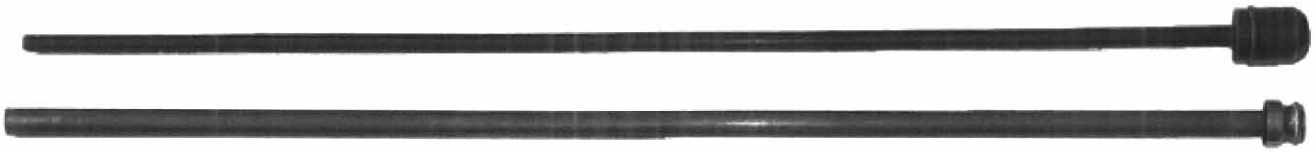


Discharge complete

The tumbler has now reached its maximum position; with the valve held fully open the reservoir pressure discharges the ball. Further movement of the tumbler releases the valve trip, allowing the reservoir pressure to close the valve. Finally, the mainspring comes to rest against the stop.

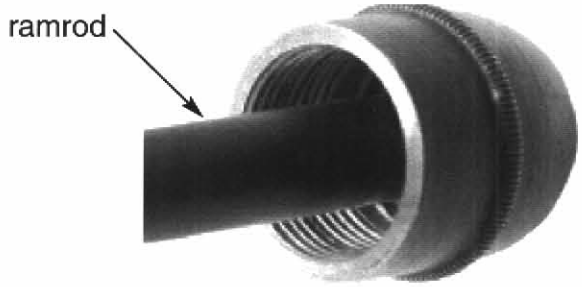
Disassembly

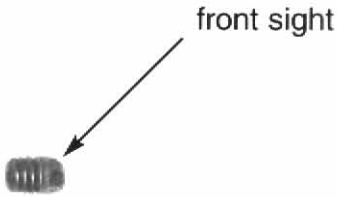
Stripping a aircane down to the basic constituent assemblies is a fairly straightforward task. It should be noted however that components of the aircane such as the casing and the barrel retaining bushes are lightly constructed and very easily damaged. Therefore it is essential that excessive force should never be applied to any component during the stripping process.
Although all components were intended to be removable by finger pressure alone, some stubborn threads that have not been disturbed for some time may be difficult. Applying heat indirectly to components by alternately dipping in boiling water then cold water, along with the careful use of a vice fitted with lead jaws will resolve most problems. Please leave the pliers and pump wrench in the tool box they have no place when working with Victorian aircanes. A breach loading aircane is used for this demonstration, however the instructions are equally applicable to a muzzle loader. Starting with the lower section containing the lock assembly unscrew and remove the ramrod. If it is a muzzle loader remove both the ramrod and the rifled inner tube .

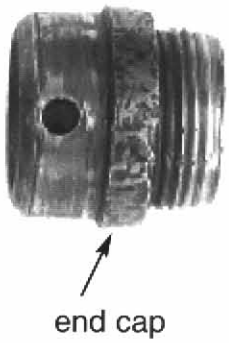


rifled liner

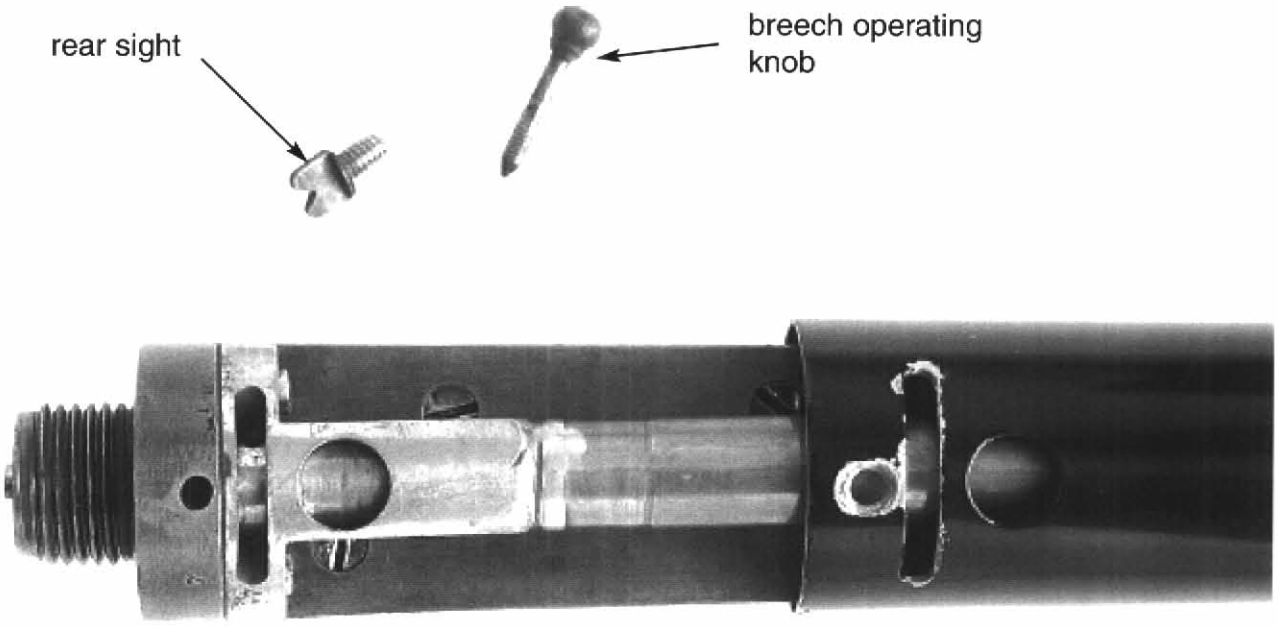
Then carefully as it is rather delicate remove the front sight. This allows the barrel bearing bush to be unscrewed and removed leaving the lock assembly and casing held together by a combination of a tapered fit and the protruding stud trigger.







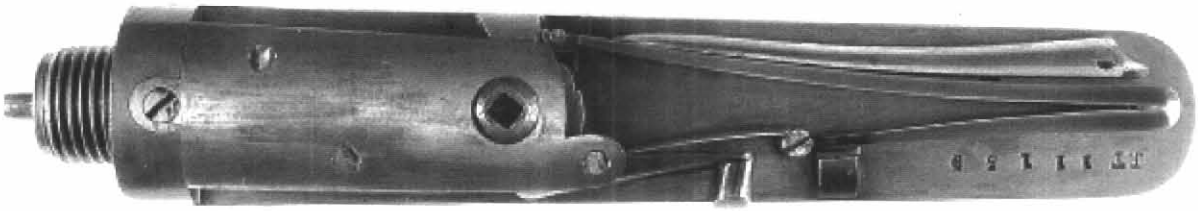
Unscrew the rear sight then press the stud trigger to clear the casing, gently tap the end of the barrel sleeve with a softwood block to free the casing from the lock assembly and remove. If the taper fit is stubborn, spray penetrating fluid in the muzzle end and stand overnight before trying again. The thread on the end of the barrel sleeve is very fine, so caution and patience are the watchwords here.

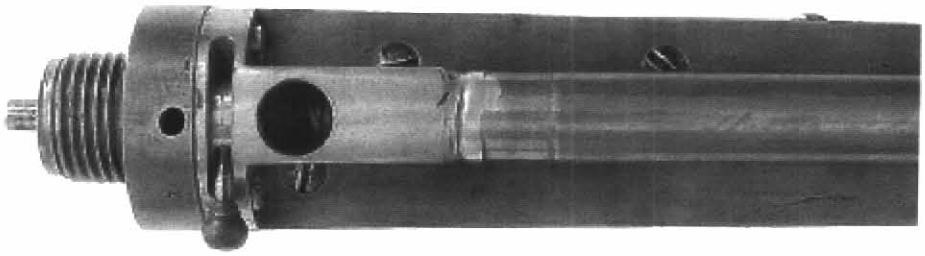


Lock and barrel assembly construction

The compact design typical of the aircane was achieved by extending from the reservoir connection body a central lockplate that utilises both sides to contain components.

On one side of the plate is the barrel, on the other is the actual lock mechanism. This makes for a neat and compact assembly, that fits into the restricted space available.



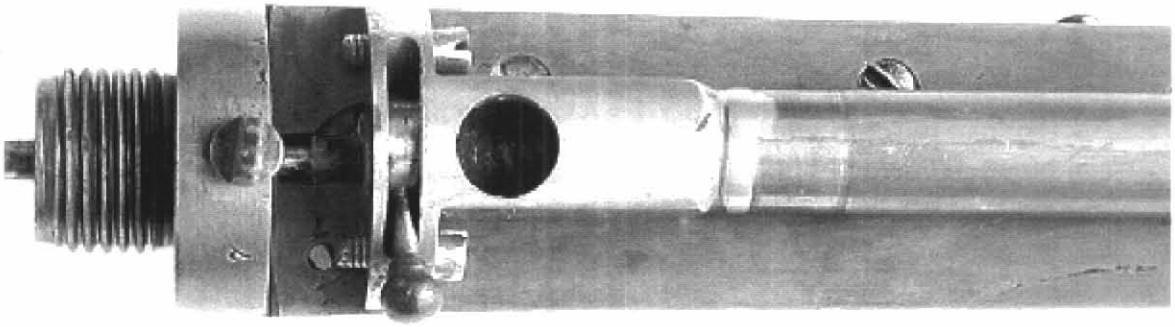


In the case of a breechloader, the rifled barrel is soft soldered directly into the barrel flange, which also contains the rotary breech.
The port in the flange lines up with the port in the cylindrical breech. Inserting a ball and then rotating the breech, seals the ball in place ready for firing.

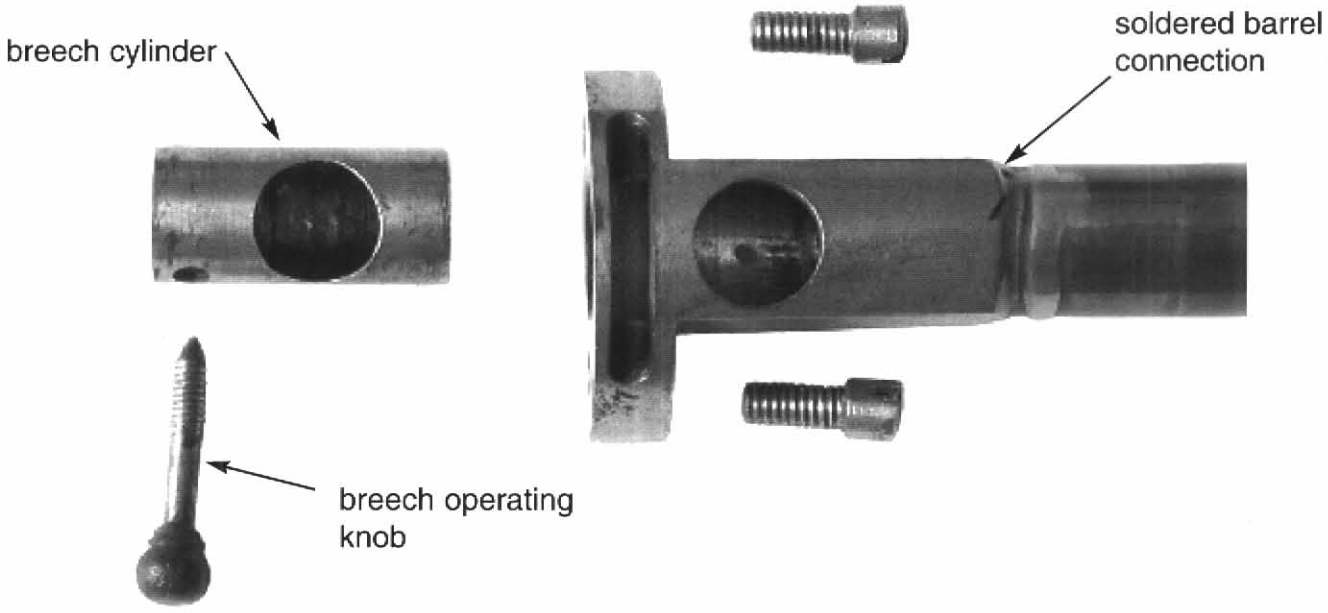
In the case of a muzzle loader, a separate smooth bore tube which also acts as a shotgun barrel is initially soldered into the barrel flange. The rifled tube, fitted in the shotgun tube as a sliding fit, is then secured with a threaded fitting at the muzzle.

The barrel is bent towards the centre line of the lock. This is not a fault but a design requirement, surprisingly it has no effect on accuracy, but allows the barrel to lie on the centre line of the casing. The barrel is made from drawn brass tubing rifled with fine polygroove rifling, very appropriate for use with pneumatics, as it provides a good grip on the ball with minimum friction and distortion.

The barrel assembly can be detached by removing the two screws from the barrel flange



Details of the rotary breech assembly

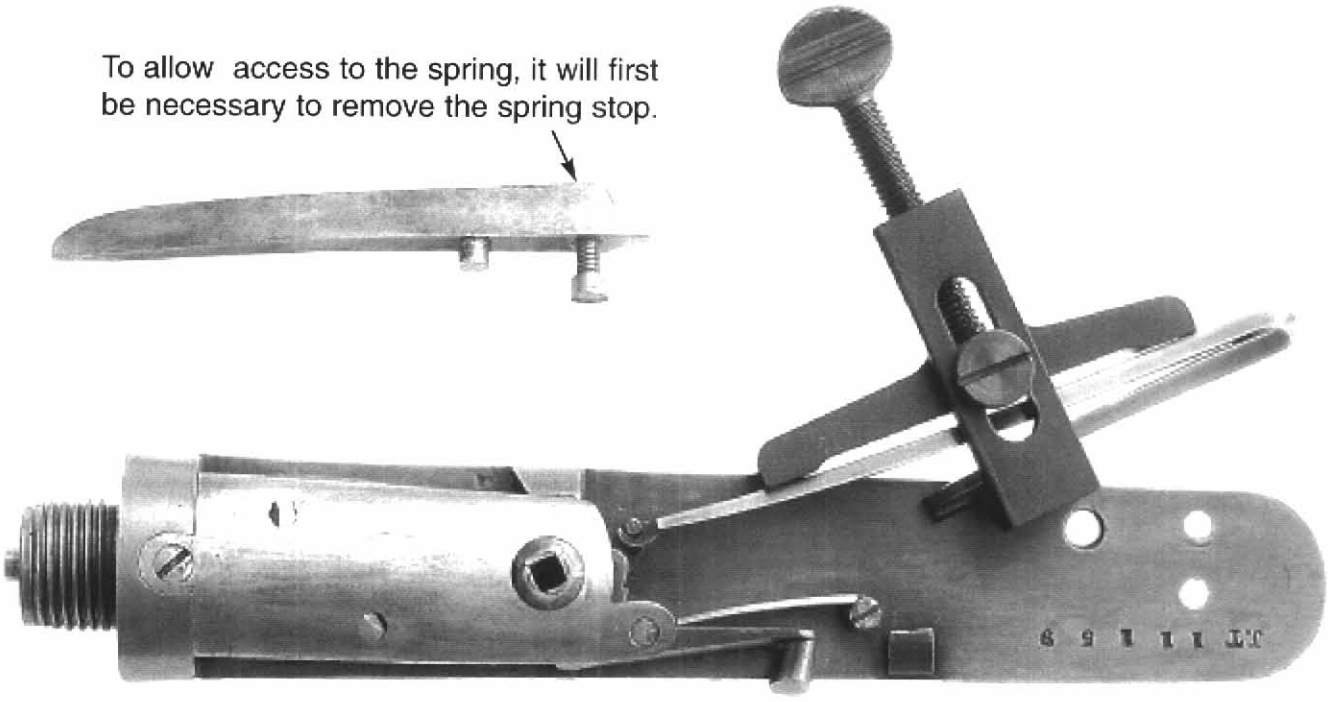


The aircane lock was a remarkable example of engineering design, especially when considering the constrained space it had to fit into.
The relationship between the lock components, is best demonstrated by removing the side plate. Before attempting this, it is advisable to take the tension off the lock by removing the main spring.

Aircane springs are very powerful and must be properly supported during removal, as they may break or cause injury if suddenly released outside the lock. Therefore the use of a proper gunsmiths spring clamp as shown is strongly recommended.

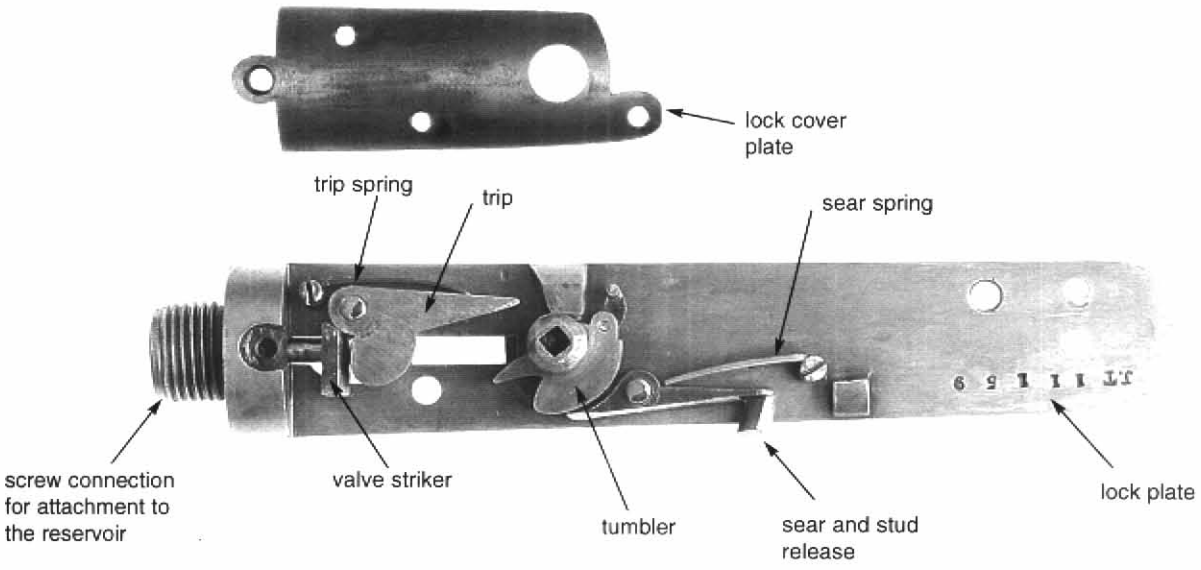
One of the lock components most prone to breakage in any lock that uses a vee spring, is the " S " link between spring and the tumbler. In a aircane this was particularly dangerous, as the uncontrolled spring could rip through the thin casing, possibly injuring the user. To avoid this a stop was fitted directly be-hind the mainspring, to limit the mainspring movement if this occurred.

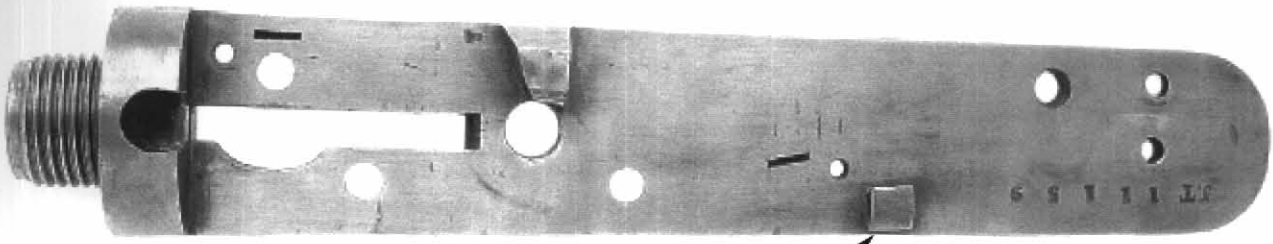
To allow access to the spring, it will first be necessary to remove the spring stop.



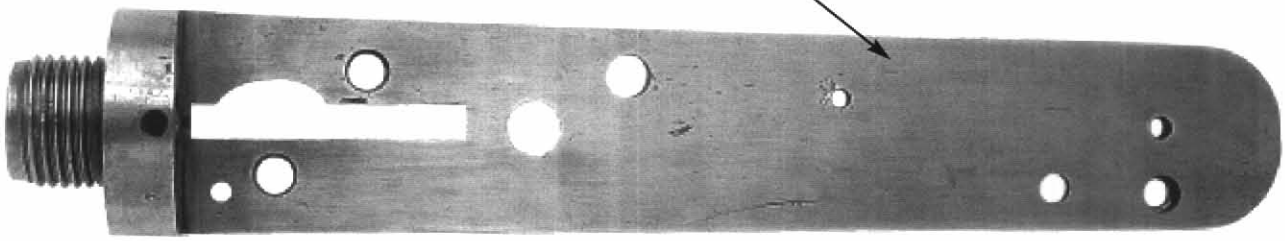
The action is cocked then the spring clamp tightened onto the spring. Release the sear and remove the spring and clamp as one unit.

Lock cover plate, mainspring and stop removed exposing the main components of the lock.

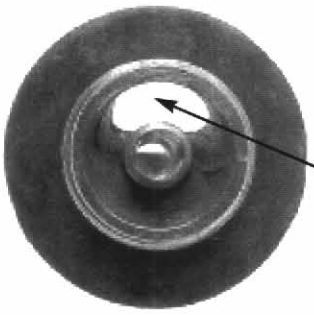




the mainspring retainer is a separate piece attached by soldering into a hole in the lockplate



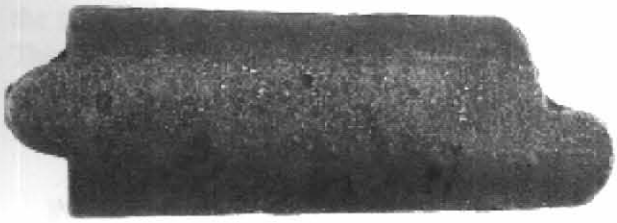
the threaded holes for attaching the barrel must have necessitated an extension to the drill bit and the tap to reach.



air transfer passage

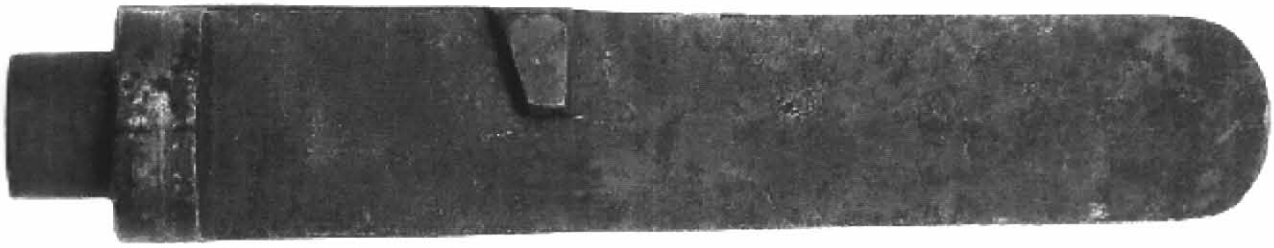
The lockplate is made as a one piece casting with a dual function. It is designed to both position the lock components and provide through the threaded section, a connection from the reservoir to the breech.

Original casting for an aircane lockplate and cover

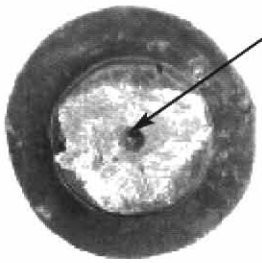


Cover plate casting

This is the only surviving example of an aircane lockplate casting that we are aware of. It indicates that casting rather than forging was the probable method of producing aircane lockplates



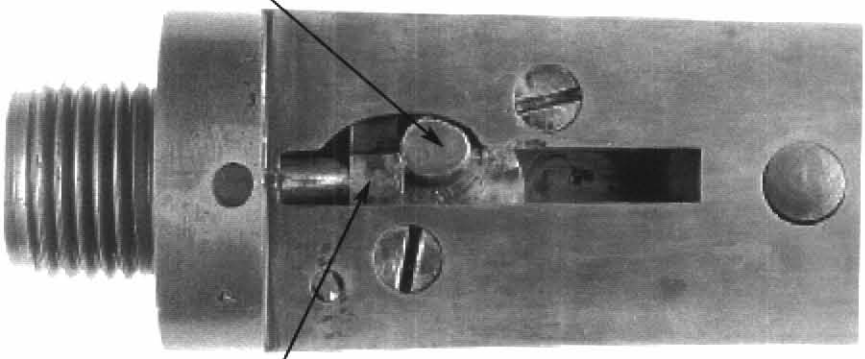
lock plate casting



positions for turning on a lathe between centres, there is a matching position at the other end of the lockplate casting

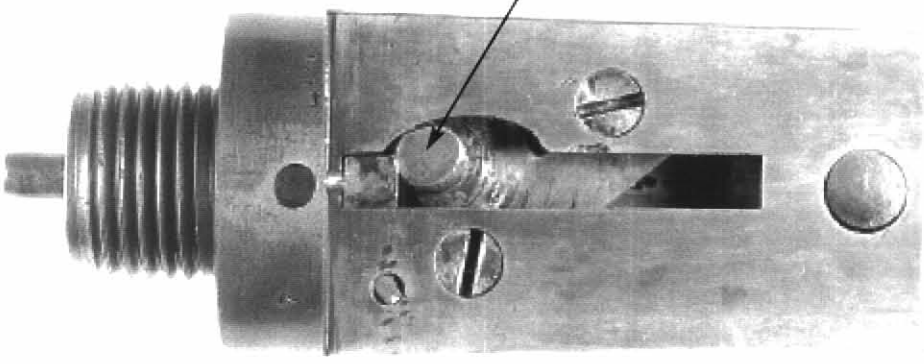
Another safety factor can be seen in the form of a semi-circular cut out. This was designed to constrain the movement of the tumbler, keeping any movement within the lockplate space envelope.

the trip projection is limited in its movement by the semi circular cut out in the lockplate

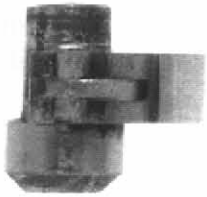


the wing on the striker pin fits into the slot on the lockplate, which means that the striker pin is supported and guided when forced against the valve by the projection on the trip.

trip projection, this is the portion of the trip that pushes against the valve striker



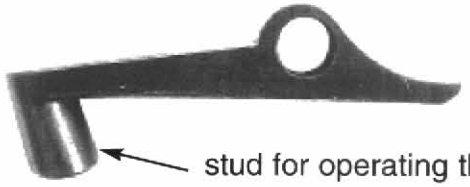
Tumbler



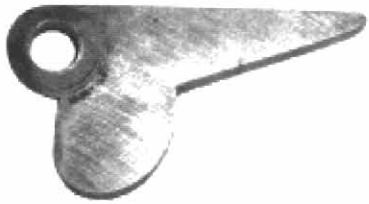
Apart from the projecting spur, the tumbler design follows normal gunlock practice. When released by the sear, the spur transmits the force of the spring as a rotary motion,to open the valve.

sear and stud trigger

The sear is unusual in that it combines both the trigger and sear in one unit. It follows conventional gun component design practice, except for the tail which is elongated and turned through 90 degrees. This portion projects through the casing when the lock is cocked, and is pressed to discharge the lock.



Trip



The trip is designed to be acted on by the spur on the tumbler, in order to convert the tumbler rotation into a straight line motion.

Striker pin

The function of the pin is to lift the valve for a brief moment, when the force of the spring is applied through the other components. Its length is critical in achieving the best performance from the aircane.

Another interesting aspect of aircane lock design are the two factors controlling the amount of air released on discharge. One is the period during which the trip holds the valve open, the second being the degree of lift the pin gives the valve. Although the positions of the tumbler and the trip are fixed, some adjustment is possible by increasing or reducing the contact time. However, it is far easier to achieve the desired result, by adjusting the length of the pin to modify the valve lift, In fact this is the method advised and used in contemporary literature.

trip spring

The trip spring is designed to re-position the trip for the next firing cycle, by returning the trip to its original position.

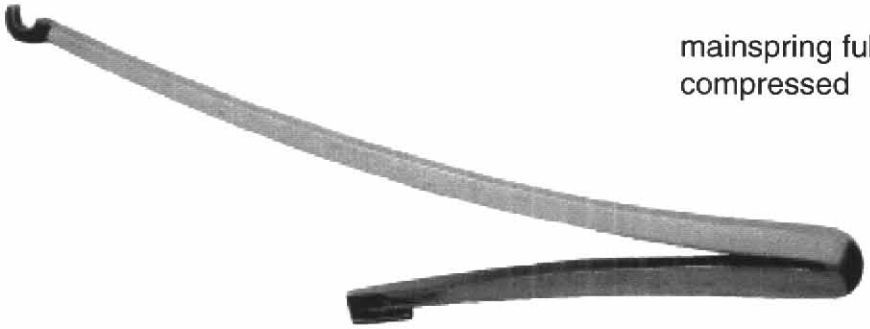
sear spring

The sear spring is a mirror image of the trip spring

Main spring

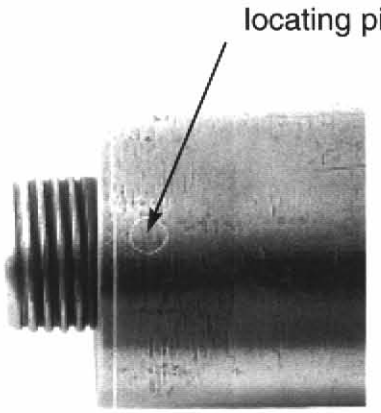
hook for connection to the link to transfer the force of the spring to the tumbler

main spring pivot



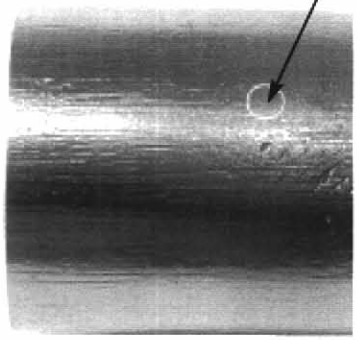
mainspring fully compressed

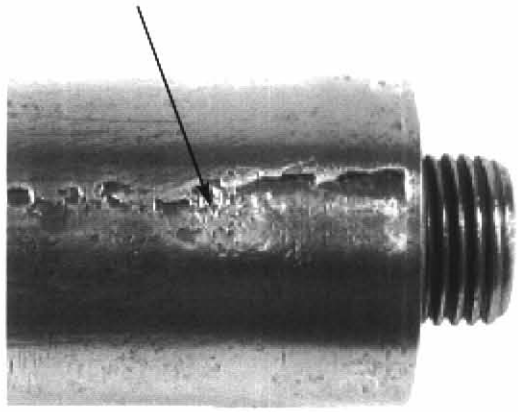
spring stop



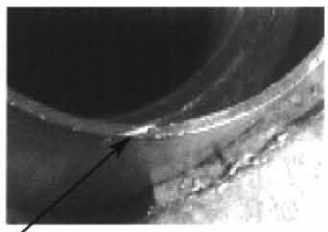
The blanking plug, is fitted to the body by pinning to locate it and then brazing. It was also threaded to take the the knob or handle, made of ivory or horn and used to grip the aircane, when used as a walking stick.

The reservoir holds the compressed air that powers the aircane. It consists of a tubular body, fitted with a blanking plug at one end and a combined inlet / exhaust valve at the opposite end. The body is constructed of sheet iron, rolled into a cylinder and the seam joined by brazing.

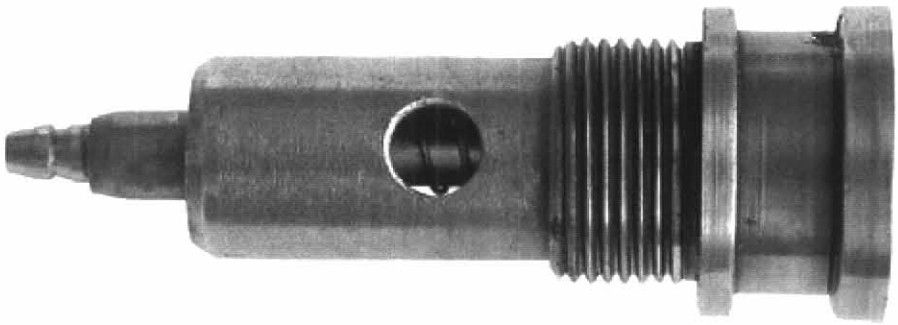




The valve end of the body, was fitted with a sleeve threaded to take the valve assembly, which was pinned and brazed in place.

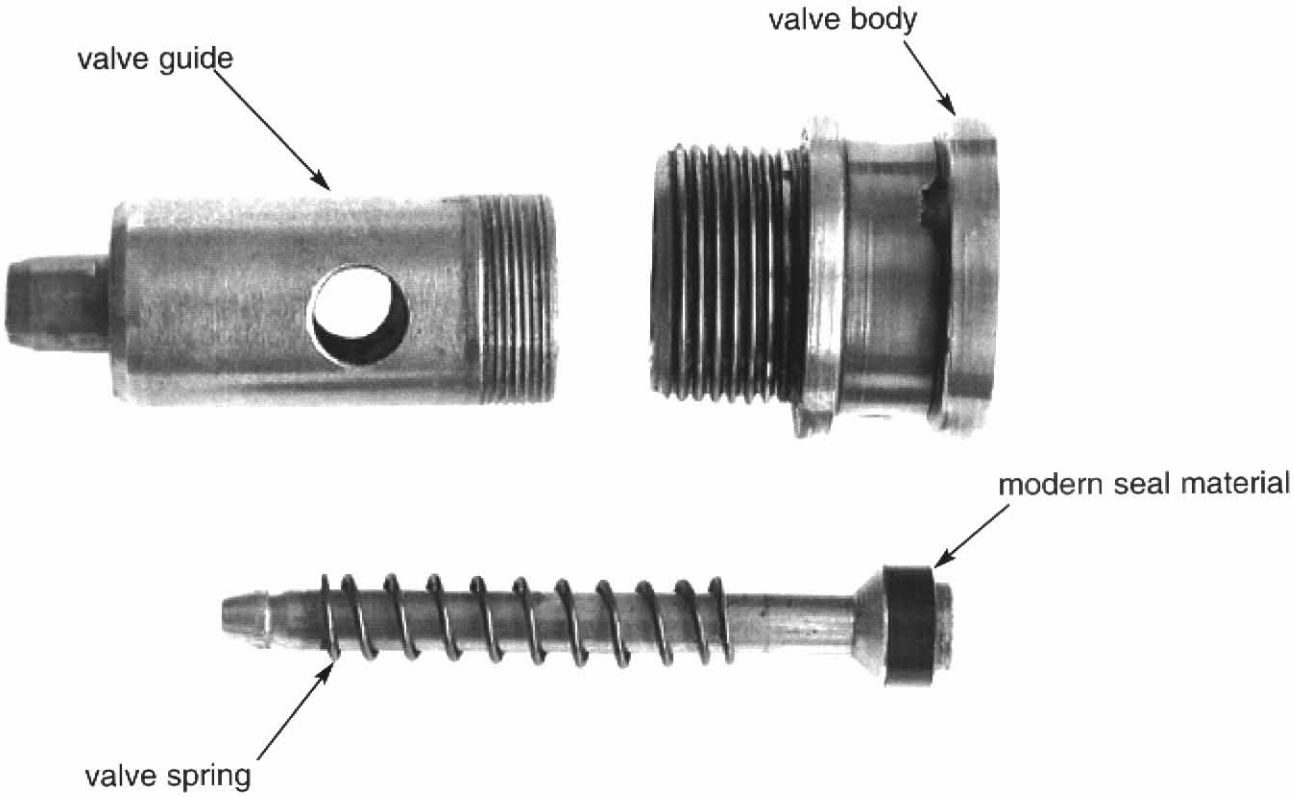


Before proceeding with removing the valve from the upper section, it is essential to first check the reservoir is empty, by depressing the valve stem. If the valve removal tool originally supplied with the aircane is available, place the pins on the tool in the holes in the valve body, and unscrew by gripping the reservoir and turning the tool with a bar. The removal tool can be clamped in a vice and both hands used to turn the reservoir. More usually, there is no tool available, therefore a good substitute is to replace the tool by holding two pins at the correct distance apart in the vice. If the valve proves reluctant to unscrew, use the hot and cold water method previously described. Please do not attempt to unscrew the valve by using a punch in the pin holes in the valve face.



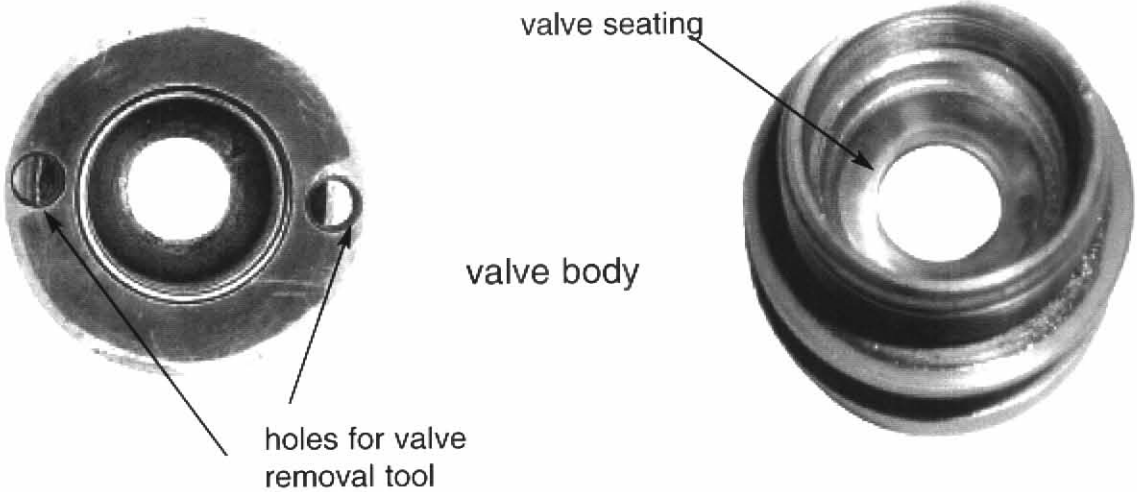
Now unscrew the valve spindle guide, the valve spindle and retaining spring can then be removed from the valve body.

Next to the lock, the valve assembly is probably the most important feature of the aircane. Made of steel, the body is recessed and threaded to take the connector which is part of the lock assembly. This connector provides both the means for assembling the aircane, along with completing the air passage from the valve to the breech. Behind the connector recess, is the cone shaped valve seat which is case hardened then polished to a high degree.



The valve spindle consists of a polished steel rod, assembled to the separate valve seal with a retaining nut. Horn was the materiel used for the valve seal, made in cylindrical form with the edges slightly relieved. This edge provided the seal against the seating in the valve body.

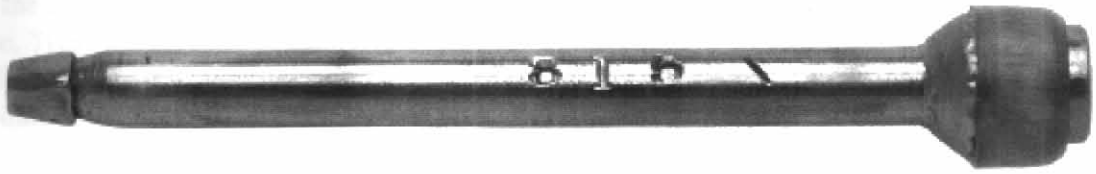
Replacing the horn with modern materials such as Delrin as in the above example, gives a vast improvement in the ability of the reservoir to hold air and allows the potential of the aircane to be realised

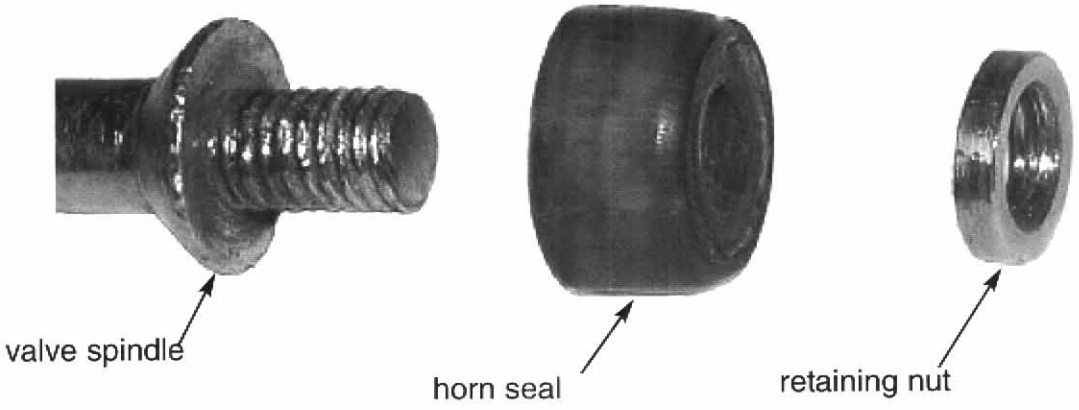


Original valve

An original valve spindle stamped with the serial number of the aircane it was fitted to.

Once the horn seal has been fitted it could not be interchanged with any other aircane

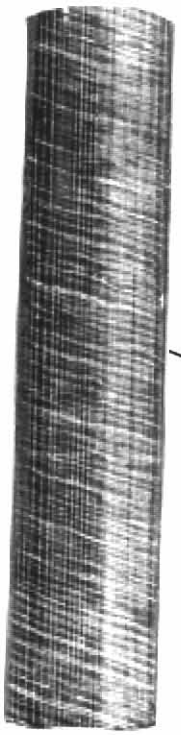




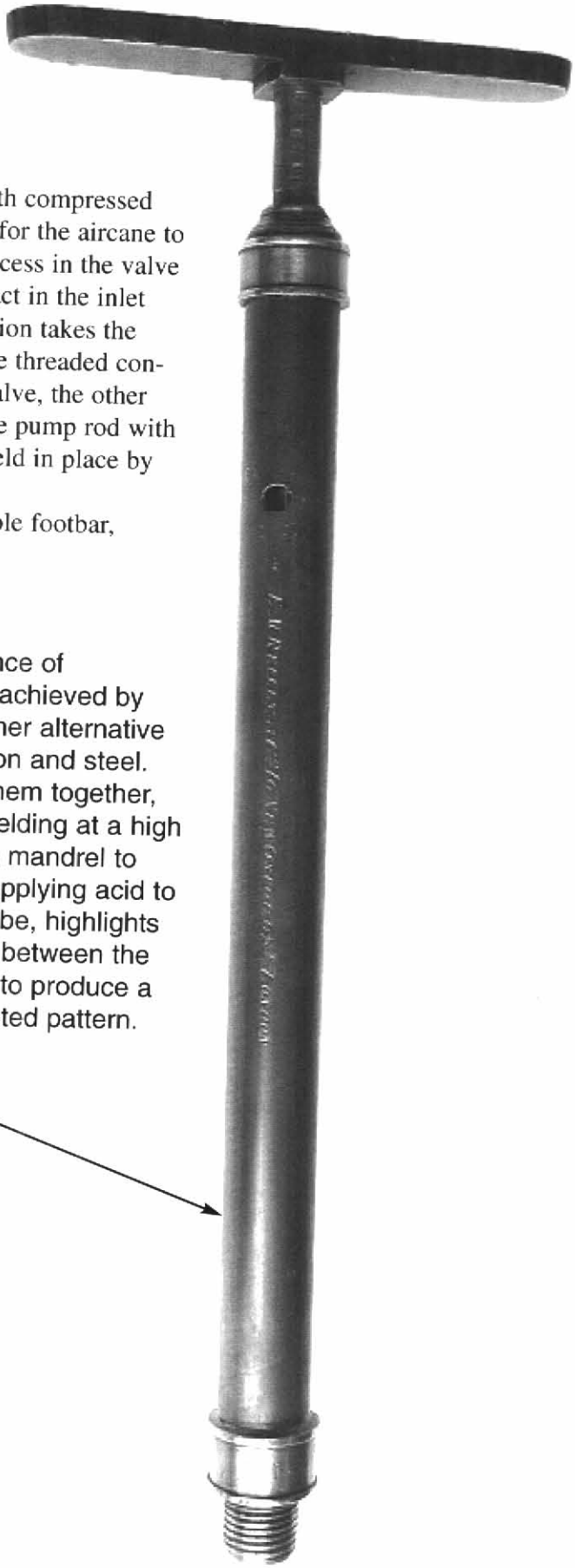
Although not really suitable for the purpose, due to its tendency to warp and distort if contaminated with dirt or oil, horn was the best material available during the period aircanes were made. Therefore ensuring a perfect contact between the valve seal and the valve seat, was crucial to the reliable functioning of the aircane.
This is highlighted by the account Reilly gives in his pamphlet of ensuring a perfect fit during the manufacturing process, by rotating the spindle at speed with the seal fitted against the valve seating, until a continuous contact was made.
However despite all Reillys claims to the contrary, ensuring constant airtightness over a period of time with horn valves was always a problem area with aircanes. This is borne out by the fact most surviving aircanes if still retaining the original valve material, invariably leak if pressurised.

Hand pump

The hand pump is designed to fill the reservoir with compressed air, to the appropriate working pressure necessary for the aircane to operate. This is achieved by screwing it into the recess in the valve body fitted to the reservoir, allowing the valve to act in the inlet mode during the pressurising cycle. The construction takes the form of a tubular body, with one end fitted with the threaded connector which connects the pump to the reservoir valve, the other end is fitted with the retainer for the pump rod. The pump rod with its integral piston head, slides in the body whilst held in place by the retainer.
This pump rod is then in turn fitted with a removable footbar, threaded to fit the rod end.



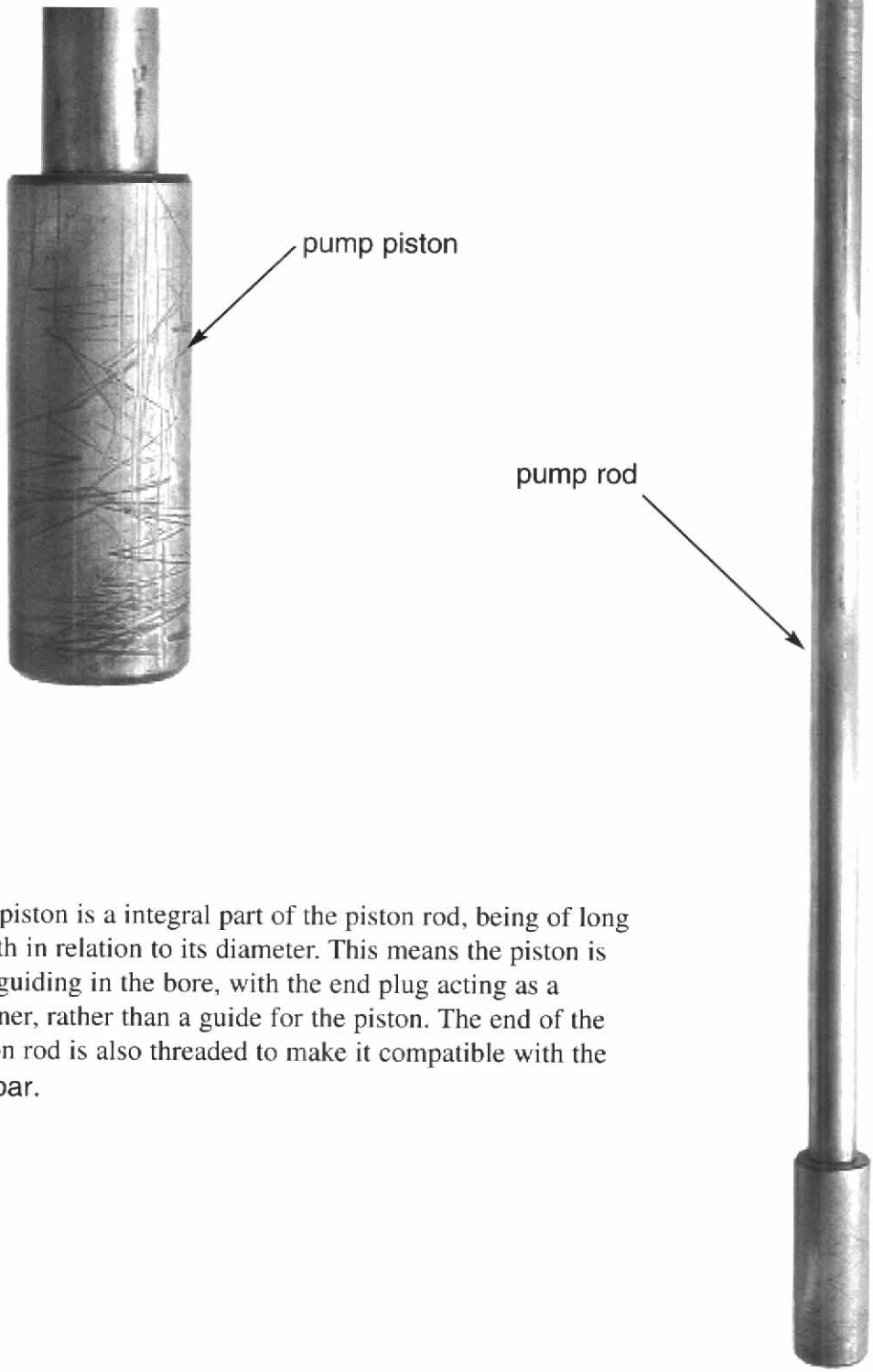
The appearance of Damascus is achieved by twisting together alternative thin rods of iron and steel. Then fusing them together, by hammer welding at a high heat around a mandrel to form a tube. Applying acid to the finished tube, highlights the difference between the iron and steel to produce a distinctive twisted pattern.



Pump body

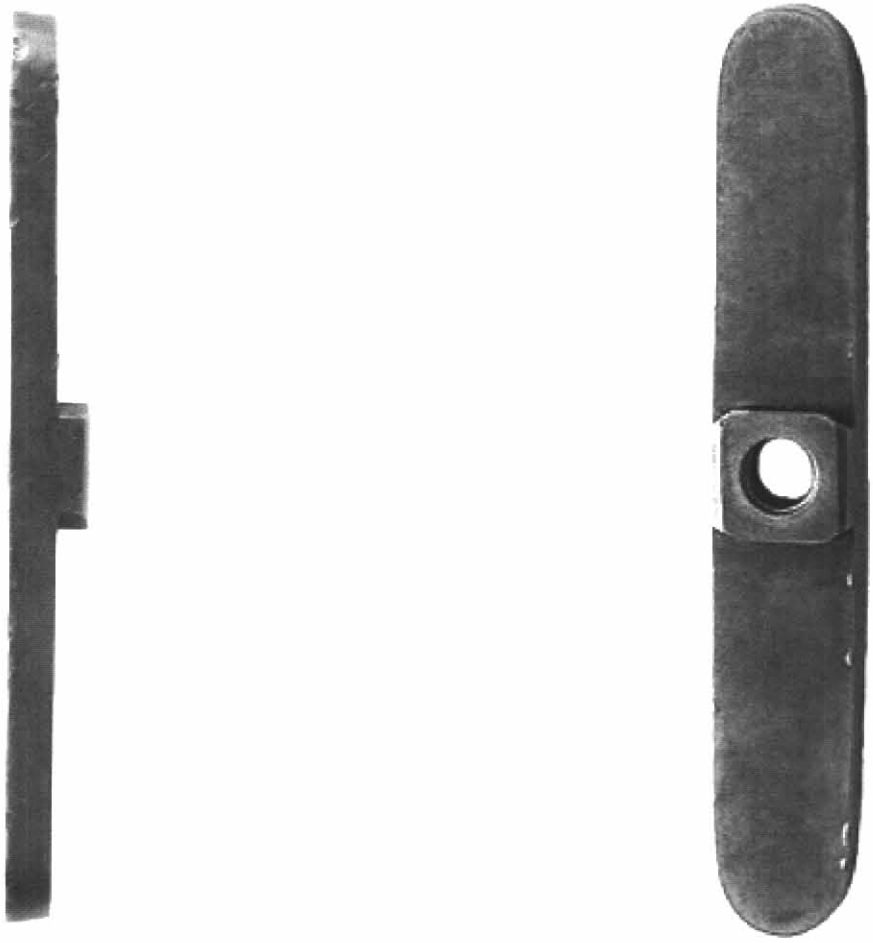
The pump body is made from drawn, rolled, or in some cases, Damascus tubing. Damascus being the choice for a expensive cased set, where no doubt its distinctive appearance would have been a added attraction for any prospective purchaser. In order to achieve a close sliding fit with the piston, the internal bore of the body has to be dimensionally accurate and concentric over its full length. This was accomplished by the use of the standard gunsmiths technique of fine boring, which is a process still used by modern gunsmiths for achieving close tolerances in shotgun barrels. In practice, it consists of passing a long square shaped bit repeatedly through the bore, until the desired size is achieved. Sharpened on one edge and adjusted with packing, the bit produces a extremely fine cut that gives a very accurate and smooth finish. On completion of this process, the piston is lapped to the bore in order to achieve a tight sliding fit, that gives the high degree of air compression required. Finally, a hole is positioned in the body directly in front of the piston in its fully extended position, to allow air ingress on the compression stroke.

Pump piston and rod



The piston is a integral part of the piston rod, being of long length in relation to its diameter. This means the piston is self guiding in the bore, with the end plug acting as a retainer, rather than a guide for the piston. The end of the piston rod is also threaded to make it compatible with the footbar.

Pump foot bar



Made of plate, in use the footbar is screwed to the end of the piston rod, which allows the pump to be secured by foot pressure when charging the reservoir.

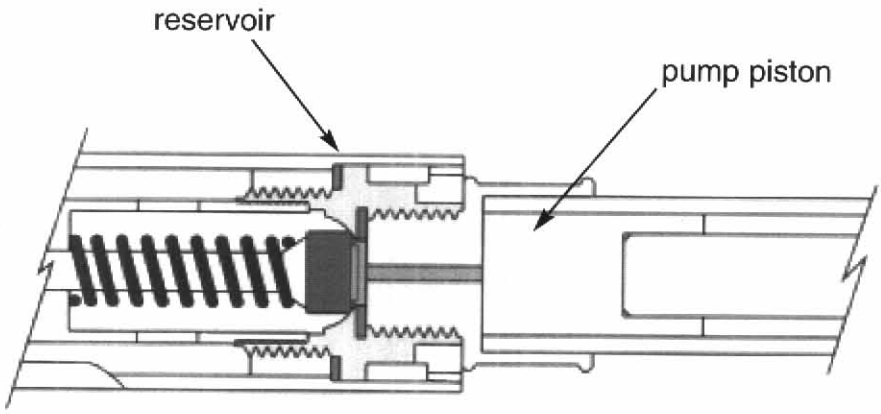
At first glance, the overall size and volume of the pump both appear to be rather limited in relation to the size of the reservoir to be filled. Using the pump supplied with the aircane confirms this, as it takes 270 strokes to fill the reservoir to a pressure where no more air could be forced into the reservoir.
However, given the light construction of the reservoir, this was probably a deliberate design intention on the grounds of safety. Using the standard pump, it was impossible to achieve a pressure that could be dangerous in a well maintained reservoir.

To determine the pressure a standard pump was capable of achieving an aircane reservoir was fitted with a pressure gauge (after hydraulically testing the reservoir to 2000 lbs per square inch) so that the pressure could be established directly. The piston diameter was 0.668 inches, 0.35 sq inches.

270 strokes of the standard pump starting from an empty reservoir brought the pressure to 600 lbs/sq inch.

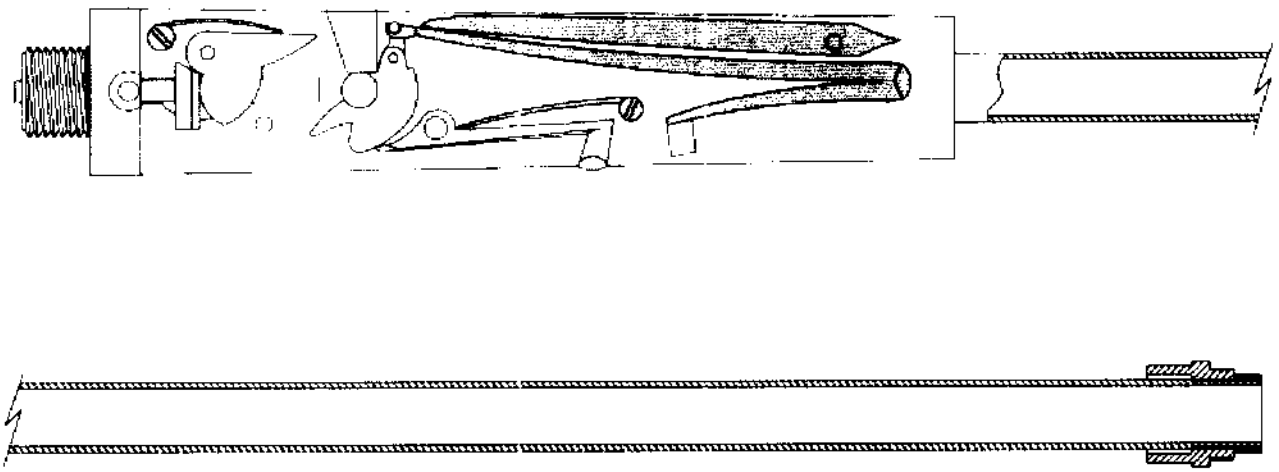
At this stage no more air would go into the reservoir.

The pump length and bore diameter effectively regulate the pressure that can be reached with the standard pump!



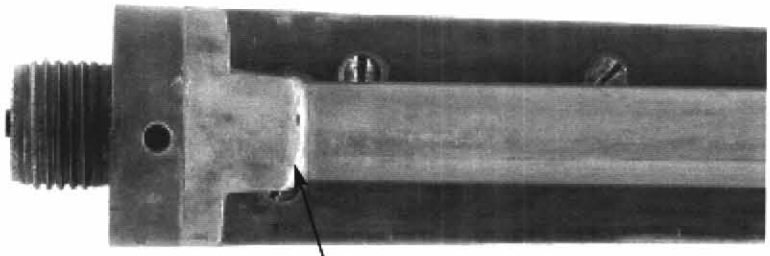
The muzzleloading aircane differed from the breechloader only in that the barrel was connected directly to the air passage and the addition of a seperate shot barrel.

Muzzle loading aircane with the cover removed

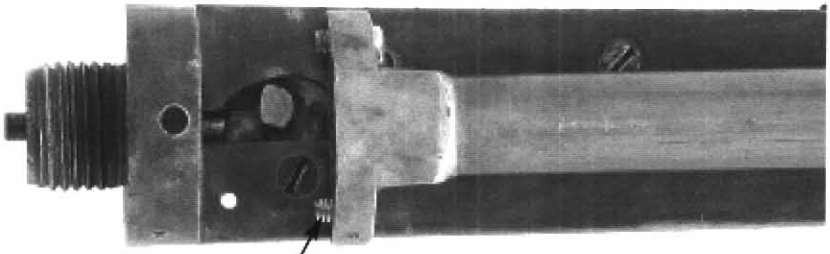


muzzle loading aircane and shot barrel

Muzzle loading aircane - barrel assembly



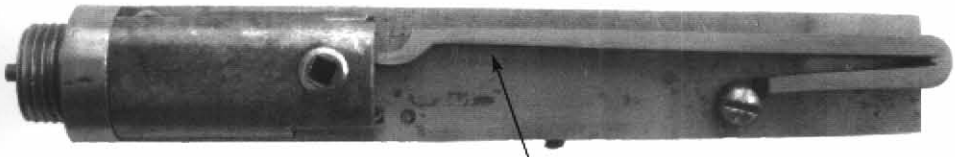
soldered joint between the barrel and flange



barrel/flange
the assembly was secured to the air passage on the lockplate by the two retaining screws

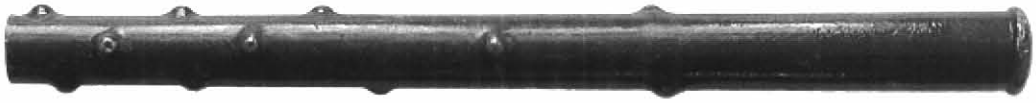
1 inch diameter aircane
unknown maker

Although based on the same principle as the standard aircane, there were a number of differences in the internal construction of the smaller cane.



note the compactness of the mainspring in comparison with that of a standard aircane

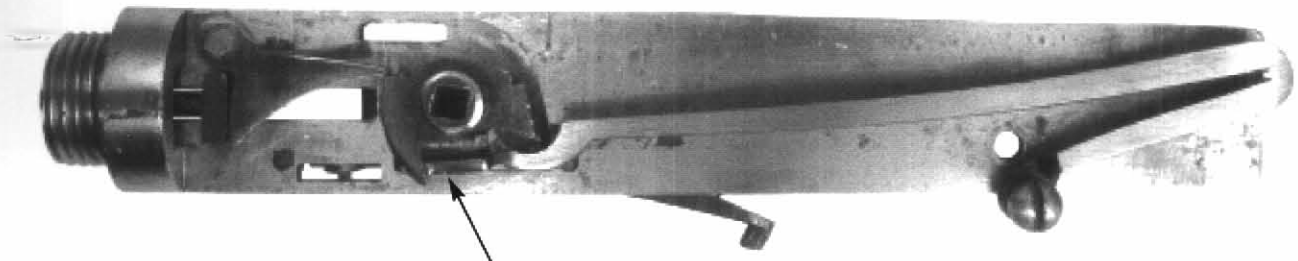
folding rear sight located by the action retaining screw



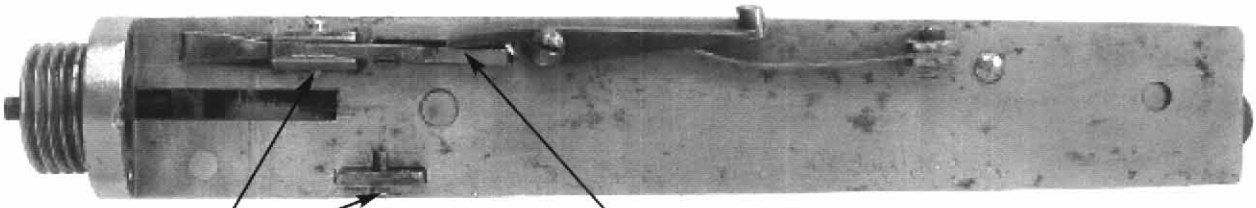
the rustic effect was achieved by attaching metal deposits randomly to the aircane body then painting

Small aircane lock operation

The design of the lock and barrel assembly of smaller diameter aircanes, follows the same principles of the standard aircane described above.
However, if we now examine a 1 inch diameter, aircane it is clear the restricted space available, requires major changes, in both the component size and position. The two major changes required, are the elimination of the spring stop and a radical re- design of the sear and trigger arrangement.
Both the sear and trigger become separate items and because of the foreshortened width of the lockplate, have to be mounted on the opposite side to the tumbler



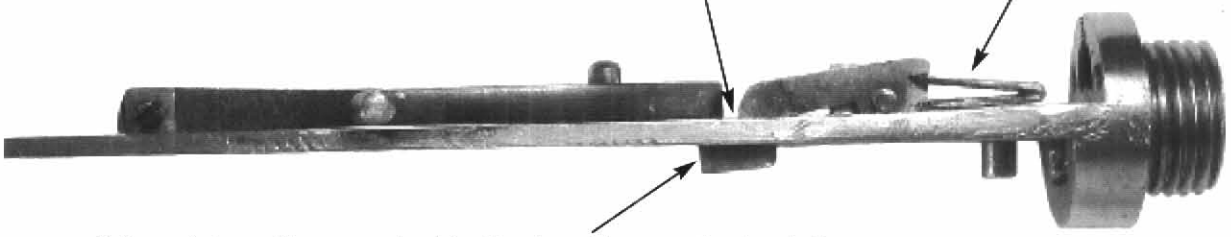
action in the cocked position, the tumbler is held against rotation by the sear



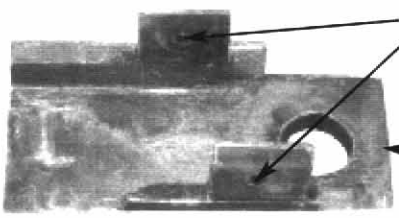
lock cover retaining pins

sear held against the tumbler by the stud trigger

sear spring



this point on the sear holds the tumbler against rotation by the mainspring in the cocked position, this is angled so that when the sear is released the sear is pushed back allowing the tumbler to rotate



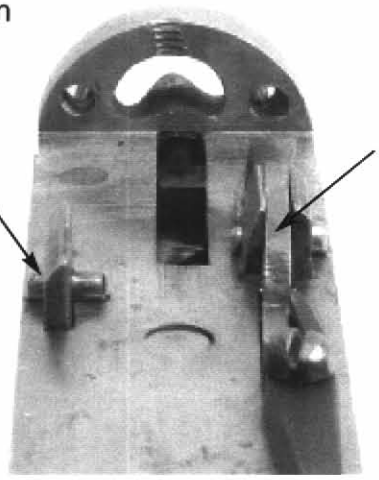
holes for lock cover securing pins

lock cover / tumbler retaining plate

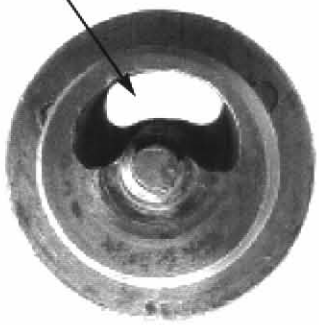
Lock components

lock cover in position held by retaining pin

sear



reservoir end of lock showing the air passage



this is slightly angled to allow it to push the sear clear when the stud trigger is pushed

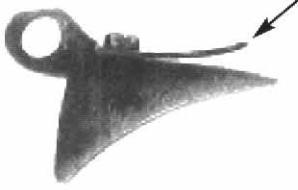
tumbler key side

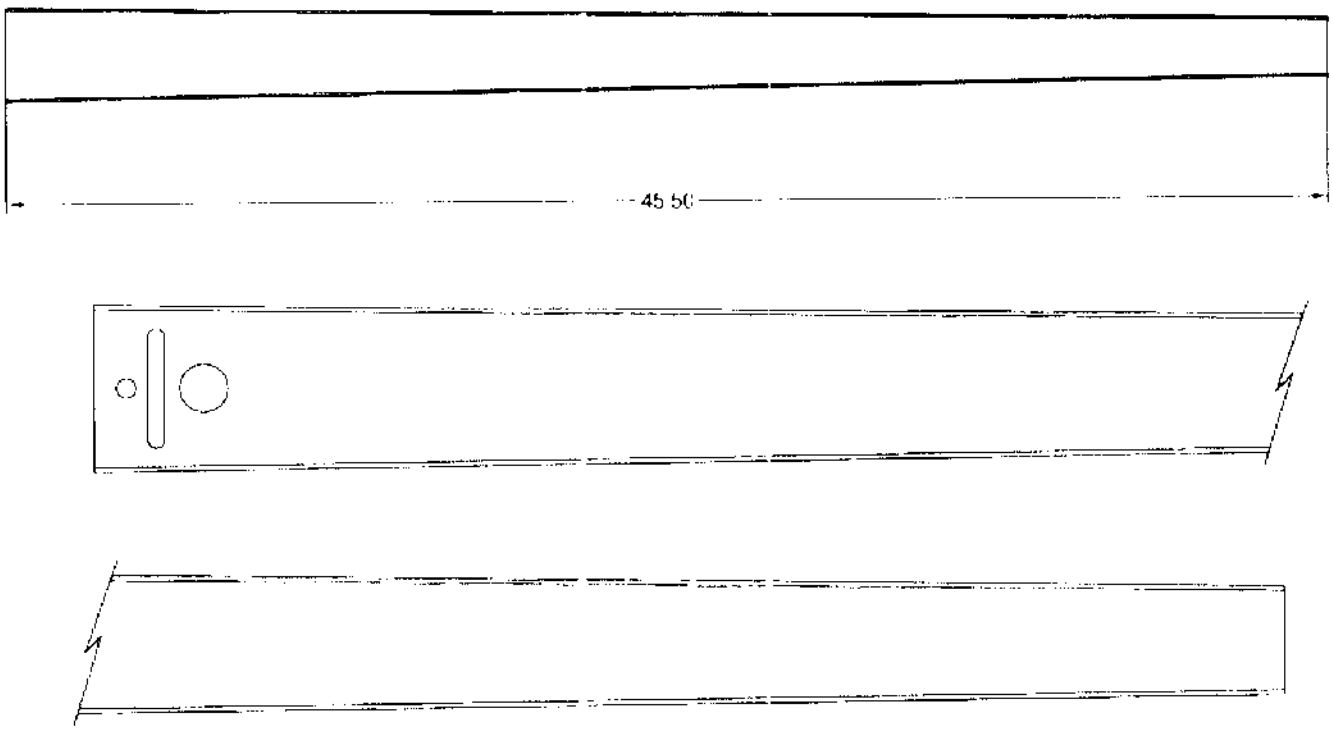
striker

tumbler spindle side

trip

trip return spring

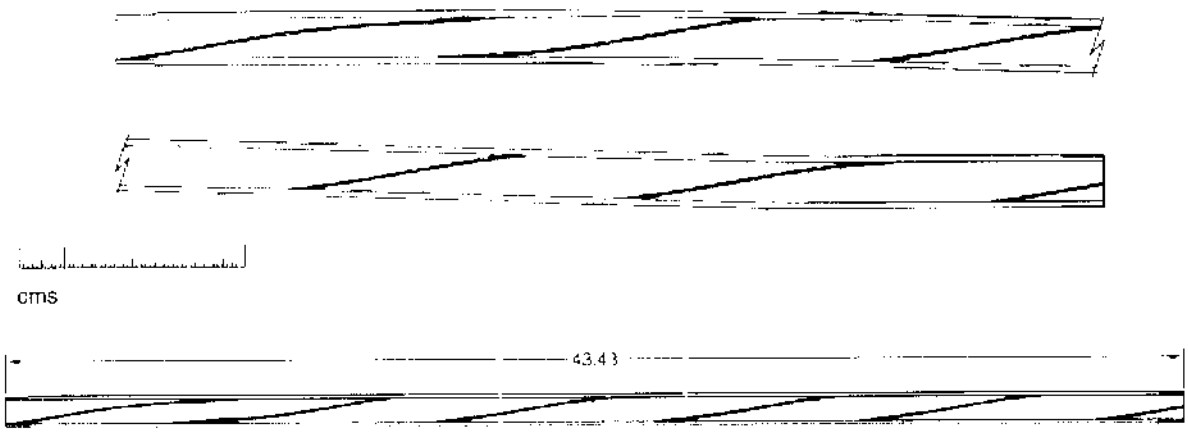




lock and barrel cover

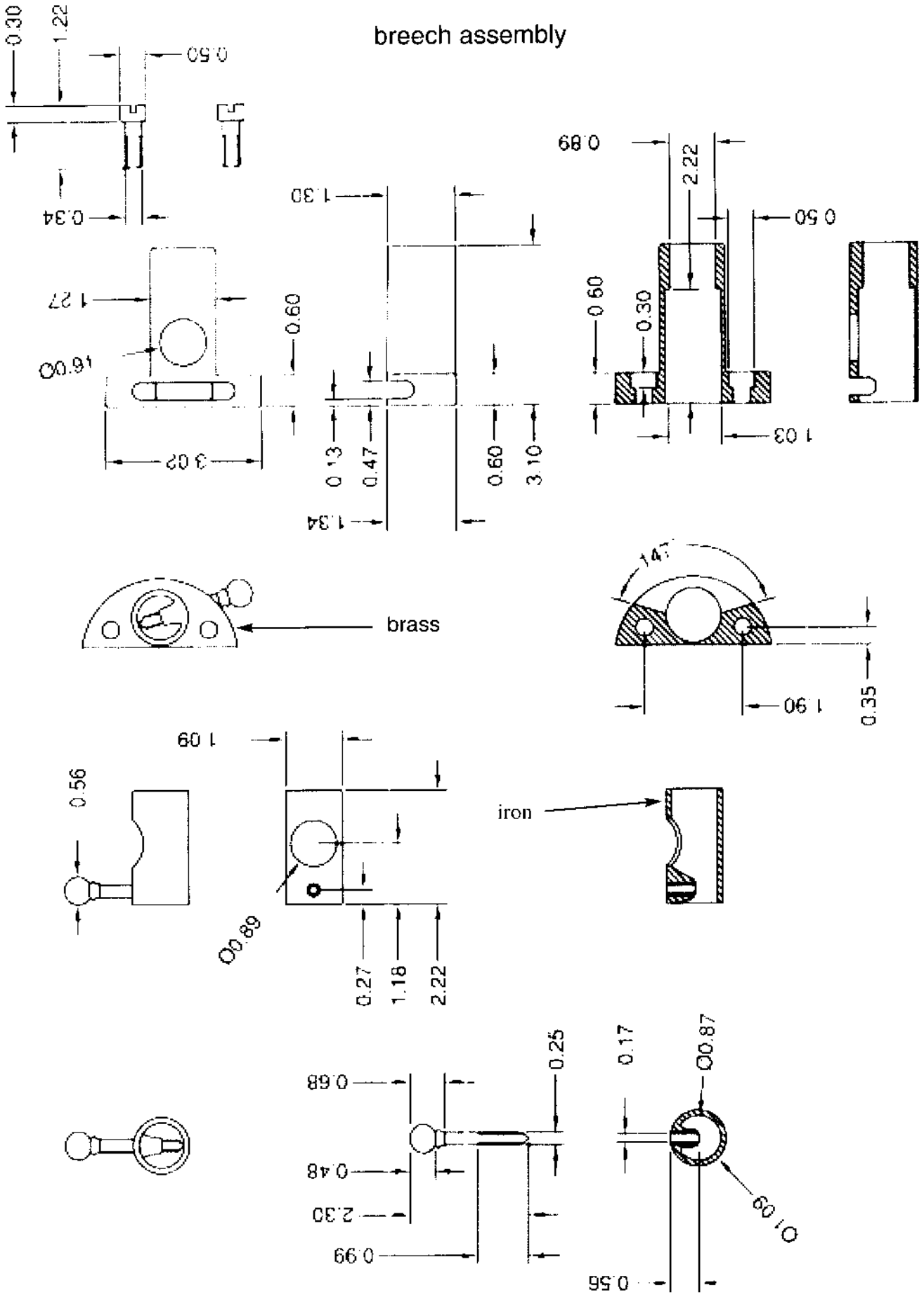
made of sheet metal rolled into a cone then brazed along overlap joint

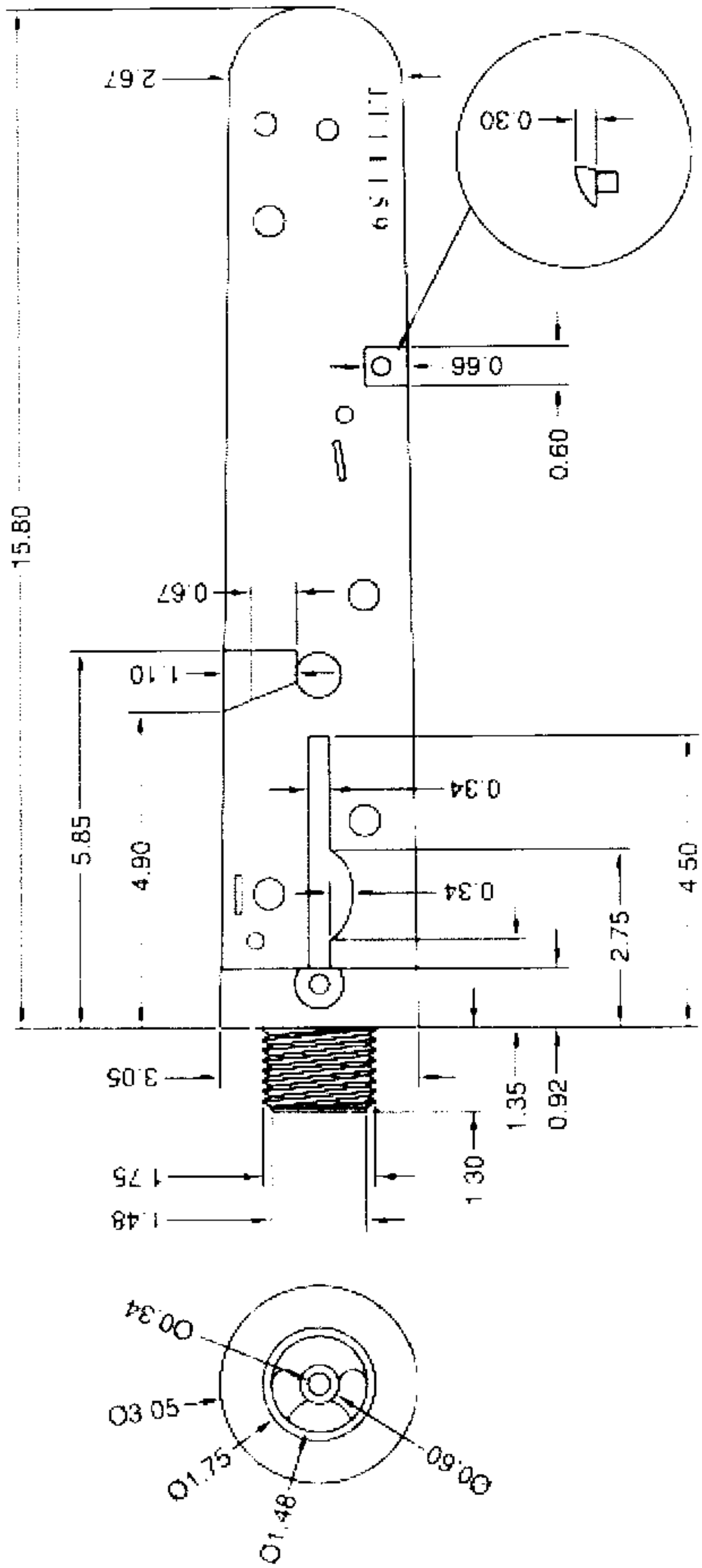
CMS



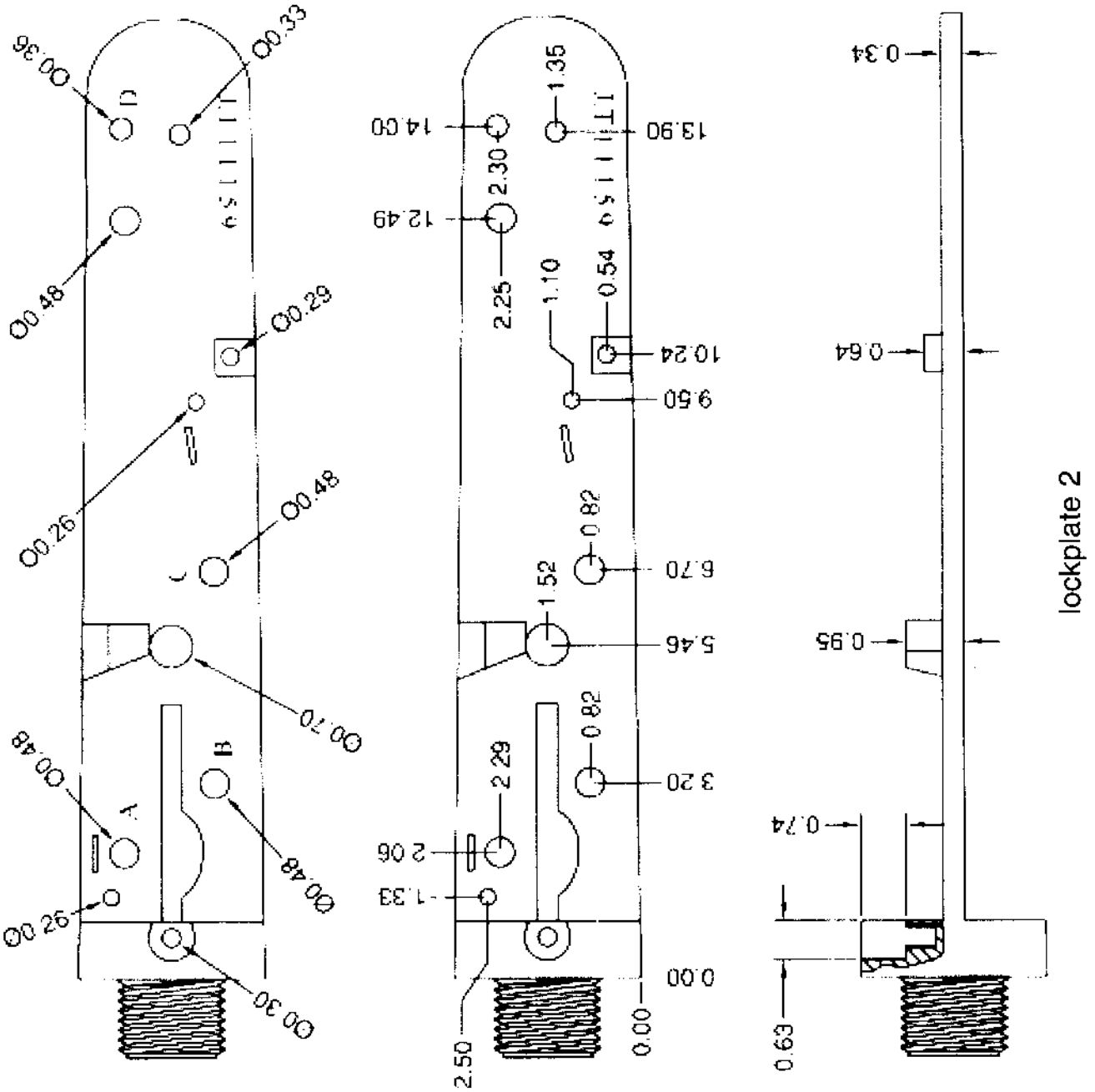
Rifled barrel (brass)

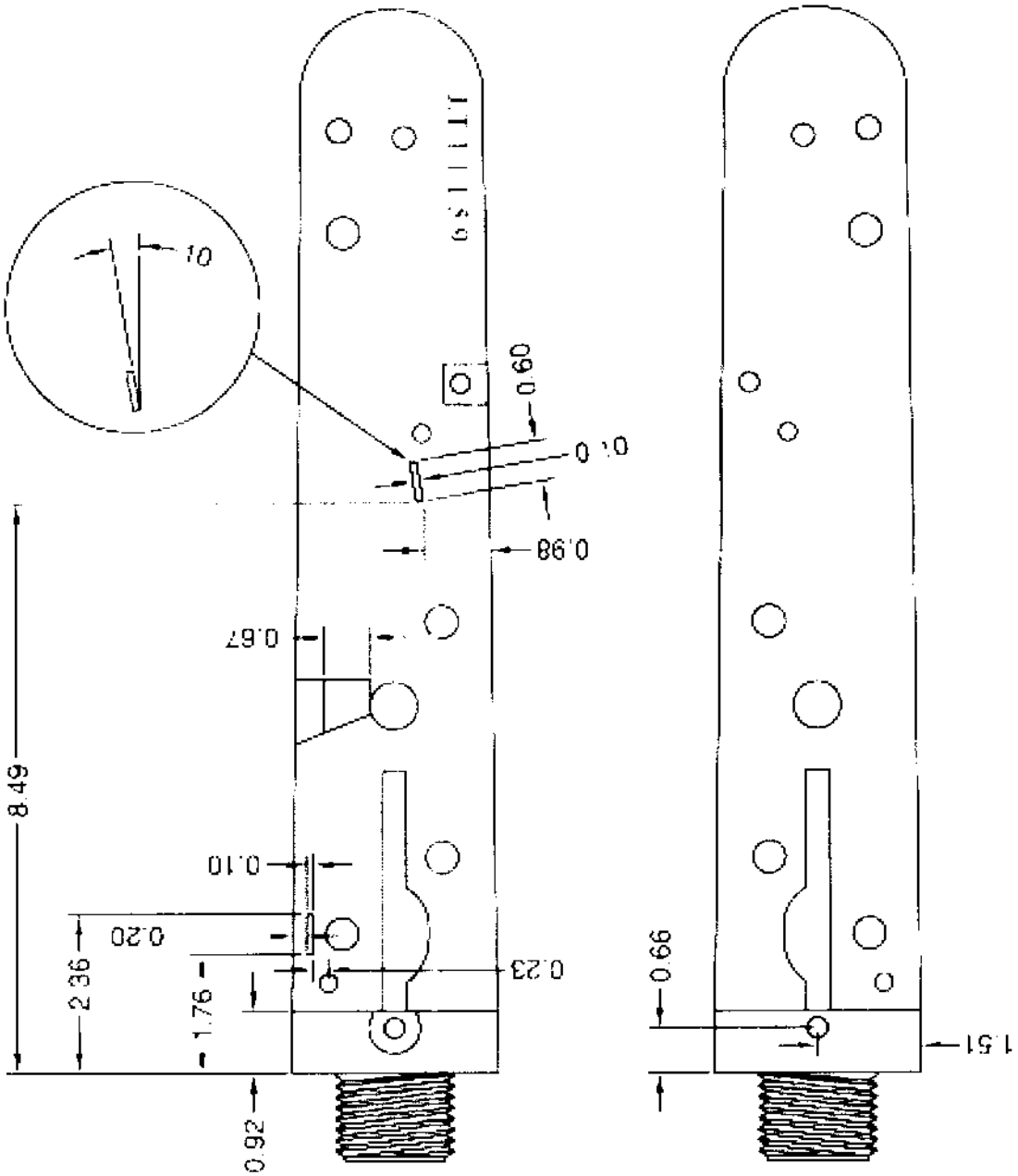
breech assembly



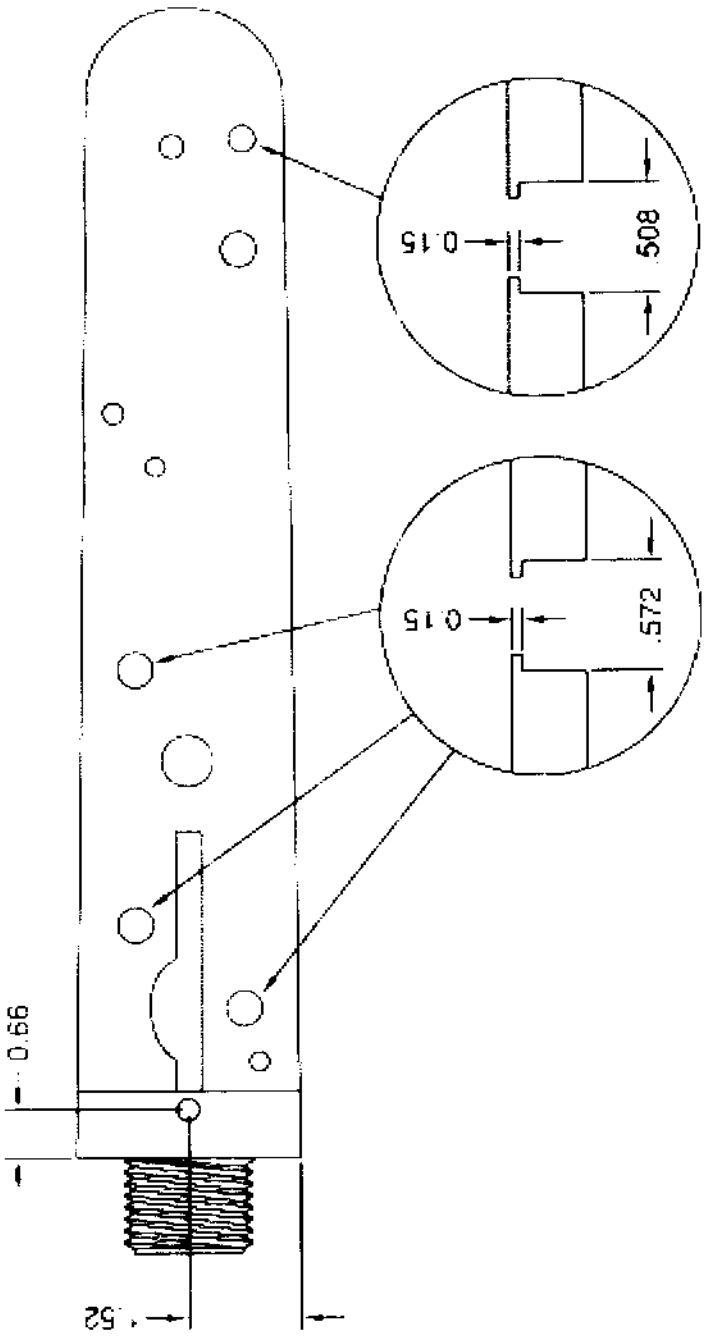

15.80
2.67
0.30
0.66
0.60
0.67
1.10
5.85
4.90
0.34
0.34
4.50
2.75
3.05
1.35
0.92
1.30
1.75
1.48
O0.34
O3.05
O1.75
O1.48
O0.60

lockplate 1


Ø0.36
Ø0.33
Ø0.48
Ø0.29
Ø0.26
Ø0.48
Ø0.70
Ø0.48
A
B
Ø0.48
Ø0.26
Ø0.30
14.00
13.90
1.35
2.30
12.49
2.25
1.10
0.54
10.24
9.50
0.82
6.70
1.52
5.46
0.82
3.20
2.29
2.06
1.33
0.00
2.50
0.00
0.34
0.64
0.95
0.74
0.63
lockplate 2

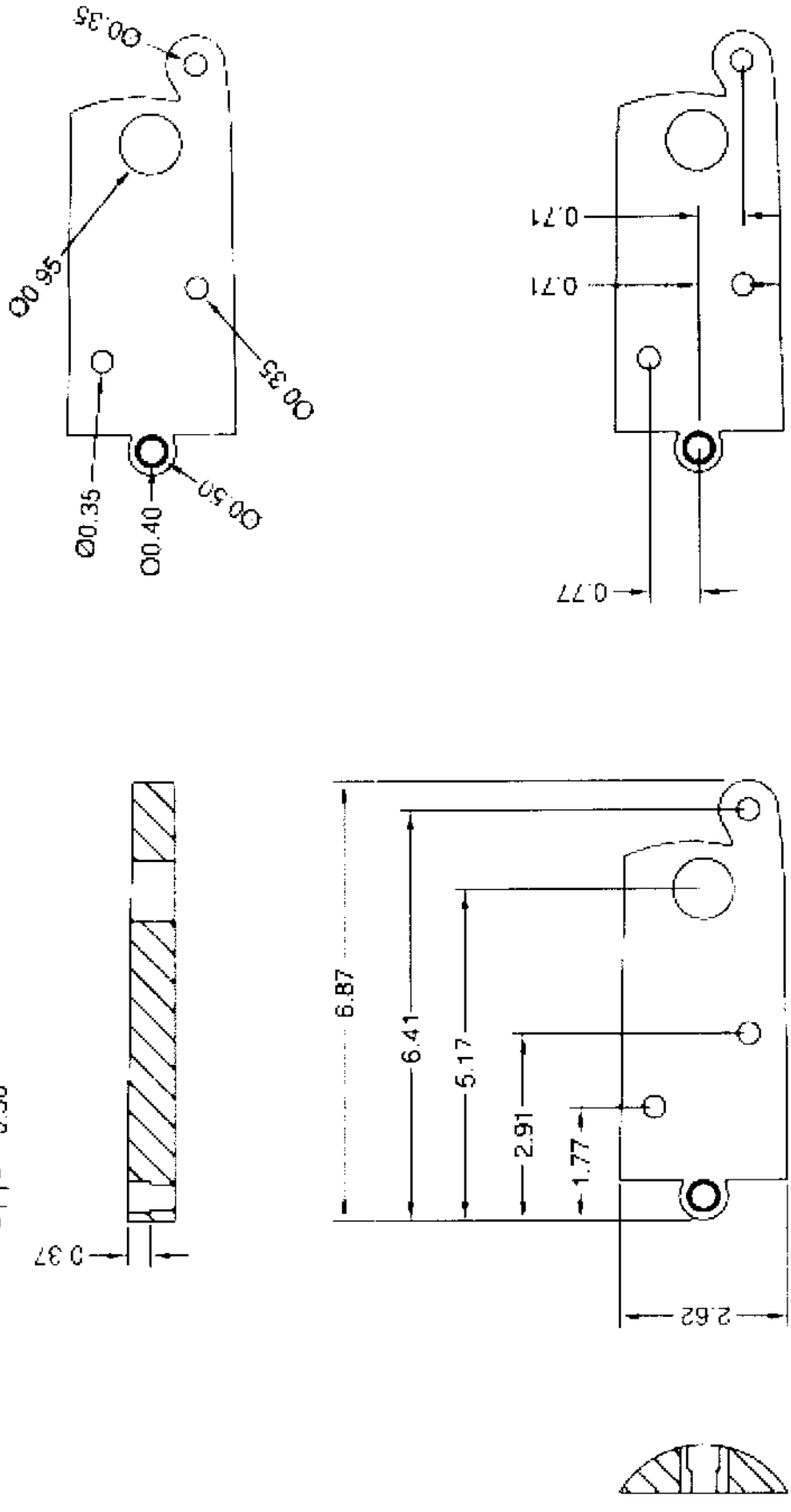


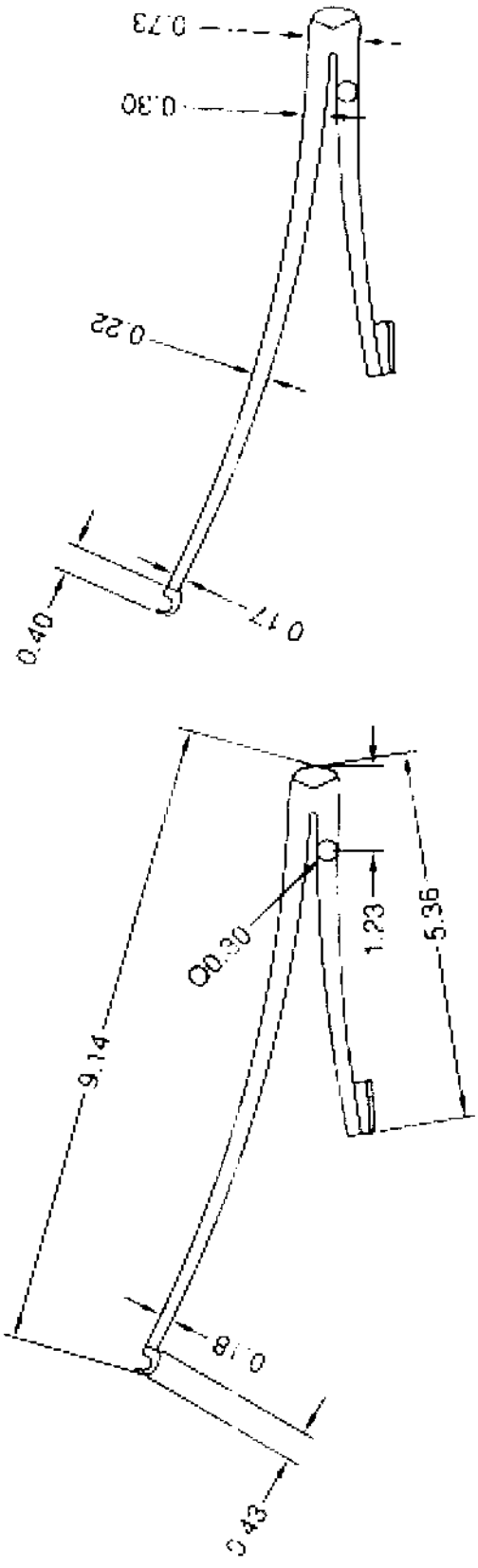
lockplate 3



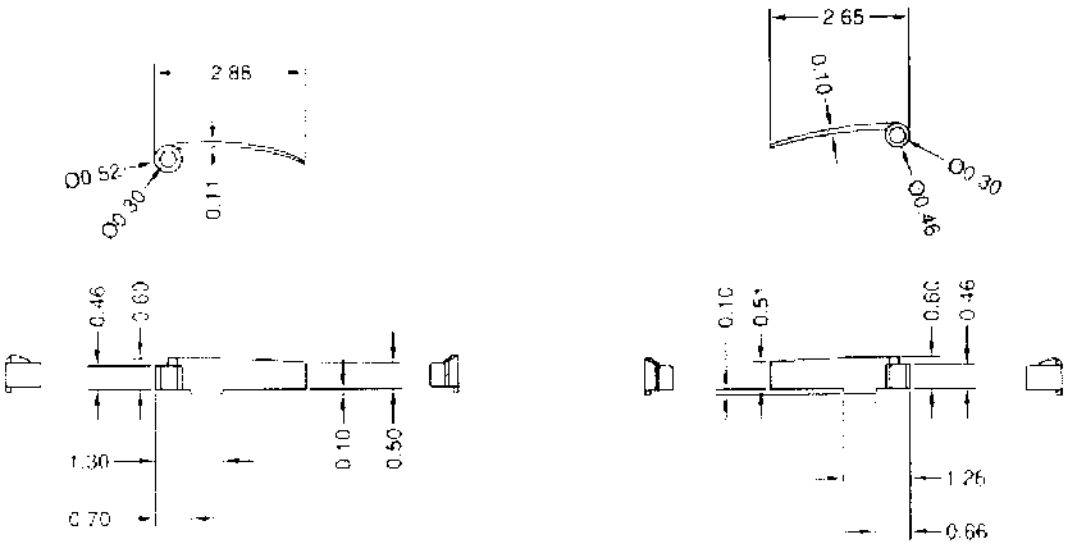
lockplate 4

lock cover plate



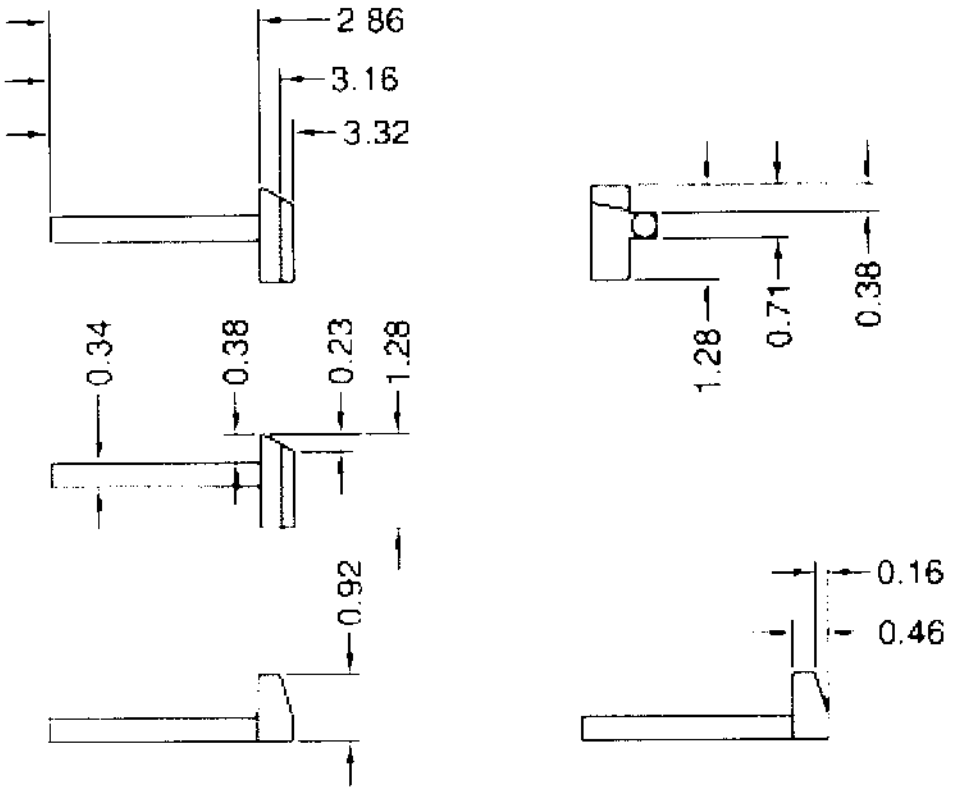


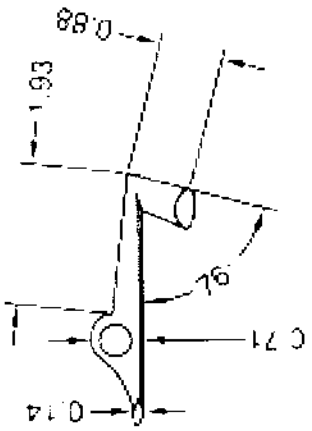
mainspring

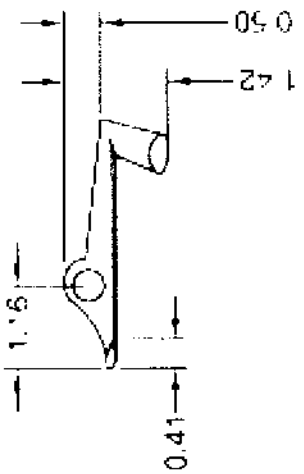


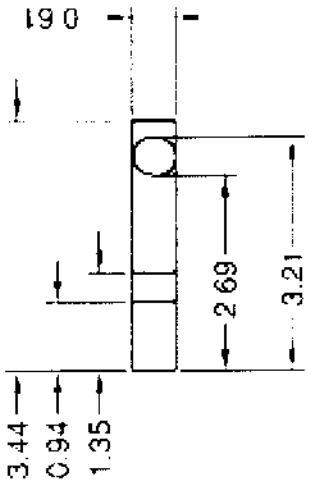
Trip and sear return springs

Striker

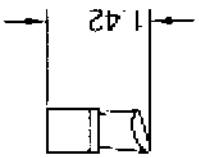




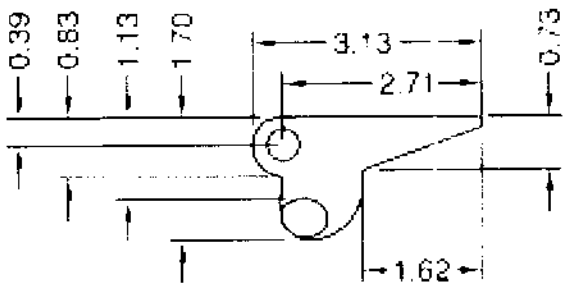


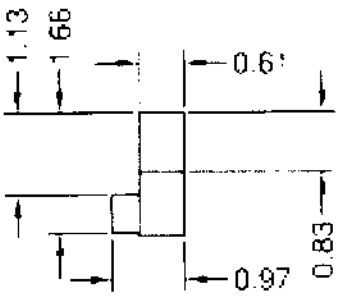


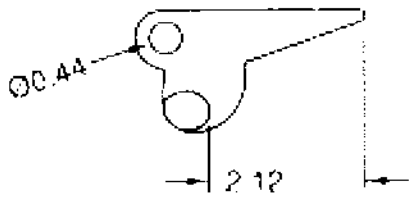
Sear

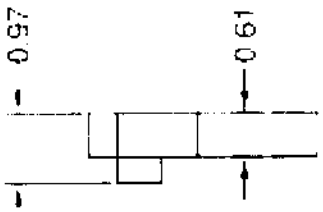


Trip

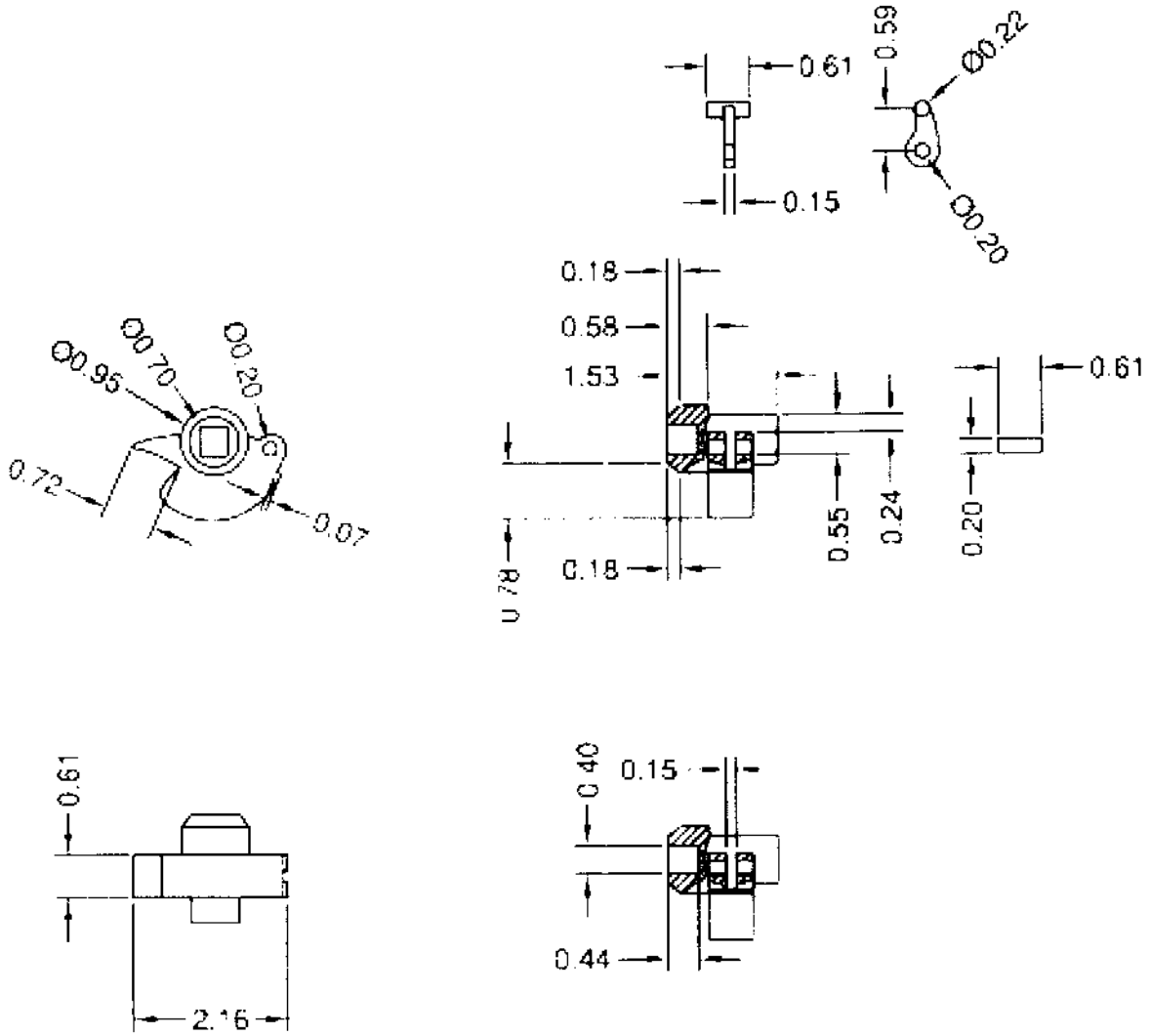

0.39
0.83
1.13
1.70
3.13
2.71
0.73
1.62


1.13
1.66
0.61
0.83
0.97

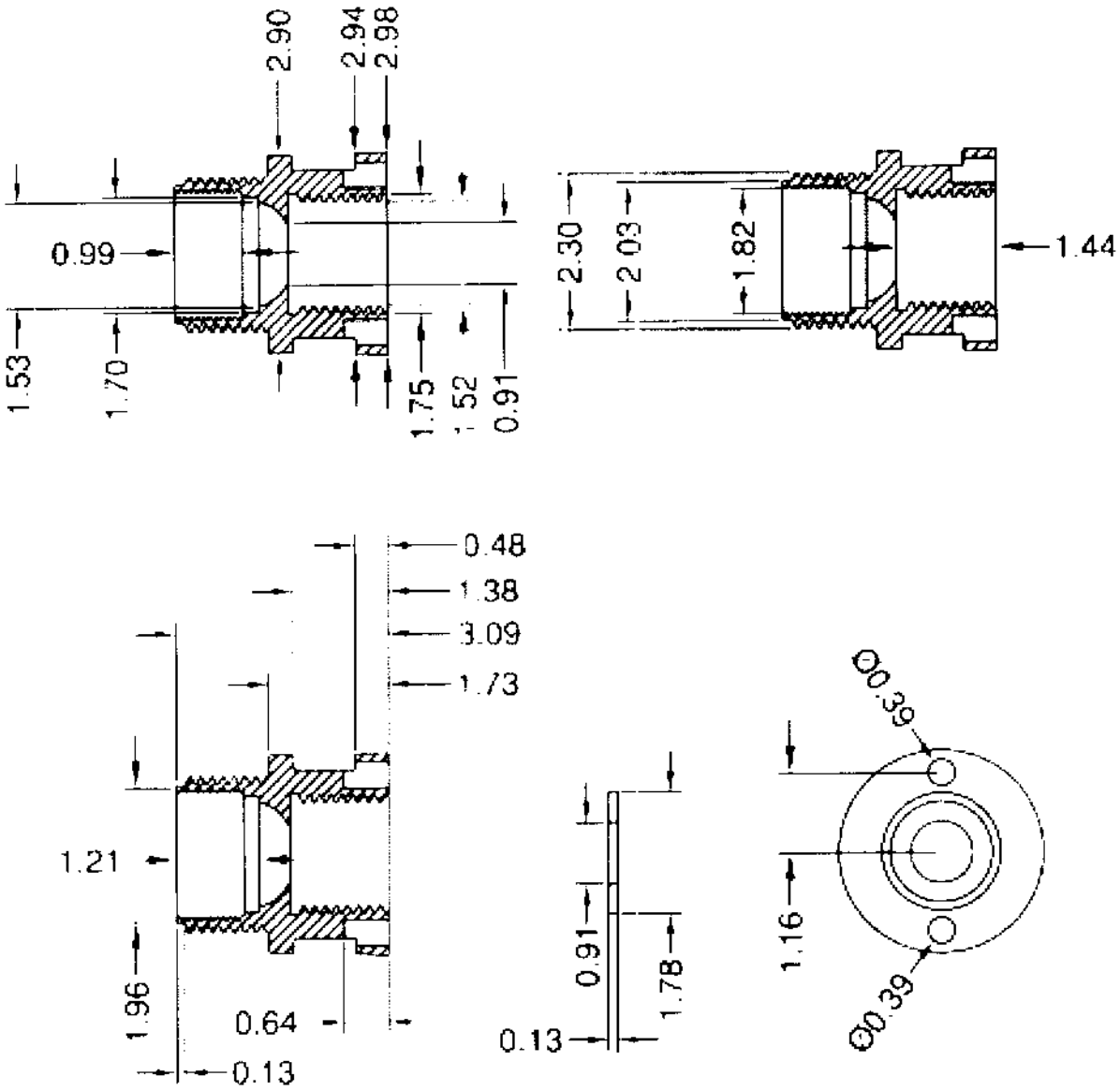

Ø0.44
2.12


0.97
0.61

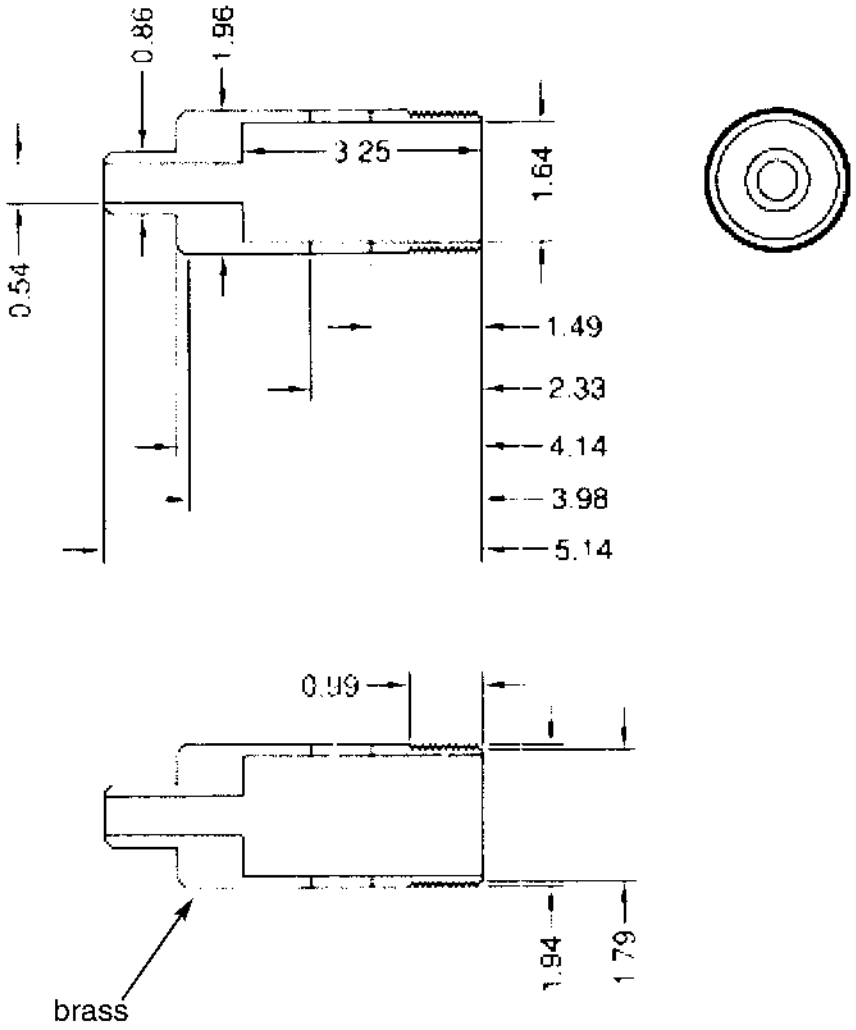
Tumbler


0.61
0.15
0.59
Ø0.22
Ø0.20
0.18
0.58
1.53
0.55
0.24
0.18
0.78
0.61
0.20
Ø0.95
Ø0.70
Ø0.20
0.72
0.07
0.61
2.16
0.40
0.15
0.44

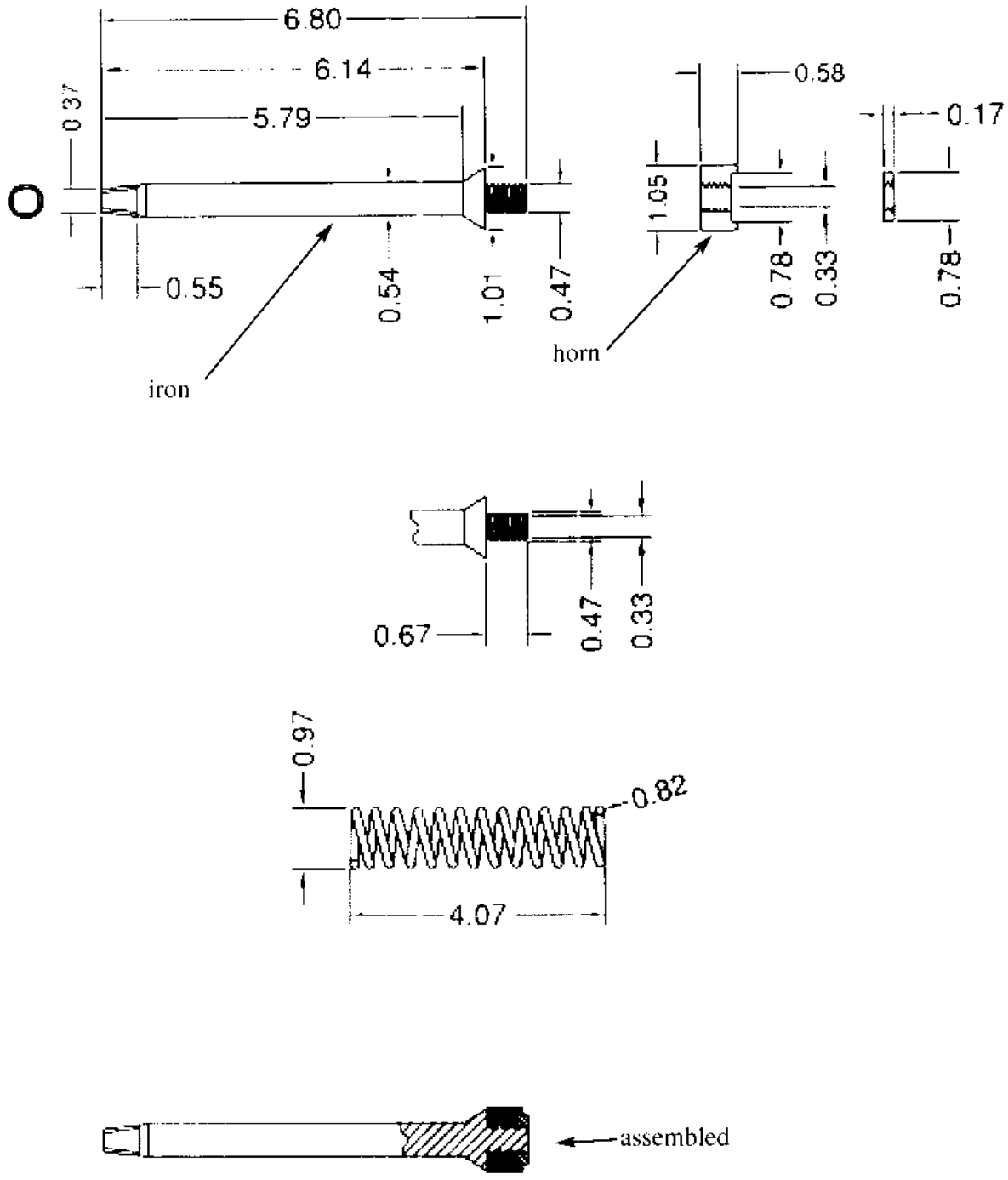
Valve body


2.90
2.94
2.98
0.99
1.53
1.70
1.75
1.52
0.91
2.30
2.03
1.82
1.44
0.48
1.38
3.09
1.73
1.21
1.96
0.64
0.13
0.91
1.78
0.13
Ø0.39
1.16
Ø0.39

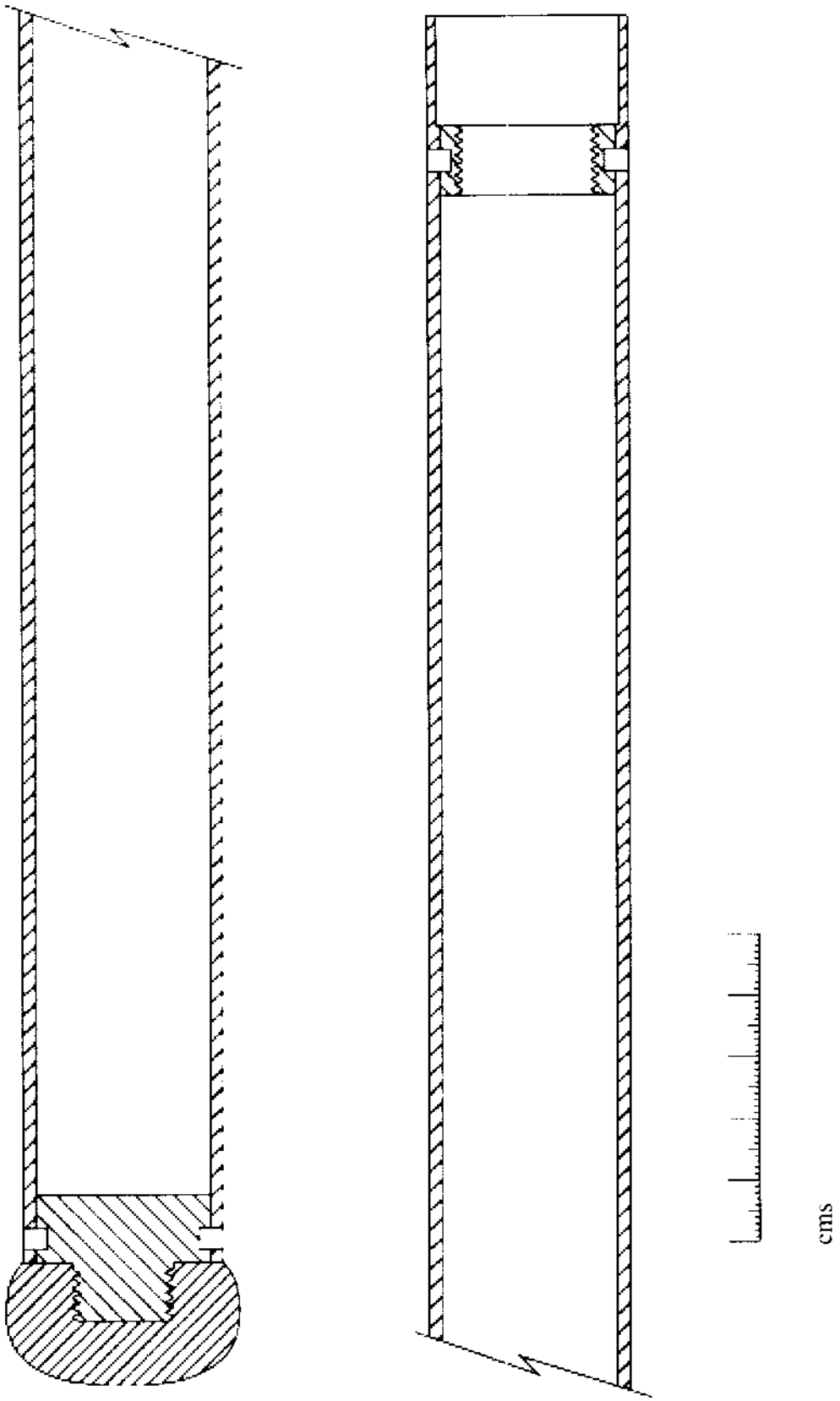
Valve guide

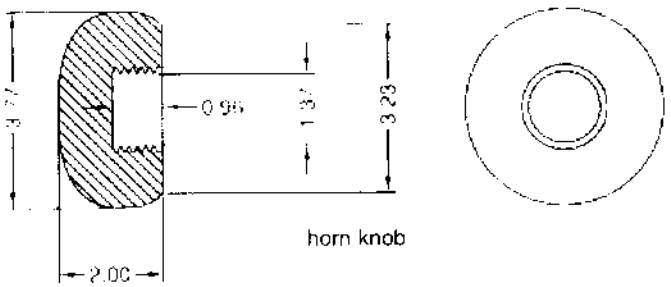


Valve assembly



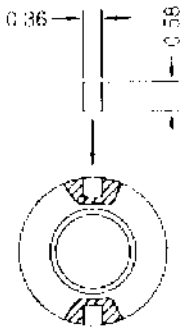
Reservoir assembly complete



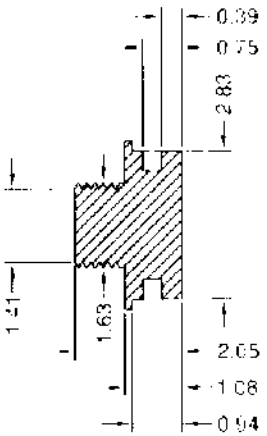


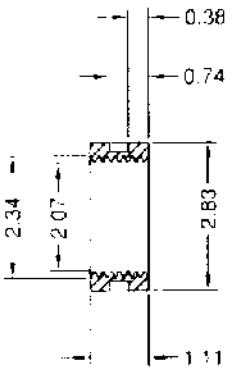
horn knob

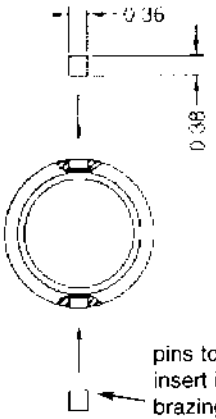
threaded insert for valve body attachment (brazed in position)



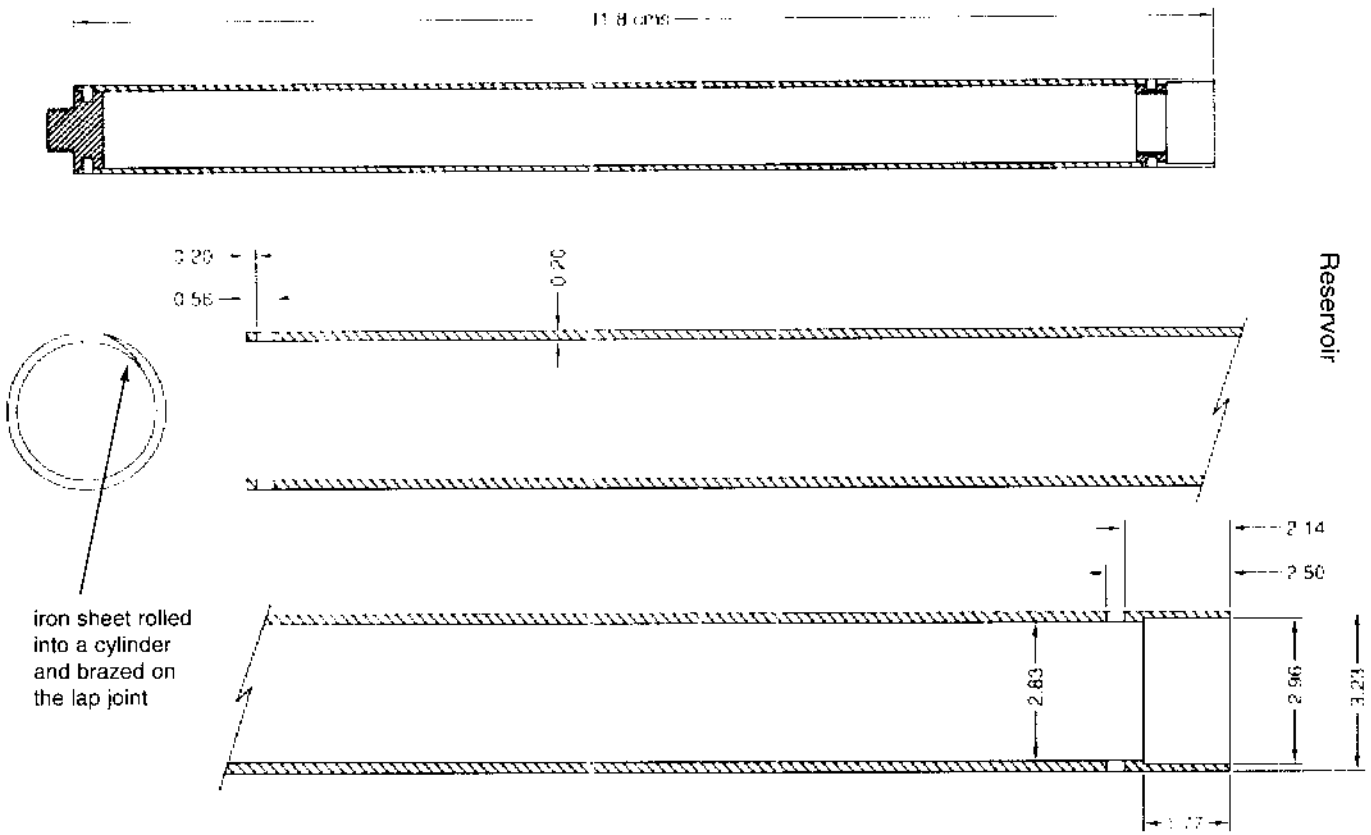
insert with thread for knob/handle attachment (pinned in position and brazed)

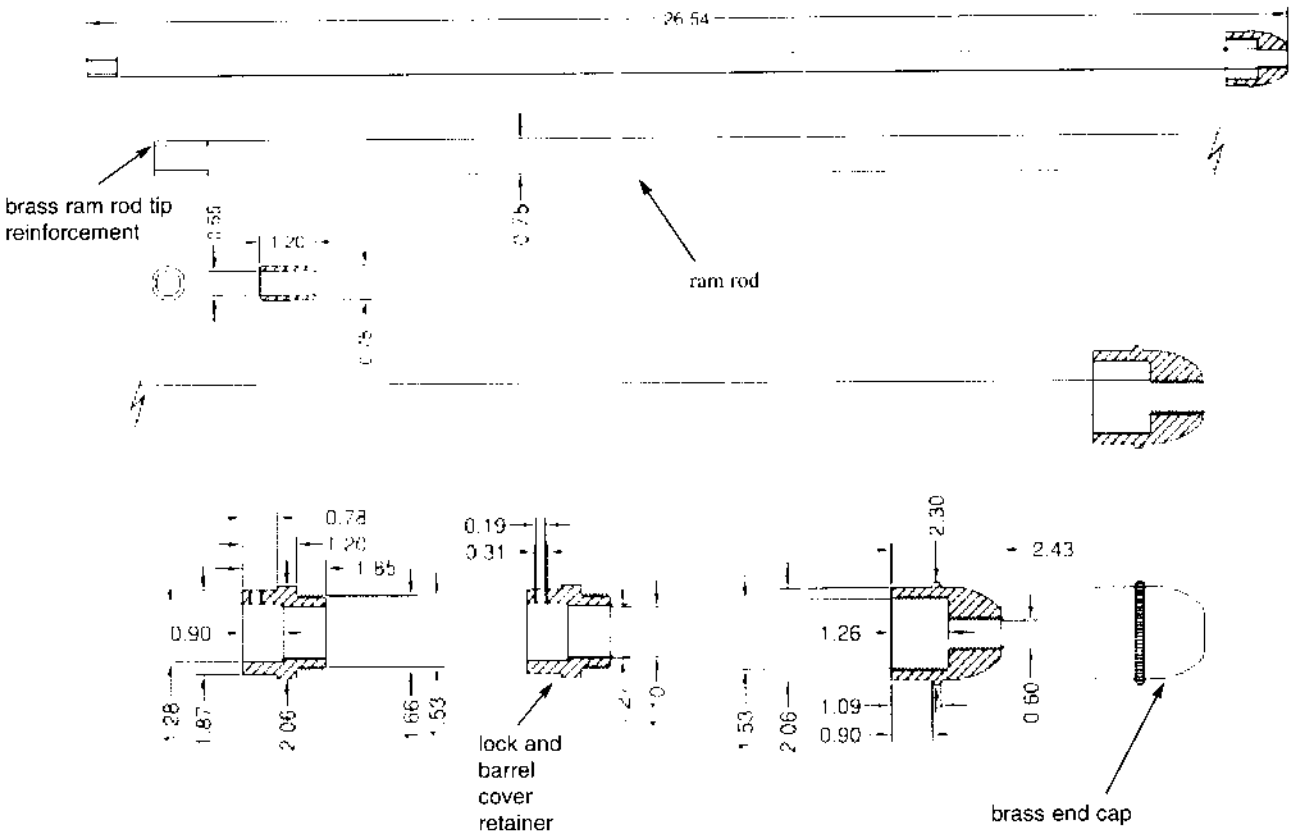






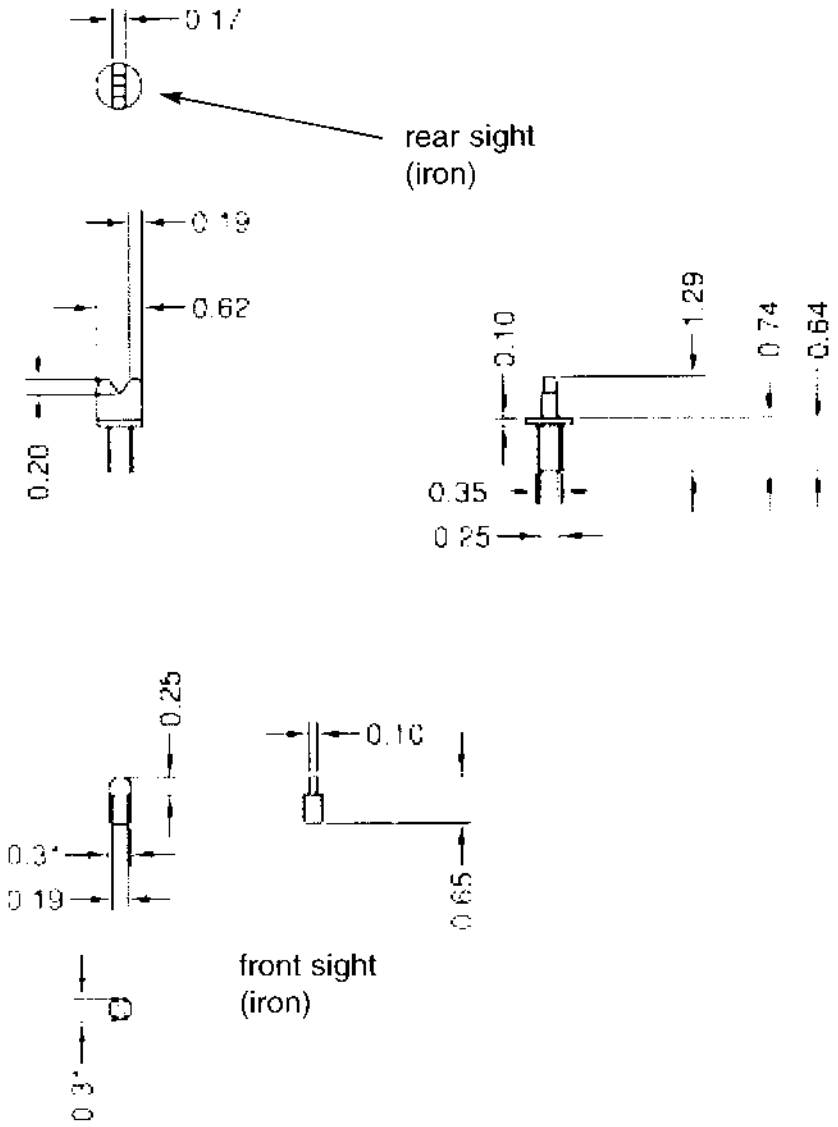
pins to hold the threaded insert in position for the brazing operation


0.56
0.26
Reservoir
iron sheet rolled
into a cylinder
and brazed on
the lap joint
2.83
2.96
3.23

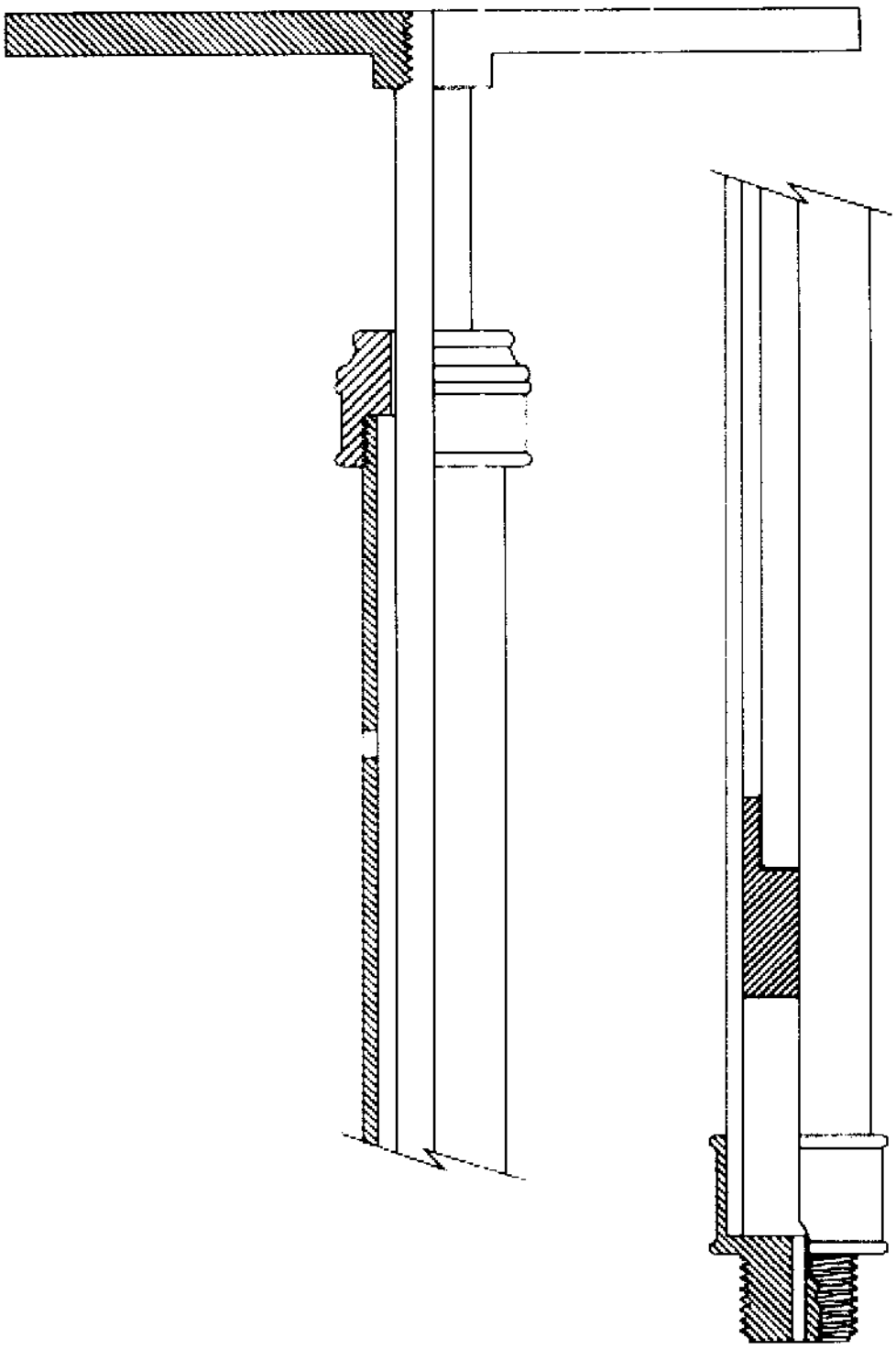


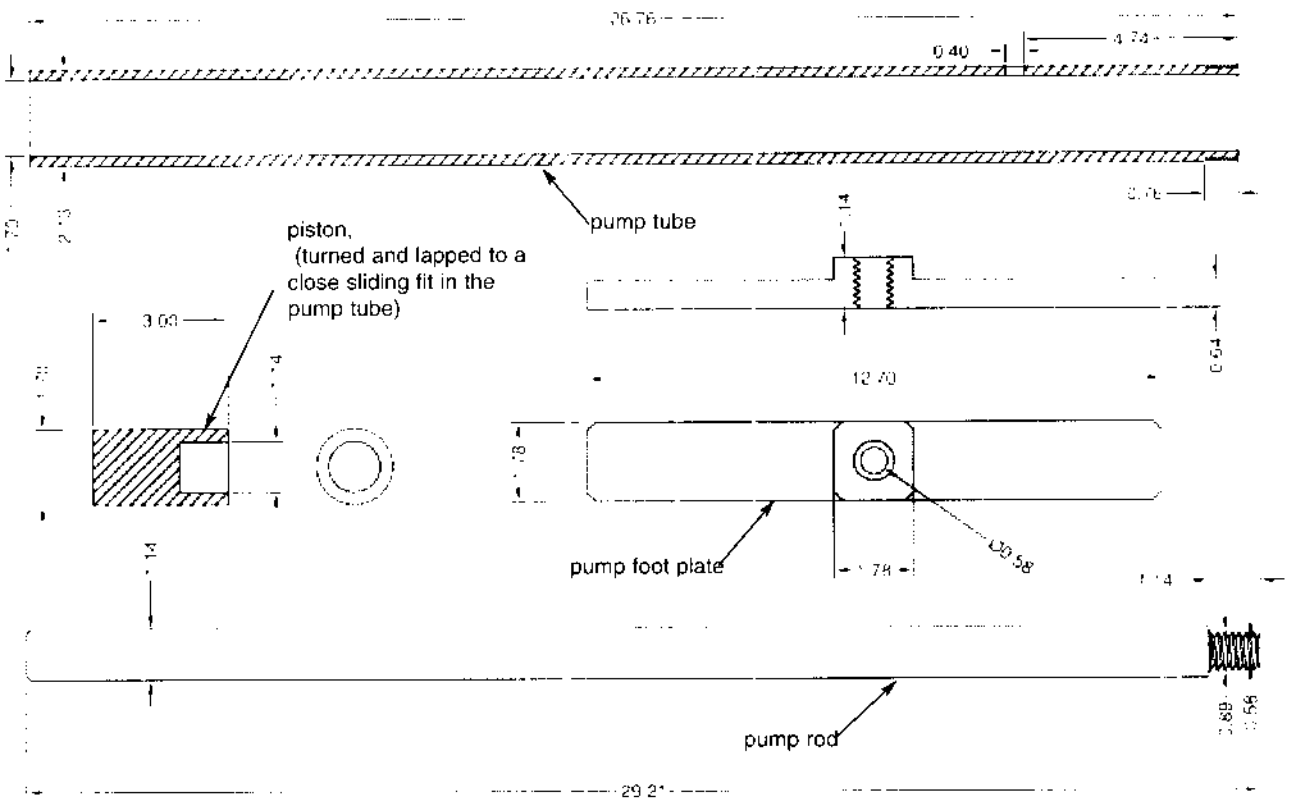
Ram rod and end cap

Front and rear sight

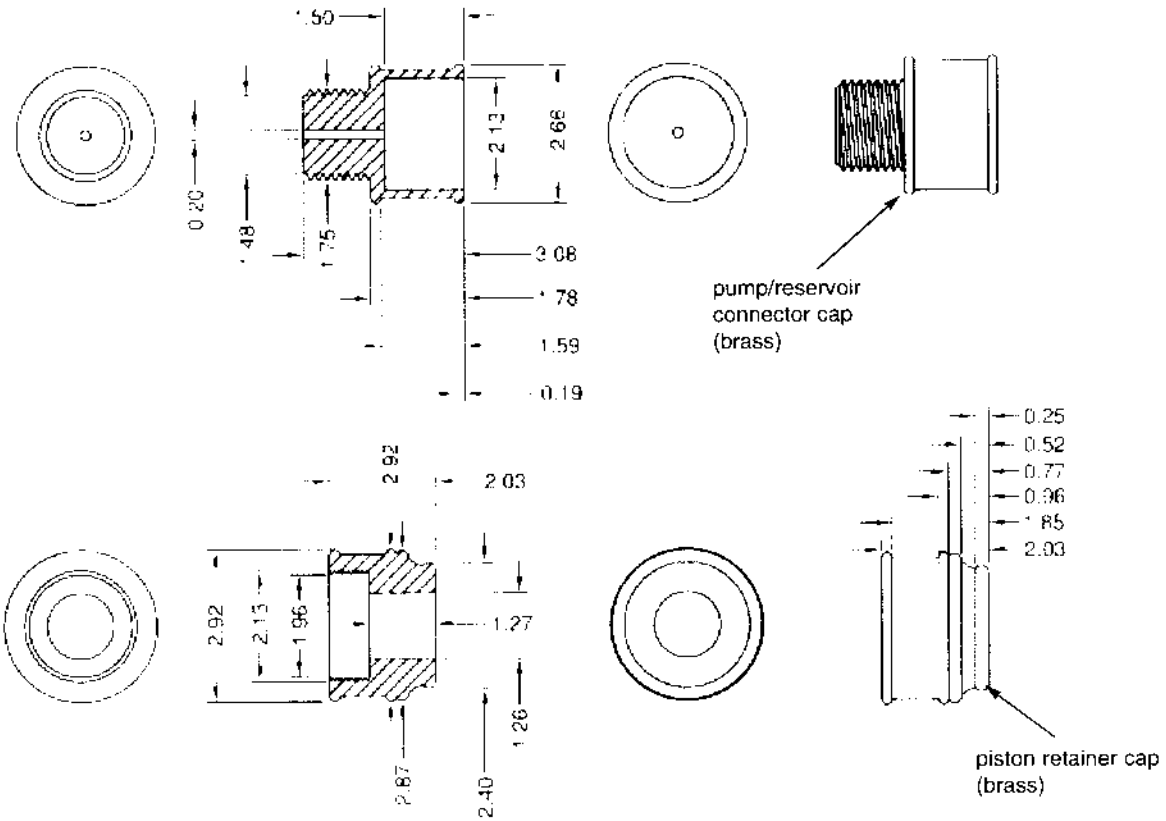


Pump assembly

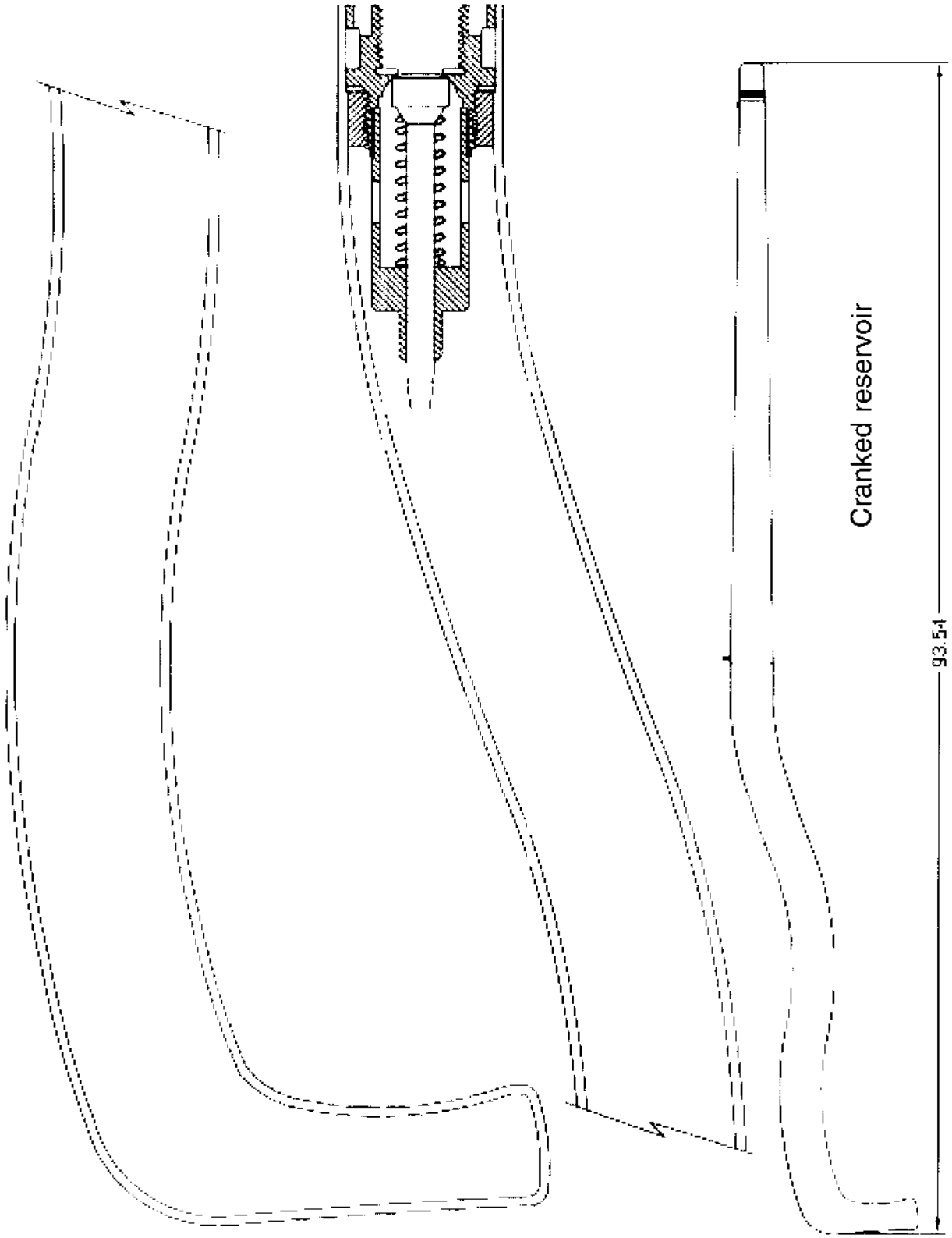


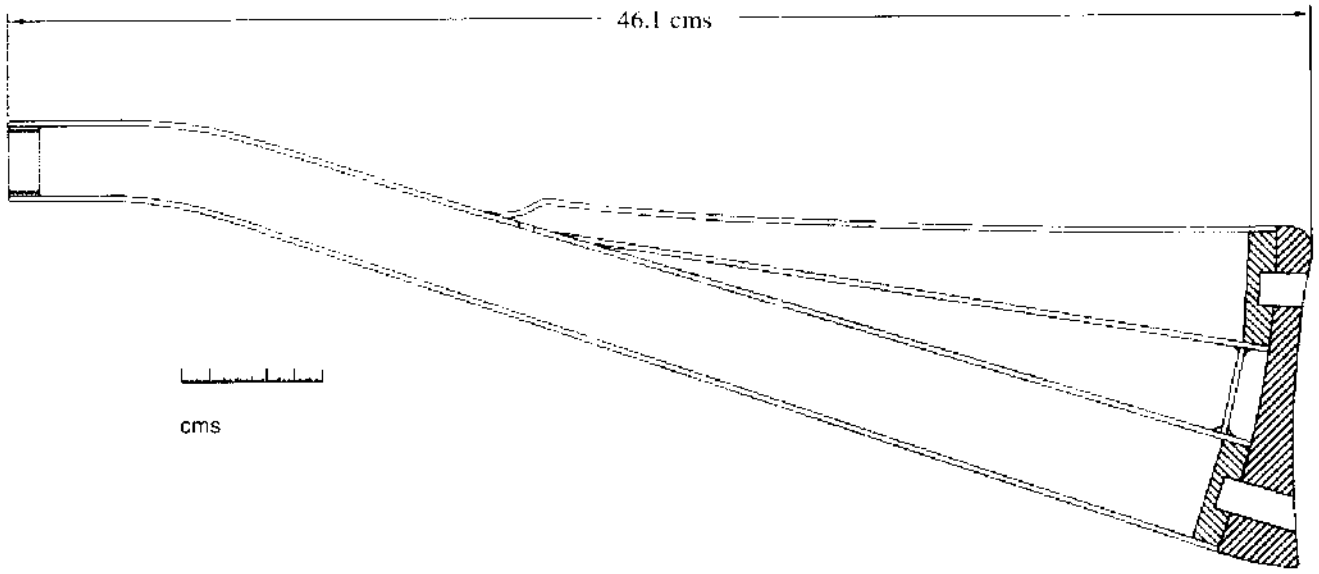


Pump components

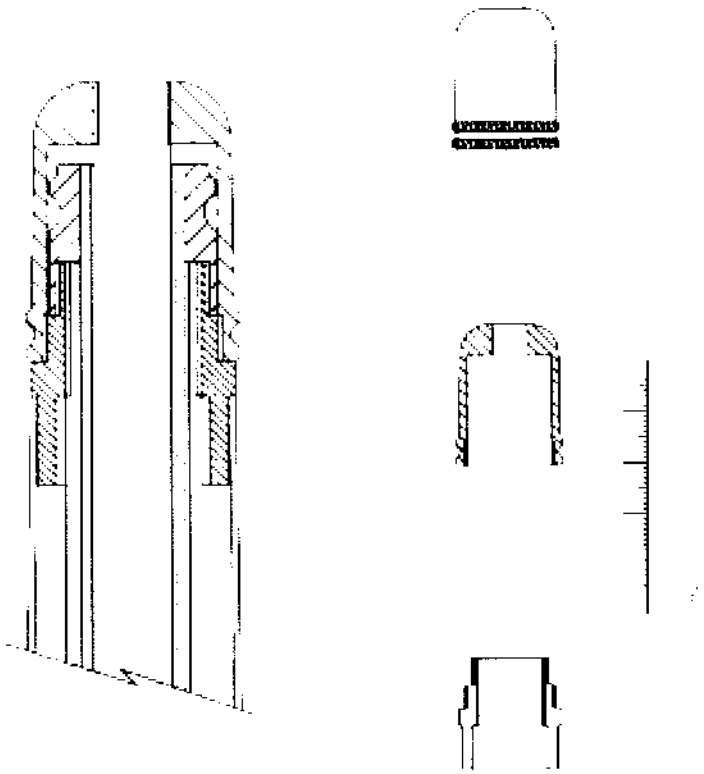


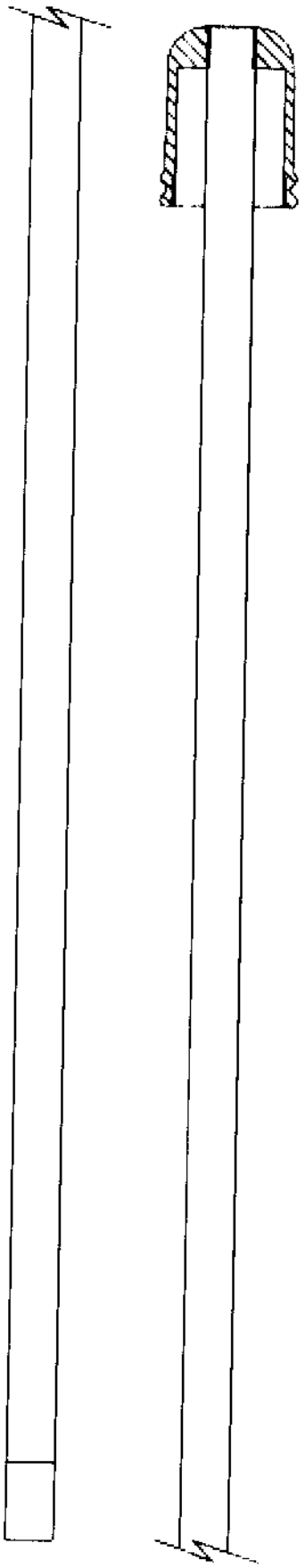
Pump components continued


Cranked reservoir
93.5-1

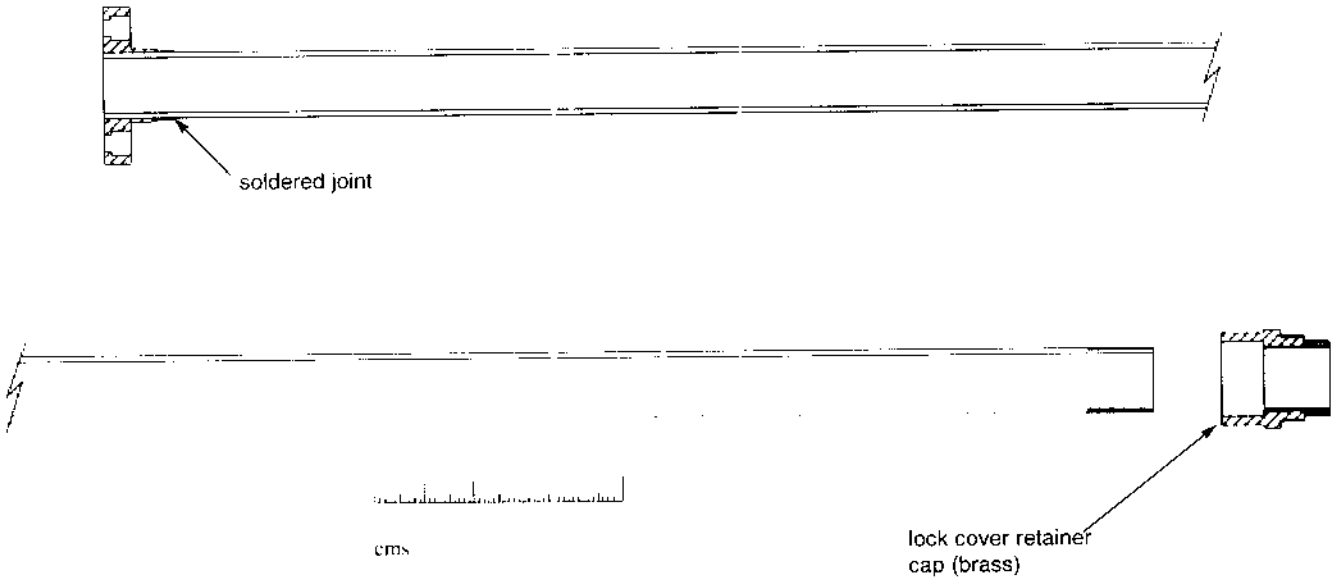


Stocked aircane reservoir

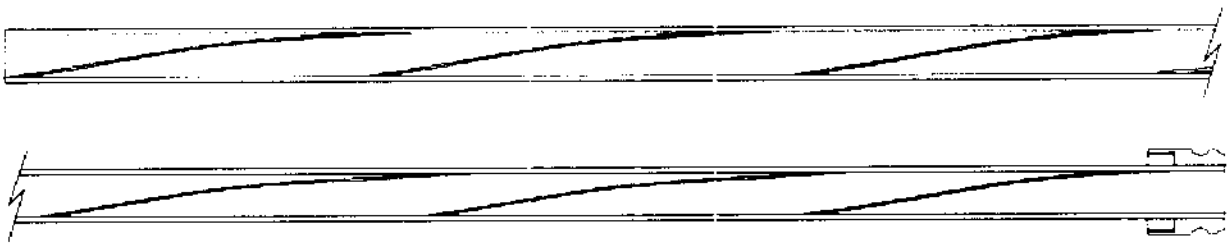




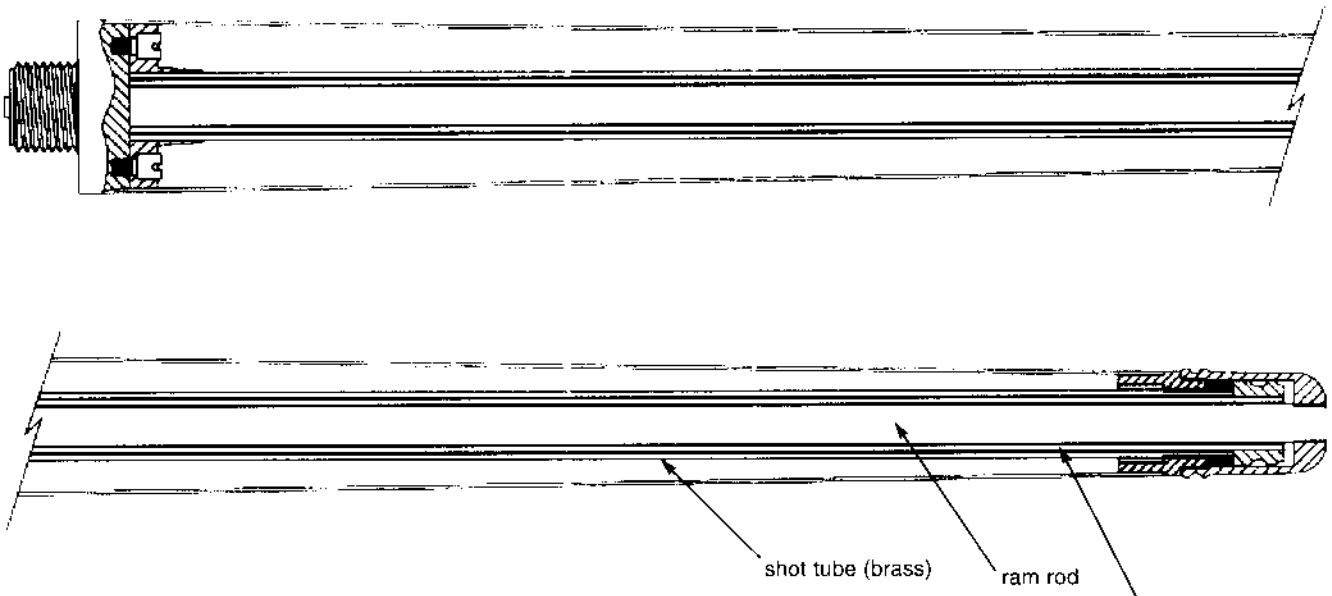
Ram rod and cap



Brass smooth bore
shot tube



Rifled liner and screw cap (brass)



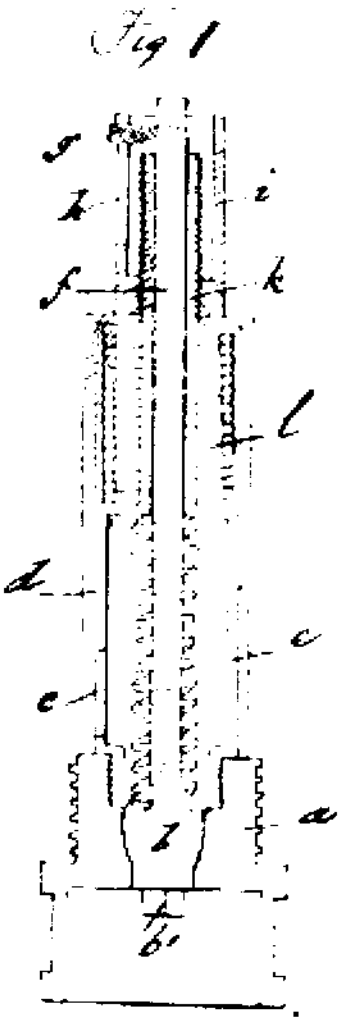
Muzzle loading aircane
in section

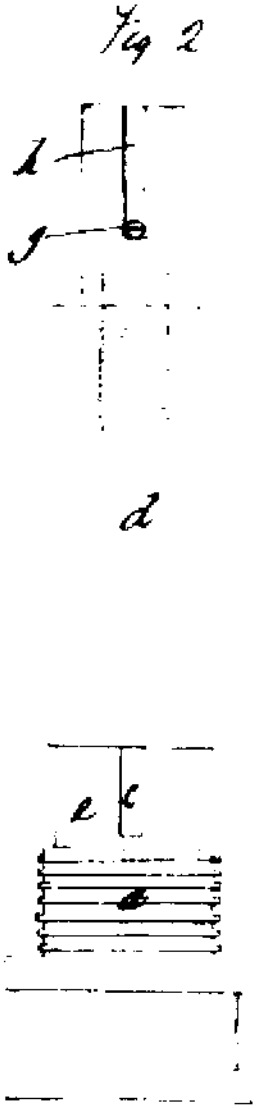
cms

Once the basic design of the aircane was established, there appears to have been very little further development over the period aircanes were used. The exception being the very ingenious valve modification proposed by James Townsend, which was the subject of registered design No 2052 October 8, 1849
Townsends design, proposed controlling the power of the aircane by constricting or expanding the airflow through the valve. This was accomplished by fitting a slotted spring loaded sleeve, screwed to the existing valve and connected to the spindle by a peg engaging in the slot. The head of the valve spindle, was made square to allow it to be turned by a external key. Therefore turning the key, drove the sleeve to contract or expand the air passage to the valve, thus controlling the power output.

The main attraction of course, was the ability to adjust the power of the aircane by external means. Unfortunately, it has not been possible to ascertain if the design was ever produced commercially, as it does not feature in any sources known to the authors. However, as most collectors would not be aware of the significance of the square on the end of the valve spindle, a example may very well exist in your collection unnoticed!. If as a result of this information an example is discovered, the authors would be very grateful if it were drawn to their attention.

Townsend registered design an improvement to aircane valves





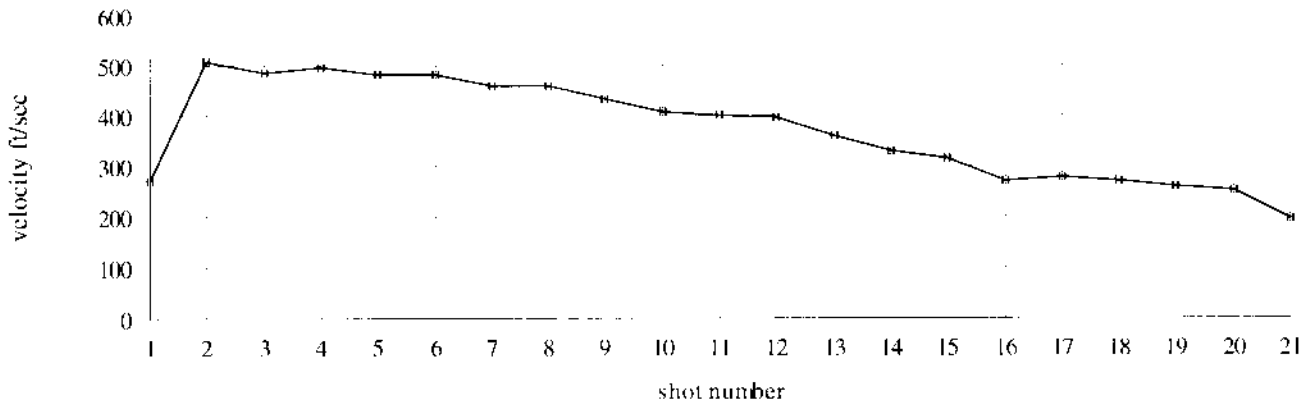
The object of my improvement is to enlarge or contract at pleasure the opening through which the condensed air passes from the reservoir to the barrel during the momentary opening of the valve so that the force of the shot may be regulated. Fig 1 represents a vertical section and Fig 2 an elevation of my improved valve. The whole of the parts above the screw (a) are enclosed in the reservoir, (b) is the valve through which the condensed air is admitted to the barrel, the said air having to pass through the opening (c), (d) is a tube which slides on the tube (e) in which the opening (c) is made and which said tube (d) by sliding over the said opening enlarges or contracts it. The head of the valve is made square so that a key being put theron, the said valve and rod (f) may be turned. By turning the rod (f) the screw (g) working in the slot (h) turned around this tube (i) which thereby advances or retires on the screw (k) and slides forward or backward the tube (d) which covers the opening (c), (l) is a coiled spring which forces back the tube (d) when the tube (i) retires on the screw (k). The form of the parts bcdghikl is new the rest is old.

Performance

Reilly muzzle loading aircane 32 calibre 51.5 grain ball

600 lbs/sq inch start pressure

Shot no	Velocity ft per second	Energy ft lbs
1	272	8.46
2	508	29.52
3	486	27.02
4	495	28.03
5	482	26.57
6	481	26.46
7	459	24.10
8	460	24.20
9	435	21.64
10	408	19.04
11	400	18.30
12	396	17.94
13	361	14.91
14	328	12.31
15	314	11.28
16	270	8.34
17	279	8.90
18	270	8.34
19	260	7.73
20	251	7.21
21	196	4.39



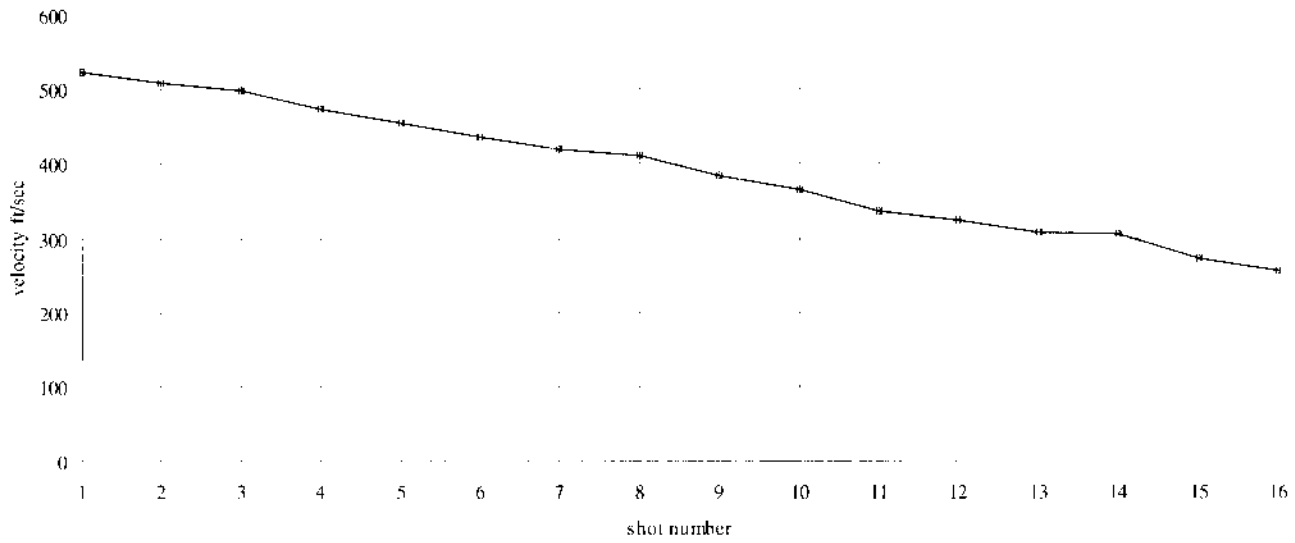
From this graph it can be seen that the valve on the first shot has closed very quickly due to the pressure differential between the reservoir pressure and the air pressure in the barrel giving a lower velocity.
The next shot is higher because the valve has not closed so quickly allowing more air to be released

Performance

Townsend breechloading aircane 69.1 grain ball

600 lbs/sq inch start pressure

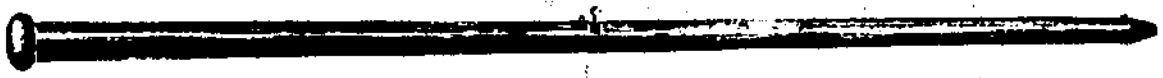
Shot no	Velocity ft per second	Energy ft lbs
1	523	41.98
2	508	39.61
3	499	38.22
4	474	34.48
5	454	31.63
6	437	29.31
7	420	27.07
8	412	26.05
9	384	22.63
10	366	20.56
11	337	17.43
12	324	16.11
13	308	14.56
14	305	14.28
15	271	11.27
16	256	10.06



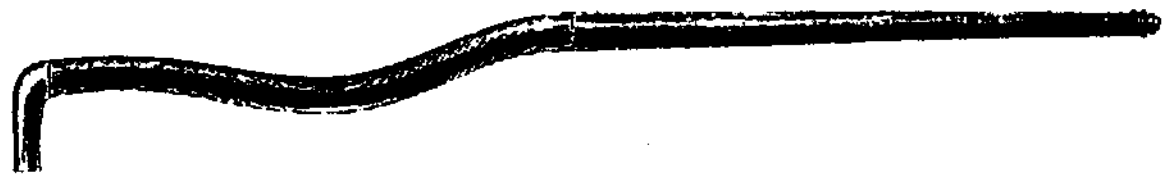
Air Guns.

No. 5480. Air gun cane, with rifle and shot barrels, complete with pump, key, mould and shot measure. Price, £2 10 0

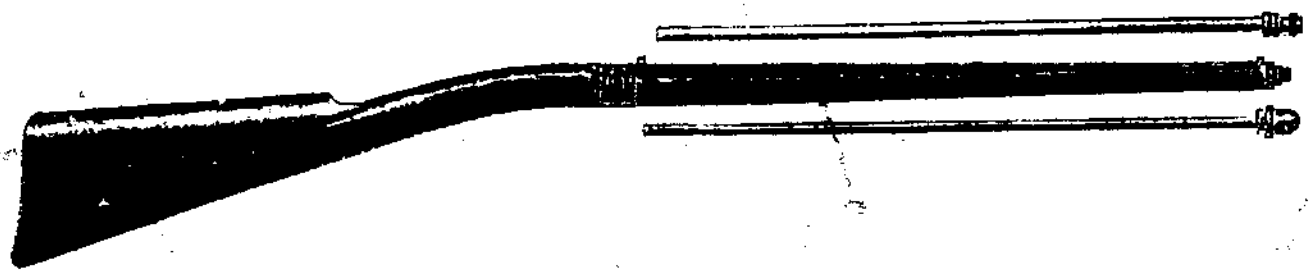
" **5492.** As above, but with rifle barrel only; with pump, etc., complete " £2 5 0



" **5494.** As **5490,** but with shot barrel only: with pump, etc., complete Price £2 5 0



" **5496.** Bent air cane gun, with rifle and shot barrels, complete with pump, etc. Price £3 0 0



No. 5498. Air gun, with butt to use from the shoulder, with rifle and shot barrels, complete with pump, key, bullet mould, and shot measure Price £4 4 0