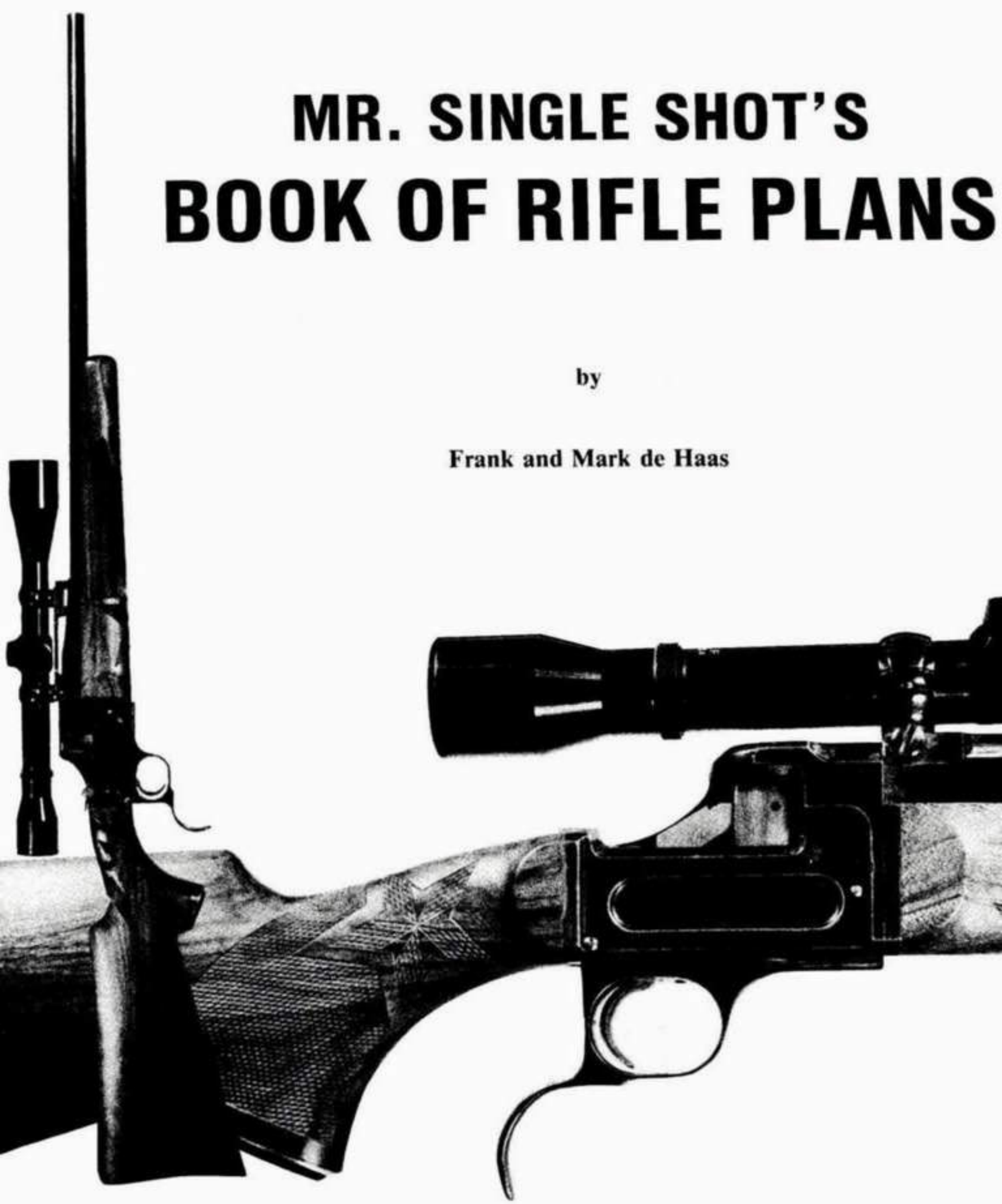
MR. SINGLE SHOT'S
BOOK OF RIFLE PLANS

by

Frank and Mark de Haas



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Frank and Mark de Haas

Other books by Frank de Haas

Single Shot Rifles & Actions
Single Shot Actions - Their Design and Construction (with Mark de Haas)
Mr. Single Shot's Gunsmithing - Idea Book
Bolt Action Rifles - Revised Edition
Managing & Mastering the Set Triggered Rifle

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About the Authors

Frank de Haas and Mark de Haas, a father and son team, joined their talents and skills in putting together this book. As a team they have done much rifle shooting, participated in competitive matches together, hunted together, designed and built rifles together and wrote a few articles together. Together they were also teacher and student, and as they grew older the father and son often traded roles, learning from each other.

Frank is well known among riflemen for the many articles he has written about shooting, gunsmithing, rifles and rifle cartridges which have appeared in the leading gun magazines, and for his five other published gun books. His principal interest in firearms has been in rifles, and this field narrowed down to single shot rifles and bolt action rifles, in that order of priority. Now semi-retired, he has the time to indulge in something he has always been interested in—that of building firearms of his own design and describing to others how they are made, as he has done with four of them in this book.

Mark practically cut his teeth on his father's workbench. Under his father's supervision he began target shooting and hunting at an early age and became very proficient at both sports. He was taught to make every shot count. Watching and helping his father in their home workshop he learned how to mend a broken stock, how to thread, chamber and fit a barrel to an action, how to use a file to make and fit small parts, how to install a crosshair reticule in a scope and how to shape, finish and checker a stock. He was schooled in ballistics and reloading. He spent four years in the U.S. Marine Corp with three of those years spent as a member of the Marine rifle team and one year in Viet Nam as a sniper instructor. The highlight of his competitive shooting came in 1966, at the age of 24, when at the National Matches in Camp Perry he won the 1,000 yard Leech Cup match. After his tour of Marine duty he attended South Dakota State University and graduated with a B.S. degree in Mechanical Engineering. He is still shooting competitively.

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INTRODUCTION

by

Frank de Haas

For many years a dream of mine was to design and build a non-bolt action single shot rifle I could call all my own. That dream was slow in being fulfilled and I kept telling myself I had good reasons for putting it off. Anyway, my dream action had to be different from all others and it had to be of simple design and construction, but most of all it had to be one I could make in my modestly equipped home workshop.

It was the late John Amber, who edited my book **Single Shot Rifles and Actions**, who shook me into action. Nearing the end of his editing job on this book, he called me with a request to write one more chapter describing what I thought was the ideal single shot action in view of the fact that I had found some fault with almost every action covered in the book. The result was Chapter 52. The trouble was that in writing that chapter I designed an action which I could not make. That action, however, with some changes became the DeHaas-Miller action which I have described in another book.

As soon as **Single Shot Rifles and Actions** came on the market I began receiving many inquiries from readers, many of whom were aspiring gun designers and those desiring to make their own single shot rifle from scratch. I had no idea there were so many. A letter and a visit from one of them indirectly challenged me with the end result of coming up with our FM No. 1 VAULT LOCK action design and building a couple of rifles on it.

It took all of one long Iowa winter. There were many problems to solve in designing and building this action, and although it is very odd-ball, the rifles built on it were very shootable and extremely accurate. And because they were very shootable I wrote about them, with the articles appearing in RIFLE magazine. It was an action that I could make, and did make, and I felt that single shot rifle fans would be interested in the design. They were. Mark and I drew and wrote up a set of plans (see Chapter 2) on how to make it and from that beginning this book was born. Shortly afterward I began working on the FM No. 2 VAULT LOCK design. I recall having two special problems working out this design. One was what sort of lever or other arrangements to use to open and close the action. I absolutely refused to consider the usual swing-down-and-forward under finger lever. Read the beginning of Chapter 3 and you will learn what I came up with. The second problem was the safety. For several weeks I was stymied trying to figure out a simple one. I took the problem and the unfinished action to Mark. We worked late several nights, tried at least a dozen arrangements and discarded all of them. Ready to give up, we tried one more. It worked—a lever, two pins and a spring. We were just not looking for such a simple solution. Afterward, we laughed at our futile efforts.

Of all the rifles which Mark and I made, I am most proud of the FM No. 2 VAULT LOCK rifle with the oak leaf engraving and the myrtle wood stock, shown in Chapter 3.

Designing the CHICOPEE rifles was a command performance. Fans wanted a simple action for small cartridges and we aimed to please. We believe we not only designed two simple actions, but simple actions commensurate with strength, durability and reliability. Look them over in Chapters 4 and 5. We suggest you make one of them for your first rifle project because we can promise you that it will be a wonderful little rifle. We know you will like it.

I have written many gunsmithing how-to articles and my aim has always been to write and illustrate these articles in a way to be easy to follow and understand by all interested readers. I think I have succeeded in this. Mark and I have put this book together in the same way and have continued this practice with each of the four rifle making plans in this book. Mark and I are not professionals and we did not write this book for the professional gunsmith or machinist, but for the beginner and amateur home-workshop gunsmith. We sincerely hope you will use this book to build one or more of our rifles.

Even though you may not yet be interested in making one of our rifles, you will surely be interested in this book for other reasons. Whether you are a gunsmith, amateur gun designer, firearms student, gun writer or shooter, we hope you will enjoy reading about our unique designs and learn all there is to know about them.

January 1987
Frank de Haas

Fig. 1-1

This rifle is the final version of our FM No. 1 VAULT LOCK and was built by amateur gunsmith Ronald Van't Hof. It is stocked with a fancy piece of walnut, is fitted with 27'' tapered octagonal barrel chambered for the .223. The scope is mounted in Redfield Jr. mounts and it weighs 8.5 pounds. This particular rifle has to date fired over 7000 rounds.

Chapter 1

Information You Will Want to Know

The most important piece of information you will want to know is whether or not it is lawful for you to make a rifle. We can best answer that by quoting directly from the most reliable source, which is the book **Published Ordinances Firearms** put out by the Department of the U.S. Treasury, Bureau of Alcohol, Tobacco and Firearms. In the Question and Answer section of one of these editions we find the following:

Question: Can a person not licensed under the Gun Control Act make a rifle for himself?

Answer: Yes. Provided it is not for sale or distribution and provided further that it is not a firearm as defined in the National Firearms Act.

There you have it in simple words. Yes, it is not against any federal law for you to make one of the rifles described in this book. The only restrictions are that the rifle or rifles you make are for your own use and not for sale, the rifle not be a full automatic and that the barrel be no shorter than 18 inches for centerfire caliber and 16 inches for .22 rimfire calibers, and that the rifle be at least 26 inches in over-all length. You need no federal license or permit and no registration is required. However, the state, county or city in which you live may have certain restrictions regarding your ownership and use of it and we suggest you check into this before starting a rifle building project.

Following are illustrations of the four single shot rifles and actions covered in this book, along with a very brief description of each. Additional illustrations and fuller descriptions, as well as the detailed drawings and instructions for making each, are in the following chapters. Here then are the rifles and actions. They are listed in the order they appear in the following chapters, which was also the order in which we designed and made them.

Figures 1-1 and 1-2 show our FM No. 1 VAULT LOCK rifle and action. It has a cylindrical falling breech block with a manually cocked, horizontally swinging hammer mounted in the left receiver wall. This action was designed to handle most standard rimless cartridges as well as most rimmed ones. It is a very unique action and for this reason alone you might want to make it.

Figures 1-3 and 1-4 show our FM No. 2 VAULT LOCK rifle and action. Like the No. 1 action, this action also features the cylindrical breech block but in most other respects it is a radical departure from it. Learn more about it in Chapter 3. We consider it the ultimate in the VAULT LOCK design. Of the four of our action designs, this one is the most popular and versatile. You can find the story about our VAULT LOCK rifles in our book, **Single Shot Actions - Their Design & Construction.**

The question we are asked most often about our VAULT LOCK designs is, "Why the round breech block?" The answer is simple—because a round hole through a chunk of steel is far easier to make than a square cornered hole with parallel sides. We would not have designed and made these actions had we not seen that the cylindrical breech block design was the only possibility of making a falling block action in our home workshop. Our goal and challenge was to make a sound falling block action and it was the round breech block design that allowed us to do so. We designed the entire action around it. We had no desire to make this action better than any other falling block, all we wanted was to be able to make it. In this sense, these acitons are not as desirable as the DeHaas-Miller action.

> NOTE: Plans on how to make the patented DeHaas-Miller falling block, single shot rifle are not included in the book and we do not expect to include it in future editions. Because the D-M action has a rectangular shaped breech block which requires a similar shaped square cornered and parallel sided hole to be made through the receiver, it is much more difficult to make than our round breech block VAULT LOCK actions and thus beyond the ability of most amateur rifle builders. The complete and detailed story on this rifle is told in our book **Single Shot Actions - Their Design & Construction.**

Figures 1-5 and 1-6 show our CHICOPEE Rimfire rifle and

Fig. 1-2
The FM No. 1 VAULT LOCK action opened. The action can only be opened after the hammer is cocked, as shown here, and while the action is open, the hammer cannot be released. When cocked the hammer lies flush within the left receiver wall leaving ample room for loading. The angled top front surface of the cylindrical breech block provides ample space for the extractor to tip back to extract and eject cartridges or cases. Originally designated as the F.D.H. System No. 1, and after building two more each with further changes and improvements we changed the name to the FM No. 1 VAULT LOCK as this name aptly describes the breeching system in that it resembles the locking bolt in a vault door. It was a warm Friday in May when we first fired our prototype VAULT LOCK rifle, we fired it many times and with such pleasing results that we included the letters FM in the designation.

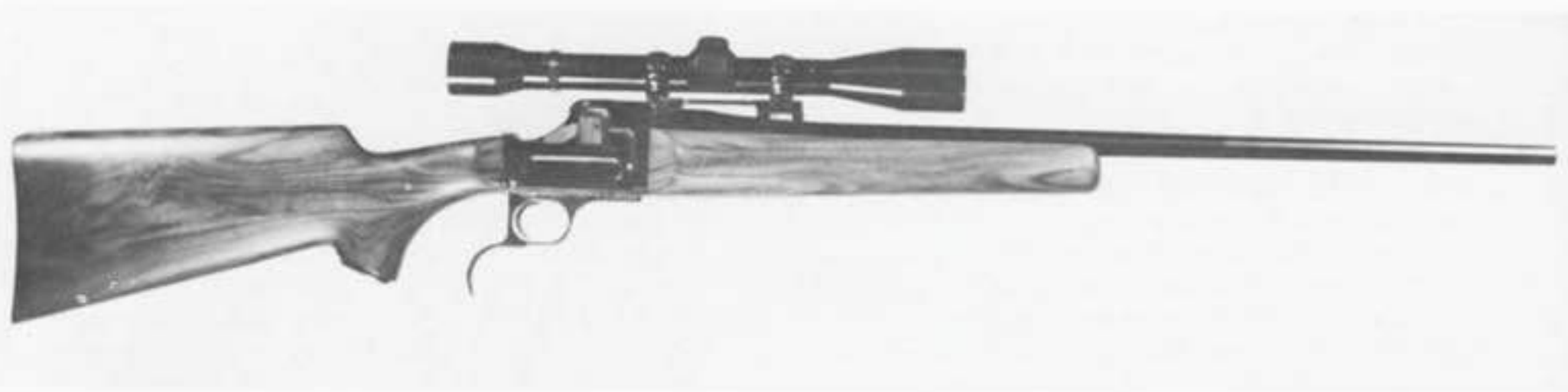


Fig. 1-3
This is an example of our final version of the FM No. 2 VAULT LOCK rifle. It is the action from which the drawings in Chapter 3 were made. This particular rifle is stocked with French walnut, fitted with a 24" sporter barrel chambered for the .223 cartridge and mounted with a Weaver K-6 scope in Redfield Jr. mounts.

action. Designed especially for the .22 rimfires, it has many features unique in a .22 rimfire rifle which you may find interesting. If you do your part well in the making of it, this might become your favorite small game rifle. For more information on this rifle, consult Chapter 4.

Figure 1-7 and 1-8 show the CHICOPEE C.F. rifle and action designed especially for the smaller and moderate pressured centerfire cartridges. Look it over in Chapter 5 and you may conclude with us that it is an ideal rifle for the .22 Hornet or .25-20 cartridge.

Perhaps your next questions will concern your workshop and the hand and power tools needed to make one of the four rifles described. To start with, you will need a workbench to which a vise is attached, and an assortment of metal working hand tools. You will need an array of files, screwdrivers, punches, drill bits and taps. You will need a hacksaw, wood saw, hand drill, tap wrench, chisels, rasp, and other tools of that nature.

As for power tools, the minimum that you will need without hiring some of the work done, will be a drill press and a bench lathe with a six inch or more swing and 24 inch or more centers. The lathe is needed for the barrel work; threading it, facing it off, etc. If you do not have a milling machine, then you will need a milling attachment for the lathe. One of the miniature lathes will not do. Our lathe is a Craftsman with 30" center and 1.5 inch diameter spindle. We made several of our prototype rifles without the aid of a milling machine or hiring that work done, and this included two FM VAULT LOCK rifles and two CHICOPEES, removing unwanted metal from the receiver and other parts by drilling, sawing, chiseling and filing it off. It is slow work doing it this way but it can be done. Some of the procedures we followed using this method are described in Chapter 2. But if you want to do the receiver work yourself without a great expenditure of effort, you will need a mill. Low cost mills are available today which are ideally suited for the home metal workshop. Some will even double as a drill press. Ours is a Jet No. 626 and we can recommend it. A grinder is also a useful power tool to have in your shop for sharpening tools. Lastly, you will need a torch to heat small parts and for silver brazing.

Besides the necessary tools and this book, what else will you need to build one of our rifles? You need a strong desire to do it, lots of patience and the determination to finish the job once you have commenced it. You need mechanical ability and the skill and know-how to use metal working tools. You have to know how to use a file, how to drill and tap a hole, how to operate the machine tools you own, and you must have a general knowledge of firearms mechanism. You must be able to read and follow instructions.

This book tells you how to make four different and distinctive rifles but it does not tell you how to cut a thread on a rifle barrel with a lathe, how to ream a hole, or what headspace means, these and many more things you will have to learn from other books if you do not already know them. If you do not already have a few gunsmithing books we suggest you obtain some. Check them out in Brownell's catalog. You do not have to be a trained or experienced toolmaker, machinist or gunsmith to make the rifles in this book—we did not have

Fig. 1-4

Close-up view of the FM No. 2 VAULT LOCK action taken after the stock was chekered. The action is shown closed and with the hammer in the fired position. This action differs mainly from the No. 1 VAULT LOCK in that it has an entirely different firing mechanism and a different mode of operation. The recessed panels on both sides of the receiver reduce action weight.

Fig. 1-5

An F.D.H. CHICOPEE R.F. rifle chambered for the .22 Long Rifle cartridge ready and fully equipped with sling and scope for the small game hunter. This was our prototype model with a 23'' half octagon barrel, 4X Bushnell scope, Jaeger 7/8'' carrying sling and auxilliary open sights.

Fig. 1-6

Close-up of the F.D.H. CHICOPEE R.F. action showing it opened. A groove in the upper surface of the breech block becomes the loading platform to guide a cartridge into the chamber. The entire firing mechanism of this action is built into the sandwich constructed breech block which in turn fits between the sandwich sides of the receiver. To close this action you merely press upward on the trigger guard and when fully closed the locking latch shown behind the hammer flips forward to lock the breech block closed.

Fig. 1-7

This is the larger centerfire version of our CHICOPEE deisgn which we have designated the F.D.H. CHICOPEE C.F. It differs mainly from the rimfire action and rifle in that the rifle has a two-piece stock, heavier and stronger action and a different breech block locking mechanism. This rifle chambered for the .218 Bee cartridge has a 24'' round tapered barrel on which is mounted an obsolete Fecker Woodchucker 7X scope and weighs about 8 pounds.

these people in mind when designing our rifles or when writing this book.

The following gunsmithing books contain a wealth of rifle building information and we suggest you get all of them and learn what is in them: **Gunsmithing** by Roy E. Dunlap; **N.R.A. Gunsmithing Guide** by various qualified authors; **Mr. Single Shot's Gunsmithing-Idea Book; The Modern Gunsmith** by Clyde Baker; and **Rifle Gunsmithing** by Jack Mitchell.

From beginning to end we had the amateur gunsmith and the home workshop craftsman in mind. We kept the actions as simple as practicable and if you have ever contemplated making a square or rectangular hole through a large piece of metal as required in the making of a common falling block action, you will certainly appreciate the round breech block VAULT LOCK design. The same goes for the even simpler CHICOPEE designs.

Because we had the amateur gunmaker in mind we also left out most of the non-critical dimensions from the drawings. The design of all our actions allows for lots of leeway in radii, angles, pin and screw sizes, etc. The drawings are exact size and the dimensions not given can be taken directly from them. Just as we had to do in making our rifles from these drawings, you may have to make some parts over two or more times before getting them right.

You will also like to know that all four of our rifle designs have been proven safe and shootable. We have omitted giving any instructions on how to disassemble or assemble any of the actions because we feel this would be needless information since, if you built one or more of these actions you would learn first hand how to do it. Using our plans we have had reports and have seen these rifles built by others, receiving good reports from all. None of them reported that they had any problems reading the drawings and following our instructions. One owner of an FM No. 1 VAULT LOCK that he made has fired it several thousand times without a single hitch. It was the first rifle he ever made and he prizes it highly. If a quality barrel is used you can expect any rifle you make from our designs to be as accurate as any commercial rifle of the same caliber and weight.

Almost everything you need in the way of tools, materials, and supplies to make any or all of our rifles is available from Brownell's Inc., Montezuma, Iowa. If you are not already familiar with this gunsmithing supply firm you ought to be. They put out a big catalog and from it you can order just about everything you will need. They can supply barrels, sights of all kinds, scope mounts, gun screws, tool steel, drill rod, springs—hundreds of sizes—and much, much more. They also have the tools, there is no end to the selection; drills and taps, punches, screwdrivers, saws, files, chambering reamers, measuring tools, special cutters—if it can be used to make or fix a gun, Brownell's will have it. And supplies, they have them too, everything from gun oils, finishes, bluing chemicals, you name it, they have it. Every gunsmithing book in print is also available from them. The only things you can't get from Brownell's to make our rifles are the block of steel for the receiver and the wood to make the stock, and these items are available from your nearest machine shop or steel supply firm and from your local lumber yard.

We have done our best to make these plans as detailed and as complete as possible so that when you start a project of making one you can carry it through to completion. As you

Fig. 1-8
Like the F.D.H. CHICOPEE R.F. action, the action of the C.F. rifle is of sandwich construction with the two sides of the breech block and the receiver made of common cold rolled flat stock steel.

near the end of the project don't all of a sudden rush it to a finish. Take your time at this point, especially with the shaping of the stock. When finishing the metal or wood, sand and polish the surfaces level and very smooth. We want you to be proud of the finished product. If the rifle proves to be what you expected and we are confident it will, we want you to do one more thing, and that is to stamp the gun to identify it. Put your name and address, along with the year and caliber, on the left side of the barrel. Follow by stamping the receiver to identify it: on the No. 1 VAULT LOCK stamp: FM No. 1 VAULT LOCK. On the No. 2 VAULT LOCK STAMP: FM No. 2 VAULT LOCK. On the CHICOPEE R.F. stamp: F.D.H. CHICOPEE R.F., and on the centerfire stamp: F.D.H. CHICOPEE C.F.

Enough of the VAULT LOCK and CHICOPEE actioned rifles have been made by us and others using these plans to make us confident that the designs are sound and the plans complete. However, since we have no control as to the materials you use in making these actions and rifles, or in the care in which they are constructed or in the way the guns may be handled, we cannot assume any responsibility or liability for any accident that might be incurred in the making of these guns, in the handling of them or in their use.

If a firearm is handled or used carelessly or thoughtlessly it can become a dangerous weapon. Always remember to handle a gun as though it is loaded. Don't keep live ammunition lying around on your workbench, and never use a live round to check headspace or anything else. Always stamp the rifle for the correct caliber designation that it is chambered for and use only that ammunition in it. If a cartridge does not chamber easily and fully with finger pressure, then do not force it into the chamber by closing the breech block on it. Doing this will inevitably lead to trouble. Before firing a rifle make sure that both the chamber and bore are free of grease and oil. All of our rifles have positive safeties but the best SAFE is an unloaded gun. An open actioned gun can't be fired, but more important is that it will let your companions know that it cannot be fired. When target shooting or hunting small game or varmints with one of our rifles there is no excuse for carrying the rifle loaded or unloaded with the action closed. Gun accidents are seldom accidents, they generally come about because of careless or thoughtless gun handling and use.

Fig. 2-A

A fine FM No. 1 VAULT LOCK rifle in .223 caliber which was made from the plans and instructions outlined in this chapter. It has a 27" tapered, octagonal barrel on which is mounted a Weaver 3x9X Marksman scope in Redfield Jr. mounts. Although the action is odd and unusual this rifle is altogether very shootable, having been fired a great many times. The VAULT LOCK action is unique in that it has a cylindrical breech block, side loading/ejection port and a breech block which is solidly supported above and below the chamber. It also features a horizontally swinging hammer, an automatic SAFE, fully adjustable trigger, extractor suitable for either rimmed or rimless cartridges and throughbolt stock fastening. It is opened and closed by the finger lever which encircles the front end of the trigger guard.

Chapter 2

HOW TO MAKE
The FM. No. 1 Vault Lock Action and Rifle

We will readily agree with anyone who describes our FM No. 1 VAULT LOCK rifle and action (Fig. 2-A) as the most unusual and unique single-shot rifle action to be seen in these modern, high technology times. One look at it and we think you will also agree that it is "something else", to use a modern cliche. We make no claims to be the originators of any of its many different and unusual features, as it is more than likely that all of them have been used and perhaps patented many years ago by inventors of single-shot rifle mechanisms. These features might include those visible at a glance from the outside of the action such as the vertical rising and falling cyclindrical breech block which is supported at its top as well as below, a side loading port, a horizontally swinging hammer and a plunger which serves both as a sear and safety and inside the action, a ball and socket linkage between the finger lever and the breech block. However, we like to think that we were the first to refine these features and put them all together into a compact, strong, safe and shootable breech loading action; one which an amateur gunsmith, knowledgeable about firearm mechanisms and skilled in metal working, can make in his or her home workshop. We have proof that this last statement can be done as we have seen rifles and photos of rifles which were built by amateur gunmakers using our original plans much less detailed than the ones in this chapter.

The FM No. 1 VAULT LOCK action is a true falling block. It is operated by an under finger lever to open and close the breech (Figs. 2-B, 2-C, & 2-D). Its cylindrical breech block is solidly supported in the receiver by two rings of steel above and below the breech. It is loaded from the side rather than through an opening on top and this feature allows the scope to be mounted very low over the receiver. The horizontally swinging hammer is built into the side of the receiver and it has to be manually cocked (Figs. 2-E & 2-F) to fire the rifle. A heavy plunger, which serves both as a sear to hold the hammer cocked and to release it and as a safety to prevent the rifle from being fired, is conveniently placed and positive in its function. The hammer must be cocked before the action can be opened and loaded, and on being cocked it is automatically placed on SAFE. When cocked the hammer cannot be lowered or otherwise released unless the action is closed. When the action is closed, to fire the rifle the sear/safety plunger is pushed down until it is stopped by the sear lever, after which, when the trigger is pulled to trip the sear lever, the hammer can fall. The trigger is fully adjustable. The extractor is activated automatically when the action is opened and it is adaptable for both rimmed and rimless cartridges. Coil springs are used throughout.

The FM No. 1 VAULT LOCK action is strong and safe enough for almost all of the standard American rimmed and rimless centerfire cartridges from the .22 Hornet on up to the .30-40, and from the .221 FireBall to any standard cartridge of .30-06 head size. Because the cartridge must clear the sear/safety when loading and extracting it, this action is not well suited for rimmed cartridges with a rim larger than the .30-30 case, and we do not recommend that it be used with any belted magnum cartridge. We also advise against scaling this action up for larger cartridges or down for the small ones. As you will note on studying the exploded-view drawing (Fig. 2-1) and the component parts list of this action it has more parts than our FM No. 2 VAULT LOCK action as covered in Chapter 3. We have kept the number of parts needed to make the FM No. 1 VAULT LOCK action to a bare minimum and those parts are as simple as possible. Because this action is so

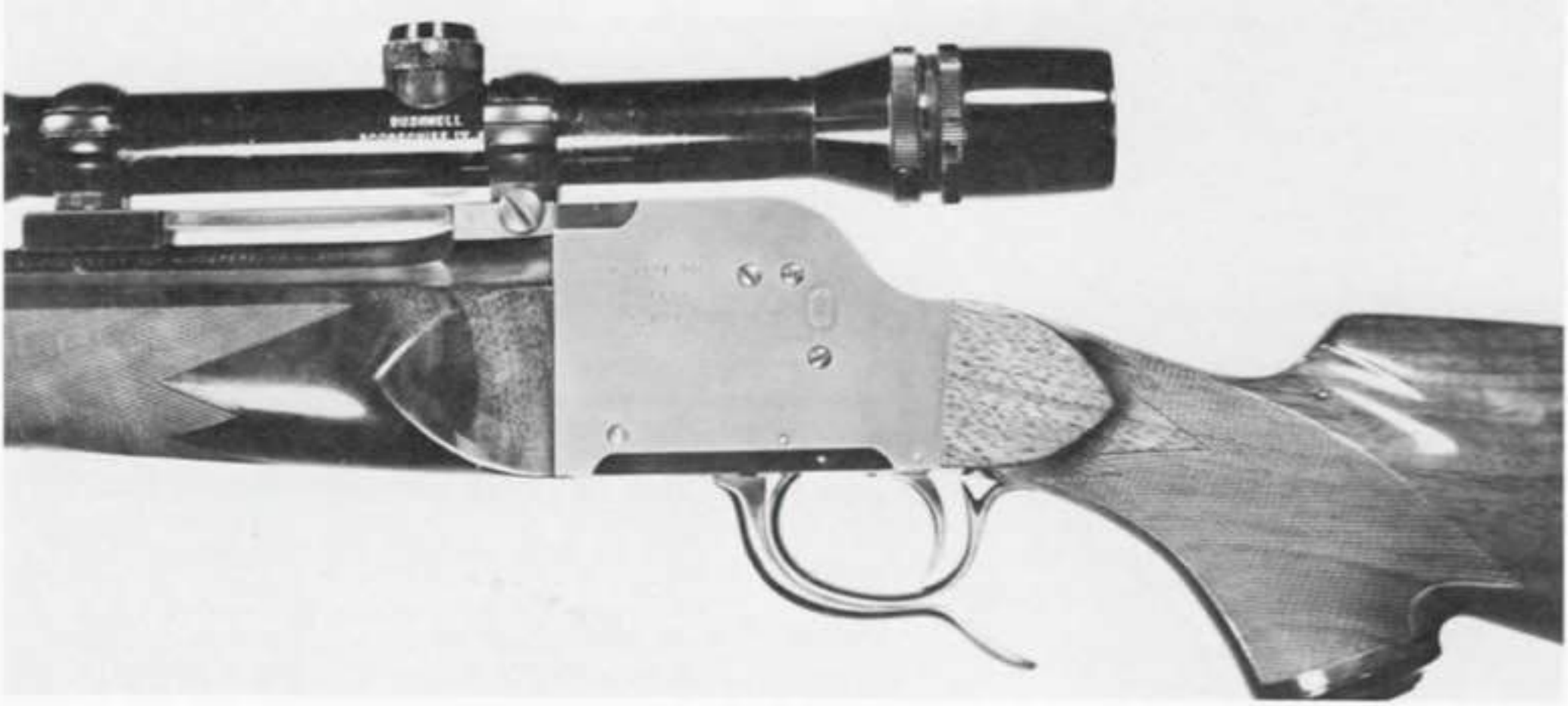


Fig. 2-B

The left side of the FM No. 1 VAULT LOCK action. The upper two screws hold the hammer in place and the small oblong part is the sear/safety hold-down plunger. The lower screw is the sear/safety retainer screw. Two other photos of this rifle and action (Figs. 1-1 and 1-2) can be seen in Chapter 1.

Fig. 2-C

A close-up of the opened action of the rifle in Fig. 2-A. The name VAULT LOCK was chosen for this action as it describes the appearance and movement of the breech block since it is not unlike a cylindrical locking bolt in an ordinary bank vault door. The hammer must be manually cocked before the action can be opened and on being cocked it is automatically put on SAFE, and in addition, locked there so that it cannot be released while the action is open.

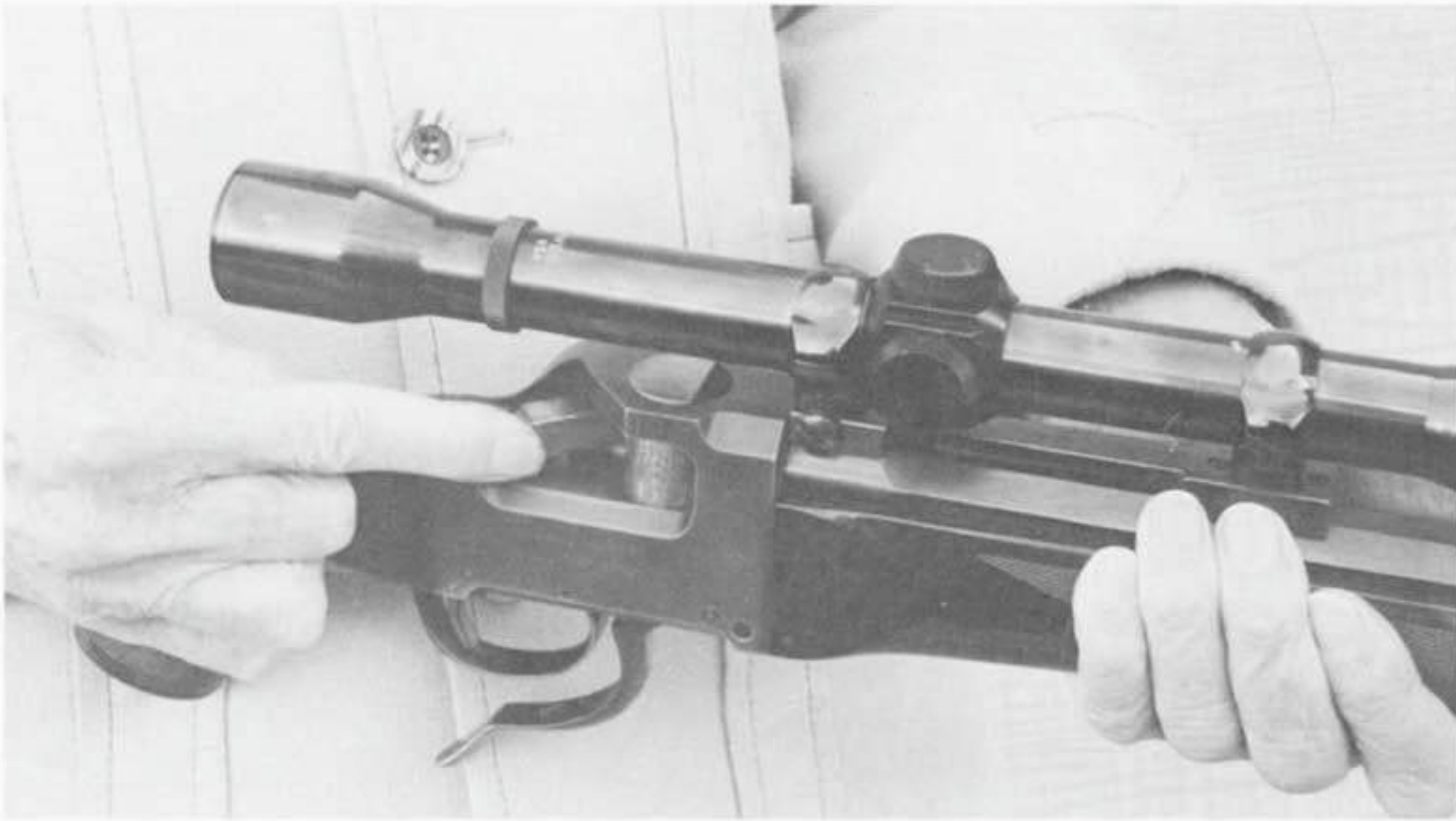
Fig. 2-D

Here the No. 1 VAULT LOCK action is shown with its horizontally swinging hammer in the fired position resting against the breech block. In this position the action cannot be easily opened because the hammer is engaged in a recess in the rear of the breech block. After the hammer was released it pushed the sear/safety to its lowest position as shown here, and held down in this position so the hammer can be cocked again by the sear/safety hold-down positioned in the left wall of the receiver with part of it projecting into the hammer groove. When the hammer is cocked again it will push the hold-down to the left to allow the sear/safety to rise in front of the hammer, rising high enough to hold the hammer locked and cocked and the trigger sear to be free of contact with the sear/safety. In other words, the hammer cannot be released unless the sear/safety is first depressed by the thumb and even then it can be depressed a short distance until it is stopped when it comes into contact with the sear in the trigger mechanism, and at this point the hammer is still being held cocked by the sear/safety. At this point, if the trigger is pulled, the tension of the hammer against the beveled surface on the top of the sear/safety will push the sear/safety down as it falls. As the hammer passes over the top of the sear/safety it has pushed it down far enough to allow the sear/safety hold-down to engage with the sear/safety to hold it down until the hammer is cocked again. Although the hammer has a horizontal swing of about 100° it in no way affected the accuracy of the rifle and while it may not be an ideal firing mechanism for an offhand target rifle we saw no disadvantage in it for varmint and bench rest shooting.

unusual it may fascinate you into wanting to make a rifle on it, and if this is the case, don't be scared off by the parts list.

In the making of the action you may be tempted to eliminate or change a part or two or make shortcuts. Remember this, we made three of these actions and rifles before settling on the final one, and the chances are that any elimination of parts, changes or shortcuts that you might consider making have already been tried by us and discarded for a sound reason. This is not to say that a few parts can't be made differently than we have shown, but just be sure you are on sound ground when doing so.

In the making of this action and rifle we suggest you follow our sequence of order in the making of the parts as we have outlined. If you are a skilled machinist and have at your disposal a modern machine shop, you can skip over much of our instructions which were written with the amateur metal worker in mind who does not have a basement full of machine tools. However, whether you are a professional or an amateur and this is your first attempt at making a complete rifle; make, fit and finish each part with care. Adhere to the dimensions and specifications which we have given in the drawings and instructions. When needed, get help from other books. Don't rush the work but don't stop it either. By all means, finish the rifle once you have started it. Look closely at the FM No. 1 VAULT LOCK rifle and action shown (Figs. 2-A & 2-C), copy its lines and you will have made one of the most shootable rifles around.

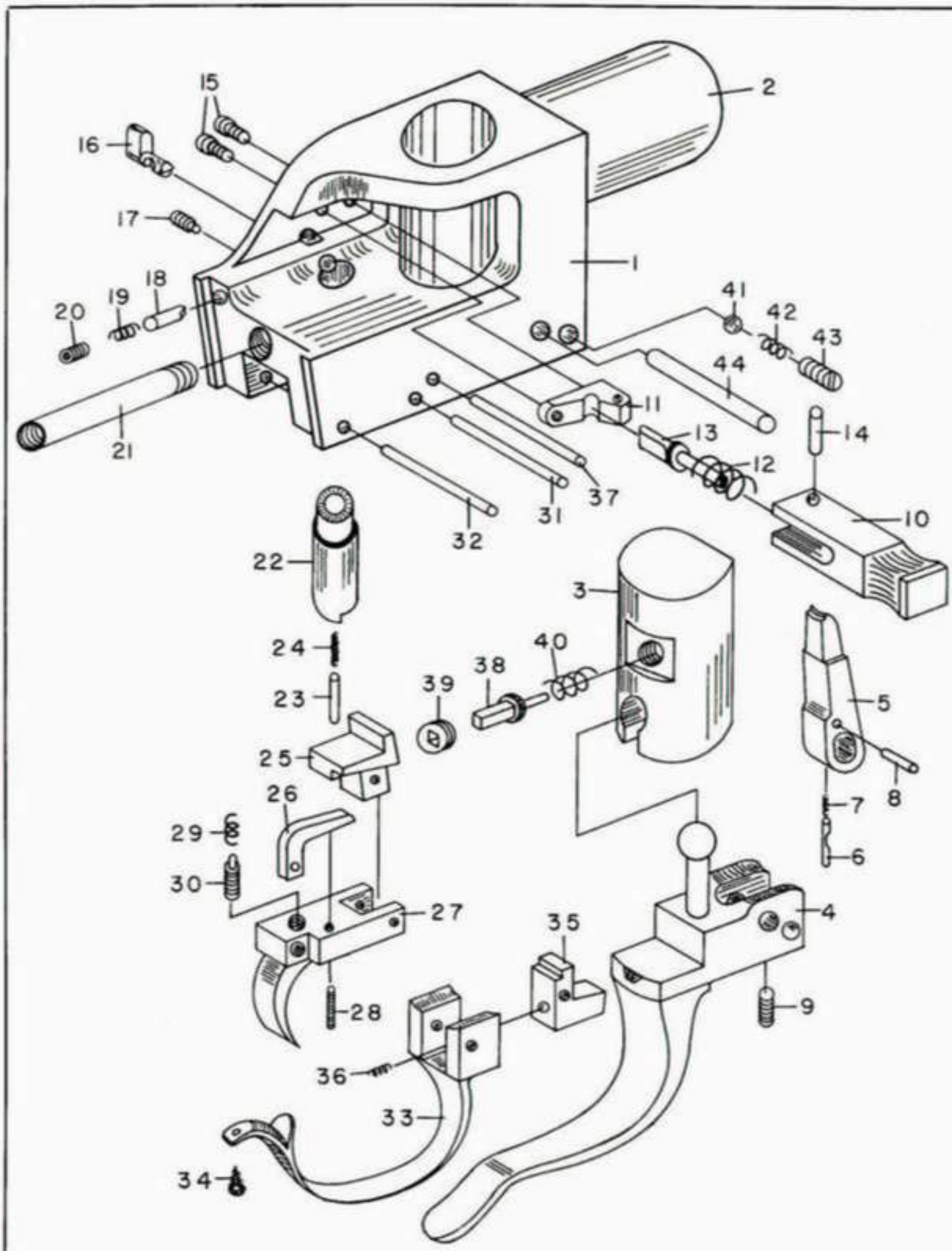


Figs. 2-E and 2-F

The hammer of the No. 1 VAULT LOCK is readily cocked with either the thumb or forefinger. If the hammer is cocked by the thumb it is best done by starting the cocking action with the side of the thumb and once you become adept at it, it can be done in one motion without difficulty although you may want to roll your thumb so that at the end of the swing the tip of your thumb pad does the final cocking. Some shooters using this rifle prefer to use the index finger to cock the hammer. In any case the hammer must be swung fully back to allow the sear/safety plunger to rise to its maximum or SAFE position.

CAPTIONS for drawings and photos with some preliminary instructions for making the FM No. 1 VAULT LOCK action.

NOTE: All the drawings except Fig. 2-1 are made actual size and any dimensions not given can be taken from the drawings.



COMPONENT PARTS

1. Receiver
2. Barrel
3. Breech block
4. Finger lever
5. Extractor
6. Extractor plunger
7. Extractor plunger spring
8. Extractor plunger pin
9. Extractor screw
10. Hammer
11. Hammer pivot block
12. Mainspring
13. Mainspring strut
14. Hammer
15. Hammer pivot block screws (2)
16. Sear/safety hold-down
17. Sear/safety retainer screw
18. Hold-down plunger
19. Hold-down plunger spring
20. Hold-down spring plug
21. Tang
22. Sear/safety
23. Sear/safety plunger
24. Sear/safety plunger spring
25. Sear
26. Sear lever
27. Trigger
28. Sear engagement adjustment screw
29. Trigger spring
30. Trigger pull adjustment screw
31. Trigger/sear pin
32. Sear lever pin
33. Trigger guard
34. Trigger guard screw
35. Sear/safety block
36. Sear/safety block spring
37. Trigger guard/sear/safety block pin
38. Firing pin
39. Firing pin retainer
40. Firing pin retractor spring
41. Finger lever tension ball
42. Finger lever tension spring
43. Finger lever tension plug
44. Finger lever pin

Fig. 2-1 EXPLODED VIEW

This is the exploded view drawing, with all parts identified and numbered. It also shows the general shape of most parts and their relationship to each other. The parts in this view are not drawn to scale.

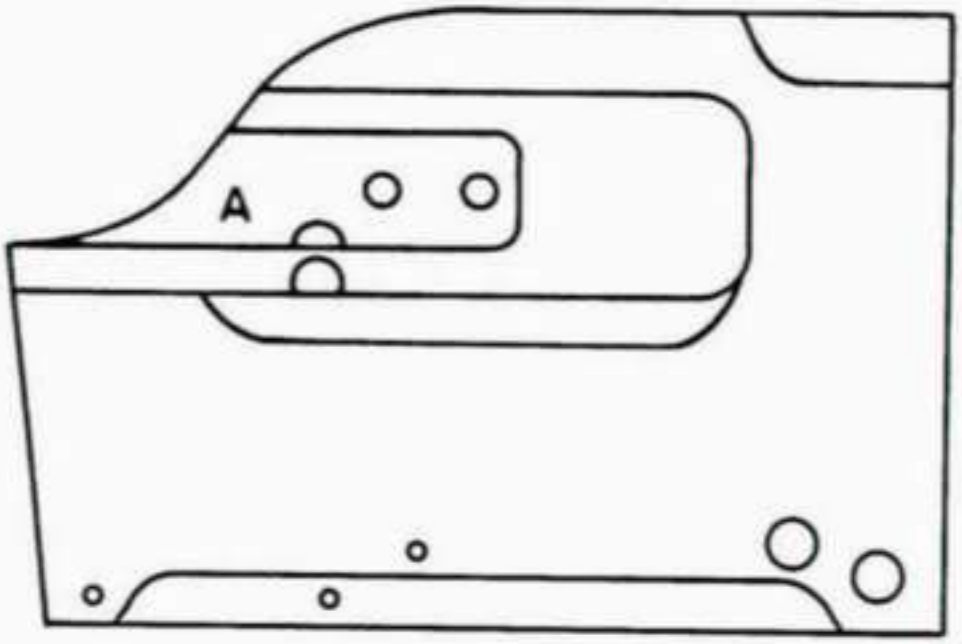


Fig. 2-2 RIGHT SIDE VIEW OF THE FINISHED RECEIVER

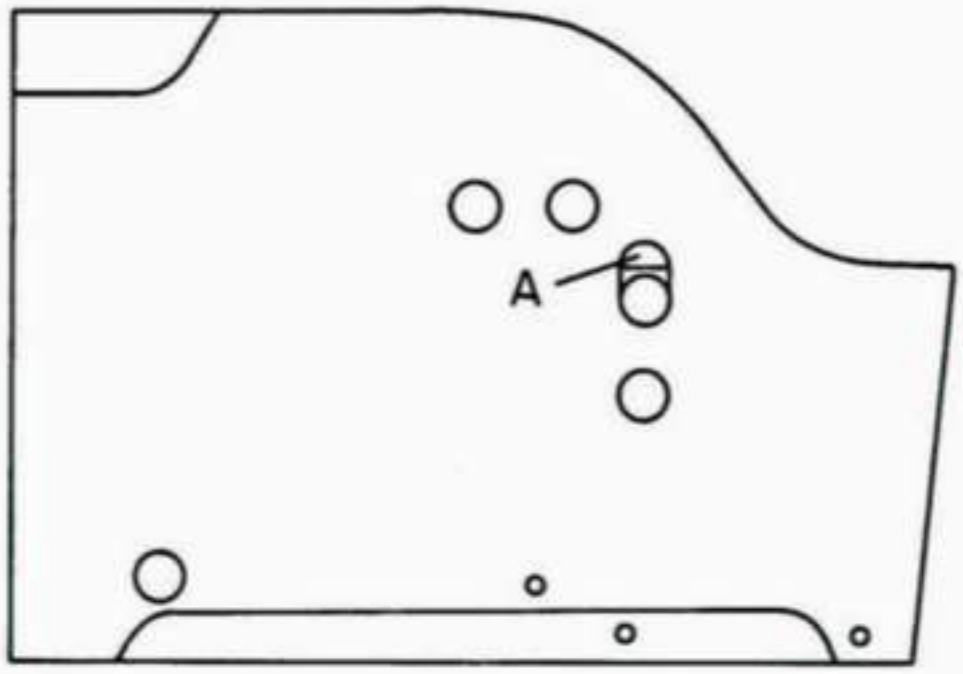


Fig. 2-3 LEFT SIDE VIEW OF THE FINISHED RECEIVER

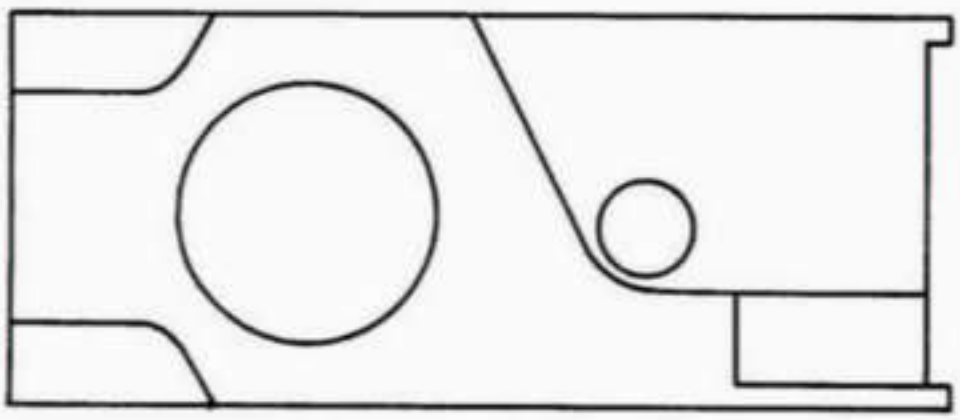


Fig. 2-4 TOP VIEW OF THE FINISHED RECEIVER
The big hole is the breech block hole and the small one is the sear/safety hole.

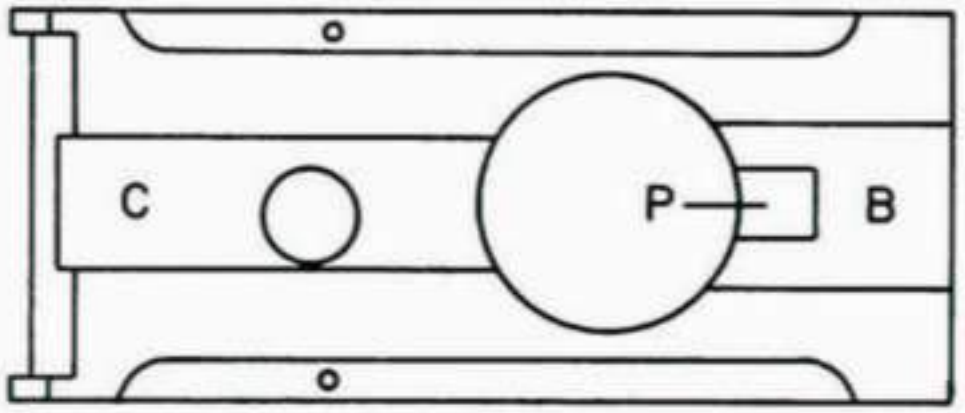


Fig. 2-5 BOTTOM VIEW OF THE FINISHED RECEIVER

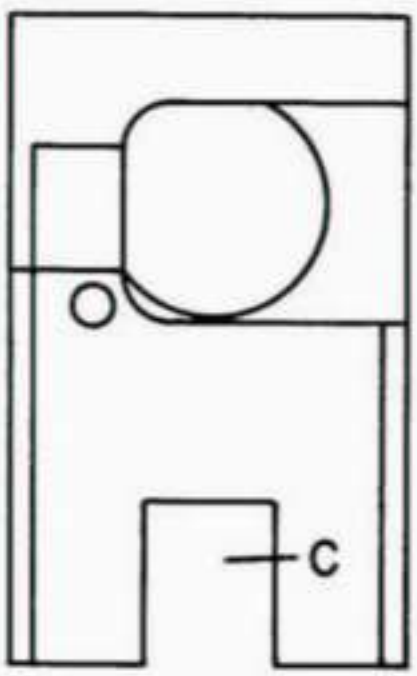


Fig. 2-6 REAR VIEW OF THE FINISHED RECEIVER

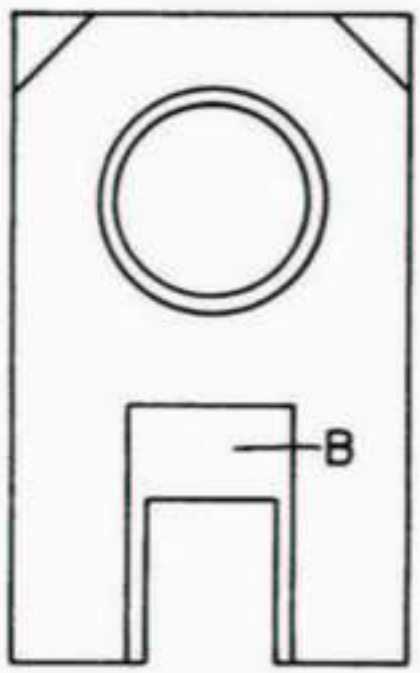


Fig. 2-7 FRONT VIEW OF THE FINISHED RECEIVER

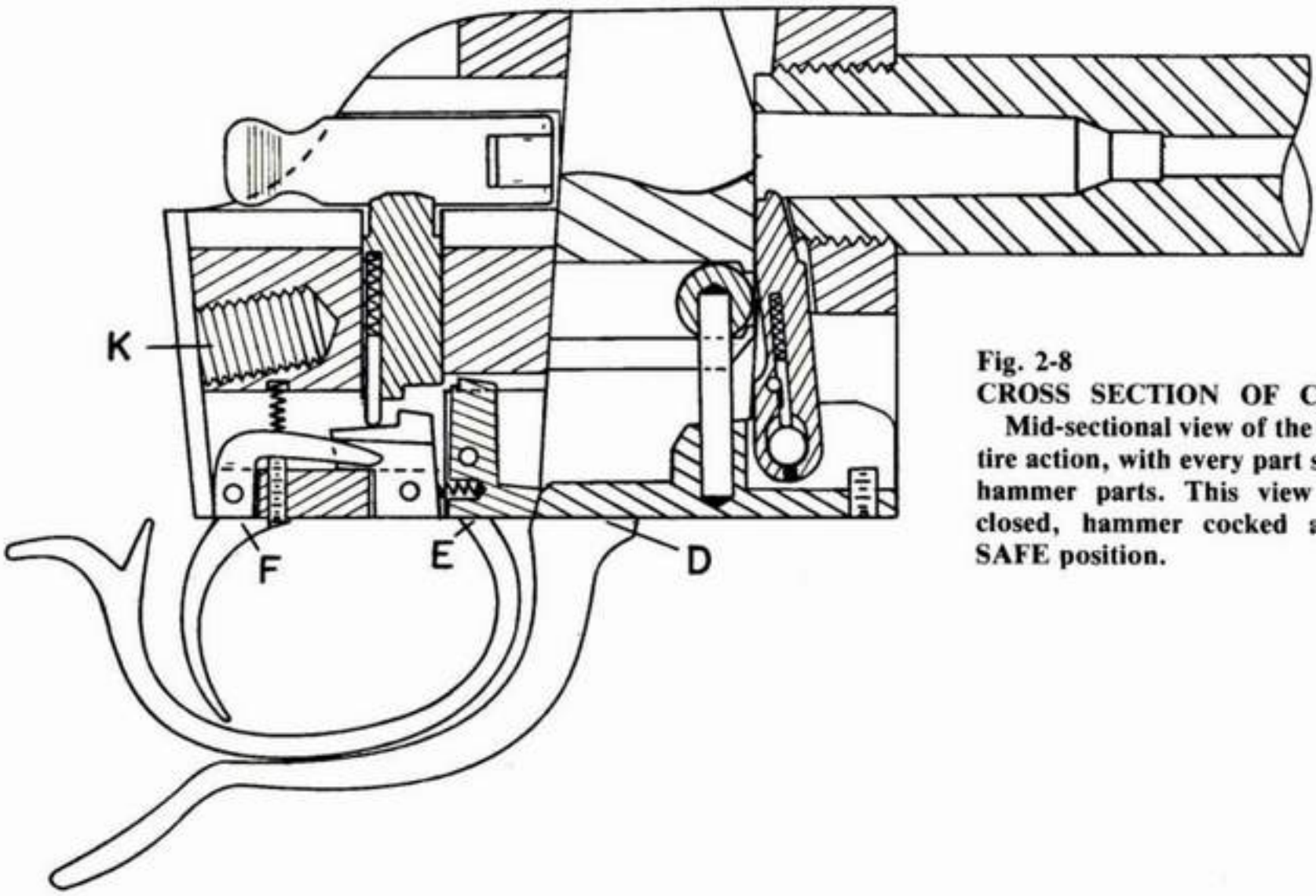


Fig. 2-8
CROSS SECTION OF CLOSED ACTION

Mid-sectional view of the right side of the entire action, with every part sectioned except the hammer parts. This view shows the action closed, hammer cocked and sear/safety in SAFE position.

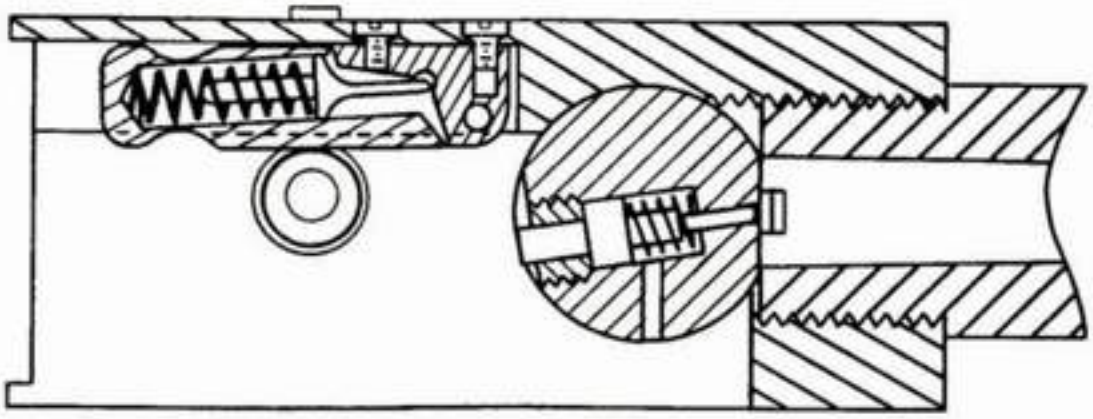


Fig. 2-9 TOP CROSS SECTION VIEW AT BORE LINE

Top sectional view of the closed action, sectioned at the bore line. This view shows the hammer and firing pin details.

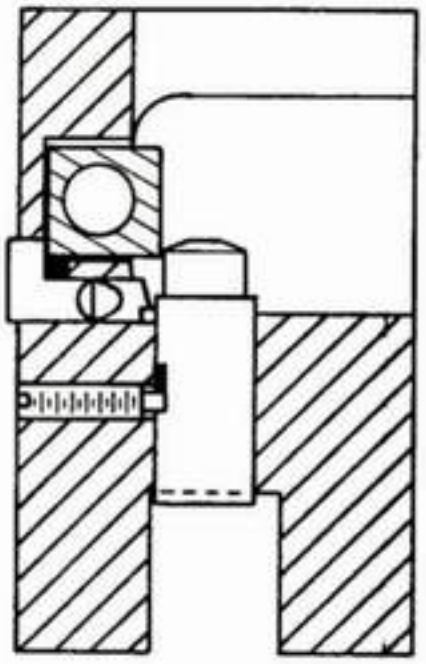


Fig. 2-10
REAR CROSS SECTION OF SEAR/SAFETY AREA (SAFE POSITION)

Rear sectional view of the closed action, sectioned through the area of the sear/safety. This view shows the action cocked and the sear/safety in the SAFE position. Note the position of the hammer, hold-down and sear/safety as compared to the position of these same parts in the following drawings.

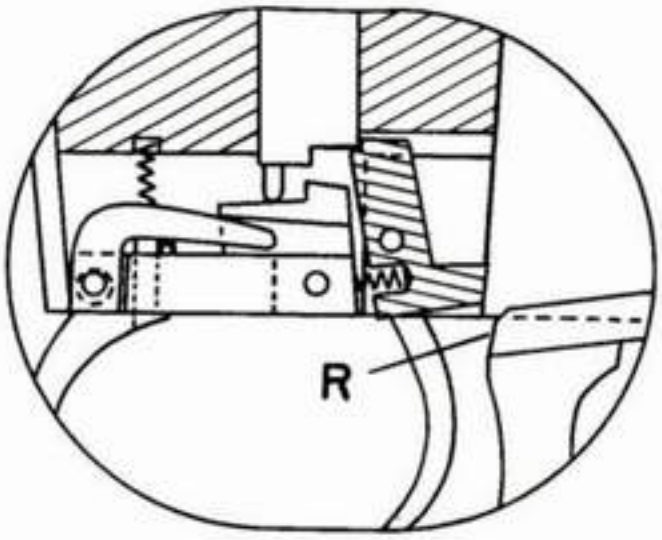


Fig. 2-11
SIDE CROSS SECTION
OF SEAR/SAFETY AREA
(SAFE POSITION)

Sectional side view of the sear/safety, trigger and sear/safety block areas showing the sear/safety in the SAFE position, and with the finger lever base (R) partly swung down which releases the sear/safety block to engage under the sear/safety to block it from being depressed. Unless the finger lever and the action is completely closed, the cocked hammer cannot be released. Also note the space between the bottom of the sear/safety and the sear.

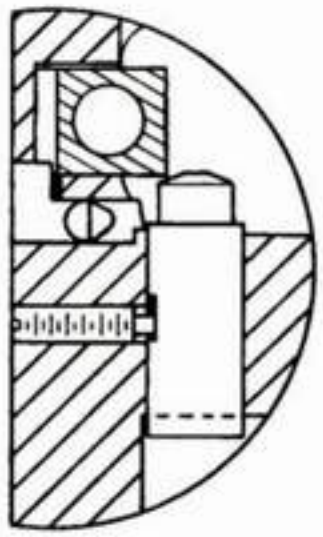


Fig. 2-12
REAR CROSS SECTION
OF SEAR/SAFETY AREA
(FIRE POSITION)

Rear sectional view of the sear/safety area showing the sear/safety depressed to the READY-TO-FIRE position. When the sear/safety is depressed from the SAFE position to this position, it is stopped by the sear and this places the beveled surface of the upper end on the corner of the hammer. If the trigger is pulled the sear will move from under the sear/safety, allowing the hammer to push the sear/safety down and fall against the breech block. To understand this better, compare this drawing with Fig. 2-10.

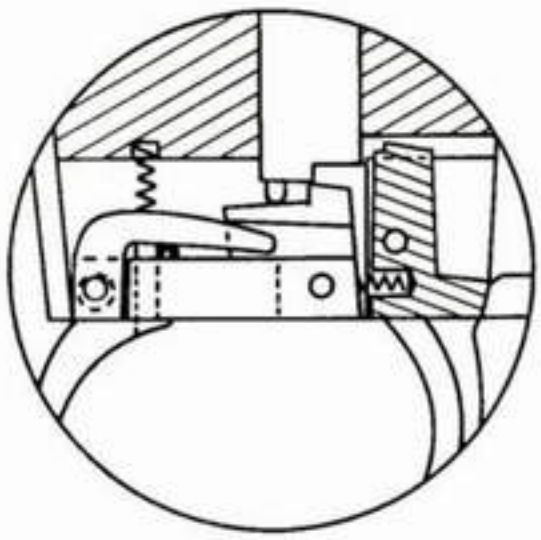
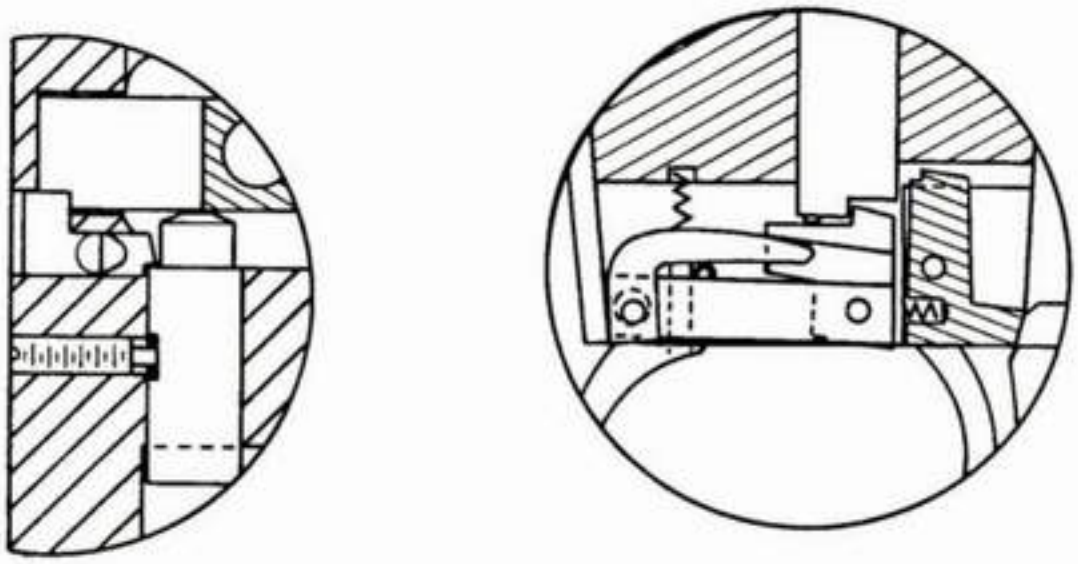


Fig. 2-13
SIDE CROSS SECTION
OF SEAR/SAFETY AREA
(FIRE POSITION)

Side sectional view of Fig. 2-12, showing the sear/safety in the READY-TO-FIRE POSITION. Note that the sear is directly under the sear/safety and is holding it up against the pressure of the hammer on its beveled surface. Also note the position of the trigger and sear lever—relaxed, with the sear lever adjustment screw adjusted so that there is no slack between the trigger, sear lever and sear.



Figs. 2-14 and 2-15
CROSS SECTIONS OF SEAR/SAFETY AREA (FIRED POSITION)

End (left) and side (right) sectional views of the sear/safety area showing the sear/safety in the FIRED position after the trigger has been pulled. Note that the sear/safety has slipped below the falling hammer and its sear past the sear edge on the sear. When the trigger was pulled from the relaxed position in Fig. 2-13, the trigger via the sear lever adjustment screw pushed the sear lever up, causing it to pivot and which in turn caused the sear to pivot forward to release the sear/safety. The rear hole in the trigger is larger than the sear lever pin that goes through it, the pin thus also serves to limit the trigger movement—both the slack and over-travel. The function of the sear lever is to give the sear about twice the pivot movement as given to the trigger. The ratio can be increased if the sear lever adjustment screw is placed further to the rear.

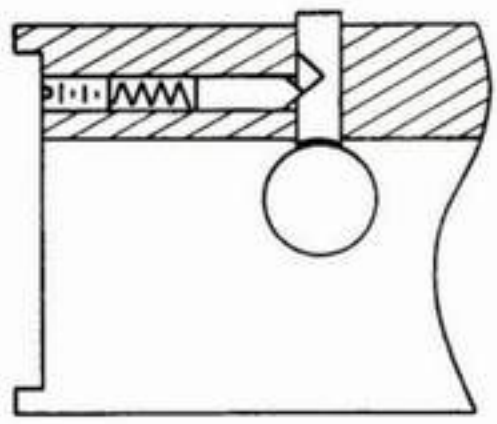


Fig. 2-16
TOP CROSS SECTION VIEW
OF THE HOLD-DOWN ASSEMBLY

The hold-down is positioned toward the left as it should be when the hammer is cocked. The spring plunger is shown riding high in the notch in the hold-down, and is putting right side pressure on the hold-down so that it will move to the right when the hammer falls. The purpose of the hold-down is to hold the sear/safety down after the hammer has pushed over it and until the hammer is cocked again. The angled sliding contact surfaces between the hold-down and the plunger must be highly polished and lubricated.

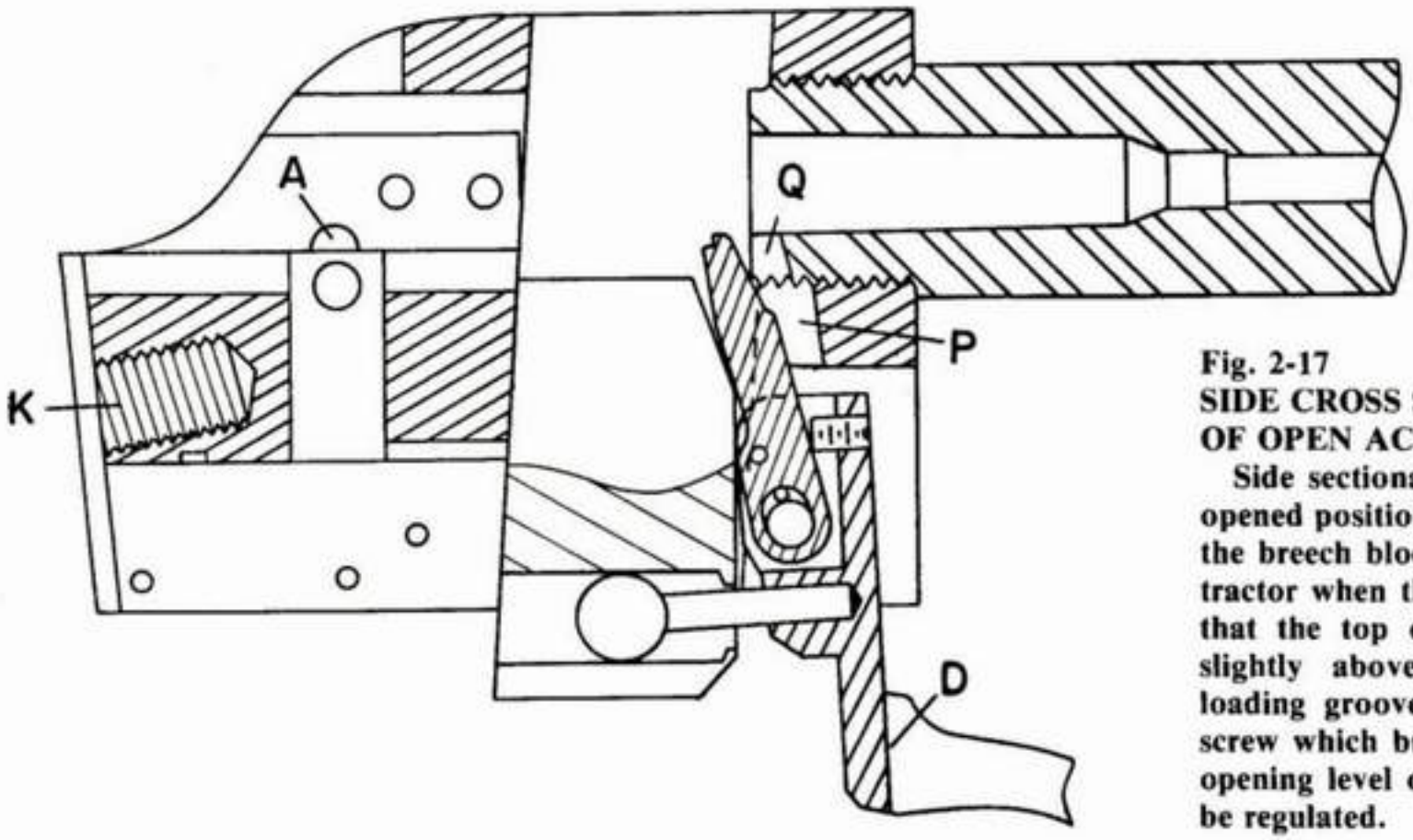


Fig. 2-17
SIDE CROSS SECTION OF OPEN ACTION

Side sectional view of the action in opened position showing the details of the breech block, finger lever and extractor when the action is open. Note that the top of the breech block is slightly above the bottom of the loading groove. By adjusting the set screw which bumps the extractor, the opening level of the breech block can be regulated.

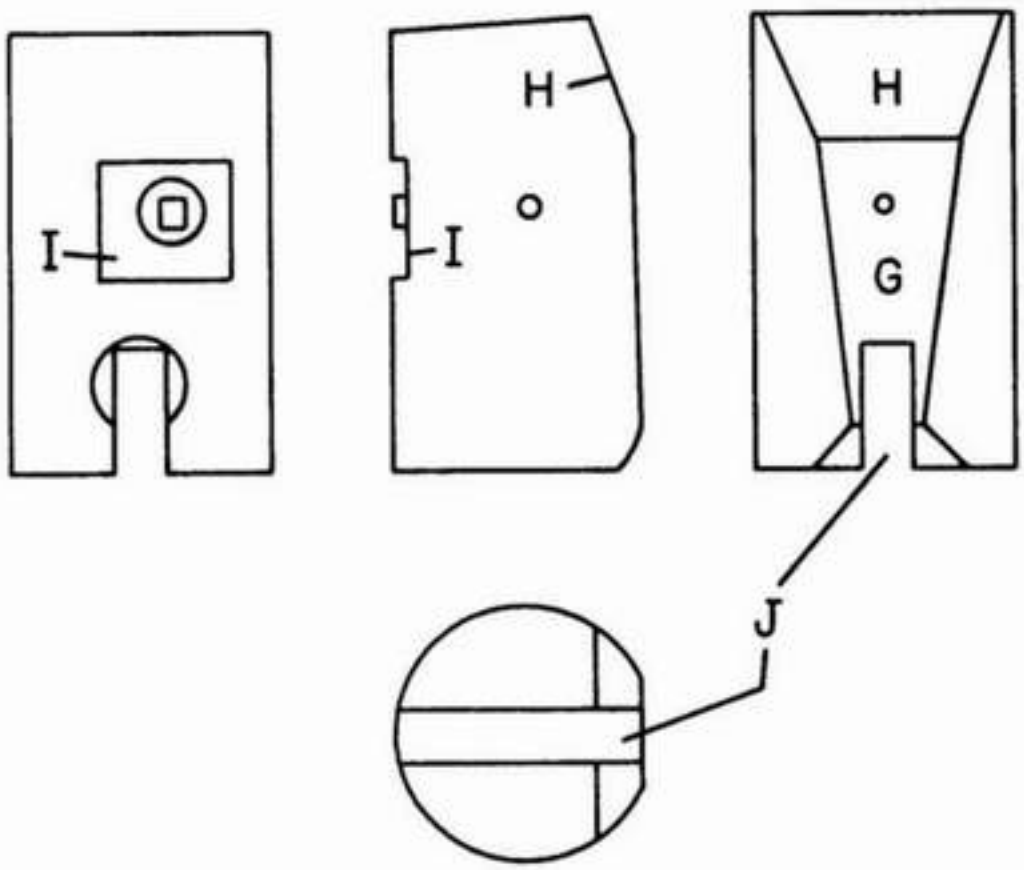


Fig. 2-18 BREECH BLOCK

This shows rear, side, front and bottom views of the breech block. See text for further details.

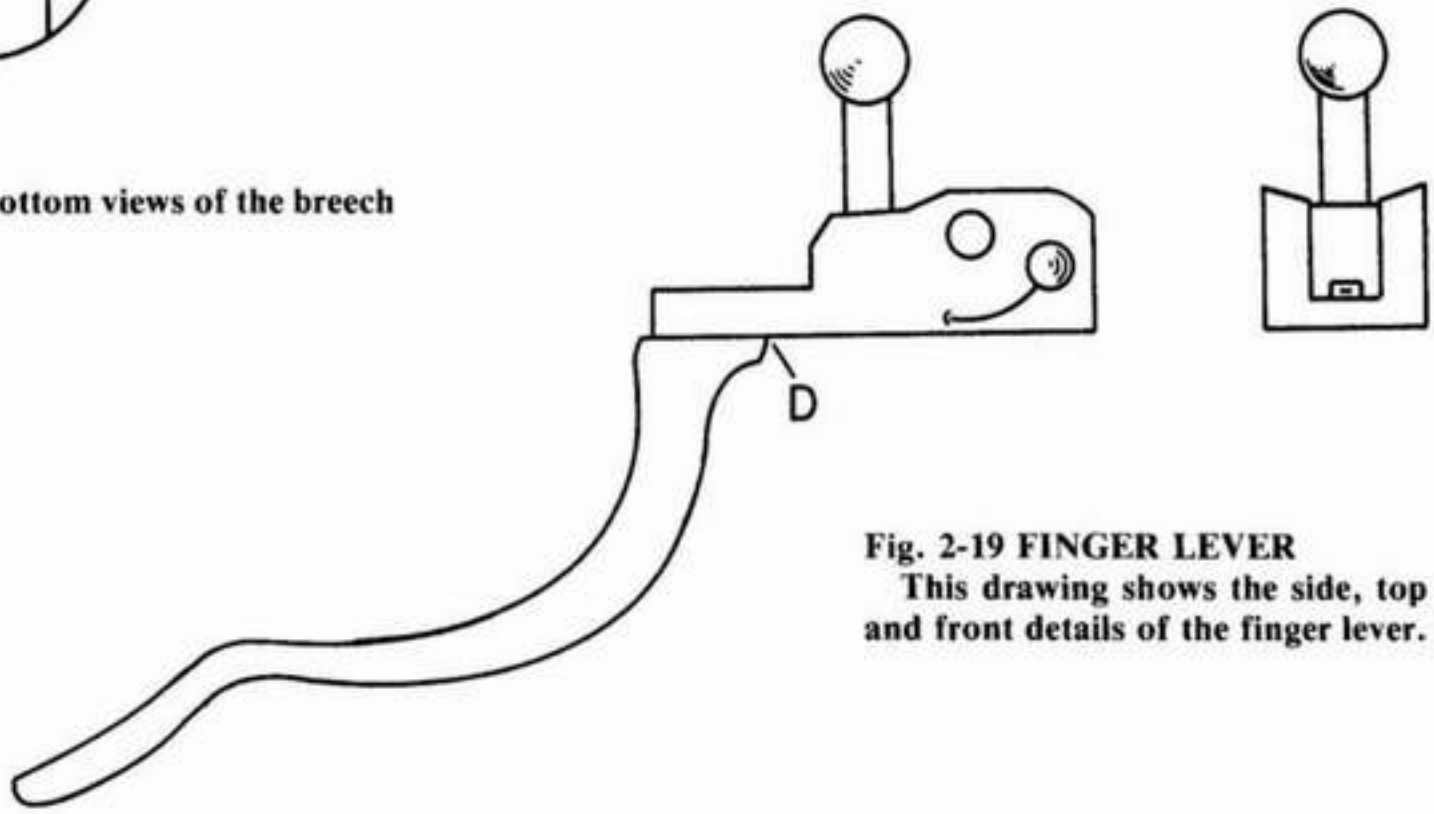


Fig. 2-19 FINGER LEVER

This drawing shows the side, top and front details of the finger lever.

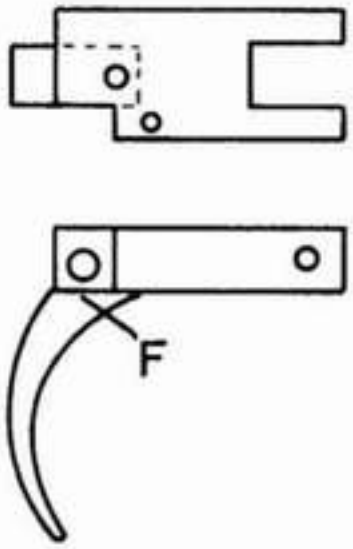


Fig. 2-20 TRIGGER

This view shows trigger details, both side and top views.

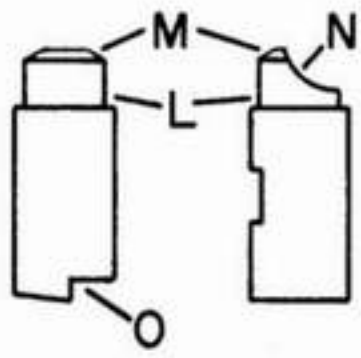


Fig. 2-21 SEAR/SAFETY

Side and rear views of the sear/safety. Also shows alternate top shape for large cartridge (at right marked N). See text for further details.

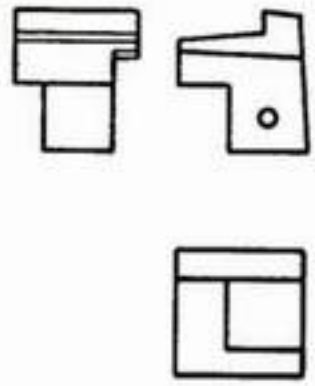


Fig. 2-22 SEAR

Rear, side and bottom views of the sear.

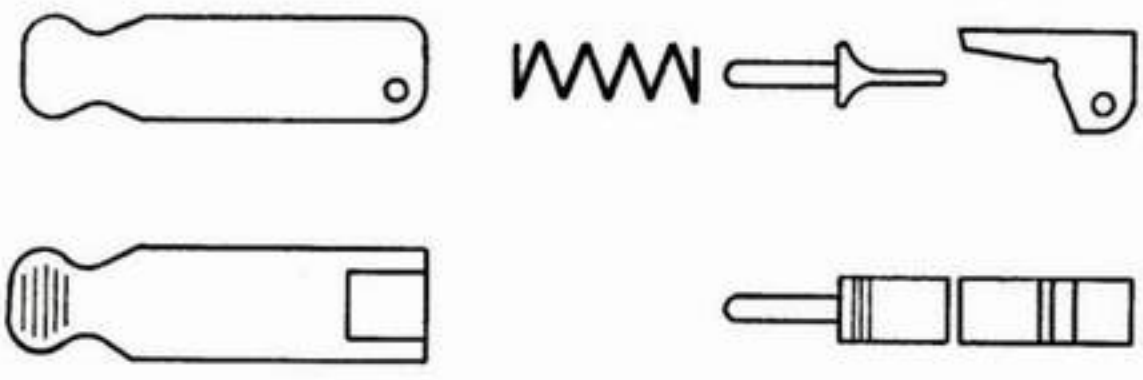


Fig. 2-23 HAMMER

Top and side views of the hammer, mainspring, mainspring strut and hammer pivot block.

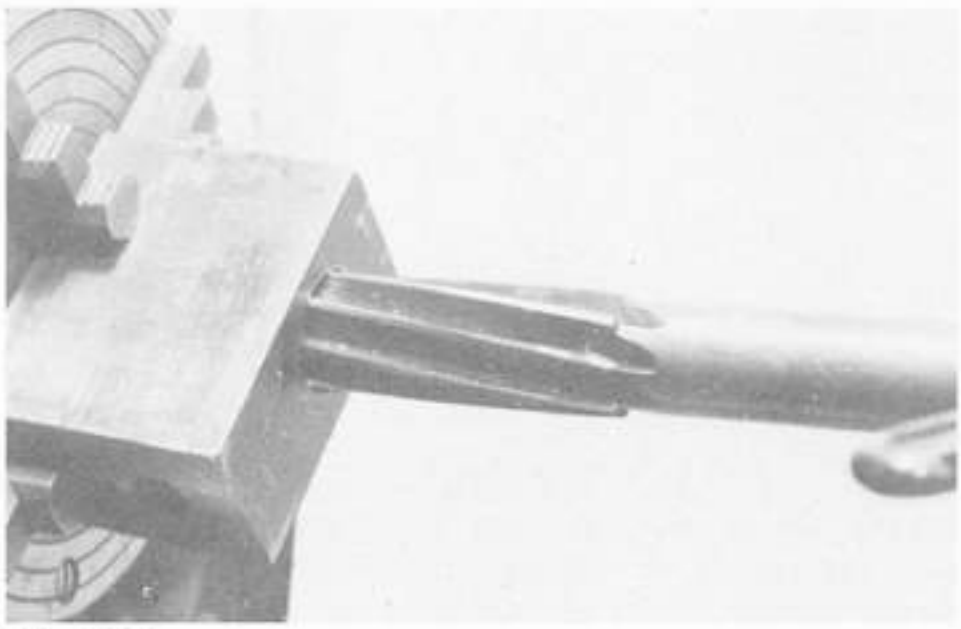


Fig. 2-24

This photo shows the receiver chucked into a 4-jaw lathe chuck and a 1'' reamer being used to ream the hole to its final size after drilling.

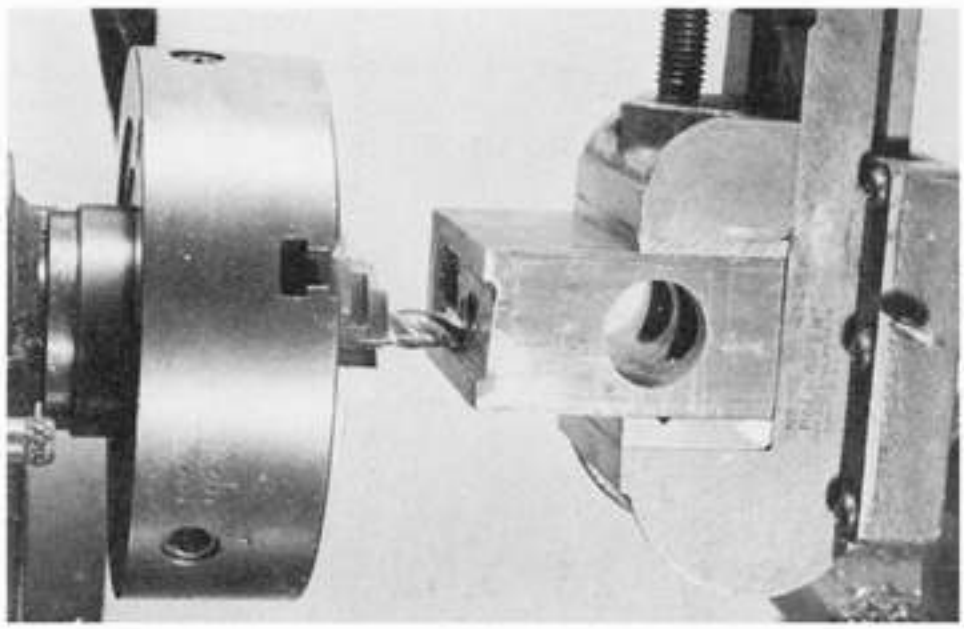


Fig. 2-26

Lacking a regular milling machine some minor milling can be done in a turning lathe setup using a lathe milling attachment as shown here. Here the end mill is being held in the lathe chuck, the receiver in the milling attachment vise and the groove in the bottom of the receiver is being milled out to final size.

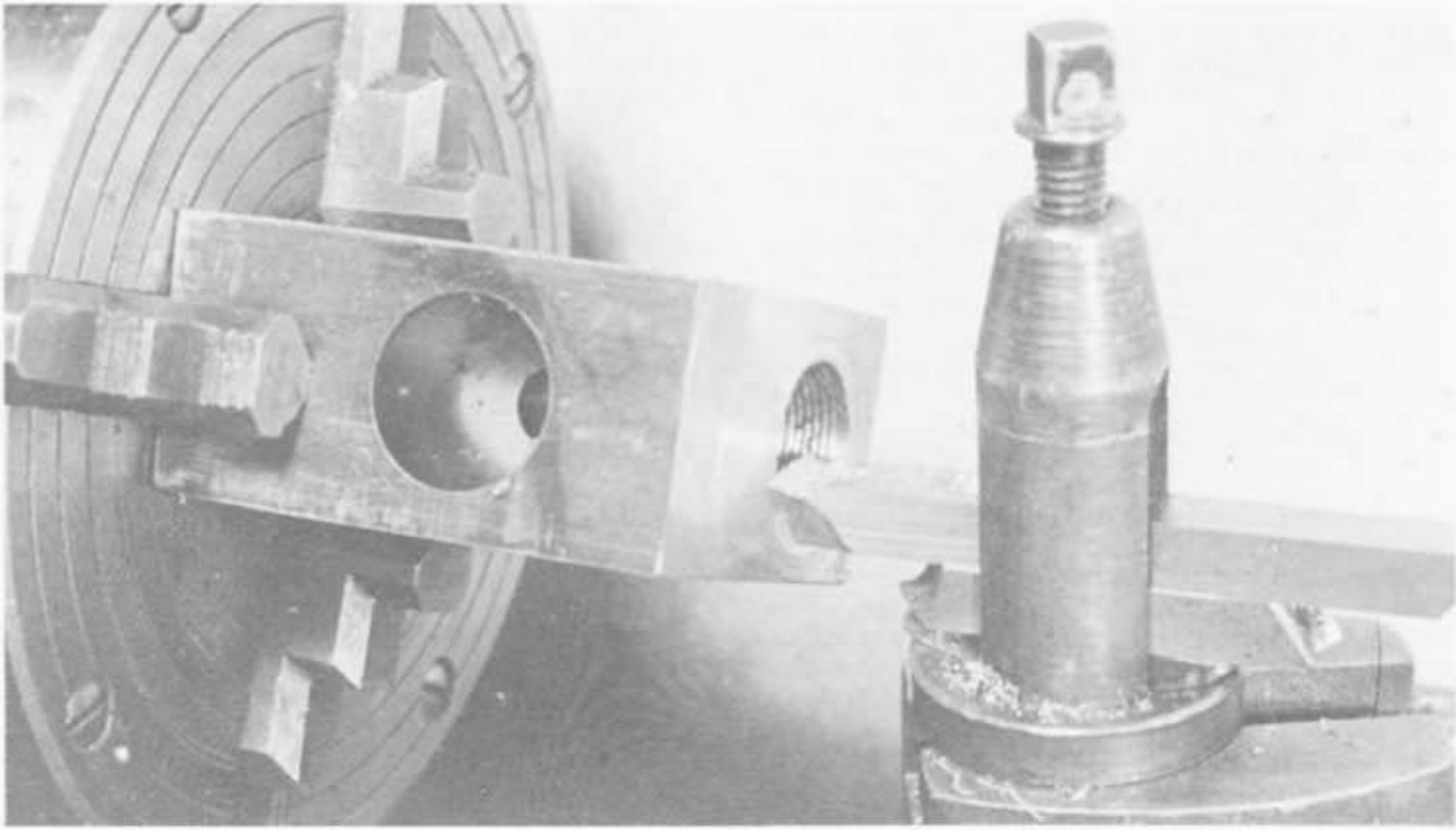


Fig. 2-25

The best way to thread the hole in the receiver for the barrel shank is in a lathe setup. The receiver must be properly centered in the chuck. Then the hole for the barrel shank is drilled and bored out after which the threads are cut as shown here. After the threads are cut then the receiver can be faced off.

Instructions and Sequence of Operations for Making the FM No. 1 Vault Lock Action

The very best steel to use for the receiver is 4140, a chrome-moly steel widely used in the arms industry for making many firearm parts including receivers, breech bolts and barrels. Some steel firms list it in three grades; 4140 Heat Treated, 4140 Normalized and 4140 Annealed. For the purpose of making the FM VAULT LOCK receiver, the first choice is 4140 Heat Treated, with a hardness of RC 27-30. Although it is very tough it can be readily machined and hand worked and it needs no further heat treating after the receiver is finished. The second best choice is 4140 Annealed, which is the cheapest and easiest grade to obtain. As is, it would be suitable for a rifle in .22 Long Rifle caliber, but for all other calibers 4140 Annealed needs to be heat treated to a hardness around 25-30 Rockwell C **before** machining. This heat treating should only be done in a controlled temperature heat treating furnace and our advice is to have this done by a heat treating firm. There are other chrome-moly steels which are also suitable for the receiver but 4140 Heat Treated is the first choice.

The breech block for the FM VAULT LOCK action can also be made from 4140 Heat Treated steel. However, softer steels can also be used such as common steel shafting. For all centerfire calibers, when a softer steel than 4140 Heat Treated is used, the breech block should only be fitted with the Mann-Neidner type firing pin with a hardened bushing. In this case the breech block need not be hardened, although you might want to have its surface hardened by having it carbonized by a heat treating firm.

Use drill rod to make all pins and plungers and none need to be hardened unless otherwise stated in the text. The hammer, hammer pivot block, sear/safty, sear, firing pin and firing pin bushing must be made of tool steel, and with the possible exception of the hammer and hammer pivot block, all must be hardened and drawn. Most of the other small parts can be made of tool steel but they do not necessarily need to be hardened. The trigger and finger lever can be mild steel.

It is suggested that in making this action you follow the step by step sequence as given here.

RECEIVER (See Figs. 2-2 - 2-7)

Start with a block 1½" thick, 2½" wide and about 3.7" long. Face the ends off square, leaving the block 3.6" long. Start by drilling and reaming (or boring) the 1" hole for the breech block. This hole must be made at about a 4° angle, plus or minus 1°. The exact angle degree is not critical. Center the hole on the top of the receiver 1.125" from the front edge and drill from top to bottom. Drill it undersized and then ream (Fig. 2-24) or bore it to 1" size. The hole should then be polished or lapped smooth.

The next step is to drill, bore and thread the hole for the barrel shank. Center the hole equal distance from the top and sides of the receiver. Start by drilling a ½" hole all the way through the receiver, so that this hole through the rear part of the receiver can serve as a quide line for the bottom left corner of the loading port. Making this hole in the receiver and turning down and threading the barrel shank is best done in a lathe setup so that the face of the receiver can be squared up with the threaded hole after the threading is done (Fig. 2-25). The barrel should always be done this way but if you have a rugged milling machine with a collet or chuck to accept a tap of the size needed, then it is alright to tap the threads in the receiver in a mill setup. The barrel shank can be threaded before or after the receiver threading, though we prefer to do it first. Since the FM No. 1 and No. 2 VAULT LOCK receivers are much alike, the information on shank size and thread pitch recommendations applies equally to both. Fig. 3-8 in Chapter 3 shows the barrel shank. We recommend a thread diameter of 1.00" with 14 or 16 threads per inch, preferably the 16 pitch. For small diameter cartridges such as the .222 family, and for moderate pressured ones such as the .30-30 family, a 7/8" diameter thread with 16 pitch threads is suitable. The threads should be close but hand-turnable fit. When you get to the point of the final fitting, the barrel must be set up very tightly into the receiver. This requires some sort of a fixture to hold the barrel and a large wrench or rod inserted into the breech block hole to turn the receiver.

The next step is to make the opening slots in the bottom of the receiver. Make the slot (B in Figs. 2-5 & 2-7) for the finger lever 5/8" wide and 1" deep, and the slot (C in Figs. 2-5 & 2-6) for the trigger mechanism ½" wide and .650" deep. These slots should be centered. All this metal can be removed by milling. These slots are also not too difficult to cut out by hand as most of the metal can be removed by drilling, then sawing and filing or by milling in a turning lathe setup with a milling attachment (Fig. 2-26).

Follow this by making the loading port. The 1/2" hole already drilled lengthwise through the rear of the receiver can form the bottom left corner for this opening. Make the opening about .8" wide, leaving a .3" thick shelf of metal above to support the top of the breech block. Extend the opening forward into the breech block hole as shown in Fig. 2-2. If you do not have a heavy mill, then most of the metal can be removed by honey-combing the area by drilling and then removing the remainder by sawing and filing.

Follow this by making the hammer recess (Fig. 2-2). It must be parallel to the bore line. It should be slightly wider than the 7/16" square hammer that it is to contain (.010" to .020" is ample), and to a depth so only a .10" sidewall remains. The front corners should be as sharp as you can make them, a 1/8" radius would be ideal. Some of the milling can be done with a milling attachment on a lathe or, if you have a heavy drill press and a compound drill press table, some of the milling can be done with it. If you do not have a mill the metal can be drilled, sawed, chiseled and filed out.

Next operation is to remove metal from the top rear of the receiver and shelf, then round and bevel this area as shown in Figs. 2-3 and 2-4. Follow this by angling off the rear of the receiver, recessing it (to prevent the stock from turning) and drilling and tapping the hole (K in Figs. 2-8 and 2-17) (3/8x24 is recommended) for the tang (Fig. 2-1). **Do not** bevel off the bottom edges of the receiver at this time. You will have to do addtional work on the receiver, but now is the time to start making and fitting the parts.

BREECH BLOCK (See Figs. 2-1, 2-8, 2-17 & 2-18)

Make the breech block from a piece of 1" diameter steel about 2" long with the excess on the top to be trimmed off after it has been fitted and hitched to the finger lever. Turn one end square and center and drill a 11/32" hole in that end as shown in Fig. 2-18, drilling almost all the way through. Drill it parallel to the squared-off end. Then enlarge the hole to 3/8" with a reamer or end mill so that the hole is left smooth. This hole must be very closely centered. After the hole is reamed, cut the slot (J in Fig. 2-18) across the bottom of the breech block, and around the front of it. Make this slot 3/16" wide. More instructions will follow.

FINGER LEVER (see Figs. 2-1, 2-8 and 2-19)

Make the finger lever next. We would suggest making this part in two pieces; the main base section first, and afterward the lever part to be welded or silver-soldered to the base as shown (D in Fig. 2-19). Use a piece of mild steel for the base, starting with a piece slightly larger than shown. Position it in the receiver, mark and center-punch the hole for the finger lever pin and drill it. Use drill rod for all pins, and 3/16" is adequate for this pin. Now mill in the 1/4" slot in the base for the extractor. Next fit the finger lever base in the receiver on its pin and do what is necessary so it can swing easily, a close fit is desirable. Follow this by drilling the hole for the ball stem. All of the approximate dimensions can be gotten from Fig. 2-19.

Use a 3/8" ball bearing for the ball. Anneal it, chuck it in a lathe chuck, file a flat spot on it, drill a 3/16" hole halfway through the center of it. Silver-solder this ball on a piece of 3/16" drill rod longer than needed. Considerable trial fitting is required to get a smooth and adequate connection between the finger lever base and the breech block. First test the ball and stem in the breech block and widen the slot for the stem where necessary so that the ball and stem slides easily in the hole in the breech block, with the stem square with the breech block. Now shorten the stem so with the stem in the base, the ball is positioned very close to that shown in the sectional view drawing (Fig. 2-8). Having done this, place the stem in its hole in the base, put the ball in its hole in the breech block, slip the parts into the receiver and put the finger lever pin in place. With one finger pressing down on top of the breech block and another finger under the finger lever base, see if you can swing the base and move the breech block up and down. The chances are that some filing will have to be done on the base and especially on the bottom front edge of the breech block before the two parts can slip past each other. Shorten the stem as required. If you get it too short, drop a small piece of metal in the hole to hold the stem up. When the proper length has been ascertained, silver-solder the stem in place. After silver-soldering, the stem can be bent slightly to achieve the final fit. Next, with the finger lever base and breech block in place and the breech block fully raised, trim off the top of the breech block flush with the top of the receiver. Now open the action and if the breech block does not open far enough so its top is level with the bottom of the loading groove, then do some filing on the finger lever base where necessary so that it will swing far enough in order to lower the breech block to this point or nearly to it as shown in Fig. 2-17.

BREECHING (see Fig. 2-8)

With the breech block fitted, the barrel can now be installed and the breech block fitted to it. The face of the breech block (G in Fig. 2-18) must be made flat where it contacts the barrel. Make the barrel shank long enough so when the breech block is fully raised, its face (at G) is slightly wider than the diameter of the cartridge head, and a width of 5/8" is good. The important thing is that the breech block face must be perfectly flat and square with the bore and breech end of the barrel. With the barrel screwed in tight, the breech block should close snug against the barrel, or not more than .001" clearance.

At this point the barrel can be removed and chambered. Use a finish chambering reamer and cut the chamber so that a new cartridge case will chamber flush with the barrel face. The chambering and headspacing must be done with the utmost care and if you have never done this before, you should consult a gunsmithing book that covers it thoroughly.

EXTRACTOR (see Figs. 2-1, 2-5, 2-8 and 2-17)

The extractor can now be made and fitted. Make it of 1/4" tool steel flat stock, making it as shown. Leave its upper end a bit longer than necesary. File a 1/4" wide slot (P in Fig. 2-5) in the receiver for the extractor so it can be slipped into place ahead of the breech block and project into the threaded hole for the barrel. This slot can be made slightly wider and deeper than needed. Next turn in the barrel tightly. Mark the location for the extractor slot on the barrel, remove the barrel and file in the slot (Q in Fig. 2-17). The slot can also be filed in while the barrel is in the receiver. The depth of this slot at chamber edge should not be greater than .125" for .222 sized cartridges, and no more than .150" for all others. The extractor shown in the drawings is for rimless cartridges. With the extractor in place and held on the finger lever pin, but before the extractor hole has been make oblong, the upper end of it must be filed or milled down so that it does not project further into the chamber than the depth of the extractor groove in the cartridge. After this, mill or file the rim recess in the extractor end, making it slightly deeper than the thickness of the cartridge rim. Next bevel the end, making it about the same angle as the bevel in front of the extractor groove in the cartridge case. Now file the hole in the extractor to an oblong shape toward the upper end so that it can drop to slightly below chamber level. A proper fit is when a case can be chambered with the extractor in place. Now install the spring and plunger in the bottom of the extractor. A 1/16" plunger is adequate, and a cross pin to keep the plunger from falling out is handy.

Drill and tap an 8x40 hole in the front end of the finger lever base for the extractor screw. This plug screw is used to bump the extractor and it has an additional function of providing an adjustment to stop the opening motion of the action so that the breech block can be halted at any level desired.

If the rifle is chambered for a rimmed cartridge, make the extractor without the oblong hole and fit it before the barrel is fully chambered. Make the upper end longer than needed, then dress it down to chamber level and cut in the rim recess with the chambering reamer while the chamber is cut to final depth. The final step in the extractor work is sloping off the upper face of the breech block (H in Fig. 2-18) to make room for the extractor to tip back, also shown in Fig. 2-17. With a rimless extractor this slope must be angled enough so the extractor can tip back far enough to allow a cartridge case to pass over it without interference. For a rimmed cartridge the slope angle has to be less, so the extractor is stopped before it becomes disengaged with the cartridge rim.

HAMMER (see Figs. 2-1, 2-9 and 2-23)

The hammer details are clearly shown in Figs. 2-9 and 2-23. Make the hammer from a piece of 7/16"' square tool steel stock 1.7" long. Drill a 1/4" hole in it at a very slight angle as shown in Fig. 2-9. Make the hammer pivot block as shown, from a piece of 1/4" tool steel. Then file a slot in the open end of the hammer to accept this block. It must fit closely in the hammer. With the pivot block in place in its slot, drill the hole for the hammer pin. A 7/64" pin is adequate. File the hammer and block flush at the end and then file the top and lower front edges of the hammer so it will fit fully forward in the hammer recess. Place a piece of shim stock above and below the hammer to center it in the recess. Push the hammer and the block forward, clamp in place, then drill and tap two 6x48 holes through the receiver wall and in the hammer block for the two block screws. Weaver scope mounting screws will do.

Next file off enough from the front right edge of the hammer so it can pivot slightly forward of the breech block hole, or about a 100° swing. Follow this by filing in the flat hammer recess (I in Fig. 2-18) in the breech block. Use the hammer to mark and spot this area. This recess should be at least .075" deep.

Make the mainspring strut as shown in Figs. 2-9 and 2-23. For the mainspring use a piece of 1/4" stiff wire coil spring long enough so when the hammer is cocked the spring is fully compressed. If the hammer cannot be cocked or if binding occurs, then the mainspring hole may have to be tapered slightly or rounded at the open end, and the hole polished smooth. The hammer action can be tested with a lighter spring at first and when the hammer functions properly the heavier spring put back in.

TRIGGER MECHANISM

The trigger mechanism is next in order. The most vital part of this mechanism is the sear/safety. Fitting it and making and fitting some of the other trigger related parts is a bit tricky if the mechanism is not fully understood. Therefore, before starting to build this mechanism, study all the drawings showing the sear/safety and trigger mechanism, especially Figs. 2-8, 2-10, 2-11, 2-12, 2-13, 2-14 and 2-15. These drawings show the side and rear sectional views of the sear/safety and related parts such as the sear, sear lever, trigger, holddown, etc. These drawings show these parts with the hammer cocked and sear/safety in the SAFE position, with the hammer cocked and sear/safety in the READY-TO-FIRE position, and the sear/safety in the fired position. As can be seen in these drawings, the vital sear/safety moves up and down between the hammer and the sear. When on SAFE, the sear/safety is at its highest position (Figs. 2-10 and 2-11), positively holding the hammer back and its lower end 1/16" or so above the sear. To put the sear/safety in READY-TO-FIRE position, it is merely pushed down with the thumb. It can only go down so far at this point, being stopped by the sear, with its upper end still holding the hammer cocked although the hammer has moved against the beveled edge of this part. With the hammer pressing against this beveled surface (Figs. 2-12 and 2-13), when the trigger is pulled and the sear moves from under the sear/safety, the hammer pushes

the sear/safety down and falls. At the same time, when the hammer passes over the top of the sear/safety, the hold-down engages with it to keep it down until the hammer is cocked again as shown in Figs. 2-14 and 2-15.

To make the trigger mechanism, the first step is to provide a hole for the sear/safety. This hole must be 3/8", but drill it with a 23/64" drill from the trigger opening and then use a reamer or end mill to enlarge it to 3/8". This hole must be located against the left wall of this opening and 1" (to center of hole) forward of the rear edge of this opening.

Continue by drilling and tapping a hole in the left side of the receiver for the sear/safety retainer screw, made in line with the hole for the sear/safety. An 8x40 screw will do fine. Turn off a couple of threads at its end, and make the end flat and smooth. The purpose of this screw is to prevent the sear/safety from turning and to limit its upward movement (Fig. 2-10). Also shown in Fig. 2-10 is the sear/safety hold-down. The hole for this part must be in line with the sear/safety hole and positioned just under the bottom of the hammer recess. This hole must be smooth, so drill it first with a 11/64" drill and then enlarge this hole with a 3/16" reamer. The left end of this hole must then be milled out about 3/16" deep and upward into the hammer recess as shown by A in Figs. 2-2 and 2-3. The lug on the hold-down must project into the hammer recess because it is the hammer that will activate this part. We made the hold-down from a piece of 3/16" drill rod and silver-soldered a lug on it to form the L-shaped piece. The right end of this piece is left unfinished until the sear/safety is made and fitted. To provide sideway (to the right) tension to the hold-down, another 3/16" hole is drilled and reamed into the rear of the receiver and into the hold-down hole as shown in Fig. 2-16. Tap the rear end of this hole for a plug screw. Notch the hold-down stem as shown, make the plunger from 3/16" drill rod, shape its end as shown, so pressure from the plunger will push the hold-down to the right. A rather stiff spring is required for this assembly.

Make the trigger next (Fig. 2-20). Common cold rolled steel can be used. The base of the trigger can be made separately from a piece of 1/2x1/4" strap, with the finger-piece silver-soldered on as indicated by F in Fig. 2-20. Drill the two holes through the receiver with the base of the trigger in place, the rear hole for the sear lever pin and the front hole for the trigger/sear pin. Pins of 3/32" diameter will do fine. Enlarge the rear hole in the trigger to 1/8", allowing the trigger to move yet serving to limit that movement. The spacing of these holes is not too critical, nor is the location of the rear hole, but note that the front hole for the trigger/sear pin is centered slightly forward of the center line of the sear/safety hole and it is important that it be so located.

Make the sear lever next. Make it from 1/8" thick tool steel. Notch the rear right side of the trigger to make room for the sear lever to mount and pivot on its pin, and drill the hole in it the same size as the pin. Drill and tap the trigger for the two adjustment screws: a 6x48 screw or smaller under the sear lever for sear engagement adjustment and an 8x40 screw turned down at one end for the trigger weight of pull adjustment. Drill a shallow hole in the receiver above this screw to hold the trigger spring in place.

Make the sear from tool steel and make it as shown in Fig. 2-22.

Now is the time to make the most vital part of this mechanism—the sear/safety. Make it from 3/8" drill rod, starting with a piece about 1.1" long. When finished it should be about .030" to .045" longer than the distance between the upper part of the sear to the underside of the hammer. The exact length is not too critical and it will depend on how the hammer and trigger parts are spaced in your action. Start by facing off one end and turning it down .180" to a slightly smaller diameter so that this end will easily slip past the cocked hammer, and so a shoulder or step will be left as shown by L in Fig. 2-21. If this end has to be turned down smaller than about .340" in order for it to clear the cocked hammer, then file the hammer thinner—either off its front face or rear. The hammer can be thinned considerably, or even tapered thinner toward the front, this may have to be done anyway later on if the hammer interferes with loading and unloading the action. Now cut a 45° bevel on the turned down end (M in Fig. 2-21). The angle of this bevel may have to be changed later on.

At this time file the point on the hold-down plunger. The edge of the point can be made to coincide with the step on the end of the sear/safety so that it engages over it when the sear/safety is depressed by the hammer. Figs. 2-10, 2-12 and 2-14 show the details.

At this point, start working on the bottom end of the sear/safety. Face off the end square and if it is noticably too long, then shorten it a bit. Follow this by drilling a 5/64" hole in the bottom rear of the sear/safety for its plunger (Fig. 2-8). The spring needs to be a soft one and about as long as the hole is deep. This spring and plunger also supplies tension to the sear. File the notch, shown in Fig. 2-21, about .90" deep and to about the center line. Now file the end so when this end contacts the sear, the hammer also contacts the beginning of the bevel on top, as shown in Fig. 2-12. You may have to make two or more sear/safeties before getting one correct, but that should be no problem. If the rifle is chambered for a small diameter cartridge such as the .222 or Hornet, the top of the sear/safety can be left blunt as shown in most of the drawings. However, if the cartridge is a larger one, the blunt end must be dished out, as shown by N in Fig. 2-21. Dish it out just enough so that it won't interfere with loading and unloading the rifle and then serrate the surface for good thumb purchase.

After you have shortened the sear/safety to correct length, file in the flat spot for the retainer screw. It must be so placed as to hold the sear edge on the sear/safety parallel with the sear edge on the sear. This exact location can best be spotted with the sear/safety fully depressed as in the FIRED position (Fig. 2-15). The bottom edge of this flat should limit the upward movement of the sear/safety to that it won't go any higher than a sure SAFE postion as shown in Figs. 2-8 and 2-10. Remove all file burrs and polish all contacting surfaces. Adjust the sear engagement screw so that there is no slack in the trigger pull. Pull the trigger back and if the sear does not tip enough to disengage with the sear/safety, then turn in the sear adjustment screw a bit further or file back the front lines of the sear edges on either or both the sear/safety and sear.

The important thing is that the sear juncture line must be very closely in line with the rear edge of the sear pin so that downward pressure of the sear/safety on the sear tends to keep the sears engaged rather than the opposite effect. If this alignment is too much directly over the center of the sear pin it can be brought further back by filing the sear notch (O) on the sear/safety. To achieve the trigger weight of pull you want, say anywhere from 2 to 5 pounds, you may have to try different strengths and lengths of springs for the trigger, and

then make an adjustment with the trigger adjustment screw. We recommend you use a medium to medium-heavy tension spring long enough and/or adjusted so that it requires at least 2 pounds weight to move the trigger alone, so that with the hammer cocked the trigger will have at least a 3 pound pull. It is important that the sear contacting surfaces on the sear and sear/safety be flat, square and in full contact with the edges sharp. After hardening both the sear and the sear/safety, the sear contacting surfaces should be carefully honed smooth. You may also have to enlarge the rear hole in the trigger to get additional trigger movement. When everything seems to be in order, disassemble the entire trigger and hammer mechanism. Remove all burrs, polish all contacting surfaces, clean everything good, put some lubricant on the parts (I recommend that Lubri-plate be used on the sliding-fit parts such as the sear/safety, hold-down and hold-down plunger) and reassemble.

Now test the hammer and trigger mechanism. On cocking the hammer the sear/safety should pop up without any interference from the hammer. Now, with your finger off the trigger, smartly depress the sear/safety. It should stop with a definite "click" as it hits the sear and as the hammer swings slightly forward to the beveled edge. If the sear/safety is not stopped at this point, then there is something wrong; not enough sear engagement, sear surface angles or sear edges not sharp enough or the sear contact line too far forward. If the sear/safety is stopped as it must, pull the trigger to allow the hammer to fall. If it does not, then the trouble most likely is that the top edge has too steep an angle, or perhaps the contacting points between the hammer and sear/safety are not polished smooth. Try rounding up the corner of the hammer very slightly, and if this does not allow the hammer to fall when the trigger is pulled, provided the sears disengage, then make the angle 40, 35 or even 30 degrees or enough to allow the hammer to readily and instantly ride the angle and fall. When you get everything working properly, harden and draw the sear/safety and sear. After this, repolish these parts. Use a fine stone to hone the sear surfaces smooth and true. Later, when the action is blued, repolish the sear/safety hole so that is is bright again.

After all of this we suggest you submit the action to an additional test—a test of at least several hundred dry firings; that is, cocking the hammer, depressing the sear/safety, pulling the trigger and letting the hammer drop. Do this with deliberate motions and if the hammer fails to stay cocked when it is cocked, or if the hammer falls when the sear/safety is depressed, or if the sear/safety does not stay down when the hammer passes over it (in which case the hammer cannot be cocked afterwards), or if the hammer does not fall when the trigger is pulled, then measures MUST be taken to correct any of these conditions. The trigger and hammer mechanism must function **properly** and **safely** and if something fails even **once** during this test, you'd better fix it.

TRIGGER GUARD AND SEAR/SAFETY BLOCK (see Figs. 2-1 & 2-8)

The trigger guard is best made by reshaping a new or old guard bow made for a double barreled shotgun. Make the base part from cold rolled steel, shaping and fitting it into the receiver. Weld or silver-solder the bow to this base. Drill the hole for the pin. Cut a slot in the base for the sear/safety block as shown in Fig. 2-8. Make this block from 3/16" thick tool steel, shaping it as shown. The purpose of this safety block is to block the sear/safety (preventing the sear/safety from being depressed while the action is open, thus preventing the hammer from falling), except when the action is fully closed. As shown in Fig. 2-11, this block is activated by the rear end of the finger lever base (R) coming into contact with its lower end. The upper notched end of this block should have a minimum spacing of about .005" with the front bottom edge of the sear/safety when the action is open. If you prefer not to have a separate trigger guard but rather have the finger lever double as the guard bow, then merely make the sear/safety block 1/2" wide, with the rest being the same. Then instead of the short finger lever as shown, make it longer and shape it to suit your taste. You can make it into an S-shaped lever like on the Winchester M-85 or a loop lever like on the Savage Model 99 or any other style.

Provide tension to the finger lever to hold it closed by a spring plunger assembly (Fig. 2-1) in the lower front corner on the side of the receiver as shown in the photograph (Fig. 2-D). With the finger lever removed, drill a 11/64" hole through the receiver wall. Replace the finger lever, and while holding it closed, enlarge this hole with a 3/16" drill, stopping when the drill point has just made a dimple in the finger lever base. This will leave a small collar in the bottom of the hole to retain the 3/16" ball bearing that is used for the plunger. Tap part of the hole for a plug screw and use a short but stiff spring to provide the tension. Deepen the dimple if necessary and, if necessary, employ another spring plunger on the opposite side of the receiver.

FIRING PIN (see Figs. 2-1 & 2-9 and in Chapter 3 see Figs. 3-7, 3-8 & 3-16)

The first choice firing pin installation to use in the FM No. 1 VAULT LOCK action is the gas and blow-out proof Mann-Neidner as shown and described in detail in Chapter 3. It is shown at the left in Fig. 3-16. It is the best choice for all centerfire calibers and especially so for cartridges using the small primers and for cartridges in the pressure range above 45,000 c.u.p. It is also the firing pin to use when the breech block is made of a mild steel because with this firing pin a hardened bushing is used to surround the firing pin tip. Full instructions are given in Chapter 3 on how to install this firing pin.

In this chapter an alternate firing pin installation is shown in Figs. 2-1 and 2-9. This is a good firing pin system but it is not as safe as the Mann-Neidner pin and for this reason it should not be used with cartridges in the higher pressure range. It is also best to use this pin only in a breech block made of chrome-moly steel or some other steel which can be hardened or case hardened. The advantage this firing pin system has over the Mann-Neidner is that it can be easily removed and replaced without removing the breech block from the action, and for this reason it might be the firing pin to use in a target styled rifle in .32-40 or .38-55 caliber. In our two FM No. 1 VAULT LOCK rifles we carry a spare firing pin in a recess in the forearm channel with the forearm having a screw with a coin-slotted head. With the pin we keep a small tool which fits the square head of the pin to easily unscrew the threaded retainer.

Here is how to make and install this firing pin. Make a special center punch to fit the cartridge the rifle is chambered for and with the case and punch in the chamber and the action closed, spot the location for the firing pin hole. Note that the firing pin is at a slight angle through the breech block, but

square with the hammer recess (1 in Fig 2-18) in the rear of the breech block. Deepen the punch mark and drill a 1/16" hole through the breech block. Reverse the breech block and then enlarge this hole to 5/64". Follow this by drilling a 1/4" hole to a depth of about .625". Follow this by drilling and tapping the rear 1/4" of the firing pin hole for a 5/16x24 threaded retainer bushing which can be made from drill rod. Now make the firing pin from 1/4" drill rod. The tip end must be a sung but bind free fit in the 5/64" hole made for it. Make the tip longer than needed. Make the rear stem of the firing pin 3/16" and make it longer than needed. File the stem square and also file a square hole in the retainer for the stem to fit through. The retainer must be flush with the breech block. With the firing pin in place and the retainer turned flush (retainer is turned by turning the firing pin) the firing pin must move at least .060", and ideally it should not move much more than this. Trim the firing pin by holding it to the rear and filing its tip flush with the breech block face, and repeat by pushing the firing pin forward and filing the stem flush with the rear of the breech block. Now trim to correct length by filing the stem so that when the firing pin is fully depressed by the hammer or similar flat piece of metal, the tip protrudes .055" to .060". The end of the tip is then rounded and polished. Drill a 3/32" vent hole in the right side of the breech block as shown. Round up the end of the square stem slightly and then harden and temper the firing pin. The firing pin should be a snug fit, must not bind, it must move quite freely. The retractor spring need not be very strong but it must be sufficient to positively retract the firing pin after a cartridge is fired and the hammer cocked.

The action is now just about completed and ready. Make the tang from 3/8" diameter rod about 4" long, thread one end to fit the hole in the receiver and drill and tap the other end for a 1/4"x28 threaded stock bolt. Bevel off the lower side edges of the receiver, as well as the top front corners. Also bevel off the lower edge of the loading port. the end of the hammer can be lightened by shaping it like a square drawer pull knob, and the front face of this knob serrated. Harden those parts which require it, as mentioned earlier in this chapter. The final steps in completeing the FM No. 1 VAULT LOCK rifle is to stock it, drill and tap it for scope mounts, polishing and bluing most of the metal parts, and reassembling and adjusting the action again.

SCOPE MOUNTS

For additional information on selecting a scope mount for the FM No. 1 VAULT LOCK rifle sees Chapter 3. Perhaps the mounts that will work best on the FM No. 1 VAULT LOCK rifle are any one of the different brands made for the Ruger No. 3 Carbine; Weaver, Cone-trol, Redfield and Buehler makes them. Depending on the size and contour of the barrel you have on your FM No. 1 VAULT LOCK rifle, you may or may not have to shim or alter one or both of the bases to bring them level with each other when attached to the barrel. The spacing between rings will depend somewhat on the scope you plan to use but for most scopes it can be about 3.5".

STOCK AND FOREARM (see Figs. 3-32 & 3-33 in Chapter 3)

Since the FM No. 1 VAULT LOCK rifle has a receiver of almost identical size and dimensions as the FM No. 2 VAULT LOCK, and a similar throughbolt stock fastening arrangement, the information and drawings relating to the stock and forearm in Chapter 3 apply to the FM No. 1 VAULT LOCK rifle as well. We suggest you make the stock and forearm from walnut and that you do all of the fitting of the stock and forearm to the rifle and the shaping of them before the receiver and barrel assembly are polished and blued. If you are a tall person with large hands, we suggest you add 1/4" to both ends of the buttstock so that the pistol grip is set back by 1/4". Also, if you are tall, you might want a forearm that is longer and fuller such as shown on the rifle in Fig. 3-A. It is not always a well figured and colored piece of walnut with a glossy finish on it which makes a fine looking stock, rather it is how well the wood is fitted to the metal, shaped and sanded that counts. In shaping you should strive for straight lines and the elimination of surplus wood, and in sanding to obtain a perfectly smooth and level surface.

Fig. 3-A

The author's FM No. 2 VAULT LOCK sporter in .223 Remington caliber. It has a 24" sporter weight barrel on which is mounted a Weaver K-6 scope in Redfield Jr. mounts. The wood is French walnut with the buttstock fitted with a Neidner checkered steel buttplate and pistol grip cap. The forearm is mounted on a through-bolt and floats free of the barrel. The action here is shown cocked.

Chapter 3

HOW TO MAKE
The FM. No. 2 Vault Lock Action and Rifle

We take great pride in presenting to you this FM No. 2 VAULT LOCK rifle and action (Figs. 3-A & 3-B). One of the rifles that we built on this action is shown on the cover, a fine rifle in every way. After reading our description of this action in Chapter 1 and seeing the illustrations of it we think you will agree with us and will want to build a rifle on it. We recommend you try it.

The No. 2 VAULT LOCK is a natural spin-off from our No. 1 VAULT LOCK as described in Chapter 2. We designed the No. 2 to be more acceptable to the majority of single-shot rifle fans. In the No. 2 we retained the easy to make cylindrical breech block system and the side loading feature in a compact receiver, but from there on almost everything else differs greatly from the No. 1. The thing you will notice first is that we have done away with the odd-ball horizontally swinging hammer and replaced it with a more conventional center hung hammer (Fig. 3-C). We have also eliminated the usual swing-down-and-forward under finger lever and in so doing developed what we think is one of the most unusual and fastest operating falling block actions ever designed.

Briefly described, the No. 2 VAULT LOCK action is a very compact falling block single-shot action featuring the following: cylindrical breech block, side loading, center hung hammer that cocks on opening the action, adjustable single stage trigger, automatic safety and an extractor/ejector system that is adaptable for rimmed or rimless cartridges, and the lowest possible scope mounting. But the feature which makes this action so unique is the trigger guard housing and its movement in the receiver and its linkage with the breech block. This housing contains the trigger, hammer and safety parts and these parts move with the housing as it swings down on opening the action.The unusual thing about it is that this housing is hinged to the receiver at the rear (Figs. 3-D & 3-E). At the front the housing is harnessed to the breech block. To open the action you merely squeeze the spur on the trigger guard against the grip and, presto, the action snaps open. It is done with the triggering hand, the hand does not have to leave the grip area to do it (Fig. 3-F) and in that one fast motion of opening the action the breech block is pulled down, the hammer cocked as it is drawn down into the receiver, the safety automatically engages with the hammer to lock it in the SAFE position and the extractor activated to extract and eject the cartridge case. Its mode of operation is very similar to that of the Heeren action as shown and described in Chapter 46 in my book **Single Shot Rifles and Actions**. To close the No. 2 VAULT LOCK action you merely push upwards on the front of the trigger guard which leaves the action cocked (Fig. 3-G) and to fire it you pull back on the safety and pull the trigger.

Even though there is only a short movement or swing of the trigger guard needed to open the action, opening the action requires little effort. It is best done with a quick motion and if done that way the hammer will always be fully cocked and put on SAFE, and the cartridge case ejected out of the action. Closing the action after the rifle has been loaded is quick and easy and this is best done just as the action is opened—by two fingers below the front extension of the trigger guard and the thumb on top of the receiver. The trigger is fully adjustable and a short, crisp let-off is easily obtainable. In fact, the trigger and hammer arrangement and the position of the sears on them is not too unlike that found on the Colt and Smith & Wesson revolvers.

In designing this action we made a deliberate effort to hold parts to a minimum and keep them simple. Our first No. 2 action was made without the use of a milling machine just to prove to ourselves that it could be done. Later on we made several more but used a small mill to make the receiver and trigger guard.

This action can be scaled down in certain of its dimensions to make it slimmer and lighter for making a rifle in the .22 L.R., .22 WMR or .22 Hornet calibers. This scaling down should only be done in the width dimension. For example, instead of making the breech block one inch in diameter it can

Fig. 3-B

Close-up view of an FM No. 2 VAULT LOCK action showing it closed and with the hammer is the fired position. Because the action is loaded from the side the scope can be mounted as low as its objective lens cell will permit and it won't interfere with the loading operation. To lighten this action, recesses were milled in both sides of the receiver. Note the excellent pistol grip, and the checkering done by Mark de Haas.

Fig. 3-C

An angled view of the FM No. 2 VAULT LOCK action showing the round breech block, center hung hammer and the safety.

be made 7/8" diameter and make the receiver 1-1/4" in width. Other than for a feather weight small cartridge rifle we feel that the No. 2 action as we have dimensioned it is ideal in size and perfectly proportioned for a sporting rifle.

It is the ideal action for most centerfire cartridges ranging from the .22 Hornet on up to the .30-06. We do not recommend it for any of the belted magnum cartridges and we do not recommend scaling the action up. We also do not recommend it be used for any of the very hot commercial cartridges such as the .220 Swift and .270, or for any of the hot wildcats or so-called "improved" cartridges.

This action can also be made with no pins showing through the receiver and in a take-down version as will be described at the end of this chapter.

If you run into a problem in the building of your action which we have not adequately covered in the plans, write us and we will make every effort to help you with it. We want you to make a rifle that you will be proud of, a rifle that will be safe and shootable (Figs. 3-H, 3-I, & 3-J).

Fig. 3-K shows how we used the No. 2 VAULT LOCK action to build a .22 Long Rifle caliber target rifle. This shows that this action is adaptable for building various different types of rifles, all the way from a light sporter to a heavy target rifle. The drawings and instructions to follow include how to adapt this action to the .22 rimfire cartridge.

Fig. 3-D

The FM No. 2 VAULT LOCK action closed, showing the hammer in the FIRED position. Note the small hole in the side of the breech block—a hole which aligns with the firing pin to allow powder gases to escape harmlessly in the rare event of a ruptured primer.

Fig. 3-E

Close-up view of the action opened, and as shown, it is opened by squeezing the spur on the trigger guard against the pistol grip. The opening is one quick movement which lowers the breech block to expose the chamber, cocks the hammer as it is drawn inside the receiver out of the path of the loading port, engages the safety with the hammer and activates the extractor to extract and eject the case from the chamber. To close the action the trigger guard is swung up by finger pressure on its forward end. On closing the action the hammer remains cocked and on SAFE.

Fig. 3-F

The FM No. 2 VAULT LOCK is simple, easy and quick to operate, load and fire. As shown here it is only necessary to place the thumb on top of the grip and two fingers on the trigger guard spur, squeeze and presto, the action is open, the fired case extracted and ejected from the action, the hammer cocked and the safety automatically engaged. To close the action merely swing the trigger guard up again with the finger under the front of the guard which leaves the action cocked and ready to fire after disengaging the safety. The opening motion should be done smartly to eject fired cases and less smartly for extraction without ejection.

Fig. 3-G

On closing the No. 2 VAULT LOCK action, the hammer is left cocked and on SAFE as shown here and to fire the rifle the safety must first be pulled back.

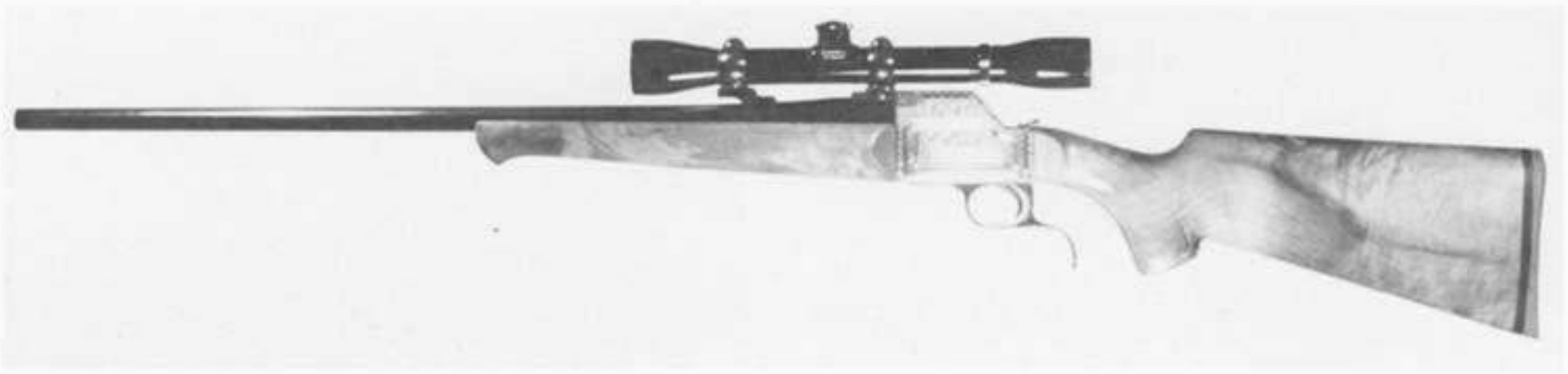


Fig. 3-H

One of the author's FM No. 2 VAULT LOCK rifles. It has a stock and forearm made of myrtlewood, a Bushnell scope in Buehler mounts and an engraved receiver, engraving done by Neil Hartliep.

Fig. 3-I
Close-up of the engraved action on the rifle shown in Fig. 3-H. It is shown here opened.

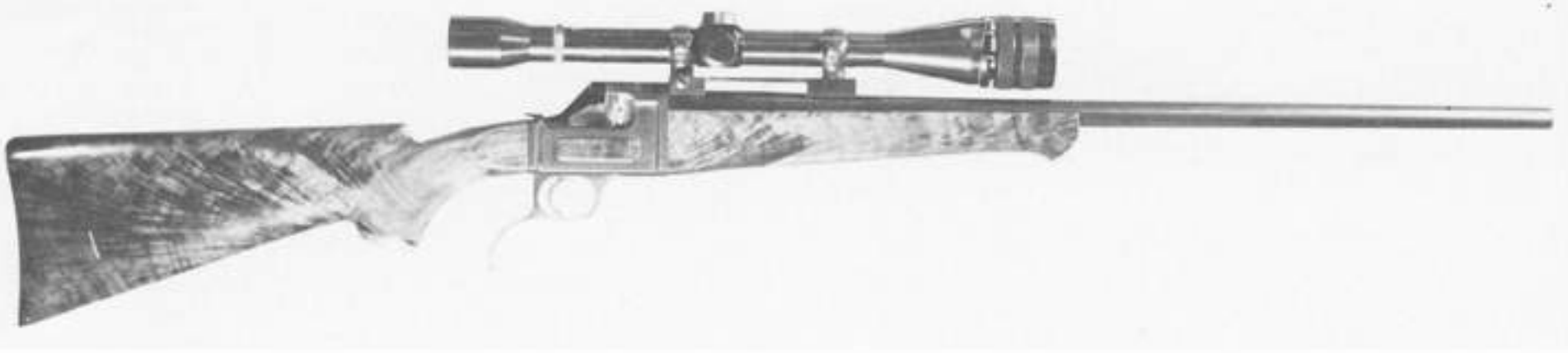


Fig. 3-J
Amateur gunsmith Ronald Van't Hof made this fine FM No. 2 VAULT LOCK rifle in .223 caliber. He used an extra fine piece of Claro walnut for the stock and forearm and the same wood is used for the inletted wood panels in the receiver. It is a rifle to be proud of.

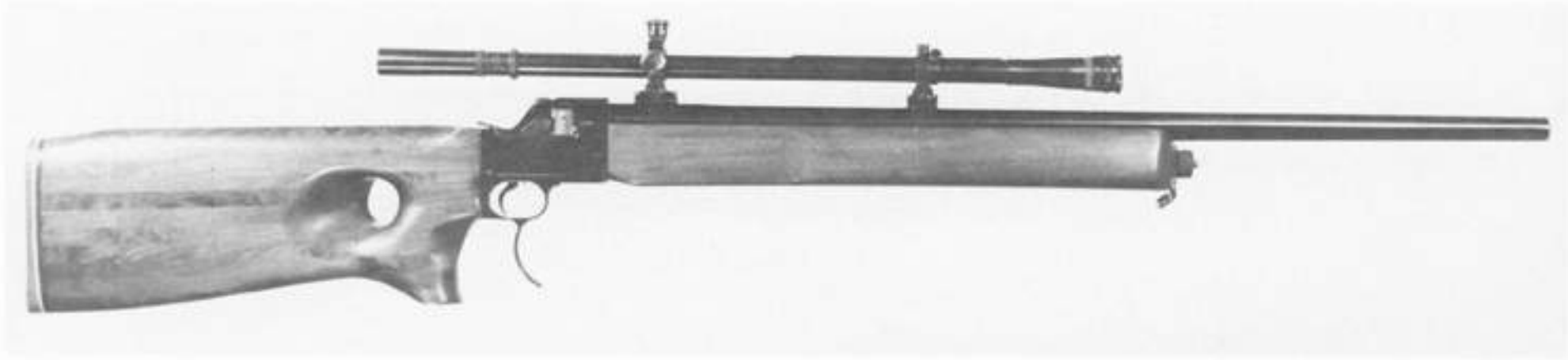
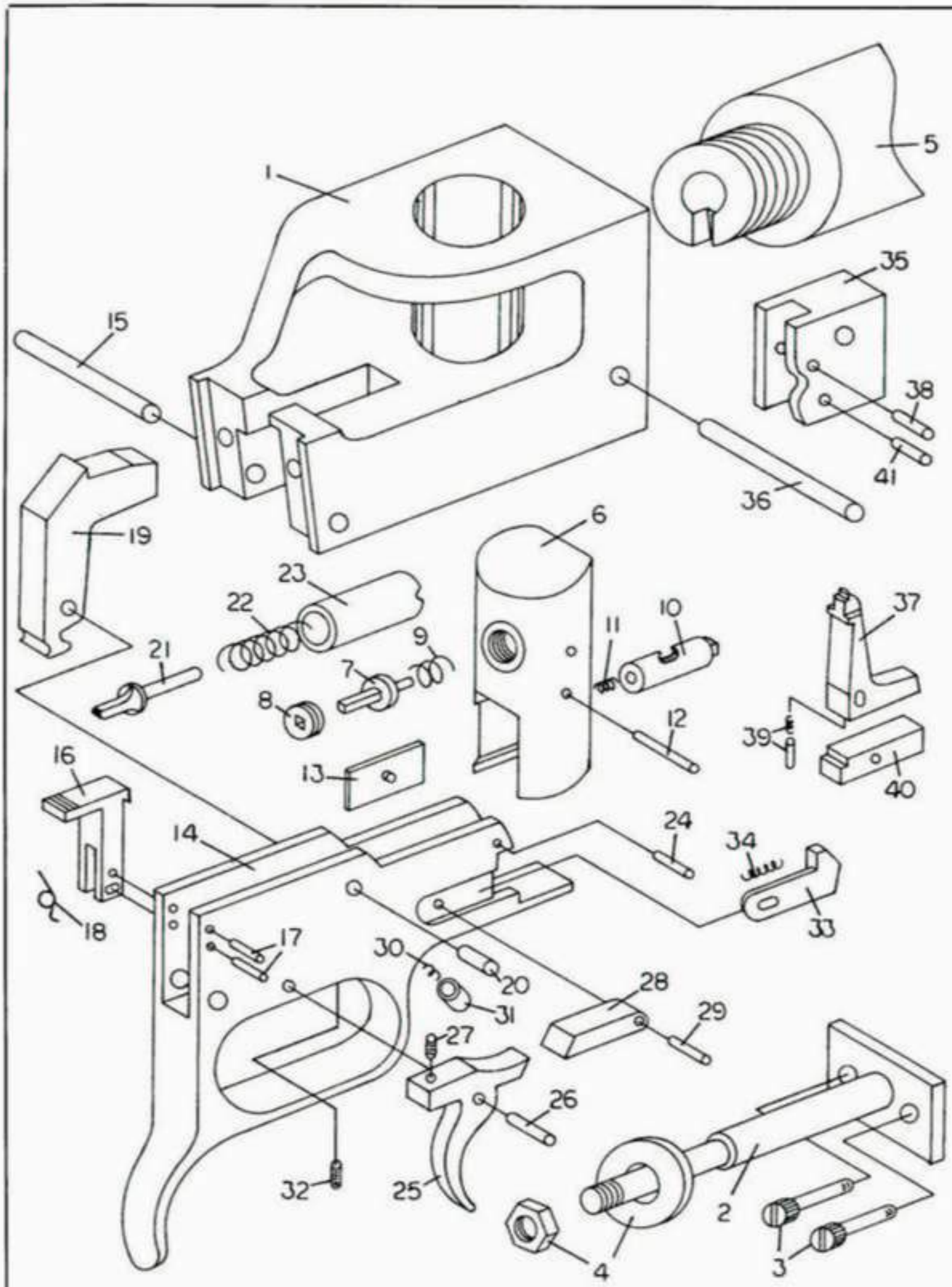


Fig. 3-K
Our thumbhole stocked .22 rimfire target rifle. This rifle with medium-heavy Shilen barrel is very accurate and comfortable to shoot.

CAPTIONS for drawings and photos with some preliminary instructions for making the FM No. 2 VAULT LOCK action.

NOTE: All the drawings except Fig. 3-1 are made actual size and any dimensions not given can be taken from the drawings.



COMPONENT PARTS

1. Receiver
2. Tang
3. Tan screws (two 10x32)
4. Tang nut and washer
5. Barrel
6. Breech block
7. Firing pin
8. Firing pin retainer nut
9. Retractor spring
10. Breech block plunger
11. Breech block plunger spring
12. Breech block plunger retainer pin
13. Pivotal bar
14. Trigger guard housing
15. Trigger guard housing hinge pin
16. Safety
17. Safety pins (2)
18. Safety spring
19. Hammer
20. Hammer pin
21. Mainspring plunger
22. Mainspring
23. Mainspring sleeve
24. Mainspring sleeve pin
25. Trigger
26. Trigger pin
27. Sear engagement adjustment screw
28. Trigger lever
29. Trigger lever pin
30. Trigger spring
31. Trigger spring adjustment screw
32. Overtravel adjustment screw
33. Hold-close plunger
34. Hold-close plunger spring
35. Extractor housing
36. Extractor housing retainer pin
37. Extractor
38. Extractor pin
39. Extractor spring and plunger
40. Extractor lever
41. Extractor lever pin

Fig. 3-1 EXPLODED VIEW

This is the exploded view drawing, with all parts identified and numbered. It also shows the general shape of most parts and their relationship to each other. The parts in this view are not drawn to scale.

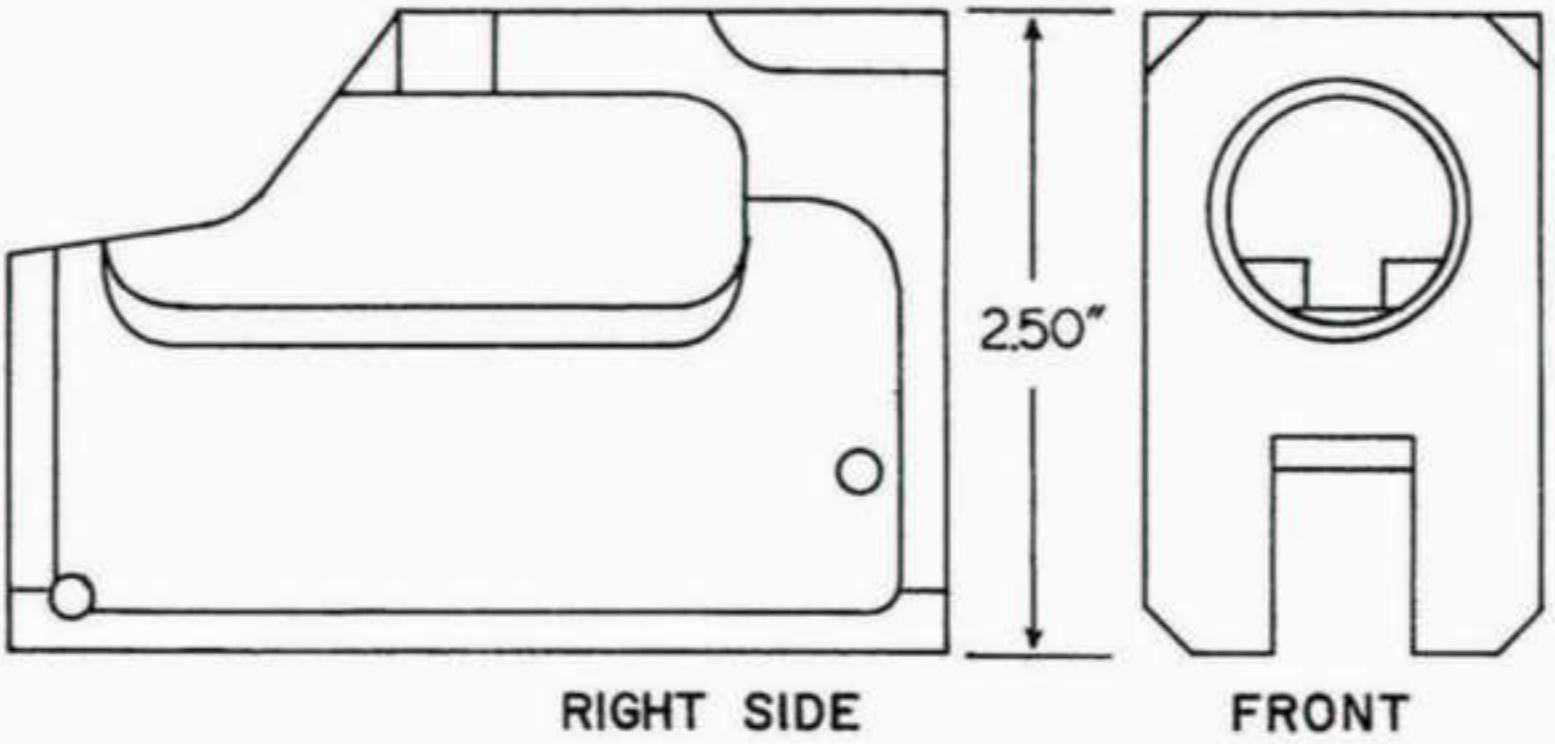


Fig 3-2 RIGHT SIDE AND FRONT VIEW OF RECEIVER

This drawing shows the receiver with a right hand loading port, but for the left handed shooter the port can be milled into the left side. The upper rear contour of the receiver can also be made different than shown. More metal can also be cut from the beveled areas to reduce weight. The recessed side panels can be omitted, but they help reduce weight and add much to the finished look of the action.

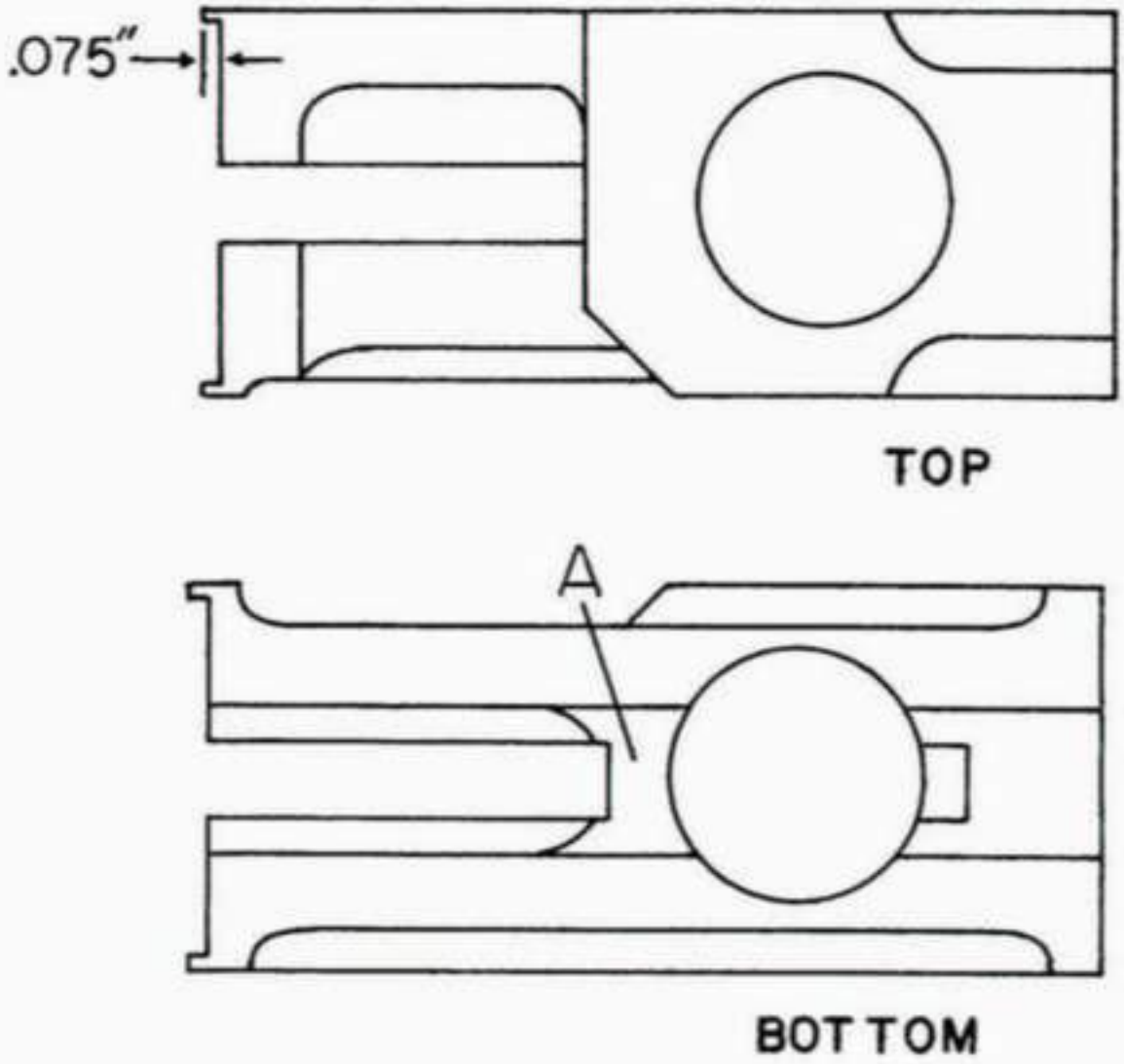


Fig. 3-3 TOP AND BOTTOM VIEW OF THE RECEIVER

The area pointed out by letter A is the lower support metal for the breech block, also shown more clearly in Fig. 3-5.

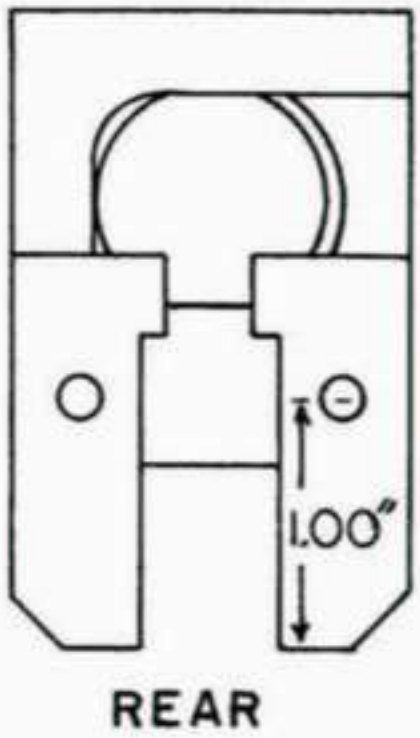


Fig. 3-4
REAR VIEW OF THE RECEIVER

The side wall of the loading port can be made thinner than shown.

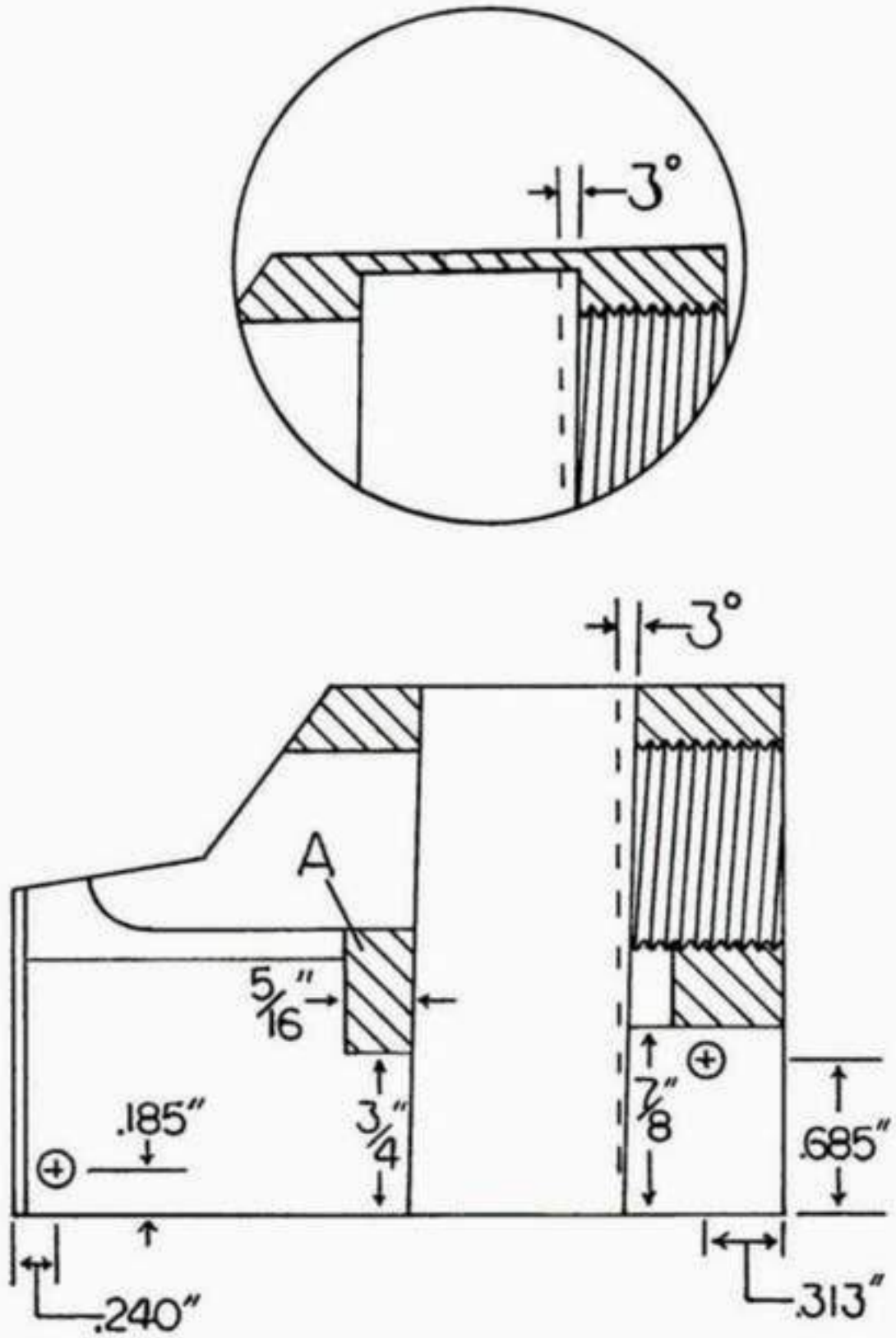


Fig. 3-5 SIDE CROSS SECTION OF THE RECEIVER

This also shows the location of the trigger guard hinge pin and the suggested angle of the breech block hole. The insert, at top, shows an alternate blind hole construction for the top shelf. See text for details.

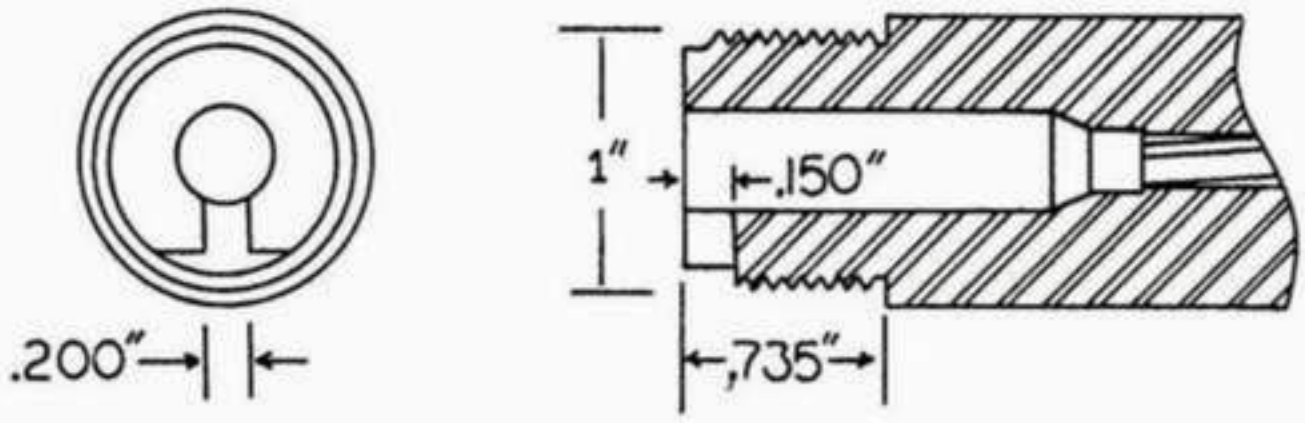


Fig. 3-6 SIDE CROSS SECTION AND END VIEW OF BARREL SHANK

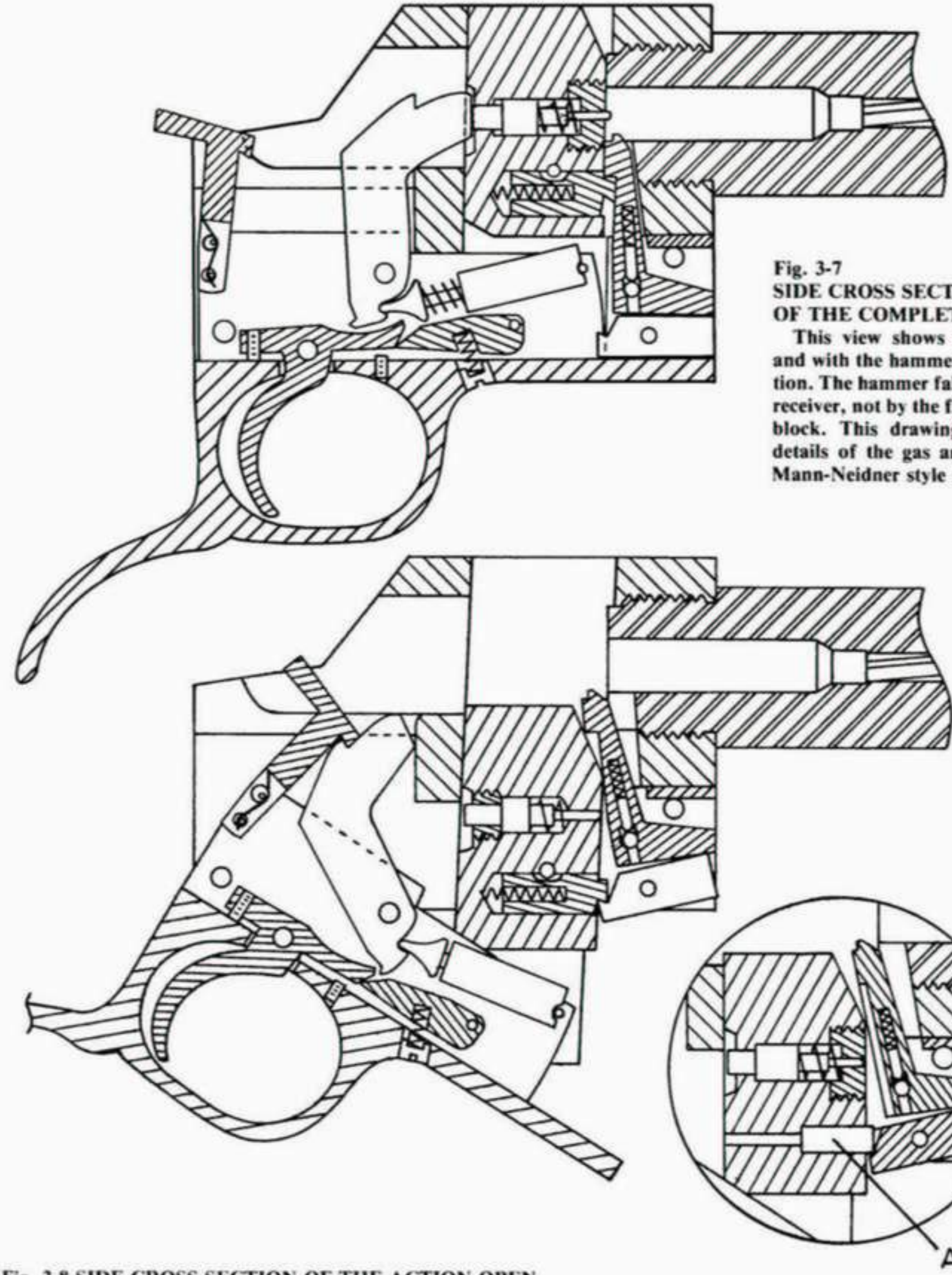


Fig. 3-7
SIDE CROSS SECTION OF THE COMPLETE ACTION

This view shows the action closed and with the hammer in the fired position. The hammer fall is stopped by the receiver, not by the firing pin or breech block. This drawing also shows the details of the gas and blowout proof Mann-Neidner style firing pin.

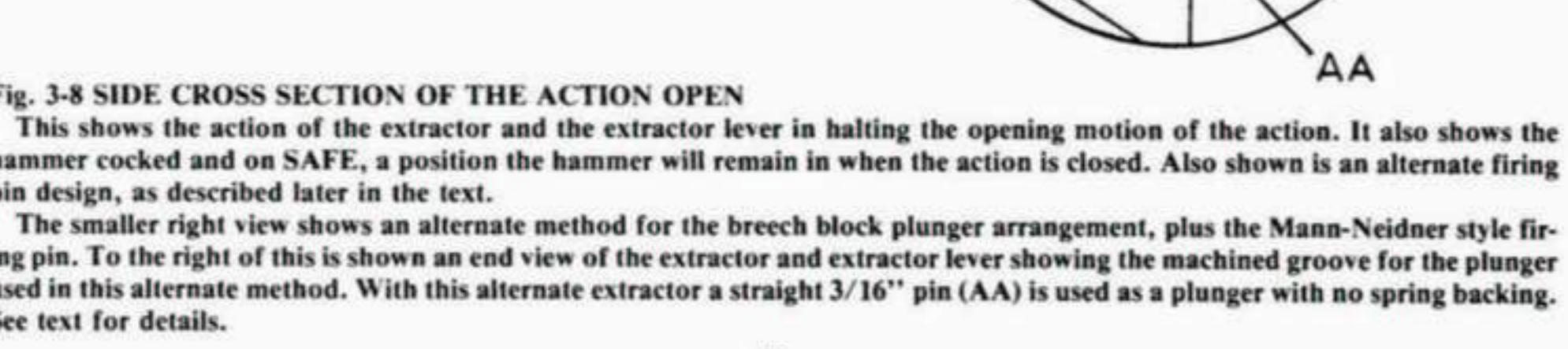


Fig. 3-8 SIDE CROSS SECTION OF THE ACTION OPEN

This shows the action of the extractor and the extractor lever in halting the opening motion of the action. It also shows the hammer cocked and on SAFE, a position the hammer will remain in when the action is closed. Also shown is an alternate firing pin design, as described later in the text.

The smaller right view shows an alternate method for the breech block plunger arrangement, plus the Mann-Neidner style firing pin. To the right of this is shown an end view of the extractor and extractor lever showing the machined groove for the plunger used in this alternate method. With this alternate extractor a straight 3/16" pin (AA) is used as a plunger with no spring backing. See text for details.

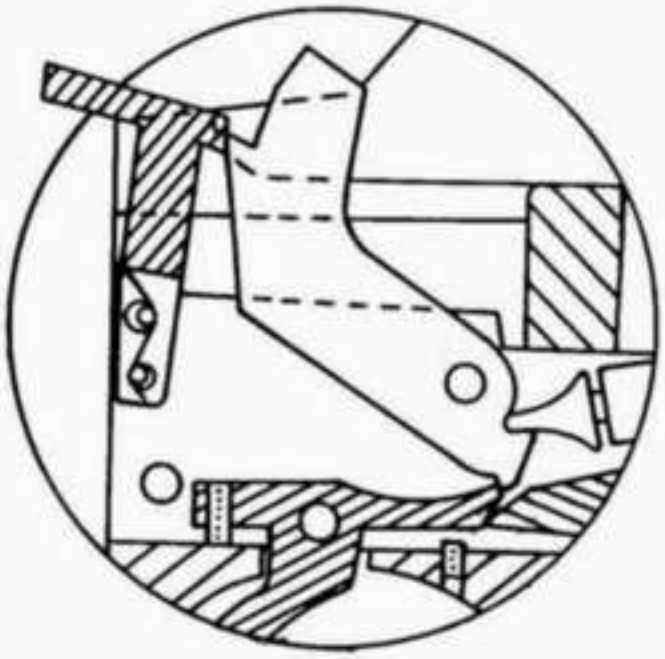


Fig. 3-9
VIEW OF THE FIRING MECHANISM IN FIRE POSITION

This shows the safety disengaged from the hammer and the trigger engaged with it.

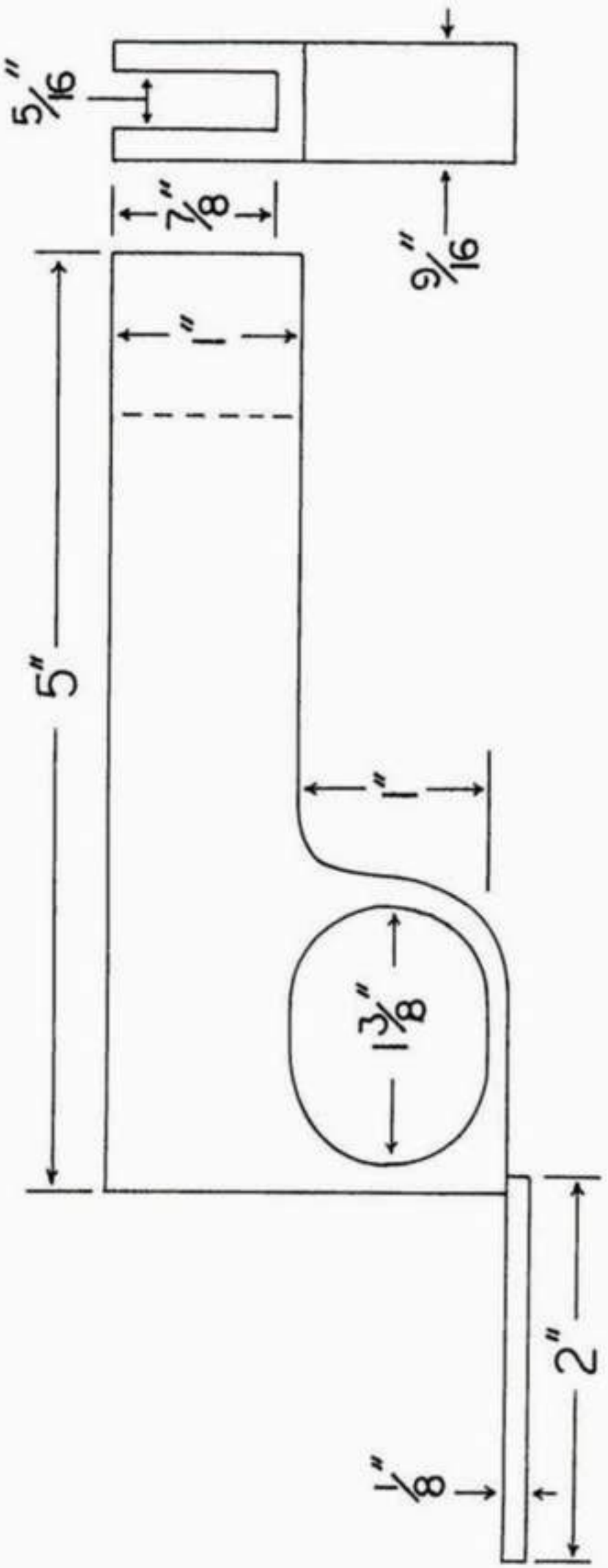


Fig. 3-10
ROUGH MACHINED TRIGGER GUARD HOUSING

This drawing shows a side and front view of a rough machined trigger guard housing. If it is made as shown the extractor housing is made as part of it, to be sawed off on the dotted line.

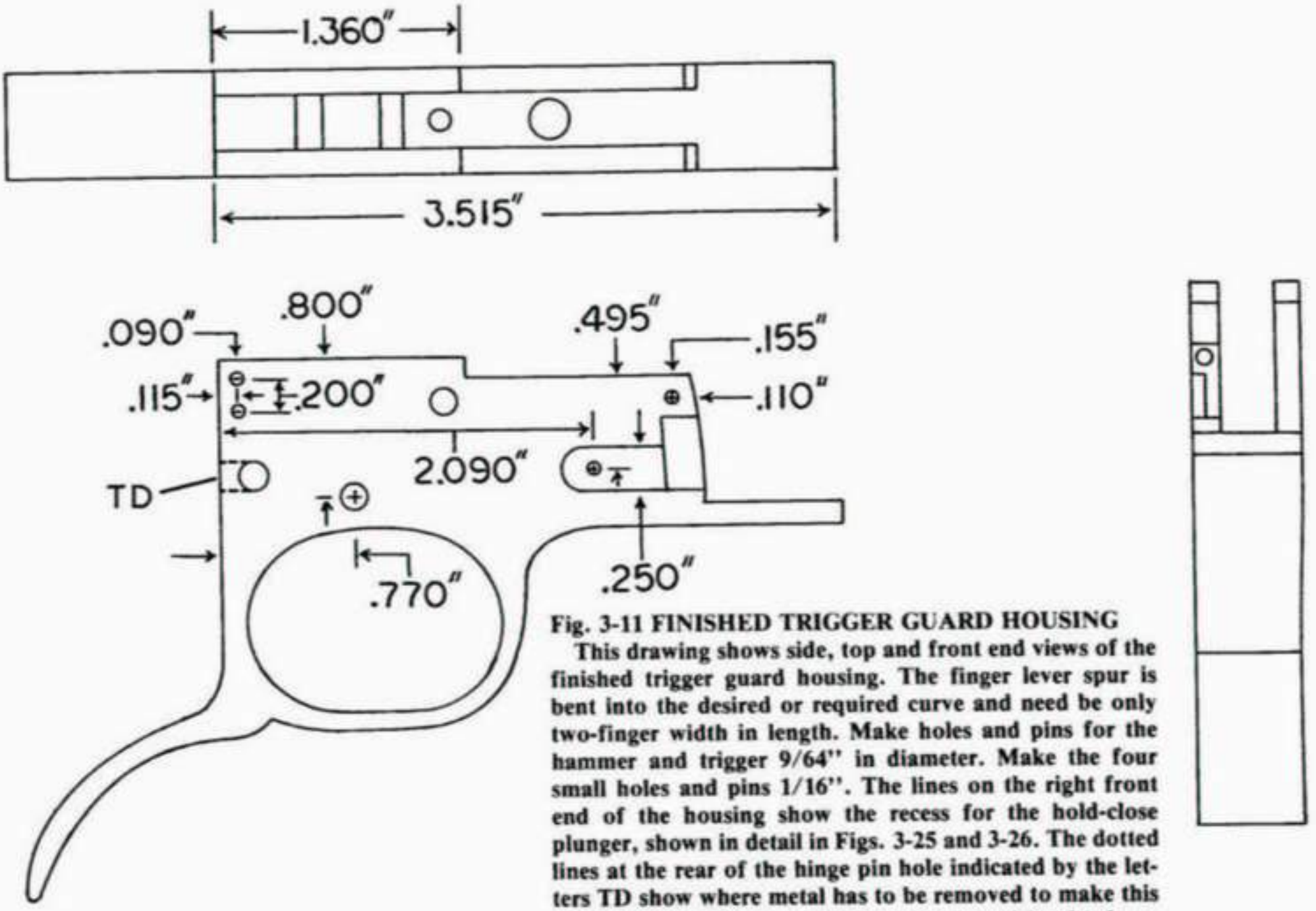


Fig. 3-11 FINISHED TRIGGER GUARD HOUSING

This drawing shows side, top and front end views of the finished trigger guard housing. The finger lever spur is bent into the desired or required curve and need be only two-finger width in length. Make holes and pins for the hammer and trigger 9/64" in diameter. Make the four small holes and pins 1/16". The lines on the right front end of the housing show the recess for the hold-close plunger, shown in detail in Figs. 3-25 and 3-26. The dotted lines at the rear of the hinge pin hole indicated by the letters TD show where metal has to be removed to make this hole a slot in order to make the action a quick take-down one as described at the end of this chapter.

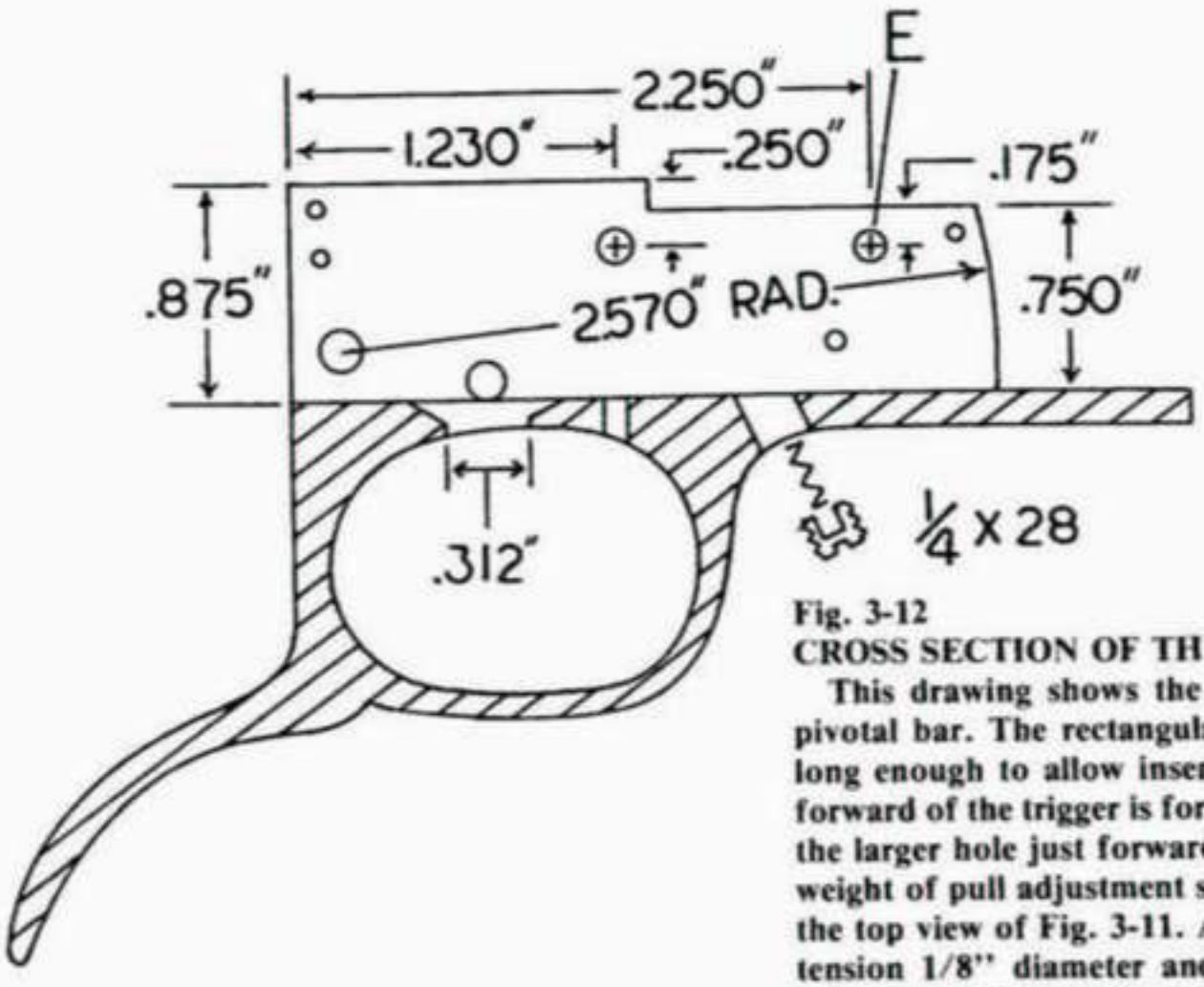


Fig. 3-12
CROSS SECTION OF THE TRIGGER GUARD HOUSING

This drawing shows the location of the hole (at E) for the pivotal bar. The rectangular hole for the trigger need be only long enough to allow insertion of the trigger. The round hole forward of the trigger is for the trigger overtravel stop screw and the larger hole just forward of the guard bow is for the trigger weight of pull adjustment screw. These holes are also shown on the top view of Fig. 3-11. A trigger spring of medium or heavy tension 1/8" diameter and about 1/2" long is adequate and primary adjustment is made by shortening the spring as required.

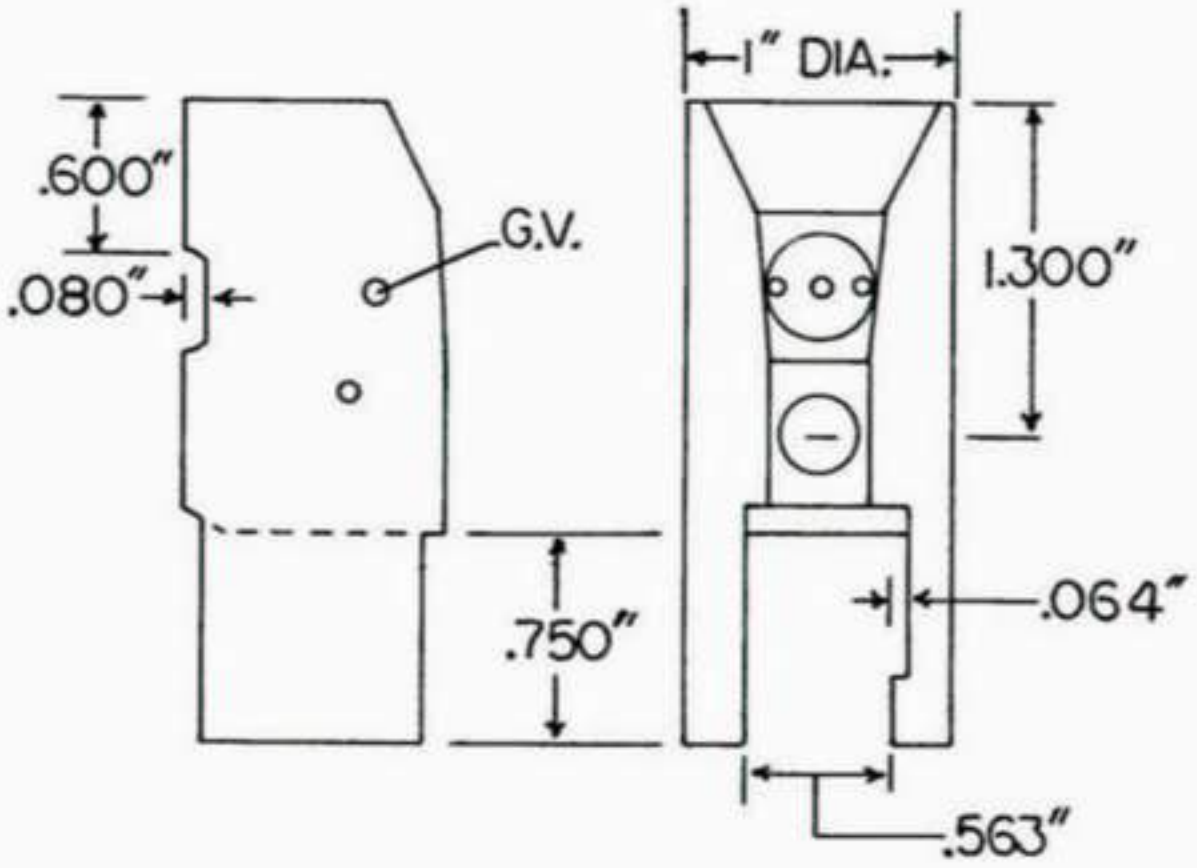
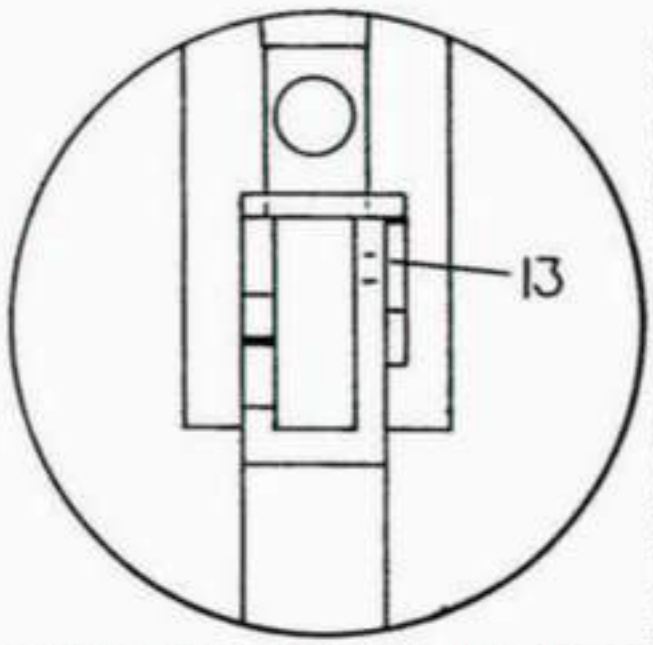


Fig. 3-13 BREECH BLOCK

This drawing shows side and front views of the breech block. The side view (left) shows the right side of the breech block and the small hole near the top is the vent hole (marked G.V.) drilled into the retractor spring area of the firing pin hole. A hole of 5/32'' is adequate for this. The front view shows the bushing, with spanner wrench holes, for the preferred Mann-Neidner style firing pin.

Fig. 3-14 BREECH BLOCK SKIRTS AND PIVOTAL BAR



This drawing shows a front view of the front end of the trigger guard housing inside the skirts of the breech block with the pivotal bar in place. The pivotal bar is the link between the housing and the breech block, and the groove it slides in must be wider than the bar in order to fully open the action. See text for further details.

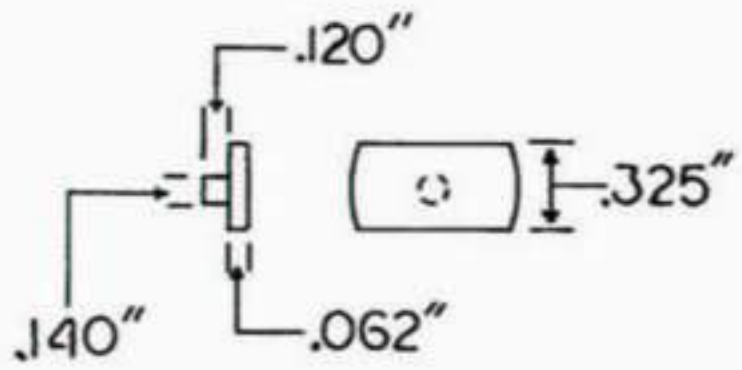
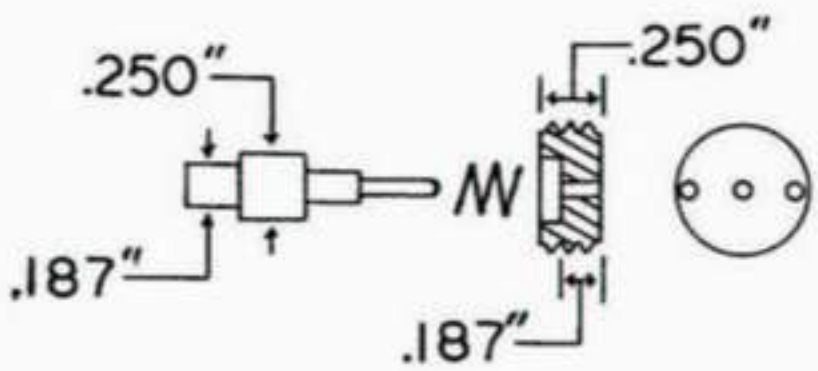


Fig. 3-15 PIVOTAL BAR

This drawing shows the end and side views of the pivotal bar. This bar fits in the hole marked E on Fig. 3-12. A 1/8'' hole and stud is adequate.



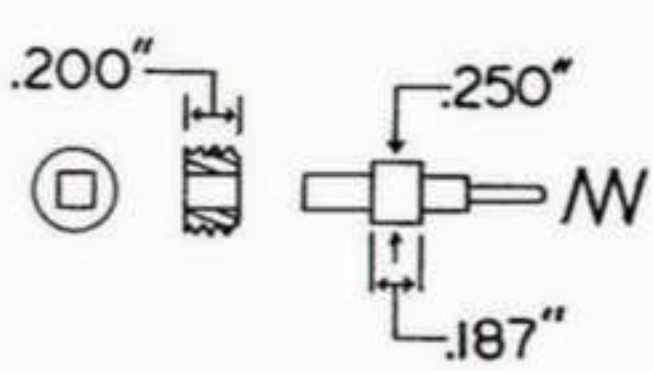


Fig. 3-16 FIRING PIN

This drawing shows views of two different style firing pins, firing pin retainers and firing pin retractor springs. The Mann-Neidner type, shown at left, is always preferred. See text for further details.

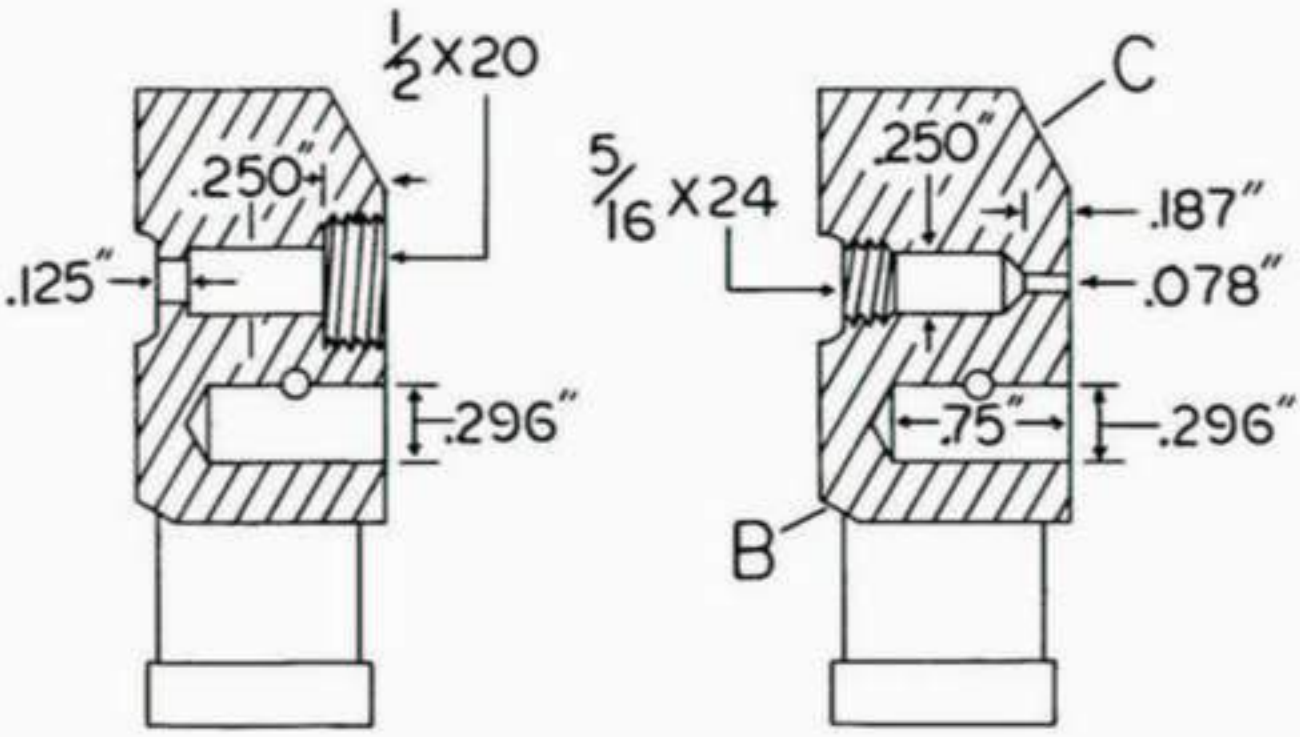


Fig. 3-17
CROSS SECTION OF BREECH BLOCK

This drawing shows side cross section views of two different methods for making the firing pin hole. The left view shows the required hole for the Mann-Neidner style firing pin, while the right view shows an alternate method. These views also show the breech block plunger hole. The letter B indicates the angled bevel which is needed to allow the action to fully open. The letter C indicates the angled surface on the upper face of the breech block to provide room for the extractor to tip back. As shown this angle is about correct for most rimless cartridge extractors. See text for more details.

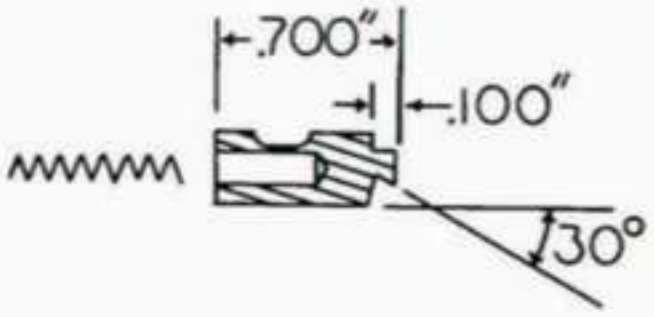


Fig. 3-18 BREECH BLOCK PLUNGER

This part serves three functions: (1) to activate the extractor, (2) to halt the opening motion of the action and (3) to halt the upward travel of the breech block. A medium tension spring, 1/8" in diameter, is adequate. A 3/32" retainer pin is adequate.

Fig. 3-19 .22 RIMFIRE FIRING PIN

A firing pin of this type is suitable for the .22 rimfire and for low pressure centerfire cartridges, but NOT for any others. The body diameter can be anything between 3/16" and 1/4" with a tip size of 5/64". The retainer pin should be at least 5/32".

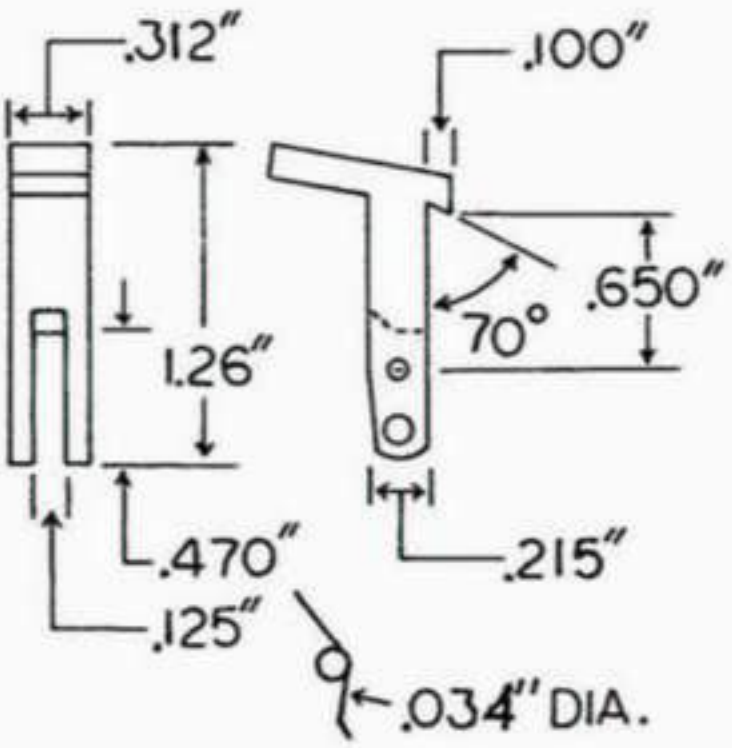


Fig. 3-20 SAFETY

This drawing shows rear and side views of the safety, and the safety spring. The large hole near the bottom of the safety limits its pivotal motion. The spring has only one coil and is made of .034" diameter spring wire. See text for further details.

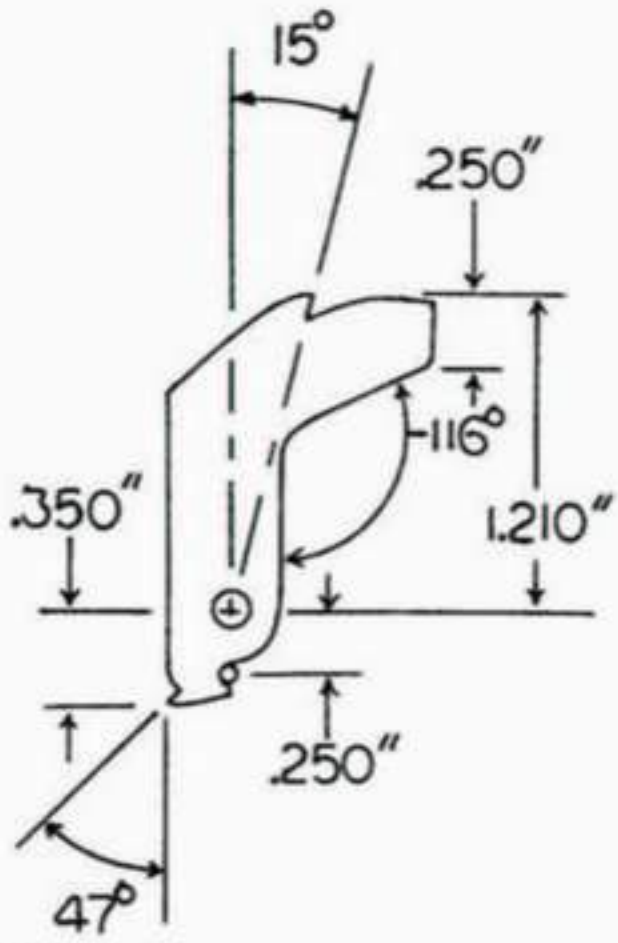


Fig. 3-21 HAMMER

This drawing shows a side view of the hammer. The hammer is 5/16" thick. See text for more details.

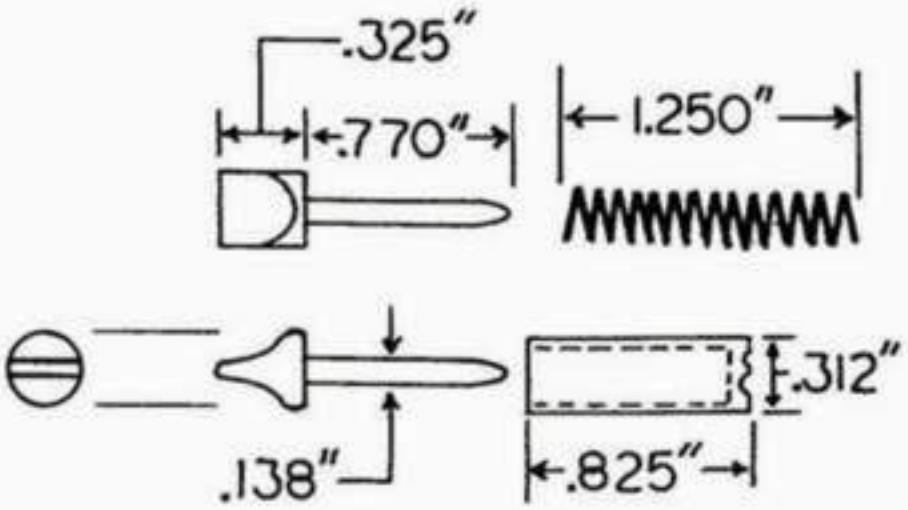


Fig. 3-22 MAINSPRING PLUNGER

This drawing shows views of the mainspring arrangement. At the left are the rear, top and side views of the mainspring plunger and at the right are the mainspring sleeve and the mainspring. The mainspring must be heavy tension and made as long as possible in the space provided for it.

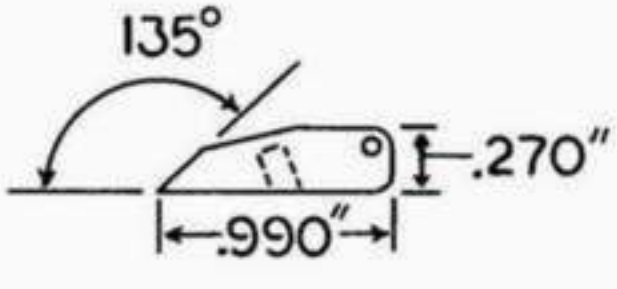


Fig. 3-24 TRIGGER LEVER

This part, like the trigger, safety and hammer, is 5/16" thick. This part pivots on the same pin that holds the hold-close plunger in place.

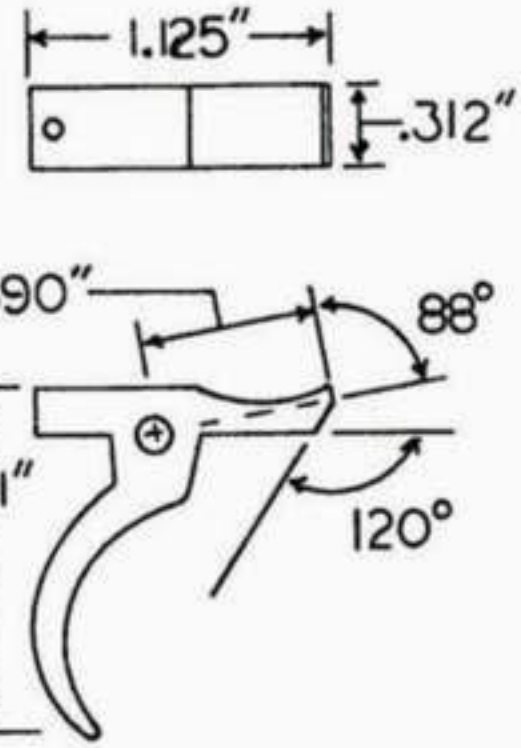
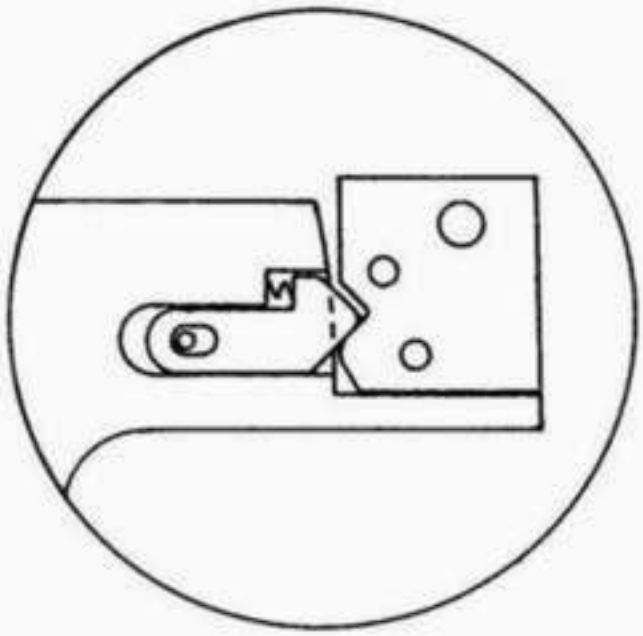


Fig. 3-23 TRIGGER

This drawing shows top and side views of the trigger. See text for further details.

Fig. 3-25 HOLD-CLOSE PLUNGER ARRANGEMENT



This drawing shows a view of the hold-close arrangement. It shows the front right end of the trigger guard housing with the hold-close plunger and spring in place and the plunger engaged in its notch in the extractor housing.

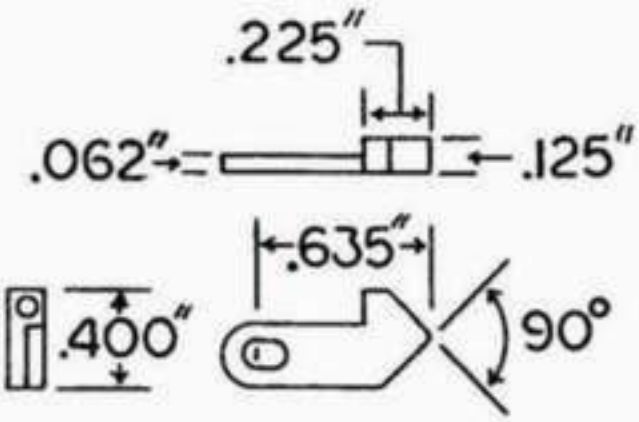


Fig. 3-26 HOLD-CLOSE PLUNGER

This drawing shows top, side and rear end views of the hold-close plunger. The spring is a heavy tension one, 3/32" in diameter and 5/8+" long.

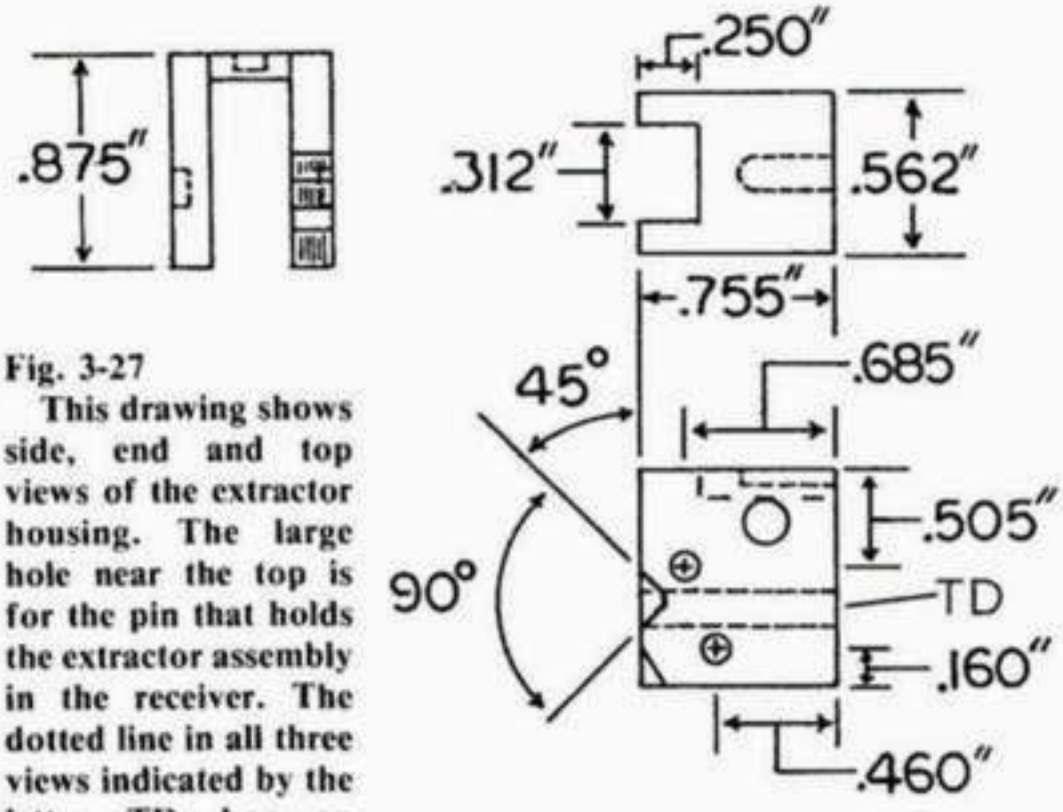


Fig. 3-27

This drawing shows side, end and top views of the extractor housing. The large hole near the top is for the pin that holds the extractor assembly in the receiver. The dotted line in all three views indicated by the letters TD show an alternate method of construction to allow for quick take-down as described at the end of the chapter.

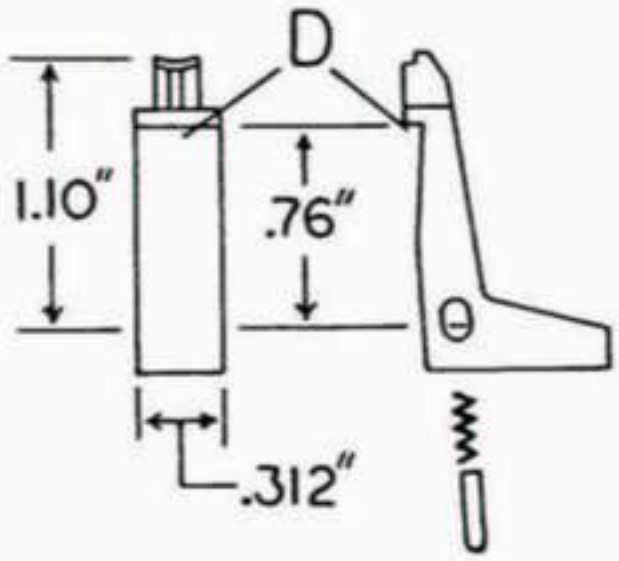


Fig. 3-28 RIMLESS EXTRACTOR

This drawing shows two views of the rimless extractor. This is the extractor that fits the barrel shank shown in Fig. 3-6. Note the oblong pivot hole and the spring and plunger that a rimless extractor requires. The spring is 1/16" in diameter, light tension. Letter D is the shoulder against which the breech block plunger engages to halt the upward movement of the breech block. Also see Fig. 3-8 for an alternate rimless extractor and the text for more details. In this alternate method a straight 3/16" pin is used.

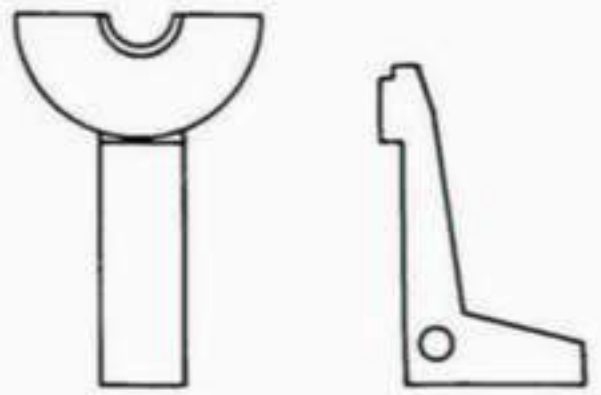


Fig. 3-29 ALTERNATE EXTRACTORS

This drawing shows views of two alternate extractors. On the left is an extractor for the .22 rimfire cartridge. Its half-moon hook should be .120" thick. On the right is an extractor for rimmed centerfire cartridges. The rim recess for both of these extractor types is best cut during the chambering of the barrel with the chambering reamer.

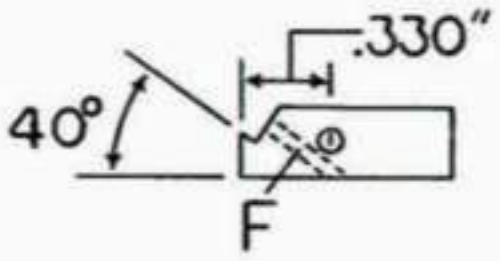


Fig. 3-30 EXTRACTOR LEVER

This part, as well as the extractor, is 5/16" thick. Dotted lines F indicate the small hole which is required if the rifle is chambered for the .22 rimfire and has the half-moon extractor hook as in Fig. 3-29. This hole provides an access for a pointed tool to depress the breech block plunger to allow the breech block to be removed. Also see Fig. 3-36 and the text for an alternate breech block removal arrangement.

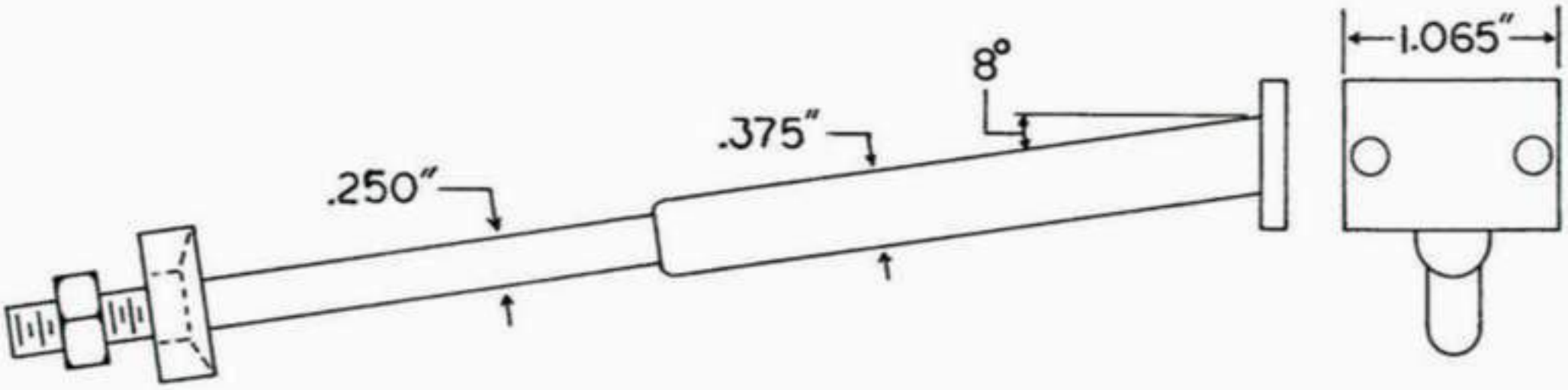


Fig. 3-31 TANG

This shows two views of the tang. The tang screws can be 10x32.

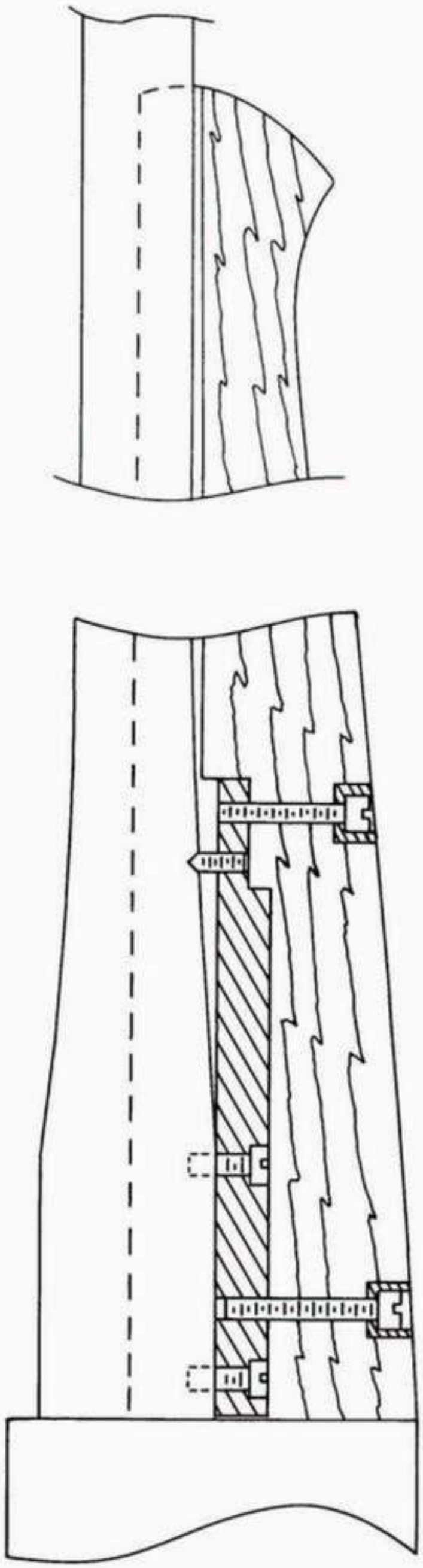


Fig. 3-32 FOREARM

This is the outline shape of the forearm on our light .223 sporter shown elsewhere in this chapter (Fig. 3-H). It also shows a preferred method of attaching the forearm to the barrel. See text for further details.

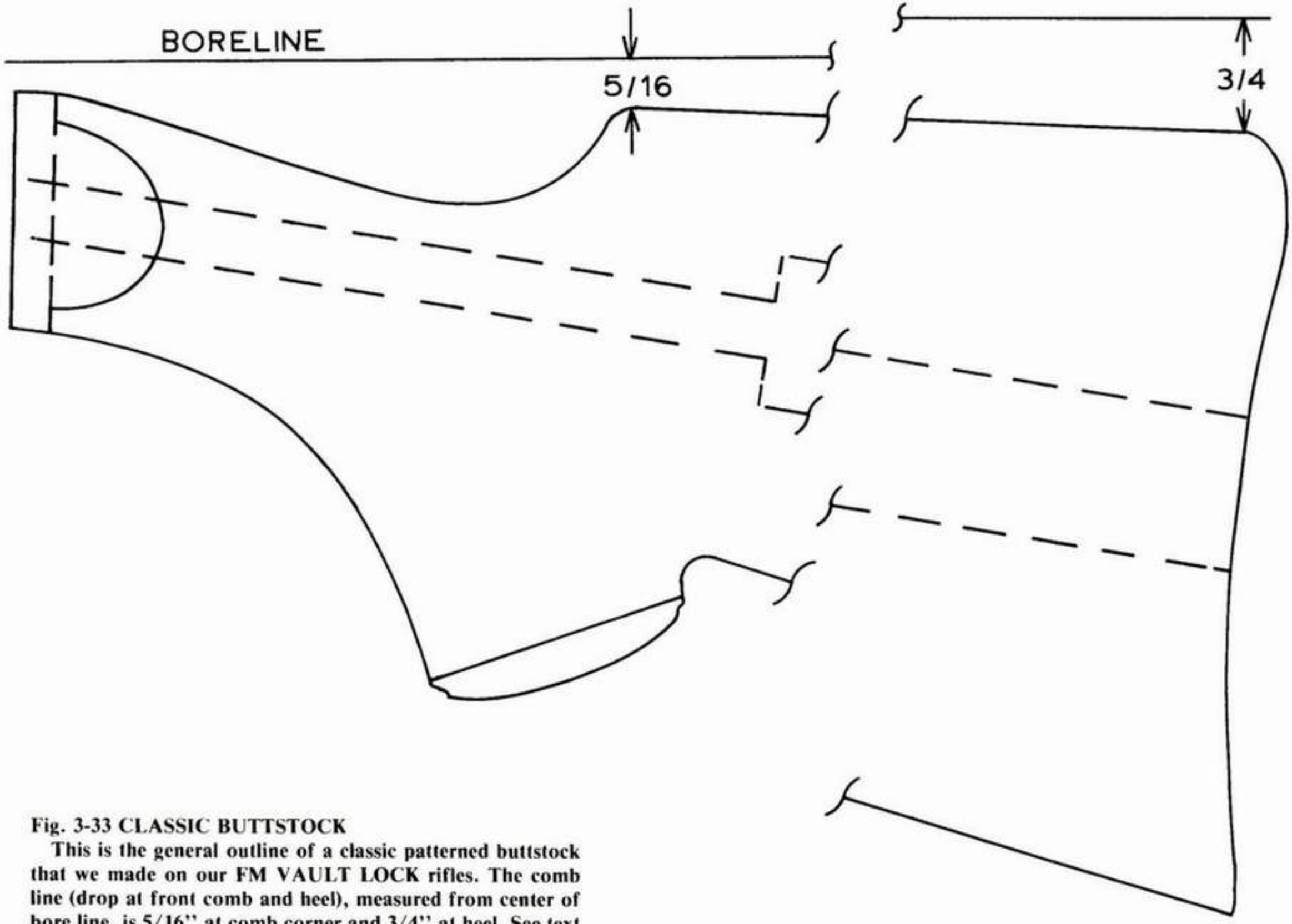


Fig. 3-33 CLASSIC BUTTSTOCK

This is the general outline of a classic patterned buttstock that we made on our FM VAULT LOCK rifles. The comb line (drop at front comb and heel), measured from center of bore line, is 5/16'' at comb corner and 3/4'' at heel. See text for further details.

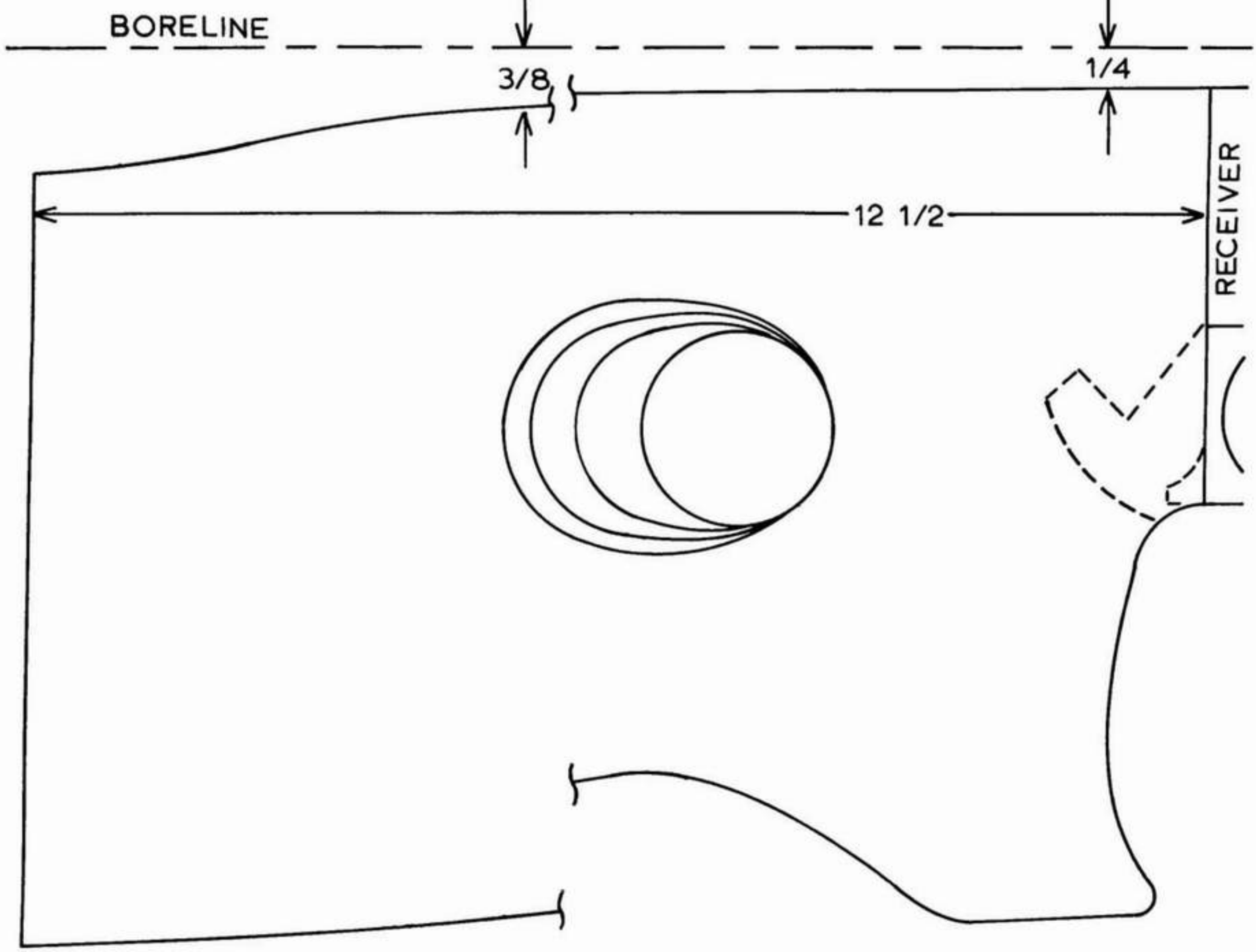


Fig. 3-34 TARGET RIFLE STOCK

This shows the detail of the thumbhole stock used on our .22 rimfire target rifle (see Fig. 3-K). The comb line is just below the bore line. This may be too high for some shooters. A 1/2'' rubber buttplate was used to produce a nonskid surface.

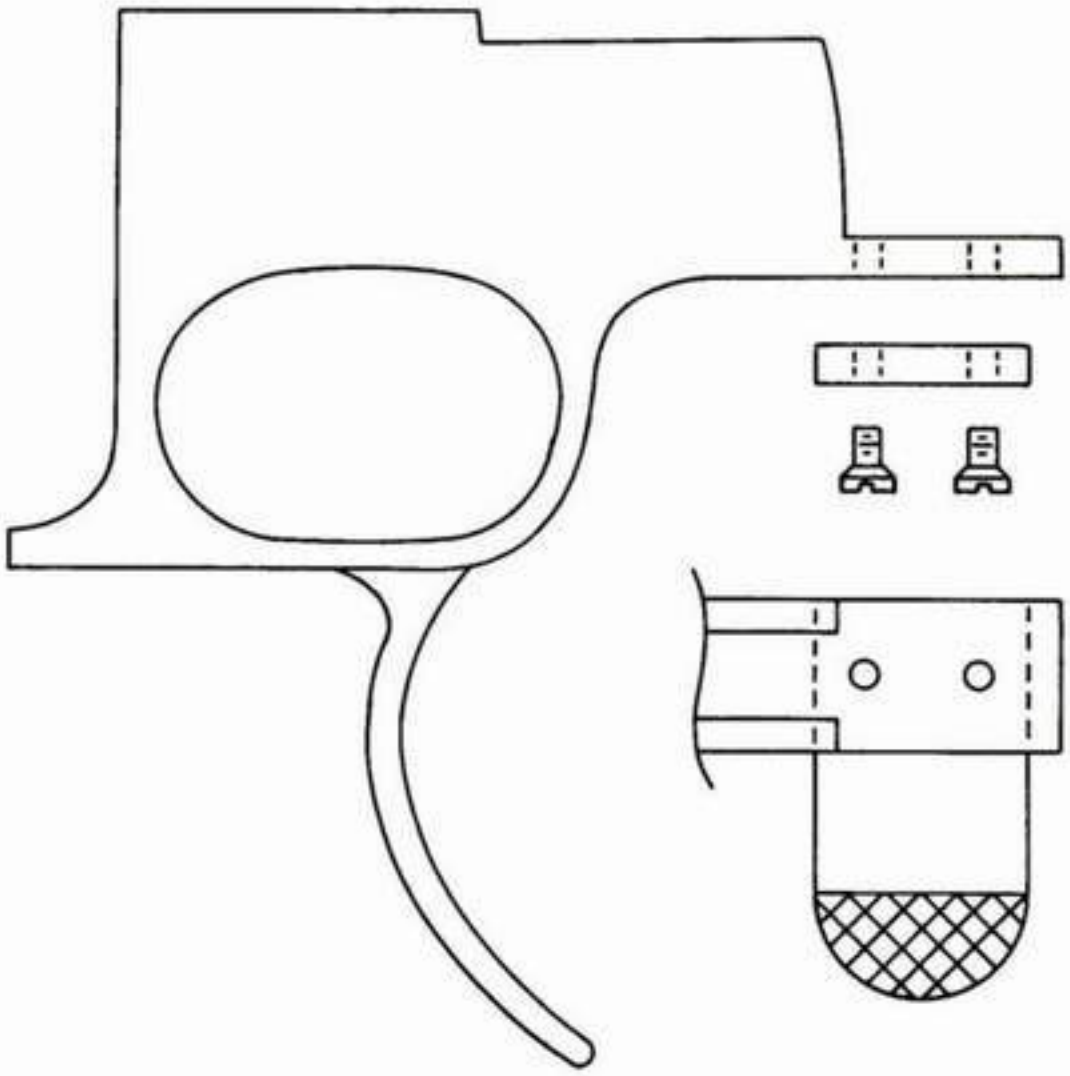


Fig. 3-35
TARGET RIFLE TRIGGER GUARD

This drawing shows the trigger guard as used on our target rifle. The short spur shown on the rear of the guard is there only to fill the gap in the upper part of the pistol grip (see Fig. 3-34). To open this action we attached a plate to serve as a thumb piece, as shown, to the front of the trigger guard housing; with the plate projecting about thumb width to the right of the receiver edge. Pushing down on it opens the action. On a later rifle we omitted the thumb plate and welded on a long finger piece to the underside of the trigger guard bow as shown.

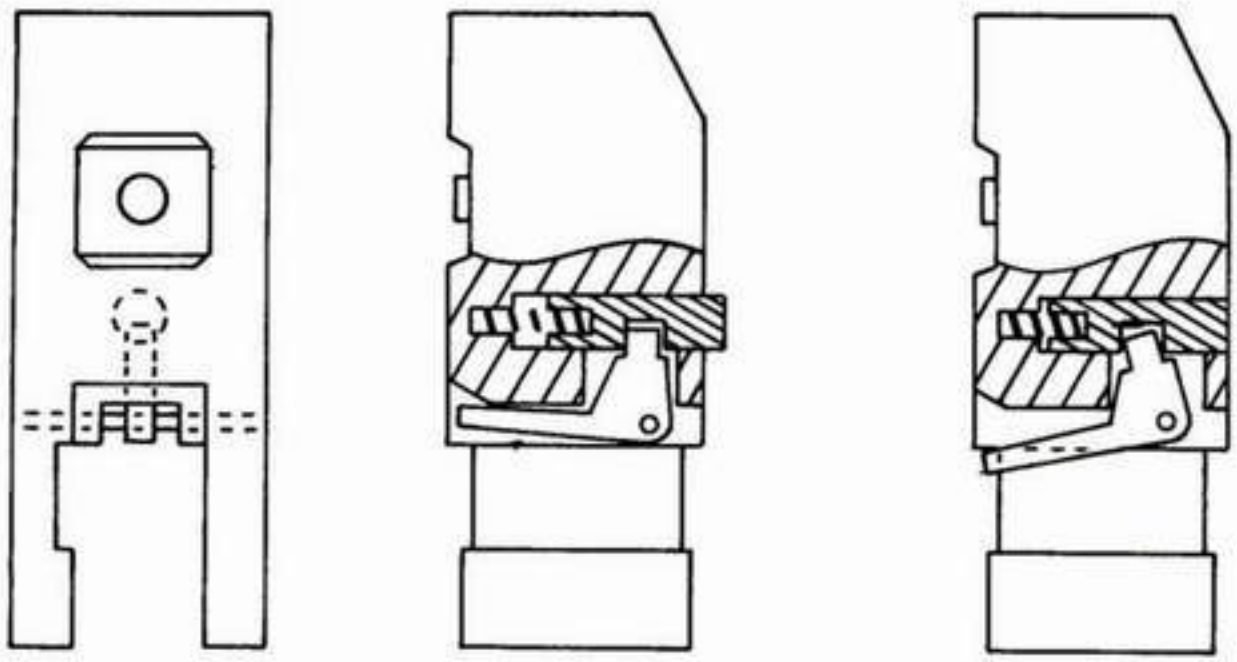


Fig. 3-36 THREE VIEWS OF THE QUICK TAKEDOWN BREECH BLOCK

On the left shows the rear view of the breech block and the position of the release lever. The other two cross section views show the lever at rest and depressed to draw in the extractor plunger. The extractor used for this system is shown in Fig. 3-8. Also see Figs. 3-11, 3-27 and 3-37.

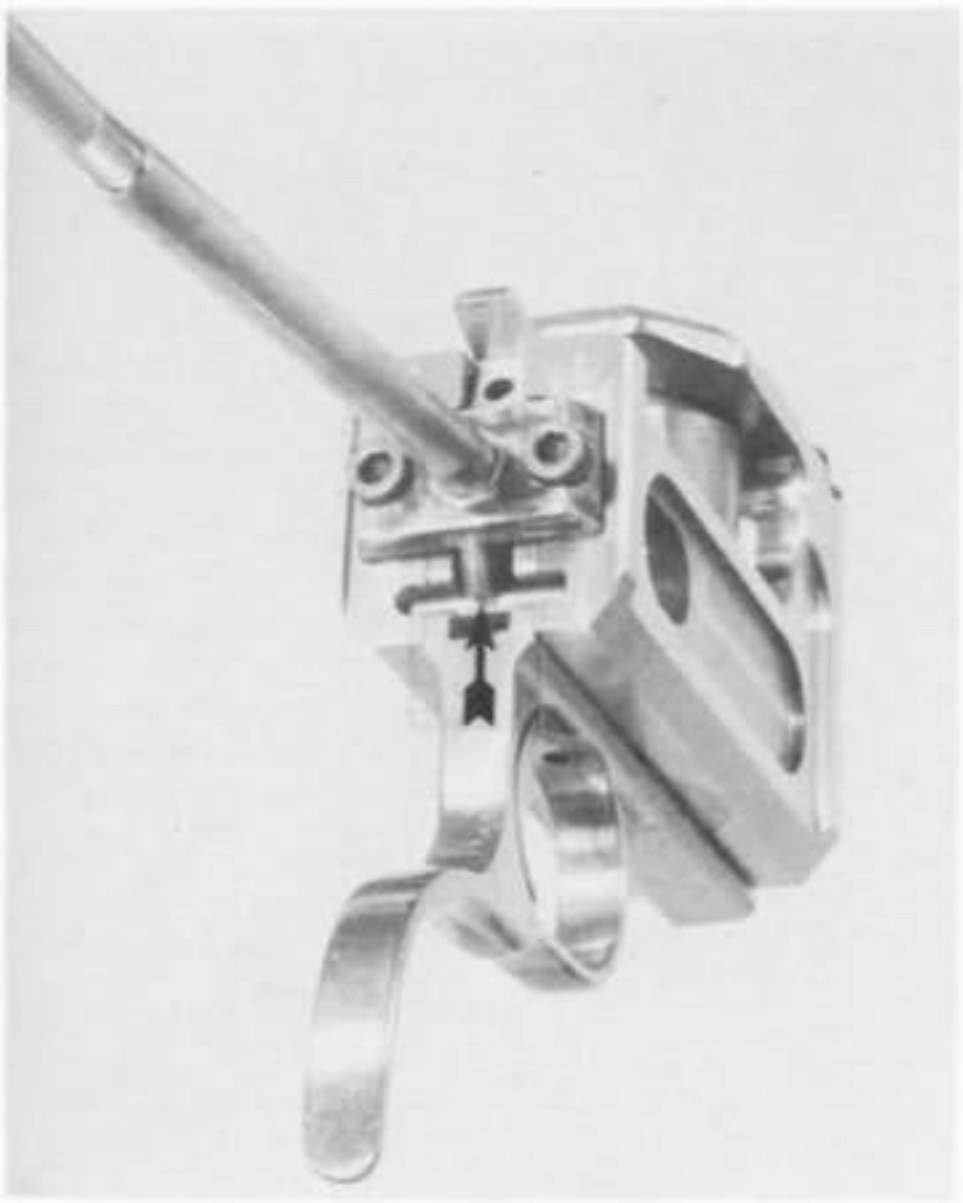


Fig. 3-37 REAR VIEW OF THE TAKEDOWN RECEIVER
Rear view of the FM No. 2 VAULT LOCK takedown receiver showing the notches on the inside of the receiver walls and the notches in the rear of the trigger guard housing, and the hinge pin positioned in those notches and held in place by the bent peg (see arrow) fitted into the bottom of the tang plate. The notches in the trigger guard housing are also shown by dotted lines in Fig. 3-11.

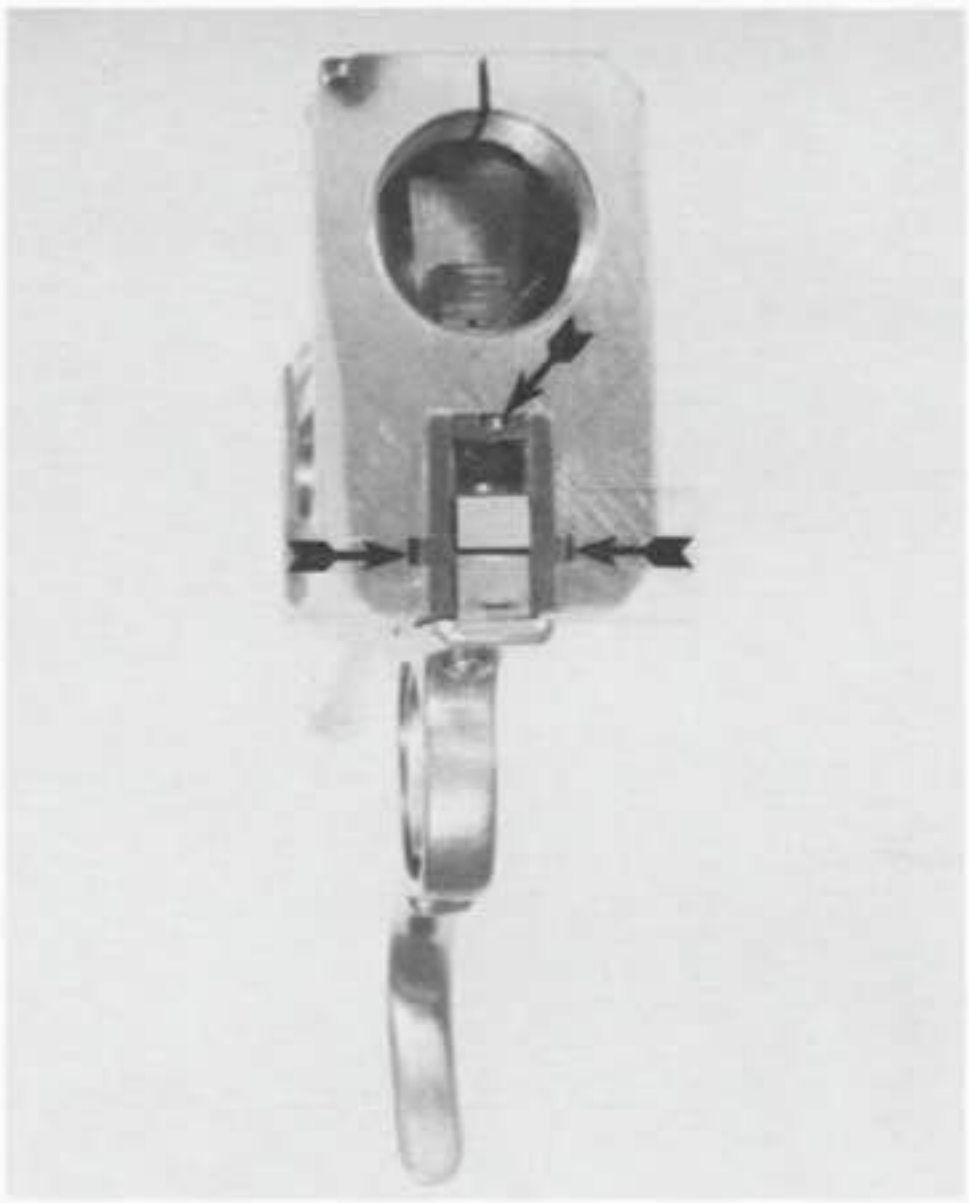


Fig. 3-38 FRONT VIEW OF THE TAKEDOWN RECEIVER
Front view of an FM No. 2 VAULT LOCK receiver modified into a takedown and quick action disassembly system. This shows the split receiver ring. The center arrow points to the groove on top of the extractor housing and the stud in the bottom of the receiver to hold the extractor assembly in position against the breech block. The two arrows at the bottom point to the two rails and grooves at each side of the extractor housing which holds the extractor housing assembly up and allows it to be slid rearward into the breech block recess for quick and easy removable after the trigger guard and breech block assemblies have been removed. Also see Fig. 3-36.

Fig. 3-39
Side view of the No. 2 takedown action showing the placement of one of the two takedown or draw screws through the upper receiver ring (the second screw is on the opposite side and about 3/16" to the rear of the first screw) and the absence of the extractor housing retainer and the trigger guard housing hinge pins. This photo also shows the recess milled into and partly through the right receiver wall (a similar recess but wider is in the left wall) to reduce the weight of the action. The clear through areas of this recess should not extend any farther forward than the breech block support area as shown by A in Figs. 3-3 and 3-5. These recesses can best be closed by making panels from the same wood that the stock is made from and epoxied in place after the rifle is finished and blued. This was done with the rifles and actions shown in Figs. 3-D, 3-E and 3-J.

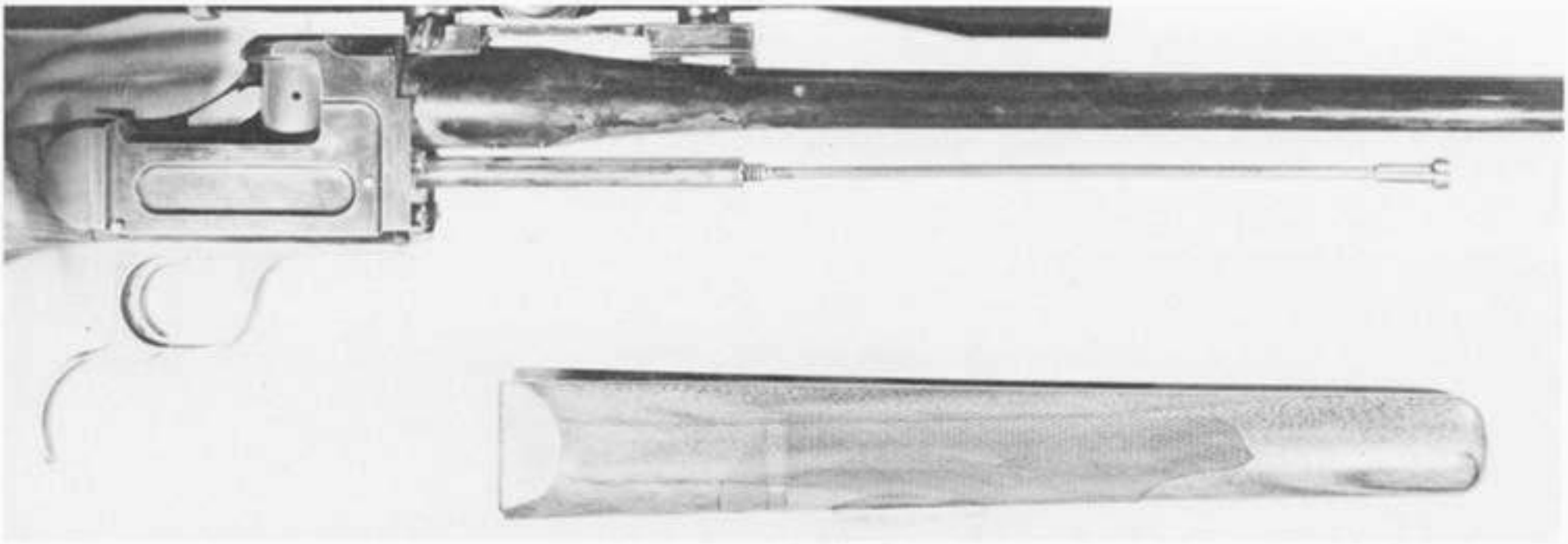


Fig. 3-40
Here is shown the forearm fastening arrangement we used on our .223 FM No. 2 VAULT LOCK rifle shown in Fig. 3-A and on our .22 caliber target rifle (Fig. 3-K). As explained in the text, this arrangement is the same as used to fasten the buttstock to the action.

Instructions and Sequence of Operations for Making the FM No. 2 Vault Lock Action

The very best steel to use for the receiver is 4140, a chrome-moly steel widely used in the arms industry for making many firearms parts including receivers, breech bolts and barrels. Some steel firms list it in three grades; 4140 Heat Treated, 4140 Normalized and 4140 Annealed. For the purpose of making the FM VAULT LOCK receiver, the first choice is 4140 Heat Treated, with a hardness of RC 27-30. Although it is very tough, it can be readily machined and hand worked and it needs no further heat treating after the receiver is finished. The second best choice is 4140 Annealed, which is the cheapest and easist grade to obtain. As is, it would be suitable for a rifle in .22 Long Rifle caliber, but for all other calibers 4140 Annealed needs to be heat treated to a hardness around 25-30 Rockwell C **before** machining. This heat treating should only be done in a controlled temperature heat treating furnace and our advice is to have this done by a heat treating firm. There are other chrome-moly steels which are also suitable for the receiver but 4140 Heat Treated is the first choice.

The breech block for the FM VAULT LOCK action can also be made from 4140 Heat Treated steel. However, softer steels can also be used such as common steel shafting. For all centerfire calibers, when a softer steel than 4140 Heat Treated is used, the breech block should only be fitted with the Mann-Neidner type firing pin with a hardened bushing. In this case the breech block need not be hardened, although you might want to have its surface hardened by having it carbonized by a heat treating firm.

The trigger guard housing and the extractor housing can be made from cold rolled steel. The hammer, trigger and safety should be made of tool steel so they can be hardened. The same tool steel can be used to make the pivotal bar, extractor, extractor lever, trigger lever and hold-close plunger, but these parts do not need heat treating. All pins are best made of drill rod. The firing pin and breech block plunger can also be made of drill rod, and they should be heat treated.

RECEIVER (see Figs. 3-2 - 3-5)

Begin by squaring off the receiver to the approximate dimensions as given in the drawings. Spot, drill and ream (or bore) the hole for the 1.00" breech block. The hole should be made at an angle of approximately 3° rearward from top to bottom (see Fig. 3-5). The amount of angle is not critical and it can be as much as 4° and still be satisfactory.

As discussed later on, the loading port can be made either to the right or to the left or it can be opened on both sides so you can load the rifle from either the right or left. If the latter is done the top shelf does not have the support of one of the receiver walls and is thereby weakened. In this case the top shelf can be made stronger by drilling and reaming the breech block hole from the bottom and not going all the way through, leaving the hole at the top closed and flat as shown in the insert of Fig. 3-5. This not only leaves the breech block hole closed above but strengthens this shelf by the 1/16" thick metal left on top. Making this blind hole is quite difficult but if you can manage it you might also consider making the receiver this way if only one receiver side is opened up for the loading port.

> NOTE: The FM VAULT LOCK action was especially designed to utilize a cylindrical breech block, the reason being that it is much easier to fit such a breech block in a receiver than one with square corners and parallel sides. However, the design in no way limits this action to a cylindrical breech block and if you have the facilities to machine a 1.00" square hole with parallel sides through the receiver then you can substitute a square block in place of the round one. In doing this nothing else has to be changed except

that the top shelf must be made longer. The use of a square breech block will make the action much stronger. Therefore, if you want the rifle chambered for a belted magnum or ultra-hot wildcat cartridge then we suggest making the action with a square breech block. Also, in this case we suggest making the firing pin to be inserted into the front of the breech block with a threaded and shouldered bushing similar to the Mann-Neidner design.

BARREL SHANK (see Fig. 3-6)

The next step is drilling or boring the hole for the barrel shank and threading it. We recommend a 1"x16 thread, although a 1"x14 is okay. Follow by threading and fitting the barrel in the receiver, but not completely at this point. Leave the shank a bit longer than is necessary and face it off square.

BREECH BLOCK (see Fig. 3-13)

Make a start on the breech block next, leaving it a little longer than final length, to be dressed to length later. Dress off the face at the same angle as you have made the breech block hole so that its face will evenly contact the breech face of the barrel. The face of the breech block need be just slightly wider than the diameter of the cartridge head the barrel is chambererd for, but in any case it need never be over 5/8" wide. Our drawings and specifications show the breech block face approximately .475" in width at the firing pin hole, which is ideal for most standard cartridges. Now, with the barrel threaded in the receiver and the breech block wedged in its hole against it, remove metal from the top of the breech block until it is flush with the top of the receiver. Do the same at the bottom of the breech block, although we still suggest leaving it project up to .10" which will be trimmed off afterwards.

The next step is to mill the slot in the bottom of the receiver for the trigger guard housing. With the barrel (or threaded stub) and the breech block wedged in, the breech block is adequately rigid to allow milling the slot through both the receiver and breech block in the same operation, thus assuring the slot in both parts will match. Make the initial slot only .750" deep. When this has been done, the barrel and breech block can be removed and the milling underneath completed; milling in front of the breech block hole to .875" depth for the extractor housing, and to the rear of the hole and support metal (A in Figs. 3-3 & 3-5) to a depth of 1.175".

Next the loading port is milled out, following that, mill the slot for the passage of the hammer and safety, and then recess the rear of the receiver for the stock abuttment. All this can be followed by removing the surplus metal from the top rear of the receiver. The beveling of the bottom sides of the receiver should not be done until after the hole for the trigger guard housing pivot pin has been drilled unless you decide to hide this pin, which is described at the end of the chapter, nor should the recessed panel milling be done until this hole has been made.

TRIGGER GUARD (see Figs. 3-10 & 3-11)

Make the trigger guard housing next. The finger piece spur can be made integral with it or it can be welded on afterwards. The housing is made long enough (see Fig. 3-10) so that the extractor housing can be cut off from the front of it.

Next remove metal from the top front part of the trigger guard housing, fitting the housing into the receiver until the bottom of the housing groove is level with the bottom edge of the receiver. With the housing held in place in this position, drill the hole through the receiver and housing for the pivot pin. After this is done the bottom edges of the receiver can be beveled and the panels milled out.

EXTRACTOR HOUSING (see Fig. 3-27)

The next step is to fit the extractor housing into place. Square the rear end of it, position it in the receiver so that the squared end touches the breech block, clamp it in place and then drill the hole through the receiver and the housing for the pin. This pin can be as small as 1/8" in diameter. You might also consider eliminating this pin by the method described later in this chapter. After this the excess metal from the bottom and front of the extractor housing is removed, making these surfaces flush with the receiver metal.

With the extractor housing in place carefully remove metal from the front of the trigger guard housing so its fits into the receiver and can be pivoted without binding.

HOLD-CLOSE ASSEMBLY (see Figs. 3-25 & 3-26)

Now is the best time to make the hold-close assembly. Mill the slot and cut into the front of the trigger guard housing for the end of the hold-close plunger to fall into. The pin to hold it in place and to limit its forward movement is also the pin that will hold the trigger lever in place. Installed, the hold-close plunger should offer considerable resistance to the opening movement of the action.

PIVOTAL BAR (see Fig. 3-15)

The next step is to link the breech block with the trigger guard housing. Make the pivotal bar and drill the hole for it. Follow this by cutting the slot in the breech block skirt to accept this bar. Note that this slot is wider than the pivotal bar, this to allow some initial movement of the trigger guard housing before the breech block is pulled down (Fig. 3-14). The purpose of this is to pull the hammer off the firing pin allowing it to retract before the breech block starts moving down. At this point, with the breech block and trigger guard housing in place, you should be able to lower the breech block part way, with its lowering motion stopped when the top of the housing comes into contact with the rear corner of the slot in the breech block. The corner of this slot (see B in Fig. 3-17) then has to be beveled off enough so that the breech block can be lowered to a point where its top surface halts 1/16" above the bottom of the loading port. Later on, depending on the size of the cartridge the rifle is chambered for, more can be removed from this bevel to allow the breech block to open still farther. The final halting of the breech block will be determined by the extractor parts.

After fitting the trigger guard housing we suggest you next fit the barrel. Breech the barrel so when it is set up tightly into the receiver there is no more than .001" gap between the breech block and barrel. Chamber the barrel, doing this with the barrel removed and headspacing so that a new cartridge case chambers flush with the breech. The chambering and headspacing must be done right and for detailed information on this we suggest you read a gunsmithing book which contains this information

EXTRACTOR PARTS (see Figs. 3-7, 3-8, 3-28, 3-29 & 3-30)

Now make and install the extractor, extractor lever and the

breech block plunger. Considerable precise fitting is required here. We suggest the following order: fit the blank extractor in the housing first but do not make its pivot hole for rimless cartridges oblong at his point. Leave the extractor hook (its upper tip end) longer than needed. Cut the slots in the receiver and barrel to accept the extractor. Shorten and shape the extractor hook as shown so that a cartridge case can be chambered with the extractor engaged with it. For rimless cases and a few certain rimmed cases, file the pivot hole oblong towards the extractor hook, making the hole oblong enough so that the extractor drops low enough to slip under the cartridge rim when chambered. Now drill the hole in the extractor stem and install the spring and plunger. Bevel the top front end of the extractor hook enough so that the extractor will snap under the rim of a chambered cartridge case. Follow this by removing enough metal from the top face of the breech block (C in Fig. 3-17) so that the extractor can tip back far enough to clear a rimless cartridge case being inserted or extracted from the chamber (see Fig. 3-8).

At this point fit the breech block plunger (Fig. 3-18) and the extractor lever. Notch the rear of the extractor lever and the lower end of the breech block plunger so that the downward travel of the breech block is now halted at a point where the top of the breech block comes within about 1/8" of being flush with the bottom of the loading port. Next cut a notch (D in Fig. 3-28) in the upper rear face of the extractor stem and on the upper end of the breech block plunger so that the breech block is stopped in its upward travel precisely when the breech block top is flush with the top of the receiver and just before the breech block contacts the barrel as shown in Fig. 3-7. The rim recess in the face of the hook must be slightly deeper than the rim of the cartridge (this applies only to rimless cases), this so that on closing the action the breech block will push the extractor ahead, allowing the hook and the entire extractor to rise and engage in the extractor groove in the case. There should be no binding of the extractor parts or in the breech block with the extractor.

An alternate method for the breech block plunger arrangement is shown in Fig. 3-8. The breech block plunger is a 3/16" round rod which should be a snug fit into its hole. The smaller hole to the rear of it provides a means to drive the plunger out. The faced off end of the plunger should project 1/8" from the breech block face. The extractor is made to nearly contact the face of the breech block and then a 3/16" wide groove is milled in its face for the plunger to slide in, with the groove milled to a height that stops the breech block at the precise place as explained in the previous paragraph. A similar groove is then milled into the face of the extractor lever as shown. The plunger can be made of brass welding rod and the use of this metal somewhat dampens the noise of the opening snap of the action. For a rifle in the .22 rimfire caliber the plunger must be fitted in a deeper hole, be a sliding fit and be backed by a spring. In addition, a hole must be provided in the extractor lever (as shown in Fig. 3-30) so that the plunger can be depressed with a tool to allow removal of the breech block, or use the method shown in Fig. 3-36.

For all rimless cases and cartridges with thin rims such as the .225 and .444 Marlin, the extractor must be made as described above. The same extractor will also work very well with most common rimmed cartridges. However, for thick-rimmed cartridges such as the .22 Hornet and .30-30, the extractor need not have the oblong pivot hole or be spring loaded, and in this case the front of the hook need not be beveled off (see Fig. 3-29). In fitting this extractor hook it is best finished and recessed at the same time as the chamber with the chambering reamer. Also, the beveled surface C (Fig. 3-17) on the top front face of the breech block must be cut back only far enough to allow enough backward extractor movement so that its hook does not disengage from the cartridge rim. For .22 rimfire, the extractor should have a half-moon hook (Fig. 3-29).

HAMMER (see Fig. 3-21)

The making of the ignition parts comes next. First make the opening in the trigger guard housing for the trigger and spot the hole location for the hammer pin. Then make the hammer to approximate shape as in Fig. 3-21, and finish smooth the surfaces in front and below its nose. Use paper or an epoxy glue to hold the hammer in place in the trigger guard housing, and while holding the housing in place in the receiver, position the rough hammer against the receiver just as it should be in the fired position as shown in Fig. 3-7. Now carefully remove the housing without disturbing the hammer and drill the hole through the housing walls and hammer for the hammer pin. Remove the hammer and drill the hole in it that will become the mainspring plunger notch. Then remove the surplus metal in front of this notch. After this the mainspring plunger and sleeve can be made and fitted, as well as the pin through the housing to hold the sleeve. After the hammer has been fitted, recess the rear of the breech block for the hammer nose to fall into, making this recess about .100" deep and shorten the hammer nose sufficiently so that it does not touch bottom when fully down.

SAFETY (see Fig. 3-20)

Make and fit the safety next. Do not drill in the holes for the safety pivot stop pin until the safety has been notched to the hammer.

With the action parts you have already made placed in the action, open the action as far as it will go and spot the approximate location where the safety notch has to be made on the hammer for the safety to engage over it (Figs. 3-8 & 3-9) and machine this notch. The angle of the notch on the safety and hammer must be such that on disengaging the safety from the hammer, the hammer is drawn back slightly. The notch on the hammer and on the safety can best be milled in by using a standard sight slot cutter and this will give you the correct angle for both notches. When the notch has been made so that the safety just engages it when the action is opened, you are then ready to spot and drill the hole through the trigger guard housing and safety for the safety pivot stop pin, enlarging the hole in the safety afterwards to allow pivotal movement. Make the safety spring with one coil about as shown in Fig. 3-20. We used .034" spring wire to give the safety sufficient tension so that it requires considerable thumb pressure to disengage the safety. This is very important as under no circumstances should the safety be dislodged regardless of how smartly the action is closed.

TRIGGER (see Fig. 3-23)

Now make the trigger. Make its sear tip slightly longer and higher than needed, center it in its hole so that it can be pivoted and drill the hole for its pin. Using pins about one inch long, mount the hammer, safety and trigger on the outside of the trigger guard housing so that you can see what has to be done. Your next job is to make the sear notch in the bot-

tom of the hammer. Make it deeper than needed so that a flat surface can be obtained. It **must** be at the approximate angle as shown in the drawing and its bottom edge should be sharp. After this shorten the sear tip of the trigger so that the trigger engages into the hammer sear slightly before the hammer becomes engaged with the safety. Before going any further, make and fit the trigger lever and drill and tap the holes for the three trigger adjustment screws. When all of this has been done, assemble all the parts into the action and you are ready to make the final adjustments and synchronize all the parts together.

To synchronize all the parts it will likely be necessary to do a little hand filing here and there and perhaps you may even have to make a part or two over if too much filing has been done. First, the breech block must open low enough to clear the extractor hook and the extractor hook tip back far enough at the same time to clear the bottom line of the chamber for rimless cartridges. If either does not, perhaps you will have to lower the notch on the extractor lever and/or remove more metal from the upper slanted surface of the breech block. Next, there must be enough width of the pivot bar notch to allow the trigger guard housing to swing down enough in its initial opening movement before the breech block is pulled down to retract the hammer. Next, on fully opening the action, the trigger must first drop behind the hammer sear notch, then the safety must engage with the hammer, and on closing the action and disengaging the safety, the hammer should move a very slight amount before being stopped by the trigger. The sear notch on the hammer should be at such an angle that with the trigger engaged with it to its full depth, on pulling the trigger the hammer is moved very slightly back. This motion should be barely perceptible to be ideal, and not perceptible at all after the trigger is adjusted for minimum sear engagement. This will mean that even with a very light tension trigger spring and shallow sear engagement, that the trigger will positively want to stay engaged with the hammer until it is deliberately pulled back by the shooter. If the trigger has a tendency to slip out of the hammer sear notch of its own accord, and you will be able to detect this easily by slowly pulling the trigger back with the hammer cocked, then you **must** correct the sear angles on either or both the trigger tip and hammer notch. Not until you are sure that the trigger functions properly and is safe should you harden the trigger and hammer. In the final honing of the sear surfaces after hardening be careful not to alter the angles or round the edges. Use a medium to medium-heavy tension spring for the triggers (this spring is under the trigger lever) and it should be of a length and adjusted so that at least a pull of two pounds is required to move the trigger alone. With the hammer cocked the trigger pull should be at least three pounds. The sear engagement, the angle of the sear and the pressure from the trigger spring including the angles of the safety notches, must be such that no matter how smartly the action is closed the hammer will stay cocked. this must be tested and if the safety does not hold when the action is closed very rapidly, or if the sear does not hold when the safety is disengaged, corrective measures **must** be taken. The testing should include snapping the action closed with safety removed and again with the safety in place but with the trigger tied back with tape or with a bread wrapper tie. These corrections may include one or more of the following: increasing the angle of the sear notch on the hammer, increasing the sear engagement of the trigger with the hammer, increasing the trigger weight of pull by use of a stronger or longer spring or adjusting it to give more tension to the trigger lever, increasing the angle of the safety notches and/or using a stronger safety spring.

FIRING PIN (see Figs. 3-7, 3-8 & 3-16)

The firing pin need not be the last thing of this action to make and install, but it should not be fitted until after the extractor parts have been fitted and the hammer fitted. We have shown two methods of installing firing pins for centerfire cartridges, plus one for rimfire. The first method we describe is the preferred Mann-Neidner method shown at left in Fig. 3-16. For the centerfire firing pin installation (Figs. 3-7 & 3-8), proceed as follows: Spot the location for the firing pin tip hole using a special center punch (which you make) that fits through the flash hole of a cartridge case the rifle is chambered for. Align the breech block in a drill press vise and drill a 3/16" hole through the breech block from front to rear. With a 1/4" end mill replacing the drill, bore this hole to within 1/8" of the hammer nose recess. Follow this by boring the hole for the bushing with a 7/16" end mill 1/4" deep, replacing the end mill with a 1/2x20 tap and tap threads in the hole. Finish the thread tapping with a bottoming tap. Now make the bushing as shown (Fig. 3-16, left) only longer than needed in front and make it so it bottoms cleanly, after which it is dressed off flush with the breech block face and finished. This bushing can be made from the threaded end of a 1/2x20 S.A.E. bolt and such a bushing need not be hardened further. Otherwise, make the bushing from drill rod or tool steel so it can be hardened. Now two small shallow holes must be drilled near the outer edge, opposite each other, and a spanner wrench made to fit these holes so the bushing can be removed for installation of the firing pin.

Now make the firing pin (Fig. 3-16, left). The tip end must be a snug but bind free fit in the 5/64" hole made for it. Make the tip longer than needed. Make the rear stem of the firing pin 3/16" and make it longer than needed. The firing pin must move at least .060", and ideally it should not move much more than this. Trim the firing pin by holding it to the rear and filing its tip flush with the breech block face. Now trim to correct length by filing the stem so that when the firing pin is fully depressed by the hammer the tip protrudes .055" to .060". The end of the tip is then rounded and polished. Round the large end slightly and then harden and temper the firing pin.

For the alternate method of firing pin installation see Fig. 3-16, right and Fig. 2-9 in Chapter 2. For a detailed description and full instructions on how to make this firing pin see Chapter 2.

With either method, the firing pin should be a snug fit, yet must not bind—it must move quite freely. The retractor spring need not be very strong but it must be sufficient to positively retract the firing pin after a cartridge is fired and the hammer is cocked. Also, drill a 3/32" gas vent hole through the right side of the breech block into the retractor spring recess area of the firing pin hole, as marked G.V. on Fig. 3-13.

The hammer fall should be halted by the support wall (A in Fig. 3-5) in the receiver and not by the firing pin or by the hammer nose contacting the breech block or retainer nut. In the fitting of the firing pin it may be necessary to shorten the hammer nose.

STOCK TANG (see Fig. 3-31)

Although not at all critical, we suggest making the tang as shown. We silver-soldered the smaller diameter threaded rod to the larger tang and the larger tang to the plate. If necessary, the larger diameter tang can be bent near the plate in order to correct for or compensate for the stock drop. The screws to attach the tang to the receiver should be 10x32 or equivalent.

INFORMATION ON STOCKING THE FM VAULT LOCK RIFLE

We would like to see every FM VAULT LOCK rifle well stocked and although it is not our intention to go into stock making details, we do want to pass along some suggestions to help you make a good stock and forearm for your rifle. To assist in the direct way possible we have included full sized drawings of the buttstock and forearm, along with details on a good method to attach the forearm to the rifle.

We suggest that you use a quality piece of wood to make the stock and forearm as it is not much more difficult to make a stock from a fine piece of wood than it is from a poor piece. You can order matching buttstock and forearm blanks from Fajen's Inc., Warsaw, MO, in walnut, myrtle and maple.

The buttstock drawing is that of our light sporter rifle (Fig. 3-33). It is of the standard classic style. We suggest that you draw the outline of this stock onto a piece of cardboard, cut the outlined stock from the cardboard, and use it as a pattern on your stock blank. Cut the ends off the blank leaving it about one half inch longer than needed. Next spot the through-stock bolt hole at both ends and drill the hole through the blank. Next inlet and fit the stock against the receiver. When you have it partly fitted, place the cardboard pattern on the blank to check the alignment of the blank. If necessary, you can bend the tang as needed. Use a cleaning rod in the bore to determine the approximate comb line. The comb line drop figures given in the drawing are ideal with a 32 or 40mm objective lens scope mounted low on the rifle. If a target scope or a scope with a larger objective lens is mounted on the rifle the comb can be made a bit higher. Secure the blank to the receiver with the tang bolt, establish and mark on it the comb line and cut the blank to this line.

Your next step is to saw off the butt end as required to obtain the length you want and to attach the buttplate. We suggest the use of the Neidner checkered steel buttplate for this as it is ideal in shape and size for this rifle. It will be a bit difficult to fit but the extra work will be worth your while. As an alternative we suggest using the Pachmayr Presentation rifle butt pad which is easy to install. However, if this pad is used, it should be trimmed to a size and shape no larger than the Neidner steel buttplate. The reason for this suggestion is that you can then govern the shape of the buttstock to that of the buttplate. After installing the buttplate you are ready to draw in the pistol grip and bottom stock line and saw off the excess wood. This should be followed by installing the grip cap, and for this we strongly suggest using the Neidner checkered steel cap or one no larger than it. Just as the buttplate will serve as a guide to shape the butt, so the pistol grip cap will guide the shaping and sizing of the grip. By using them you are not so apt to finish up with a stock that is too bulky.

The forearm should match the buttstock in size and also match the barrel, according to its size and length. Unless you are making the rifle into a target model, keep the forearm trim and no longer than necessary. A 12" forearm is ample in length for a 26" barrel and a 10" one for a 22" barrel. We suggest attaching it as shown in Fig. 3-32. Attach an aluminum bar to the barrel with two 8x40 screws and attach the forearm to this bar with two 8x32 screws. Then the forearm channel can be sanded out so the forearm is completely free of contact with the barrel. We suggest putting a set screw at the end of the bar to contact the barrel and its use will allow you to maintain a minumum gap between forearm tip and barrel and still maintain a constant free-floated barrel. Its use will probably not affect the accuracy or zero retention of the rifle.

The procedure we follow is to first inlet and fit the forearm to the barrel, then attach the anchor bar, inlet the forearm over it and attach it, and then sand the channel out to float the barrel. You can find much additional information on stocking a single-shot in **Mr. Single Shot's Gunsmithing-Idea Book**.

An alternate method to attach or fasten a forearm to a VAULT LOCK action is shown is Fig. 3-40, and it is the method we used to fasten and free-float the forearm on our .223 rifle shown in Fig. 3-A. It is the method to use when you want nothing to contact the underside of the barrel. This method or arrangement cannot be rightly called a forearm hanger and we prefer to call it a forearm fastener. It is essentially identical to the internal stock tang method used to attach the buttstock to the receiver. Like the stock fastener, this forearm fastener consists of a plate attached to the front of the receiver with four screws (we used 10x32 socket-head screws), a 3/8x4" rod screwed or silver-soldered to the plate, and a long draw bolt threaded into the rod. The plate can be the same size as the front of the receiver and the forearm abutted against it or the plate made small and hidden by the forearm being inletted over it. The draw screw should have a large head or a head fitted in a large escutcheon to prevent the forearm from splitting at the end. Because the draw bolt must be drawn up very tight to keep the forearm rigid we suggest that a glass bedding compound be used on the rear of the forearm and to include several inches of the rod to mate it to the plate and/or the front of the receiver. Once the forearm is attached and the barrel channel sanded out to be entirely free of contact with the barrel even with the weight of the rifle resting on the tip of the forearm, you will have a forearm fastening that is hard to beat.

SCOPE MOUNTS FOR THE FM VAULT LOCK RIFLE

The FM VAULT LOCK rifle is not well adapted for use with open sights. However, if you wish to use the rifle with open sights we suggest the use of the Williams Guide rear sight and a front sight mounted on a Williams ramp base. To use open sights the stock will require a lower comb line than we have shown in the drawings.

Any target scope can be mounted on the FM VAULT LOCK rifle using appropriate target scope bases to match the contour of the barrel. The target mount bases made for the Model 52D Winchester or Model 40X Remington can be used if the action is fitted with a straight tapered barrel. The spacing and location of these bases should then be dependent on the length of the scope used.

To mount a hunting scope on this rifle a wide variety of mounts can be used. If you are economy minded then use the Weaver top detachable mounts, either the high, medium or low rings, with the two-piece bases. The two-piece bases are those specified for the Ruger No. 3 Carbine and they can be

spaced or the underside of the front base filed to fit almost any contoured sporter barrel.

If you prefer all steel mounts then select one made by Buehler, Redfield or Conetrol. Order the bases to fit the Ruger No. 3 and with a minimum of filing the bases can be fitted to almost any barrel. We especially like to use the two-piece blank bases that Buehler makes, grinding a groove in the underside of them to fit the particular barrel contour we happen to be using. With most two-piece mounts we usually space the bases so that the rings are about 3.5" apart, with the rear ring as close to the receiver as the base will allow.

A TARGET RIFLE ON THE FM. No. 2 VAULT LOCK ACTION

The FM No. 2 VAULT LOCK action is quite ideal on which to build an accurate rifle for competitve target shooting in .22 rimfire or in the popular centerfire cartridges such as the .222, .223 Rem. and 6mm x 47. We made our first one in .22 Long Rifle caliber using a Shilen barrel blank made especially for this purpose. It is listed in Brownell's catalog as barrel No. 9. We turned this blank down to a straight taper 1.150" at the breech and .725" at the muzzle. Our rifle without scope weighs 12 pounds and is 44" in overall length (Figs. 3-K & 3-34).

Fig. 3-29 in the drawings shows the alternate extractor for use when the rifle action is chambered for the .22 rimfire cartridge. Fit the extractor before any chambering is done. After it is fitted, remove metal from its center to bore level, or just enough so that the pilot of the chambering reamer can be inserted into the bore with the extractor in place. Then, with the extractor in place and held firmly against the barrel, cut the chamber by hand.

Fig. 3-19 shows an alternate firing pin design that can be used when the rifle is chambered for the .22 rimfire cartridge. The firing pin hole must be located so that the firing pin tip is in line with the cartridge rim recess. Firing pin tip protrusion for a .22 rimfire must be less than the depth of the rim recess, or .035" to be ideal. The tip can be either round and flat with slightly rounded edges, or flat and shaped like a screwdriver tip.

In making a target rifle in any caliber, we suggest making the tang with a plate large enough to hold four screws instead of two as shown in the exploded view drawing (Fig. 3-1). Fig. 3-34 shows the outline and dimensions of our thumbhole stock. The details of how we shaped the trigger guard spur are shown in Fig. 3-35.

If the barrel is a heavy one and if the forearm is carefully bedded against it, the forearm can be attached directly to the barrel with two screws threaded into anchor blocks and the chances are that the accuracy and zero retention won't be affected to any bothersome extent. However, to avoid possible trouble on this score, we suggest that either a one-piece forearm anchor block be used as shown in Fig. 3-32 or a heavy tang fastener (Fig. 3-40) be used so that the forearm can be entirely free of the barrel. When using the anchor block method, make the block of aluminum or steel at least 5/8" square and 8" long, attaching it to the breech end of the barrel with three or four 8x40 screws in a four inch space at the breech and relieving the front four inches of the block so it does not touch the barrel. Then attach the forearm to it with two 10x32 screws and inletting the forearm channel so it does not contact the barrel at any point, even with the entire weight of the rifle resting on the forearm.

We used the tang or drawbolt method of attaching the forearm to our target rifle. This forearm drawbolt is made like the stock tang with a plate attached to the receiver with four screws. Here the forearm bears only against the front of the receiver and the plate. We used an anchor plate 1" x 1¼" in size and 3/16" thick and used four 10x32 socket-head screws to anchor it in place. We used a 5" piece of 1/2" drill rod for the tang, silver-soldering it in a hole drilled in the plate. Then we extended the tang with a 1/4" rod to the tip of the forearm, threading its end for the draw nut. We suggest using a glass bedding compound to bed the rear of the forearm against the receiver and over the plate and screw heads for a secure and permanent fit. Fitted in this manner and with the forearm drawn tightly against the receiver, it cannot turn, split or yield. After glass bedding sand out the forearm channel so the forearm is free of the barrel.

A TAKEDOWN No. 2 VAULT LOCK

Shooters who have seen our several No. 2 VAULT LOCK rifles and who have examined our plans for building this rifle have repeatedly inquired whether or not the action could be made as a takedown, that is, with a barrel that can be easily and quickly removed and replaced and in which the three main working assemblies, the firing/trigger guard mechanism, the breech block and the extractor assembly, can be equally as easily removed and replaced without the use of any tool. Many of these shooters have also asked if the two pins through the receiver to hold the trigger guard and extractor assemblies in place can be hidden. The answer is "Yes", and the drawing (Fig. 3-36) and photos (Figs. 3-37, 3-38 & 3-39) show how we did it.

To make the action quick and easy to disassemble without any tools and to hide the trigger guard housing hinge pin and to do away with the extractor housing retainer pin at the same time, we made the action as follows. As shown in Fig. 3-37, we milled recesses in the inside of the receiver walls to accept and locate the hinge pin where it would have been if the hole for it had been drilled through the receiver. To hold this shorter pin in place a bent pin (see arrow) was silver brazed in the bottom center of the tang plate and its end filed so that with the tang in place the hinge pin is held in place. Then, to be able to remove the trigger guard assembly quickly and easily from the receiver, slots were made in the trigger guard housing instead of holes as shown by the dotted lines TD in Fig. 3-11.

To be able to easily remove the breech block we milled a slot in the bottom of the breech block and fitted it with a small lever (Fig. 3-36) so that with the trigger guard housing assembly removed, this lever can be reached with a finger, pivoted to depress the spring backed breech block stop plunger and the breech block withdrawn from the bottom of the receiver.

To complete the quick disassembly system we did away with the extractor housing retainer pin all together. Then, to hold the extractor housing in place two 1/8" wide and 1/16" deep grooves were milled in each side of the housing (as indicated by the dotted lines in Fig. 3-27) just between the extractor and extractor lever pin holes and matching grooves milled in the inside of the receiver to accept pieces of 1/8" square rod pressed into the extractor housing grooves. The grooves in the receiver were then polished smooth to allow easy passage of the square rods in place in the extractor housing (see arrows in Fig. 3-39). All this allowed the extractor

housing assembly with the extractor in place to be slid rearward into the breech block recess and thus removed, of course only after the trigger guard assembly and breech block has been removed. One thing more, a stop of some sort is needed to hold the extractor housing in its proper rearward position. If you plan on fitting the forearm to the action as shown in Fig. 3-40 (you would not want to use this if you wanted to make the barrel a takedown) then this plate would serve as the stop. On our action we merely fitted a pin in the bottom of the receiver ring, made it a drive fit in its hole, and then milled a matching groove (see arrow Fig. 3-38) in the top of the extractor housing just long enough to place and hold the housing in its proper position.

Here is how the quick action disassembly system works. Open the action and then close it enough to move the hammer away from the front of its slot and then push the trigger guard forward enough to disengage it from the hinge pin, tip the rear of the guard down away from the pin then slide it to the rear and pull it out and away from the receiver and breech block. Next remove the breech block by pivoting the plunger stop lever and withdraw the breech block. Follow this by sliding the extractor housing assembly rearward into the breech block recess and out the bottom.

It took us some time to figure this all out but it turned out to be much simpler than we had first thought.

We really do not know why anyone would want to have a rifle which allows quick and easy removal and replacement of the barrel except for just the novelty of it, or to have a rifle with interchangable barrels, but if you want this feature on the No. 2 VAULT LOCK rifle here is how we did it, and it works reasonably well. The principle is similar to that used on some B.S.A. and Greener Martini rifles, that is, via a split receiver ring and a cross bolt to pull the split receiver together. As shown in Fig. 3-38, we split the top of the receiver ring, sawing it in two with a hacksaw. Then we drilled, counterbored and threaded two opposing holes through the thick top of the receiver ring to accept 10x32 sockethead screws; the front screw about 1/4" back from the front of the receiver (Fig. 3-39) and the second about 3/16" back of the first one. The holes were not drilled all the way through; only the heads show, one on each side. There is considerable metal on both sides of the receiver ring, but with the right or loading port side still yieldable enough to allow the two takedown screws to draw the split receiver easily together, a necessary requirement with this takedown system.

We then threaded the barrel so that, with the takedown screws loose, the barrel could be easily turned into the receiver by hand. In fact, this takedown system works best if the barrel threads are a bit undersized to a point where the barrel has a perceptible looseness before it is tightened. In this way when the barrel is turned in by hand until stopped when the barrel shoulder contacts the receiver, the tightening of the two takedown screws will cause the V threads when drawn together to draw the barrel back to become very tightly jammed against the receiver and thus providing a secure and rigid barrel to receiver fit. Wear the threads in by removing and replacing the barrel a number of times, tightening and loosening it, and when a good smooth fit is obtained which still allows the barrel to be removed by hand after the takedown screws are loosened, hand tighten the barrel as before, tighten the takedown screws and make an index mark at that spot on the side of the barrel and front of the receiver. Now you are ready to face off the breech end of the barrel and/or breech block for the .001" space between breech block and barrel as recommended, chamber the barrel and make the extractor cut. Now is also a good time to install the scope mount base or bases, and for this we recommend the Weaver type bases with top detachable mount rings, this because the scope must be removed to unscrew the barrel. Now is also the time to install the forearm anchor block and forearm. We suggest using a 10x32 sockethead screw to attach the forearm so that the same Allen wrench can be used to loosen the takedown screws and remove the forearm screw. To hold an Allen wrench, we further suggest you drill a hole in the rear of the forearm and cut a groove from that hole to the bottom of the forearm for the short end of the wrench. Now if you make the action a quick demountable one, after removing the action parts, the Allen wrench can be slipped out, the two takedown screws loosened and barrel with forearm attached turned out of the receiver.

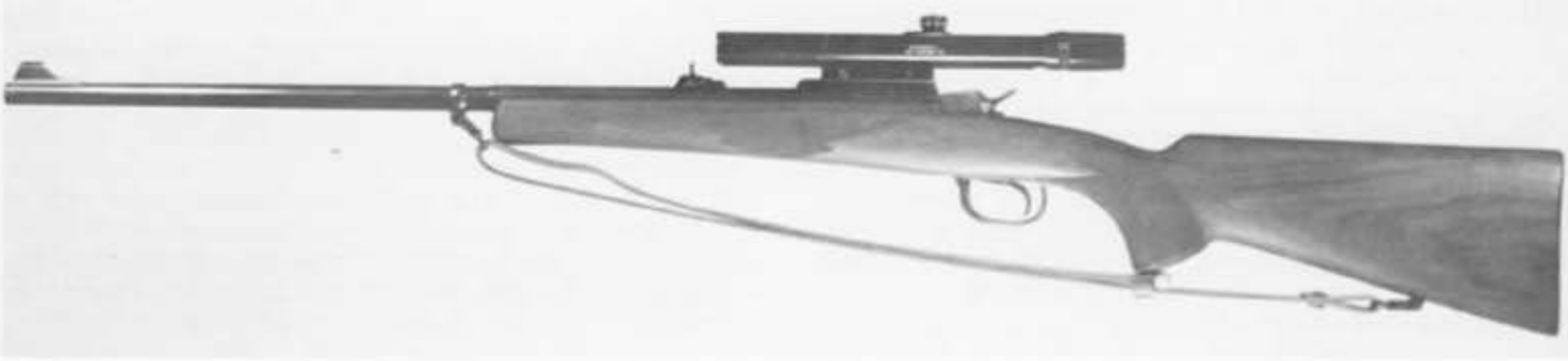


Fig. 4-A
An F.D.H. CHICOPEE R.F. rifle chambered for the .22 Long Rifle cartridge ready and fully equipped with sling and scope for the small game hunter. This was our prototype model with a 23" half octagon barrel, 4X Bushnell scope, Jaeger 7/8" carrying sling and auxiliary open sights.

Chapter 4

HOW TO MAKE
The F.D.H. CHICOPEE R.F. Action and Rifle

If you want to make a .22 rimfire rifle for yourself, or for your wife, son or daughter, or for a grandchild, a rifle for hunting small game, plinking or for casual target shooting, then we have the answer for you in these pages. Take a second look at the illustration shown here and read our description of the rifles shown (Figs. 4-A & 4-B) and it may be exactly what you have been looking for in an accurate rifle, a safe one to shoot and one which you probably can make in your own limited equipped home workshop. The rifle is our F.D.H. CHICOPEE R.F., and we had you in mind when we designed it and when we drew up the plans and instructions on how to make it.

The F.D.H. CHICOPEE R.F. rifle is a single-shot having a swinging block action. We named it the CHICOPEE R.F. because its action has features found in certain Stevens and Page-Lewis .22 rimfire rifle actions and because these rifles were once made in Chicopee Falls, MA. Even so our CHICOPEE action is entirely unlike any that Stevens or Page-Lewis ever made with some additional features which makes our action stronger, safer and easier to make.

We have already described the CHICOPEE R.F. action and rifle in Chapter 1 but we will describe it here again briefly (Fig. 4-C). It has an action in which the breech block swings down for loading and unloading, an action in which the breech block is securely supported at its rear and locked closed by a rotary locking bolt. It has a manually cocked hammer which rebounds to the safe position after firing. The trigger is fully adjustable and the extractor is a postive one. It is a rather long and thin action (Fig. 4-D), ideal for the one-piece stock, a feature many single-shot rifle shooters want. It is an action held in the stock by two screws, a feature common with most high powered bolt action rifles. Lastly, it is an action of sandwich construction; that is, the receiver and breech block are fashioned from common flat steel stock which makes for easy construction. Besides all of this, and except perhaps for the barrel, it is an action and rifle you can put together from material available everywhere. The few materials you cannot obtain locally can be purchased from Brownell's Inc., Montezuma, IA.

In the CHICOPEE R.F. action the entire firing mechanism is built between the walls of the breech block, and by having one wall removable it makes it easier to make and fit the firing mechanism parts. The action is simple to operate; merely rotate the locking lever back and the breech block swings downward of its own weight to expose the chamber (Fig. 4-E). Loading is easy because the top surface of the breech block has a groove in it to guide the cartridge into the chamber. To close the action merely place your finger on the bottom of the trigger guard and swing the breech block up and when fully closed the rotary lock will automatically lock the action closed. Although it is a strong action we recommend it only for the .22 Short, Long and Long Rifle rimfire cartridges. If you follow our instructions in making this action and rifle, if you use care in the making of the action with a precisely fitted barrel and breech block, you should end up with a sound rifle which will, if you take proper care of it, last for many years. We have the drawings exact size showing every part and detail clearly and the instructions for making each part and assembling them are explicit. If this is the first time you have ever attempted such a project you will no doubt find it necessary to make one or more parts over again just as we had to do. We have proved that the design of the F.D.H. CHICOPEE R.F. rifle is sound so now it is up to you to prove to yourself that you can make one.

Fig. 4-B

Another F.D.H. CHICOPEE R.F. rifle. This one with red cedar stock and 23" round tapered barrel weighs less than five pounds. The Brownell rib screwed to the barrel not only provides a mounting base for a scope sight but also a base for an open rear sight. The front sight is mounted on a low Williams Shorty front sight ramp screwed to the barrel.

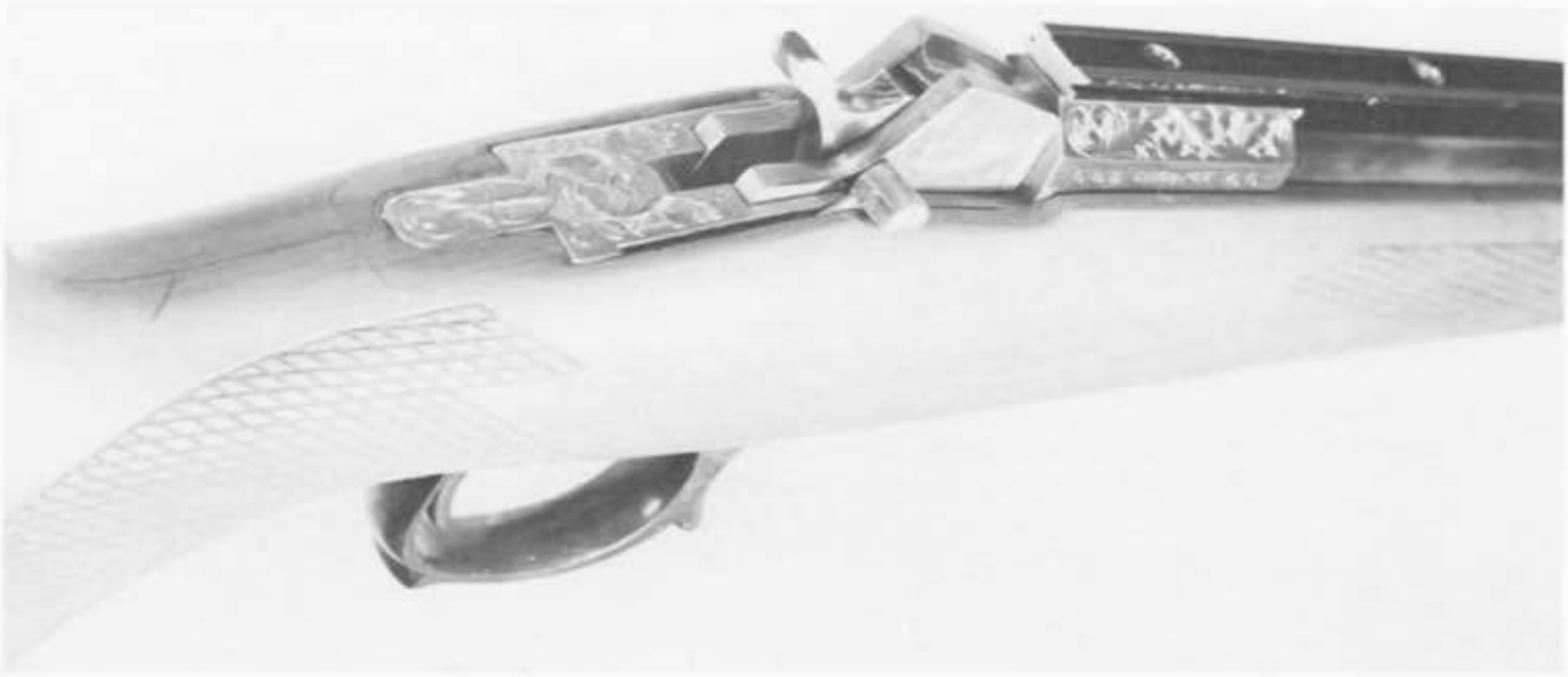


Fig. 4-C

Close-up view of the F.D.H. CHICOPEE R.F. action closed. It is securely fastened in the one-piece stock by two screws, one on each end of the action in the manner most high powered bolt action rifles are made. Rotating the knobbed lever positioned along side of the hammer unlocks the breech block and allows it to swing down of its own weight to expose the chamber. Engraved by Dennis Brooker, Prole, Iowa.

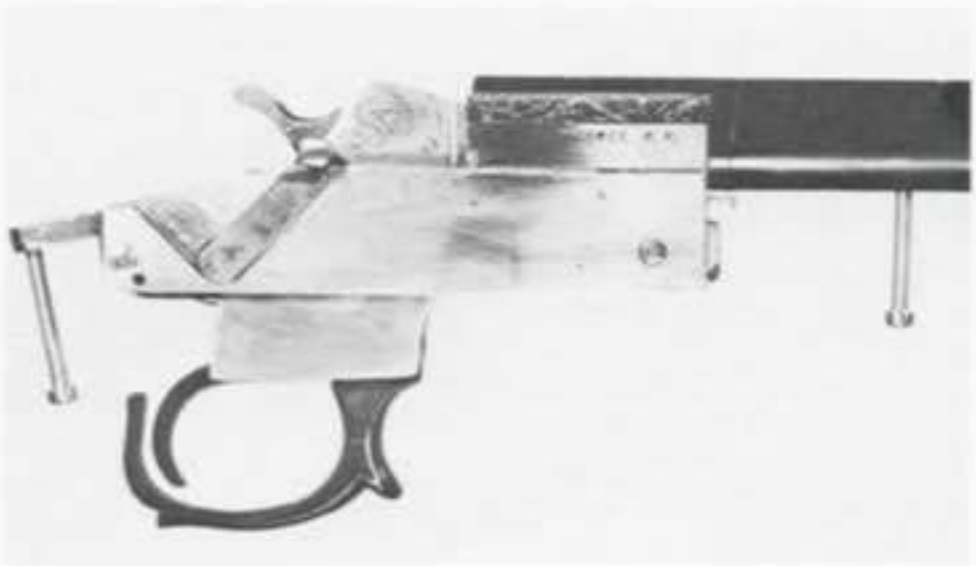


Fig. 4-D

The F.D.H. CHICOPEE R.F. action with stock removed showing the two screws which secures the barrell and action assembly in the one-piece stock. It also shows the recess in the receiver for the locking lever.

Fig. 4-E

An angled view of the action open showing the loading groove on the top of the breech block in line with the chamber to make for convenient and easy chambering of a cartridge. This also shows the extended half moon extractor.

CAPTIONS for drawings and photos with some preliminary instructions for making the F.D.H. CHICOPEE R.F. action.

NOTE: All the drawings except Fig. 4-1 are made actual size and any dimensions not given can be taken from the drawings.

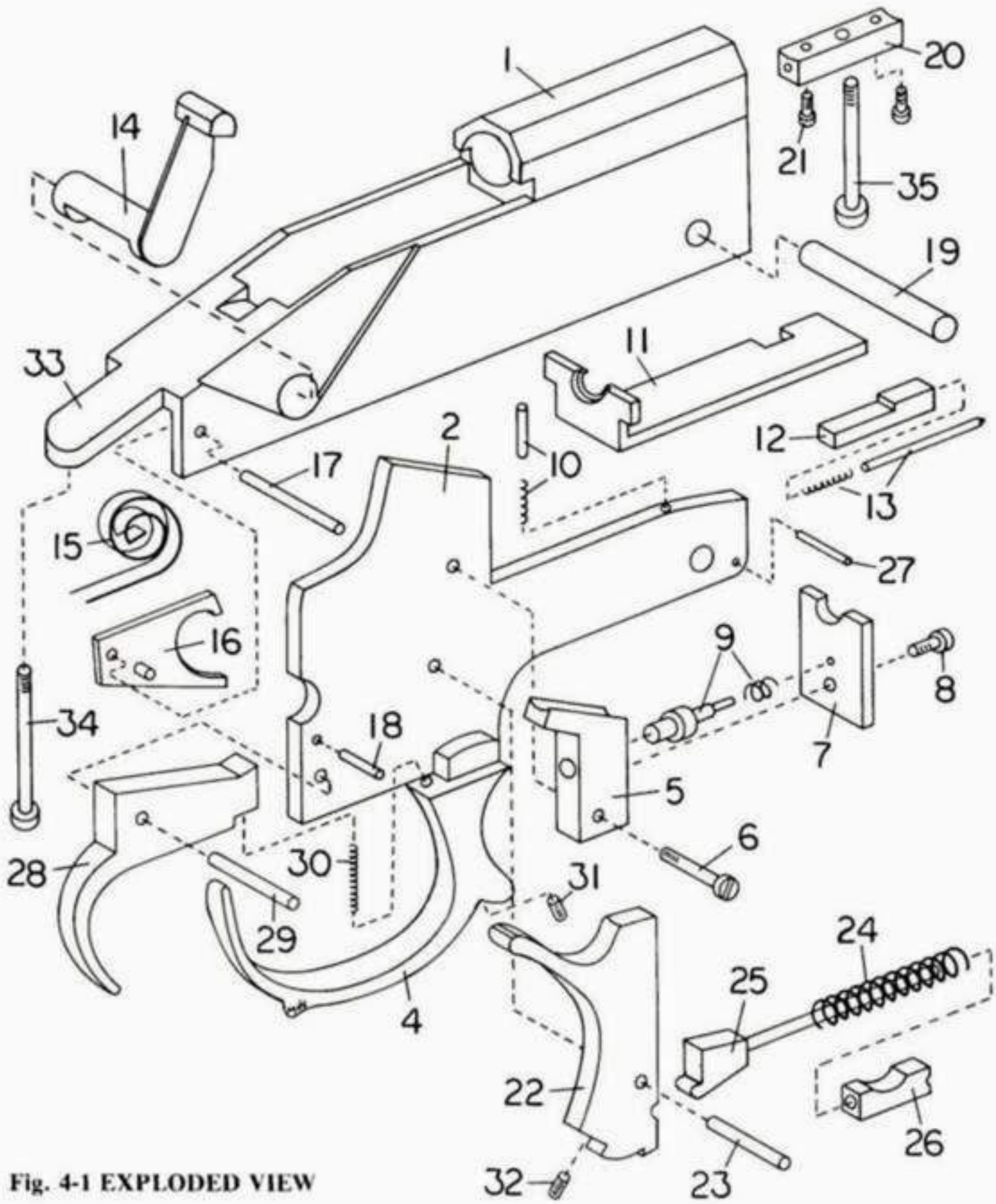


Fig. 4-1 EXPLODED VIEW

COMPONENT PARTS

1. Receiver
2. Left breech block side
3. Right breech block side (not shown)
4. Trigger guard
5. Firing pin block
6. Firing pin block retaining screw
7. Breech block face
8. Breech face retaining screw
9. Firing pin and retractor spring
10. Extractor activator pin and spring
11. Extractor
12. Extractor power block
13. Power block spring and guide pin
14. Rotary lock
15. Rotary lock spring
16. Rotary lock release lever
17. Release lever pin
18. Release pin
19. Breech block hinge pin
20. Front stock screw block
21. Front stock screw block screws
22. Hammer
23. Hammer pin
24. Mainspring
25. Mainspring strut
26. Mainspring strut sleeve
27. Mainspring strut retaining pin
28. Trigger
29. Trigger pin
30. Trigger spring
31. Trigger spring adjustment screw
32. Sear engagement adjustment screw
33. Rear tang
34. Rear tang screw
35. Front stock screw

This is the exploded view drawing, with all parts identified and numbered. It also shows the general shape of most parts and their relationship to each other. The parts in this view are not drawn to scale.

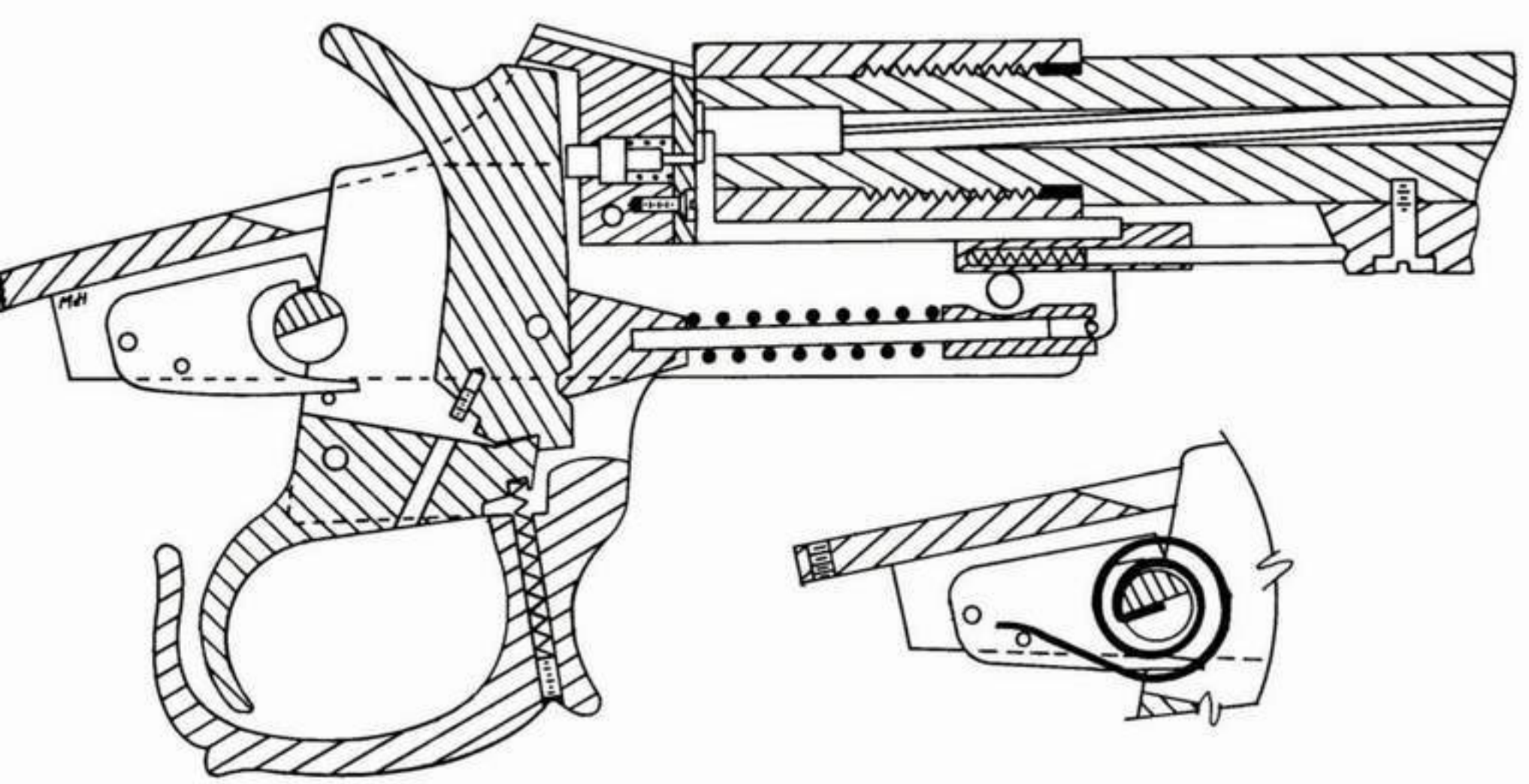


Fig. 4-2 SIDE CROSS SECTION VIEW OF THE F.D.H. CHICOPEE R.F. ACTION

This shows the action closed, locked and with the hammer in the "at rest" rebound position. This is the position the hammer is automatically placed after firing by the design and shape of the mainspring and mainspring strut. It is also the SAFE position in that the sear tip of the trigger is behind the SAFE notch on the hammer, blocking the hammer so that it cannot contact the spring retracted firing pin. Note the hole in the trigger in line with the rear adjustment screw in the hammer. Adjustment of this screw can only be made with the hammer in the rebound position. The rotary lock spring is not shown in the sectional view drawings but is shown in the accompanying detail drawing of the rotary lock and rotary lock release lever, and also in Fig. 4-16. The extractor plunger and spring (10) are also not shown. (See Figs. 4-1 and 4-7).

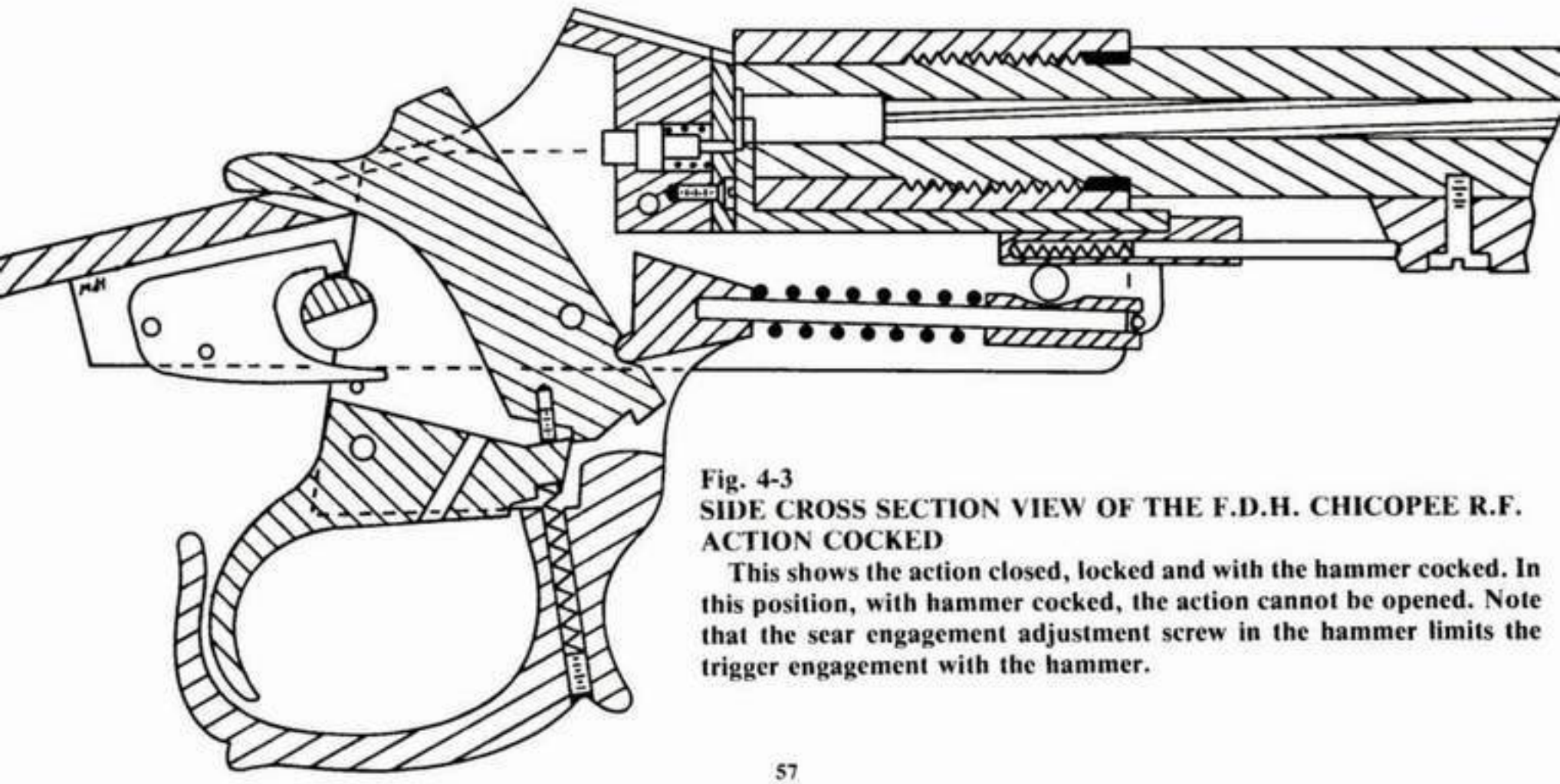


Fig. 4-3
SIDE CROSS SECTION VIEW OF THE F.D.H. CHICOPEE R.F. ACTION COCKED

This shows the action closed, locked and with the hammer cocked. In this position, with hammer cocked, the action cannot be opened. Note that the sear engagement adjustment screw in the hammer limits the trigger engagement with the hammer.

Fig. 4-4
SIDE CROSS SECTION VIEW OF
THE F.D.H. CHICOPEE R.F. ACTION OPEN

This drawing shows the rotary lock rotated to the unlocked position and the rotary lock release lever engaged with the rotary lock to hold it in that position to be released again automatically when the action is closed. The drawing also shows the extractor extended rearward.

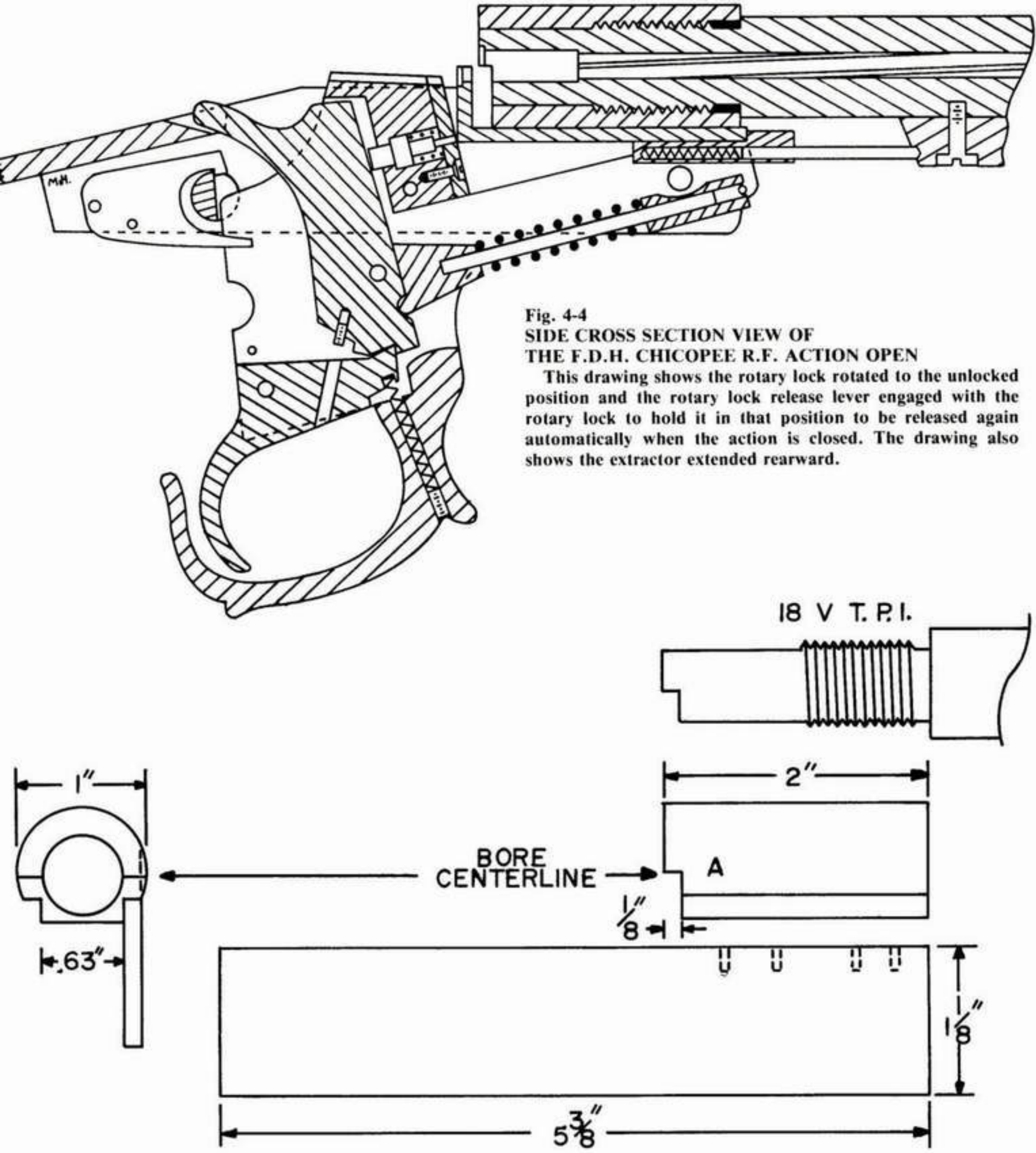


Fig. 4-5 RECEIVER PARTS

This drawing shows a rear end view of the receiver ring before it was machined octagon in shape but grooved for the receiver sides, machined flat at the bottom and with one receiver side in place as if silver brazed there. Also shown is a side view of the receiver ring and the barrel shank which had been fitted to it with both parts machined for the extractor, and one of the two 1/8" thick receiver sides drilled, as indicated by dotted lines, to accept short pieces of silver solder wire prior to the silver brazing operation. See text for details.

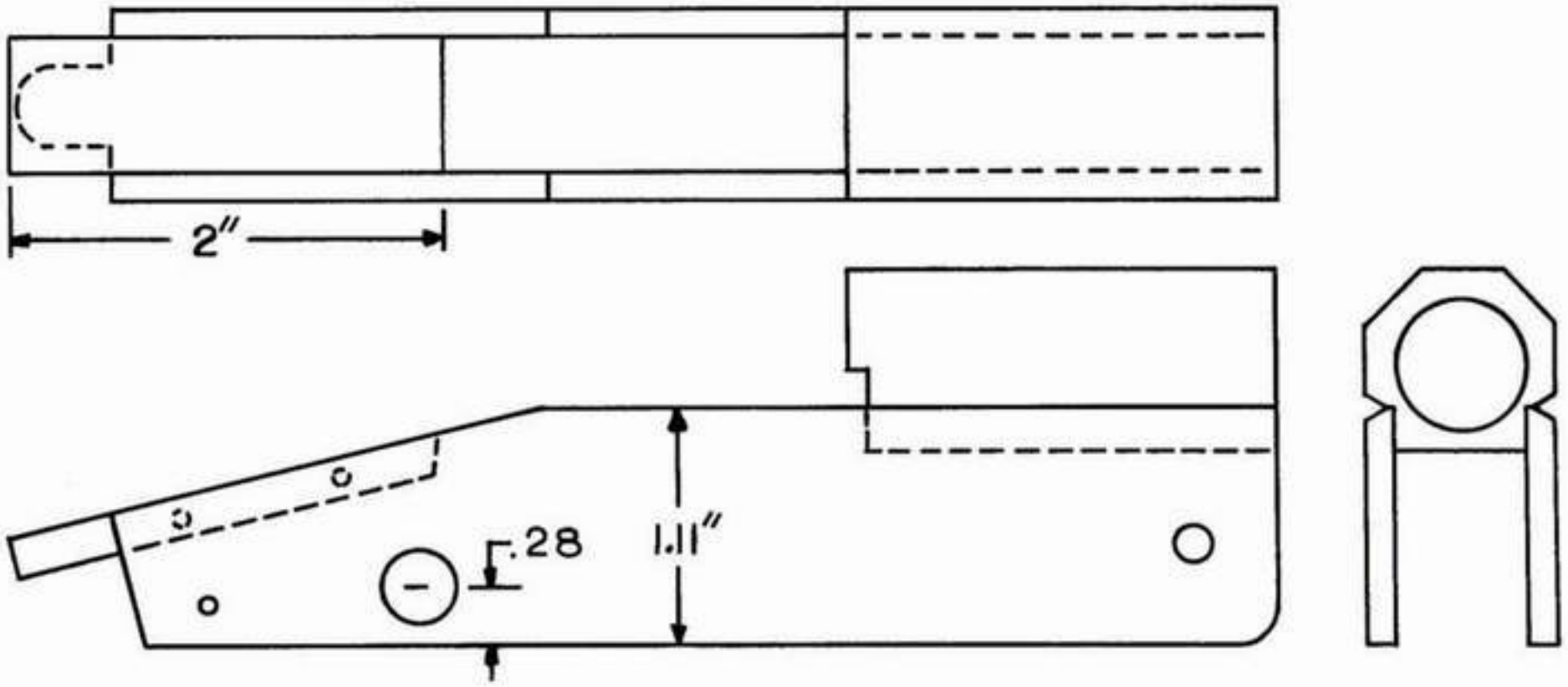
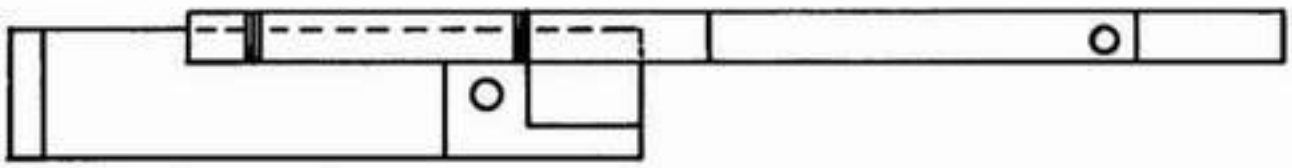


Fig. 4-6 ASSEMBLED RECEIVER

This drawing shows the top and side views of the assembled receiver with the unfinished tang in place and the front end view of the octagoned receiver ring with the two receiver sides in place ready to be steel welded to the receiver ring. Note the V channels on both sides of the receiver; channels made by beveling off the edge of the receiver ring and matching area of the receiver sides to form a channel in which to lay the steel welding bead. See text for details.



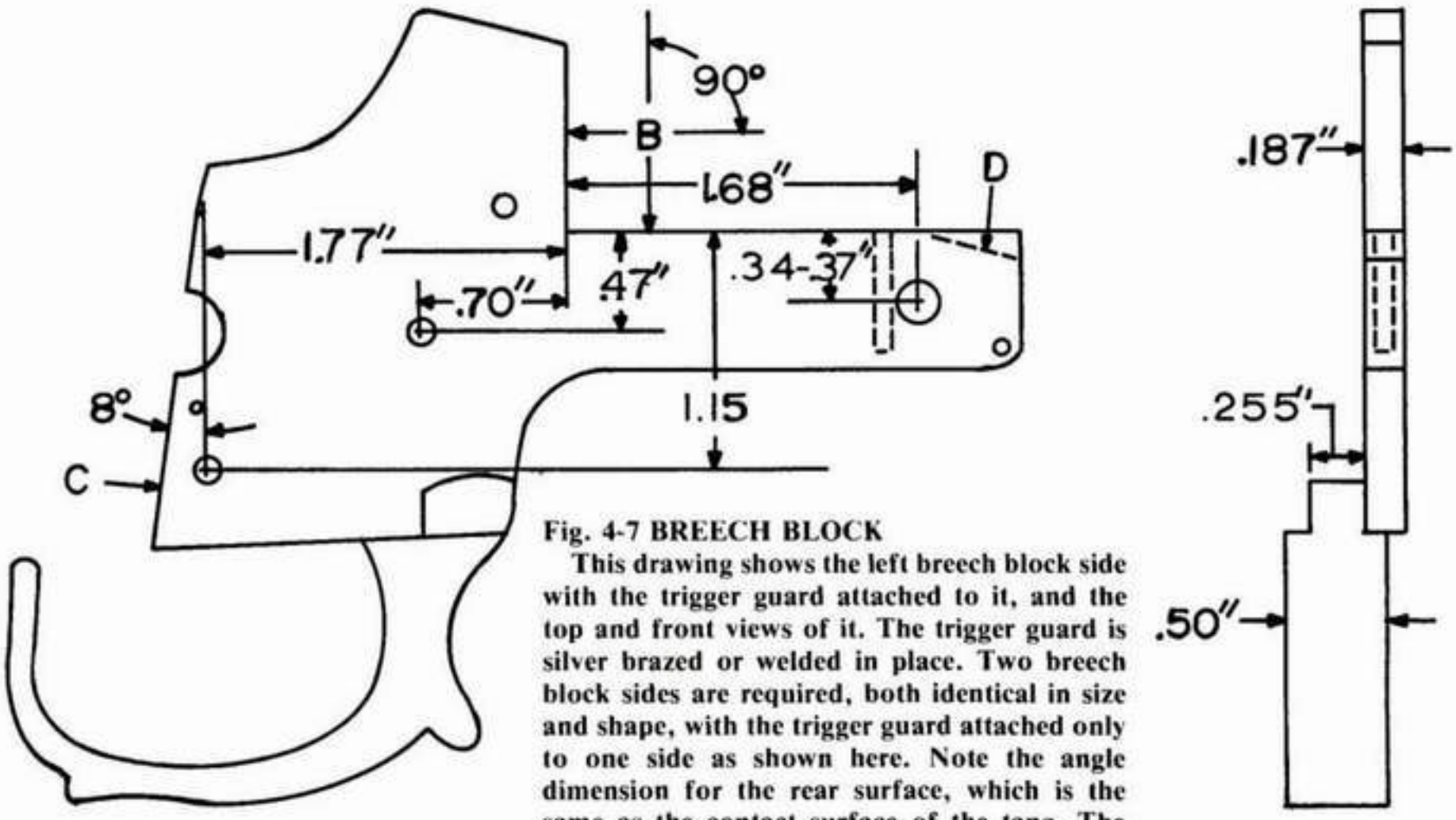


Fig. 4-7 BREECH BLOCK

This drawing shows the left breech block side with the trigger guard attached to it, and the top and front views of it. The trigger guard is silver brazed or welded in place. Two breech block sides are required, both identical in size and shape, with the trigger guard attached only to one side as shown here. Note the angle dimension for the rear surface, which is the same as the contact surface of the tang. The hole for the extractor activating pin (10) is shown here, being located just rearward of the pivot hole in the left breech block side. (Also see Fig. 4-1).

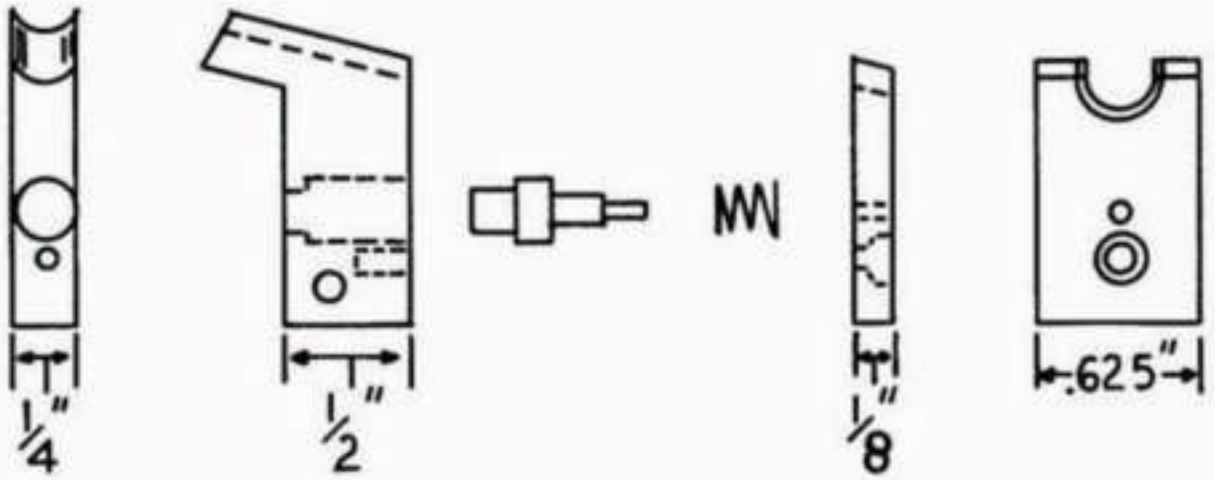


Fig. 4-8 FIRING PIN BLOCK ASSEMBLY

The firing pin assembly, showing front and side views of the firing pin block, front and side views of the breech block faceplate and side view of the firing pin and retractor spring. The grooved top of the firing pin block serves as the loading platform. A Weaver scope mount screw is used to join the parts together as shown in Figs. 4-2, 4-3 and 4-4.

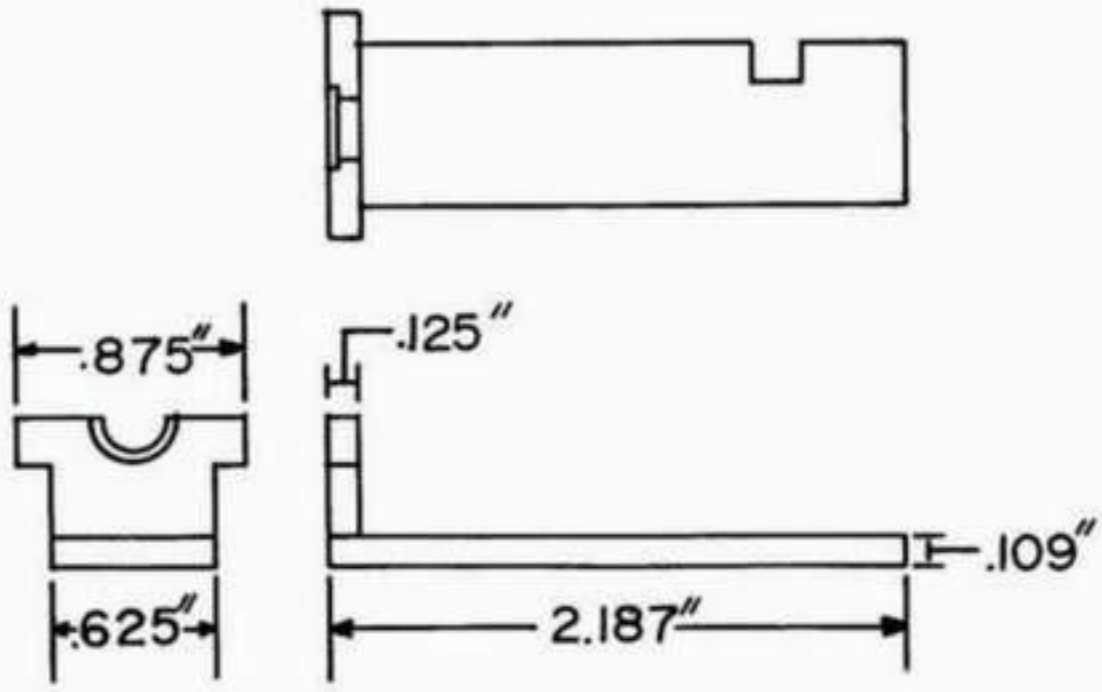


Fig. 4-9 EXTRACTOR

Rear, side and top views of the extractor. The extractor fits between the bottom of the receiver ring and the top of the breech block extensions. The top view shows the notch provided for the plunger which activates the extractor rearward upon opening the action. (Also see Figs. 4-1, 4-2 and 4-4).

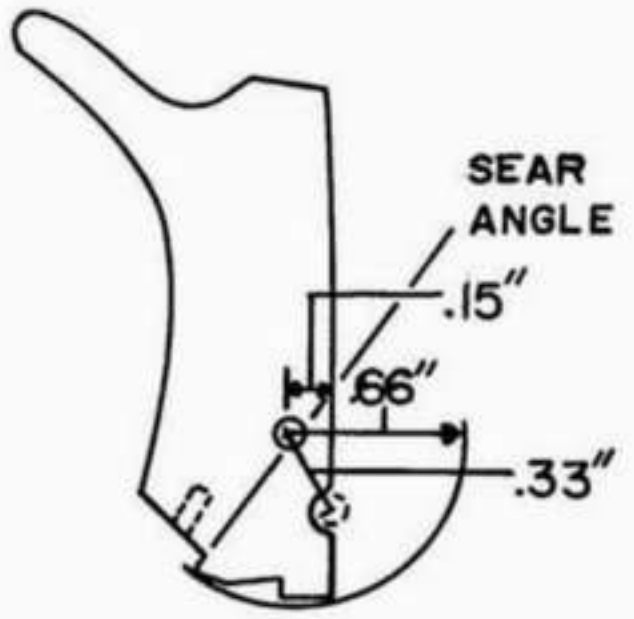


Fig. 4-10 HAMMER

The hammer of the CHICOPEE R.F. action. Further details are given in the instructions. (Also see Figs. 4-1, 4-2 and 4-3).

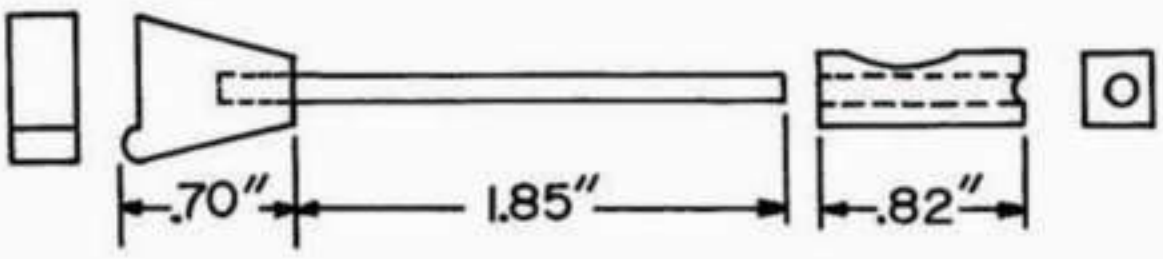


Fig. 4-11 MAINSPRING

Side and end views of the mainspring strut and strut sleeve. (Also see Figs. 4-1, 4-2 and 4-3).

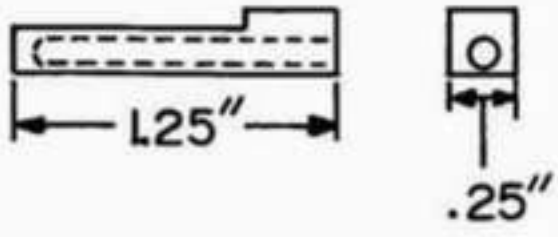


Fig. 4-12 EXTRACTOR POWER BLOCK

Side and end views of the extractor power block. (Also see Figs. 4-1, 4-2 and 4-3).

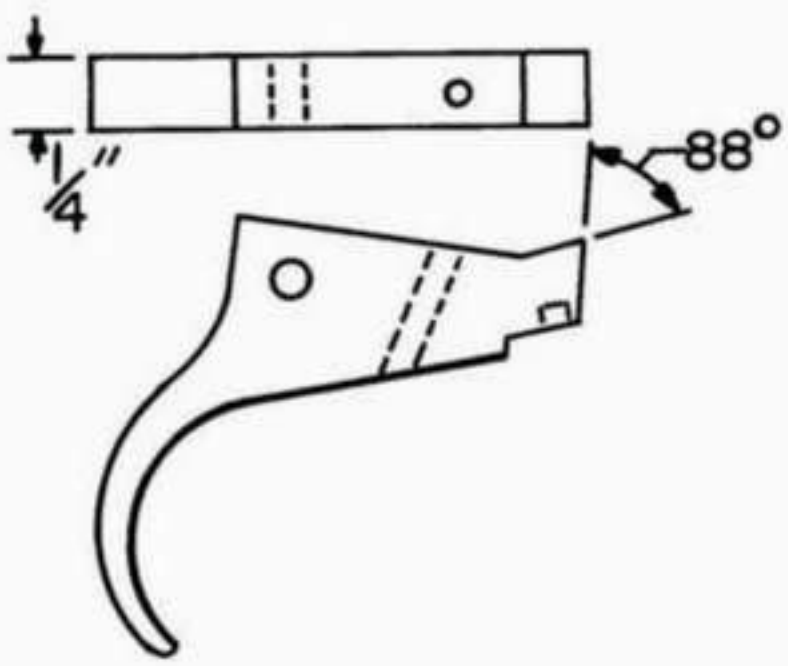


Fig. 4-13 TRIGGER
Top and side views of the trigger. (Also see Figs. 4-1, 4-2 and 4-3.)

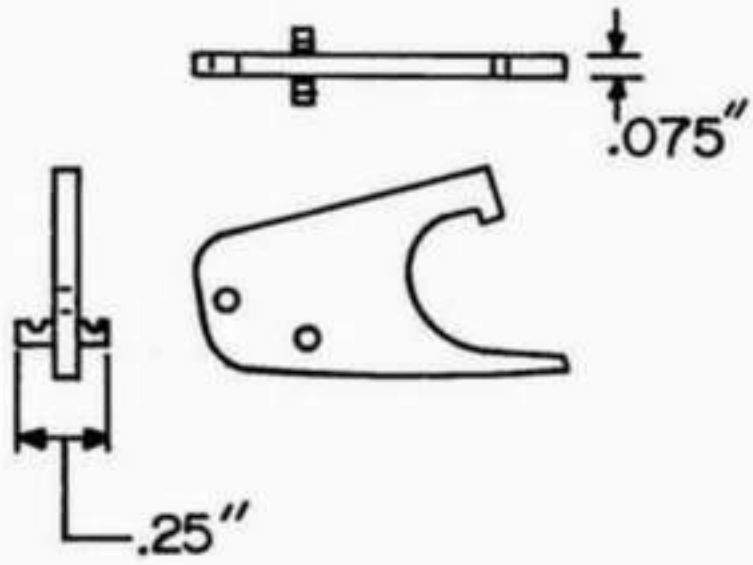


Fig. 4-14 ROTARY LOCK RELEASE LEVER
Rear, side and top views of rotary lock release lever. (Also see Figs. 4-1, 4-2 and 4-4.)

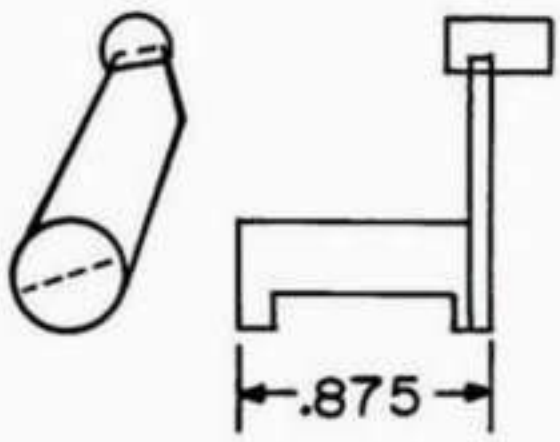


Fig. 4-15 ROTARY LOCK
Side and end views of rotary lock. (Also see Figs. 4-1, 4-2 and 4-4.)

Fig. 4-16 ROTARY LOCK SPRING
Side and end views of the rotary lock spring, plus a view showing the starting step in forming the spring. (Also see Figs. 4-1 and 4-2.)

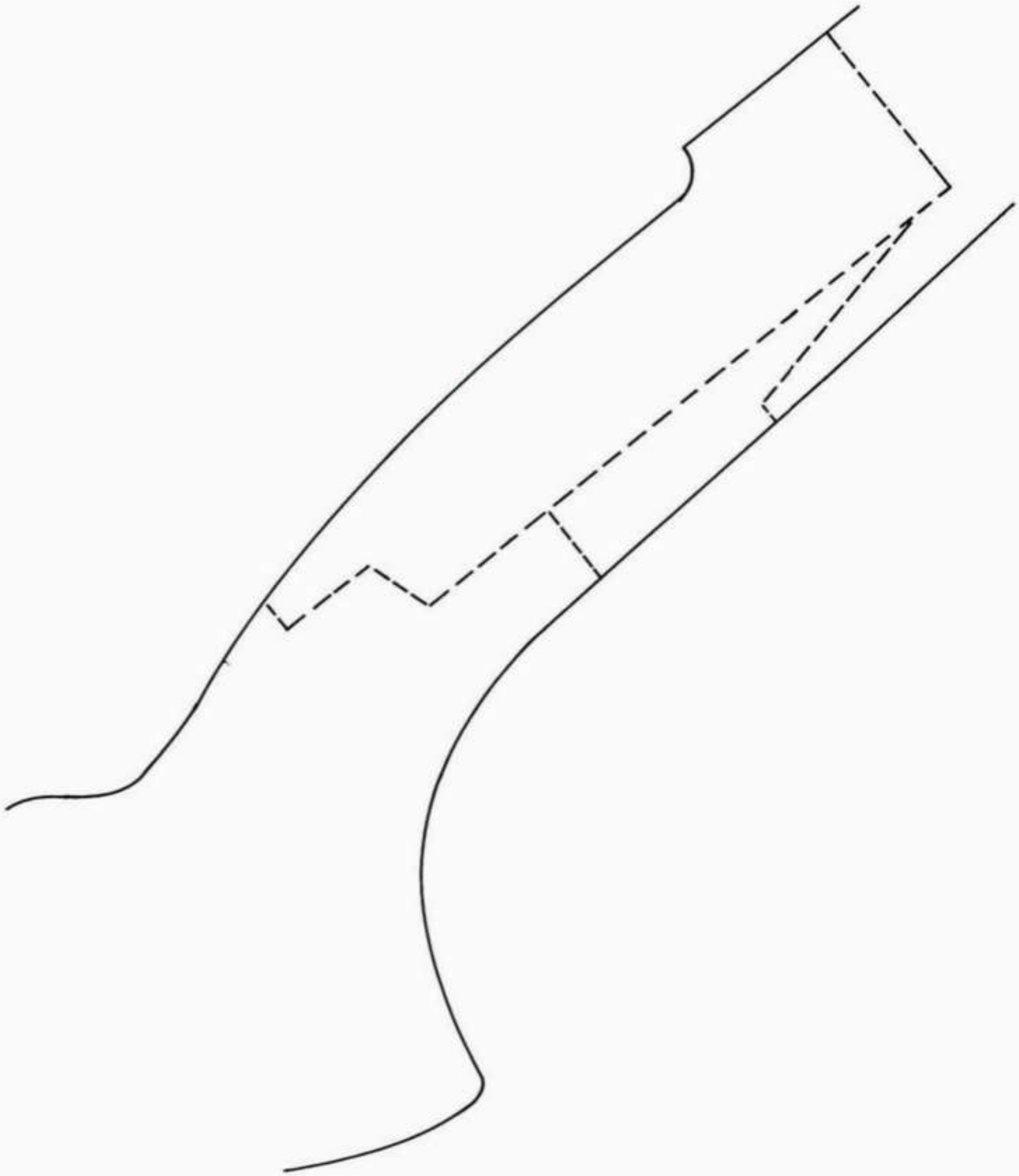


Fig. 4-17 STOCK

This is a mid-section drawing of the stock used on our CHICOPEE R.F. rifle. The dotted lines show the areas to be routed or sawed out when making laminated stocks as explained in the text.

Instructions and Sequence of Operations for Making the F.D.H. CHICOPEE R.F. Action

As you may already have noticed if you have examined the drawings, we have not provided you with every specification or all dimensions on most of the parts. We have done this purposely. If, for example, in Fig. 4-10 we had supplied all of the dimensions needed to make the hammer drawing a true mechanical drawing, it would have covered an entire page and one look at it and you surely would have thrown up your hands and given up on the entire project. Making such a drawing would have been very difficult, but far less difficult than it would be for you to make the hammer according to those dimensions. Instead, what we have done is to give only the most critical dimensions and the exact sized drawing of the parts so that you can shape each part to your own liking. In the cutting out and making of many of the parts, such as the hammer, we suggest you put masking tape on the piece of steel from which the hammer is to be made, and using carbon paper trace the outline of the hammer on it, spot the hammer pin hole and drill it and then rough saw, file or machine the hammer to shape. Leave a little extra metal on it for the final fitting. If you do not like the shape of the spur on our hammer, then go ahead and shape it to your own fancy. Making the hammer and other parts in this way is far easier than making it according to a set of figures. And, if in the making of the part, you find that you have removed a bit more metal than our drawing or dimensions show, or you have a hole drilled a few thousandths off, it probably won't matter as you can compensate for it in the making and fitting of another part to it. For example, the hammer and trigger, once you understand the relationship of the sear and safety rebound notches, they do not have to be made exactly as shown in the drawings, as long as the sear notches and pivot holes are placed in the correct positions. The entire design of the CHICOPEE action is such that there are few vital specifications to follow.

RECEIVER RING (see Figs. 4-1, 4-5 & 4-6)

Make this part from a piece of 1" diameter soft steel round stock. Trim to length and then drill or bore the barrel shank hole. A tap can be used to thread this part and 5/8 x 18 thread is ideal. The barrel should be threaded in a lathe setup. If the rifle is being made for the .22 Long Rifle cartridge, it is permissable to omit the threads and have the barrel a snug slip fit into the receiver ring and held in place by a couple of cross pins or socket-head set screws. A diameter of 1/2 or 5/8" is adequate for a slip in fitting. Fit the barrel and turn the breech end flush with the receiver ring. With the barrel in place in the receiver ring make the cut (A) for the extractor. The barrel can now be removed. Then mill in the grooves and the flat on the receiver ring as shown. If you want the receiver ring octagonal in shape on top then this can be done next or it can be done after the receiver sides have been attached.

RECEIVER SIDES (see Figs. 4-1, 4-5 & 4-6)

Use 1/8" thick cold-rolled flat stock, two identical pieces are required. Do not drill any holes in these parts at this time.

BREECH BLOCK SIDES (see Figs. 4-1 & 4-7)

Use 3/16" or equivalent thickness cold-rolled flat stock and two identical pieces are required. Remove the scale surface from these parts as well as from the receiver sides. Most dimensions are not critical except that the surfaces (B) that form the top of the breech block extension and the face of the standing breech must be level and square to each other, and the rear surface (C) at not less of an angle than shown. Proceed as follows to make these parts. On a piece of thin cardboard make a carbon tracing of the breech block side from our drawing. Cut out your carbon tracing for a pattern to use to saw out two rough breech block sides from the steel stock. Using the pattern also spot and center-punch the hammer and hinge pin holes on one of the sawed out sides. Now clamp both sides together and drill an 11/64" hole through both sides at the hinge pin location and a 7/64" hole at the hammer pin location. These holes fitted with snug fitting pins will then be your guide holes for all the remaining operations on the breech block sides so that both will be identical. Mark each side in some manner to indicate right and left side and retain this position. Your next step is to machine or file the top of the extension and standing breech face level and square.

ASSEMBLING THE RECEIVER (see Figs. 4-5, 4-6)

Before attaching the receiver sides to the receiver ring it is recommended that you spot and drill the hinge pin hole in one of the sides. Do this by clamping one side and the receiver ring together on a board or metal plate with the front of the receiver ring flush with the front of the receiver side. In the sectional view drawing (Fig. 4-2) you will note that the stem of the extractor and the breech block face plate (7) fit between the breech block and the receiver ring. Therefore, to spot and drill the hinge pin hole accurately position pieces of metal of the thickness of these two parts, or better yet, the pieces of metal that you will use for these parts (1/8" for the face plate and 7/64" for the extractor stem) in place, clamp the breech block side in place and drill the hinge pin hole using the hole already in the breech block side as the guide. Now you are ready to assemble the receiver sides to the receiver ring. We recommend silver brazing using the silver-solder wire. You will have to figure out a way of holding the three parts together and aligned so that the brazing is made sure and easy. We do it by using three C-clamps and two spacers. The spacers must be the same width as the distance between the grooves in the receiver ring for the receiver sides, or .630-.635". Make them from a piece of 1/4" or 3/8" steel pipe. If you have already made the tang (33) then it can be used as a spacer. Place one spacer at the lower edge of the receiver below the receiver ring with a clamp to hold the receiver sides in proper place on the receiver ring. Use another clamp from the top of the receiver ring to the bottom of the receiver to hold the three parts together in that direction. Place the second spacer at the rear of the receiver and clamp it in place. Vise-grip welding clamps can be used instead of the C-clamps. When you are assured that whatever clamping arrangement you want to use will work, disassemble the parts, clean the areas where the silver-solder must go, spread on a thin even layer of flux, insert the pieces of silver solder wire into the holes in the receiver side as shown in Fig. 4-5, reassemble and then apply heat from an oxy-acetylene torch until the silver solder has flowed entirely throughout both joints. Be sure that the extractor cut in the receiver ring is to the rear. The tang must not be brazed in until the breech

block has been assembled and fitted. Instead of silver brazing you can also use electric-arc welding, preferably the M.I.G. wire welding. In Fig. 4-6, showing the front view of the receiver, both sides of the receiver ring where it joins the receiver side has to be beveled off as well as the receiver side to provide a channel in which to lay a bead of weld.

THE EXTRACTOR (see Figs. 4-1, 4-2, 4-3, 4-4 & 4-9)

Use two pieces of mild steel silver brazed together. Make the stem or base from a piece of 7/64" thick steel 5/8" wide and about 2¼" long to be trimmed shorter later on. Make the extractor lip or hook from 1/8" thick stock. Start with a piece 1" long and 1/2" wide and silver braze it squarely on the end of the base. Then it is fitted by filing or machining to fit closely. This fitting can be done with the barrel in place or without it in place. In either case, after it is fitted so it slides back and forth without binding, the lip or hook must be filed or machined flush with the breech end of the receiver ring and barrel.

If you wish you can now chamber the barrel. First carefully file a shallow U-notch in the top of the extractor hook level with the bore or just enough to allow the entry of the chambering reamer pilot into the bore with the extractor in place. Then, using cutting oil on the finish chambering reamer, and turning it with a tap wrench, ream the chamber. The correct depth of the chamber is reached when you can chamber a cartridge in the chamber so that its head is flush, or .001" below the breech end. Later on after you have fitted the firing pin you must file a narrow groove down the center of the extractor face to prevent the firing pin from catching should it not retract.

ASSEMBLING AND FITTING THE BREECH BLOCK

Before the breech block halves can be assembled and fitted two items will have to be made. They are the firing pin retainer block assembly (see Figs. 4-1, 4-2, 4-3, 4-4 & 4-8), and the trigger guard (see Figs. 4-1, 4-2 & 4-7). Use 1/4" thick mild steel for the firing pin retainer block and make it as shown but leave its upper end ungrooved, and do not drill the firing pin hole; both of these jobs are best done later on. Use 1/8" tool steel for the breech block face and leave its top surface unfinished. Fit the two parts together with a 6x48 scope mounting screw. Make the trigger guard by sawing it from a 3/8" or 1/2" thick piece of mild steel stock, sawing and filing it to shape as shown, or make it from a piece of 3/8" or 1/2" square rod and bending and filing it to shape. When you have it shaped to your satisfaction and have a 1/4" thick base machined on it drill and tap the hole for the trigger spring, tapping the lower end about half way for a 6x40 socket-head screw. The trigger guard is now ready to be attached to the inside of one of the sides. For the silver-soldering drill three small holes into one side of the base almost all the way through into which you insert pieces of wire silver-solder. Apply flux and clamp the trigger guard in place to the inside of the left breech block side and then heat until the silver has flowed throughout the joint. Or, the trigger guard can be attached with arc-welding or with a screw.

With the two breech block guide pins in place clamp the firing pin block assembly between the breech block sides and drill and tap the hole for the retainer screw. This can be 6x32, 6x40 or 6x48 screw.

At this point make whatever minor adjustments are needed to slip the assembled breech block in the receiver. The breech block face must be a close fit against the breech block on both sides. Now, with the extractor in place and with only the hinge pin guide pin removed, clamp the breech block in the receiver with it forced as tightly up and forward as it will go. Use a No. 15 drill and with it drill through the hinge pin hole already in one receiver side and through both breech block sides and on through the opposite receiver side. Finish the hole with a 3/16" pin reamer. The hole is now ready to accept a hinge pin made of drill rod.

At this point you are ready to remove some metal from the top front corners of the breech block extensions as indicated by the dotted line (D) in Fig. 4-7. Be careful here as it is easy to remove too much metal—for now remove just enough to allow the breech block to swing about two thirds open.

FITTING AND INSTALLING THE TANG (see Figs. 4-1, 4-2, 4-3, 4-4 & 4-6)

Use a piece of 1/4" thick mild steel about 2" long and .630-.635" wide. Machine or file one end of it to an angle to fit perfectly against the rear of the breech block. Use cold blue as a spotting agent to achieve a close fit against both breech block sides. Clamp the tang in place and try opening and closing the breech block. If there is any binding it may be due to the top rear corners of the breech block sides not being rounded off enough or that they project too far above the tang. When you have obtained a proper fit clamp the tang in place and drill two 5/64" holes about 5/8" apart through one receiver wall and 3/16" or so into the side of the tang and insert guide pins into them. Now remove everything from the receiver, file clean the contacting surfaces between the receiver sides and tang, spread a thin layer of paste silver-solder on the contacting areas of the tang, put the tang and guide pins into place, clamp and heat until the silver-solder has melted. Instead of silver-soldering this part can also be arc-welded in place. File off the projecting ends of the guide pins and any metal that projects above the tang. The tang can be filed rounded on top. At this point you can also machine or file the rear end of the tang narrower and round its end (Fig. 4-6), as well as drill and tap the hole for the tang screw.

THE ROTARY LOCK (see Figs. 4-1, 4-2, 4-3, 4-4 & 4-15)

This mechanism locks the breech block closed and it consists of three main parts plus pins. These parts (Fig. 4-1) are the rotary lock (14), rotary lock release lever (16), rotary lock spring (15) and two pins. The function of the release lever is to hold the rotary lock in the unlocked position while the action is open and to release it again after the action is closed. To make these parts and fit them, proceed as follows. First spot the location for the rotary lock hole through the receiver. This hole must be on the juncture line with the rear of the breech block so that half the diameter of the rotary lock will engage with the breech block. Spot the correct center by placing the breech block on the outside of the receiver with the hinge pin in place and scribe a line against the rear of the breech block on the receiver side. Drill a 23/64" hole at this location through both receiver sides. Insert the assembled breech block in the receiver and while it is in the fully closed position scribe half-moon lines on the rear of the breech block sides through the hole just drilled. Remove the breech block and file the half-moon notches in the breech block sides according to the scribe marks. Reinsert the breech block into the

receiver and clamp it firmly in place in the closed position. Now use a 3/8" pin reamer and ream the hole and the notches in a single operation.

Use a piece of 3/8" drill rod to make the rotary lock bolt. Turn one end of it flat and to that end attach the stem of its lever. We made this stem from a piece of tempered steel from a discarded keyhole saw blade. Make it longer than needed to be trimmed later. If you want this stem to be flush with the receiver side then mill the recess in the receiver side (Fig. 4-1).

The stem, or the lever of the rotary lock can be positioned on either the right or left side of the receiver. Recessing the stem in the receiver side (Fig. 4-D) eliminates the need to recess the inside of the stock later on and thus weakening the stock at that point. The recess in the receiver side also provides positive stops for the rotary lock.

With the breech block removed, place the unfinished rotary lock in the receiver with its stem in the rearmost position and scribe the bolt in the inside of the receiver where half of the diameter of the bolt must be filed or milled away. Remove this metal. Just enough should be removed to allow the breech block to easily swing in the receiver while the rotary lock is in place. This done you can now shorten the stem and fit it with some sort of knob. We used a short piece of 1/4" rod rounded at both ends and silver-soldered in place. Also shorten the bolt of the rotary lock so it is flush with the receiver at the opposite end of the stem.

Make the release lever next. We also used a piece of the keyhole saw blade for this part. We suggest drilling the hole for its pin first and its location is not critical. Drill the hole for the pin in the piece of steel that you are going to use and then saw and file it roughly to shape. The only real critical thing in making this lever is to get the hook right so that the lever engages the rotary lock properly when the lock is rotated to the fully unlocked position and holds it back in that position. As shown in the drawings (Figs. 4-1 & 4-14) also fit and silver-solder a short pin in this lever on which the ends of the release lever spring will engage.

Use .025" diameter piano spring wire to make the release lever spring. It is a double spring, with the release lever fitting between the two coils. When finished and out of the action it should look like Figs. 4-1 and 4-16. Here is how we made our springs. Put a piece of 1/4" round rod upright in a vise and with a thin-bladed metal saw, saw a slot down its center about 3/8". Then a piece of the spring wire about 8" long is folded near its center leaving the two forks of it parallel and about 1/16" apart (Fig. 4-16). Now provide yourself with a 3/8" wide strip of plastic cut from a milk bottle. Insert the folded end of the spring wire into the slot in the rod in the vise, and while holding the strip of plastic where the wire will first bend as you wind it around the rod, wind double strands of wire and the plastic strip together around the rod. You may have to make a couple of practice springs before you get the hang of it, perhaps even using a needle-nose pliers to curve one side to match the other, but it is not at all difficult to get a spring that looks the same as in the drawing. Don't cut off the end of the spring yet; fit it first, slip the ends over the pin in the lever, bend them slightly and then cut them off.

Complete the lock mechanism by installing the release pin (18) (Figs. 4-1, 4-2, 4-3 and 4-4). Install it in the left breech block side. Make this pin from a piece of .031" spring wire and drill a hole so it is a press fit in it. If you do not get the pin in the exact position, adjustment can be made by bending the lower extension on the release lever.

THE FIRING MECHANISM (see Figs. 4-1, 4-2, 4-3, 4-10, 4-11 & 4-13)

Make the hammer and trigger first, then the mainspring strut and then the firing pin. Make the hammer and trigger from either tool steel or cold rolled flat stock and we suggest you use the latter. If tool steel is used it should be hardened and drawn, if cold rolled steel is used it must be case hardened. This is easy to do with Kasenit which is available from Brownell's Inc. Duplicating the exact outline and dimensions of our hammer and trigger is not essential.

Start by putting masking tape on the pieces of 1/4" steel that you intend to use and then use carbon paper to trace the outline of the hammer and trigger drawing on the taped steel. Spot and drill the pivot hole in the hammer first with a 7/64" drill. then saw and file to rough size, but do not cut in the sear and safety notches at this time. Assemble the breech block and with the hinge pin and firing pin block retainer screw in place, drive out the hammer guide pin and drill or ream the hammer pin hole to 1/8" size. From now on most of the rest of the work of fitting the firing mechanism can be done on the side of the breech block to which the trigger guard is attached. Spot and drill the hole for the trigger pin, first to 7/64" and later on to 1/8" size. If you do not want this pin to show when the action is open then do not drill all the way through the breech block side. After the trigger and hammer have been fitted you can then drill the opposite breech block side. Use a medium tension spring for the trigger. Incidently, if you make a mistake with any hole the mistake can be easily corrected. Do this by merely silver-soldering a common nail in the hole, filing the ends down and then spotting and redrilling the hole. The patch will be hard to find.

To fit the hammer and trigger, first dress the bottom of the hammer to a radius (Fig. 4-10) and then work the trigger so it will fit under the hammer. Cut the safety notch next and alter the sear tip of the trigger as needed so that it will hold the hammer nose about 1/8" away from the firing pin block. The bottom V of the notch should be deep enough so that the very tip of the trigger does not contact it. Drill the shallow hole under the front of the trigger for the trigger spring and this can best be done by having the trigger and hammer in place and using the trigger spring hole in the trigger guard as the guide for the drill.

The next step is to make the cut for the sear notch in the hammer. Start it plenty far back and file or machine it so the hammer cocks as much as we have shown it in Fig. 4-3.

The angle of the sear on the hammer must be such that when the hammer is cocked the trigger will have a tendency to stay fully engaged with it and the line in the hammer drawing shows the angle to strive for. It is also very important to have perfectly flat sear contact surfaces and sharp sear edges in order to have a safe and reliable trigger action. Drill and tap a hole for a small socket-head screw (32) in the hammer and an access hole to it in the trigger. A No. 6 screw with 40 threads is ideal.

The next step is to make and fit the mainspring parts. Make the head of the strut from mild steel about as shown in Fig. 4-11 and drill it undersized for the strut rod. The best material for this rod is the largest size spring wire in the Brownell spring wire kit, namely wire size .120". Make the strut sleeve and drill the holes for the strut pin (27). A 1/16" pin is adequate. Notch the hammer for the strut. For initial testing of the hammer action you can use a piece of medium tension coil spring for the mainspring, but for the final spring use a heavy

tension spring that will just slip over the strut rod. Before any more fitting is done you should now make and install the firing pin. Spot and drill a 5/64" hole through the breech block face so that a pin through it centers in the bottom of the cartridge rim recess of the chamber. After drilling this hole and checking that it is correctly placed, assemble the breech face to the firing pin block and with a drill, spot a hole on the front of the firing pin block. Remove the breech face and drill a 11/64" hole in the firing pin block to 1/8" of going all the way through. Follow this by going all the way through with a 9/64" drill. Make the firing pin about as shown in Fig. 4-8 from drill rod. Finished and in place with a retractor spring, it must project .035" from the rear while at the same time its tip is flush with the breech face. Fully depressed so its base is flush with the rear of the block, its tip should then protrude .035" or a thousandths or so more.

Now comes the final fitting. It is important for the safe use of this rifle that the firing mechanism functions as we designed it, and one of the design features is the rebounding hammer. It is the action of the mainspring and strut against the hammer that brings about the rebound automatically after firing and allows the trigger to move behind the safety notch to prevent the hammer from contacting the firing pin unless the trigger is pulled. With the complete firing mechanism in place on one breech block side it is easy to see the action of the strut against the hammer. File or machine the strut so that it normally holds the hammer nose off to about 5/64" from touching the retracted firing pin. The trigger tip, as well as the safety notch, must be so made that the trigger tip is free to move behind the safety notch yet close enough to stop the hammer and prevent it from contacting the firing pin if the hammer is pushed forward, or accidentally knocked forward, or if the hammer slips from under :he thumb while cocking it. You need only enough rebound to allow the above to take place, more rebound than necessary reduces the force of the hammer striking the firing pin. To increase rebound movement either deepen the strut notch in the hammer or shorten the round pushing end of the strut, or remove some metal from the upper face of the hammer. To decrease rebound shorten the upper part of the strut.

At about this point you will discover that the tang interferes with cocking the hammer and the opening of the action because the hammer spur contacts the tang. To remedy this a notch has to be cut in the tang to allow partial passage of the hammer spur (Fig. 4-3). The notch can be made with a file. You may also have to make the hammer spur thinner or undercut it more so that it does not contact the rotary lock release lever. Anyway, what you want is to have the action open sufficiently for adequate extractor movement. Even before having reached this point you will probably have to file a bit more off of the top front of the breech block extensions. Be very careful here as you want this to be the stop for the opening swing of the breech block. After you have taken care of the stop and the notch in the tang, it is then time to finish off the top of the breech block and groove it to serve as the loading platform. You merely file or machine the groove deep enough so that a cartridge placed on it can be pushed into the chamber and a cartridge or empty case extracted from it.

FINISHING THE EXTRACTOR (see Figs. 4-1, 4-2, 4-3, 4-4 & 4-9)

The extractor has two sources of power, and while either one might be satisfactory by itself we suggest you employ both. The spring backed plunger (10) fitted in the front end of one breech block extension and engaged in a notch in the extractor base provides the initial power. Use a 7/64" drill rod for this plunger. The second source to push the extractor all the way back consists of the extractor power block (Fig. 4-12), spring and guide rod. Make the power block from a piece of 1/4" square mild steel to fit between the breech block extensions and between the receiver and the hinge pin with a stop in it to fit below the extractor. Use a 1/8" or slightly smaller medium tension spring and a guide rod to fit.

STOCK (sees Fig. 4-17)

The F.D.H. CHICOPEE R.F. rifle is designed for a one-piece stock with the stock covering most of the action. The stock and the barreled action are held together with two screws (Figs. 4-1 & 4-D) similar to that employed by most high powered bolt action rifles. We used 8x32 fillister head screws, a long one to turn into the tang and a shorter one to turn into a block attached to the barrel with two scope mounting screws. We recommend that you make and use brass escutcheons in the stock to surround the screw heads.

The stock can be made from a single piece of solid wood and walnut is always the preferred wood to use. Here are the dimensions of the stock on one of my CHICOPEE R.F. rifles: overall length—27", length of pull—13", drop at comb—.750", drop at heel—1.5".

Instead of making the stock from a single piece of wood we suggest two alternatives. The first alternative is to make the stock from four separate pieces of wood. This is how we did it. The receiver is approximately 7/8" thick and we took a walnut board 6" wide, 30" long and 1" thick and had it planed to 7/8" thickness. From this board we sawed the rough outlines for the pieces that would become the center portion of a 3-layer laminated stock. The piece for the forearm was grooved for the barrel and its rear end was sawed to fit the front and bottom of the receiver, and it was attached to the rifle with the forearm screw and forearm block. In about the same way the butt section was fitted to the rear of the receiver and attached with the tang screw. Then we took a 3/4" thick walnut board and with a band saw sawed it in two edgewise to obtain the two matching boards that formed the outer layers of the laminated stock. With the forearm and butt sections attached to the rifle we simply glued the two thin layers to the center sections. The rest was merely a matter of shaping the outside. The stock on our prototype CHICOPEE R.F. rifle was made this way and the result was very satisfactory (Fig. 4-A).

The stock on our second rifle was made of two layers (Fig. 4-B); two 3/4" thick boards glued together. However, before gluing them together we sawed each board to the general outline of the proposed stock and then carefully routed out each half with a drill press to fit the barrel and action. This was not difficult. After the routing was done (as indicated by dotted lines in Fig. 4-17) we glued the two pieces together. After that it did not take too much work to finish the stock.

When you are sure everthing is correct and the action is functioning as it should, it is time to do some polishing and hardening of some parts. If you have made the hammer, trigger and breech block face of tool steel, these parts and the firing pin need to be hardened and drawn (tempered). Information on this can be found in Brownell's catalog or in books available from them. If the hammer and trigger have been made of cold rolled steel, case harden both parts all over once

with Kasenit and repeat the operation on the sears of both parts. The sides of both parts then can be repolished and a fine hone used to touch up the contacting sear surfaces. However, before you harden the trigger and hammer, carefully reread the instructions for making and fitting the hammer and trigger and the fitting of the strut to the hammer to make double certain that the hammer rebounds properly and that the trigger engages and functions properly with the sear and rebound notch. Also adjust the trigger spring set screw and the sear engagement adjustment screw to a trigger pull of at least 3 pounds.

ADDITIONAL IMPORTANT INFORMATION

The F.D.H. CHICOPEE R.F. action was designed so that the breech block will swing open of its own weight when the rotary lock is released. To achieve this free opening swing it may be necessary to polish the sides of the breech block and the inside sides of the receiver so that there is no drag or bind.

It is also very important that the breech block close tightly against the barrel breech and against the tang. If after the action is finished there remains a gap between the breech block and the barrel no matter how small it should be corrected. This is best done by replacing the breech block face plate with a thicker one. Incidently, good .22 caliber barrels for the .22 Short and Long rifle cartridges are available from Numrich Arms, Inc. West Hurley, N.Y. It makes little difference whether the barrel has a 1 in 14 or 1 in 16 inch rifling twist for the .22 Short or Long Rifle.

SIGHTS

Whether you want open sights or a scope sight on the CHICOPEE R.F. rifle you make, or you want both types of sights, we highly recommend that you use the blank tip-off scope base that Brownell sells. A five inch section of this base fitted and attached to the top of the receiver ring and barrel with two or three screws is ideal for a scope mounting, placing the scope the right height above the hammer so that the rifle can be readily cocked. If you want open sights in addition then we recommend the use of the Williams Guide rear sight and a front sight mounted on a Williams Shorty ramp base. Another choice of sights is to use an eight inch section of the blank tip-off base and dovetail it to accept the Marbles windage and elevation adjustable No. 16 folding leaf open sight along with a front sight mounted on the Williams Shorty ramp.

NOTE: Use 11/64" diameter drill rod to make the firing pins for both the Chicopee R.F. and C.F. actions. Turn the tip so it is a snug but bind free fit into the 5/64" hole drilled for it in the breech block face plate. A round needle file can be used to give this hole a slight taper from rear to front. Turn the rear end of the firing pin to 9/64" diameter. Use a light tension spring, but one long and strong enough to positively retract the firing pin. Polish the firing pin, and if need be, the firing pin hole so that the firing pin is bind free.

Fig. 5-A

The F.D.H. CHICOPEE C.F. action is of sandwich construction of four layers of steel; two for the breech block and two for the receiver, matched and joined together with screws, welding or silver brazing. It is a swinging block action with the breech block hinged on a pin or screw at its front end, supported solidly at the rear by heavy action-depth shoulders and locked securely closed by a locking lever at the rear. It is an ideal action for cartridges such as the .22 Hornet, .218 Bee, .25-20 and .256 Magnum. It is also very suitable for the .22 Long Rifle and .22 WMR Magnum cartridges.

Chapter 5

HOW TO MAKE
The F.D.H. CHICOPEE C.F. Action and Rifle

Have you ever wished for a non-bolt action single-shot rifle chambered for the .25-20 WCF cartridge? Have you ever wished to make a rifle for this cartridge or for another cartridge similar to it, say the .22 Hornet, .218 Bee, .25 Hornet or .256 Magnum but did't know how to go about it? Of course it has to be a rifle with an action (Fig. 5-A) of fairly simple design so that you could make it in your own home workshop. And have you wondered if anyone had ever made working plans for such an action and rifle? If so, you need look no farther for here they are in this chapter.

If you have some mechanical ability and some knowledge about firearms, and it you have in your shop a drill press and a metal turning lathe, plus some files, drills and hacksaw and if you can read simple drawings and instructions, you should be able to make a rifle like the one shown here (Fig. 5-B).

In Chapter 1 we have already described something about the CHICOPEE centerfire action. To begin with, this action is a swinging block action, meaning that its breech block swings downward on a hinge pin when it is opened (Fig. 5-C). Except for the receiver ring, this action is of sandwich construction; that is, both the receiver and breech block are made of layers of flat stock steel material available everywhere. The firing mechanism is a simple one and it is built between the breech block layers. Its manually cocked hammer is a rebound one that is always in the SAFE position unless the trigger is pulled. It has a fully adjustable trigger and depending on how well you make the trigger and hammer the trigger pull will be short and crisp. It has a positive extractor suitable for both rimmed and rimless cartridges. A very simple but very strong locking mechanism securely holds the breech block closed and locked. Inside the breech block and positioned between the locking lever and the hammer there is a safety device which prevents the rifle from being fired unless the locking lever is fully engaged and another feature prevents the action from being opened when the hammer is cocked. A through-bolt secures the buttstock to the receiver. Last but not least is the method used to support the breech block in the receiver to hold it snug against the breech end of the barrel against the thrust of firing.

An outstanding feature of this action is the way the breech

Fig. 5-B

This is an example of a rifle style which can be built on the F.D.H. CHICOPEE C.F. action. It is a varmint rifle in .218 Bee caliber weighing about 8.25 pounds with scope and 24'' medium weight barrel. The stock and forearm are made of fancy burl walnut and shaped sporter style with minimum wood. The scope on this rifle is an obsolete 7X Fecker Woodchucker but almost any modern hunting scope could also be used in appropriate mounts.

Fig. 5-C

The F.D.H. CHICOPEE C.F. action open with a fired cartridge case partially extracted from the chamber. To open this action the locking lever at the top rear of the receiver is pulled back which allows the breech block to swing downward of its own weight, and which also activates the extractor at the same time. The extractor is spring loaded and readily adapts to either rimmed or rimless cartridges. A groove in the top surface of the breech block serves as a loading ramp or guide. To close the action the breech block is swung upward by finger pressure on the trigger guard allowing the locking lever to snap forward into locking position. However, if for any reason the locking lever does not fully engage under the locking bolt in the receiver, the hammer cannot be cocked. This is a safety device which prevents the rifle from being fired unless the locking lever is fully engaged, and when this happens slight pressure against the rear of the locking lever will fully lock the action so it can be fired. When making this action this safety device should not be omitted. Also note the radial surface on the rear of the breech block, a surface which has full length contact with matching concave surfaces on locking shoulders (see arrow) so that all the rearward thrust on the breech block when firing the rifle is taken up by these twin shoulders and not by the hinge pin.

block is supported at the rear. The rear walls of the breech block are concave at a radius with the hinge pin and are mated with two support shoulders (see arrow Fig. 5-C) made the full depth of the receiver with both shoulders secured to the inside of the receiver walls by pins and silver brazing or welding. If the concave and convex surfaces are properly matched and the shoulders properly attached then there is little chance of wear or breech block set-back ever occuring. The breech block is so solidly supported at the rear that the hinge pin serves only as a hinge pin.

There are other things you may like about this action and rifle. One thing is that it looks like a single-shot with its two-piece stock (Fig. 5-D). Even though it is larger and stronger than it need be for the .22 rimfire cartridges, it can never-the-less be used for them to make up a fine small game sporter or an accurate target rifle. The action can easily be made heavier. For example, the breech block and receiver can be made with thicker walls and the receiver ring made larger to accept a larger barrel shank, and if this were done the action could be used to build a Schuetzen target rifle in .32-40 or .38-55 calibers. The trigger guard can be shaped differently than we show it. We know of two shooters who have made rifles on the action identical to our plans with one being chambered for the .222 and the other the .223. Both rifles have been fired many times without a sign of trouble. Just the same, it is our recommendation that this action be only used with less powerful cartridges than these. For these and other more powerful centerfire cartridges we recommend either our No. 1 or No. 2 VAULT LOCK actions as described in Chapters 1, 2 and 3.

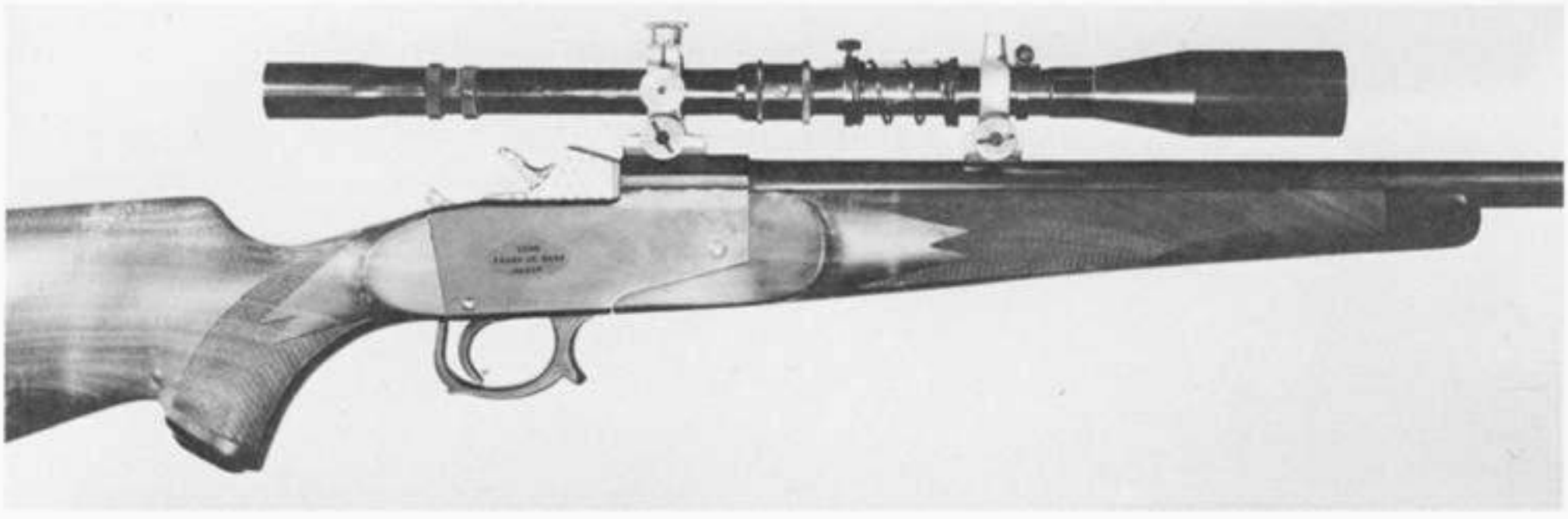
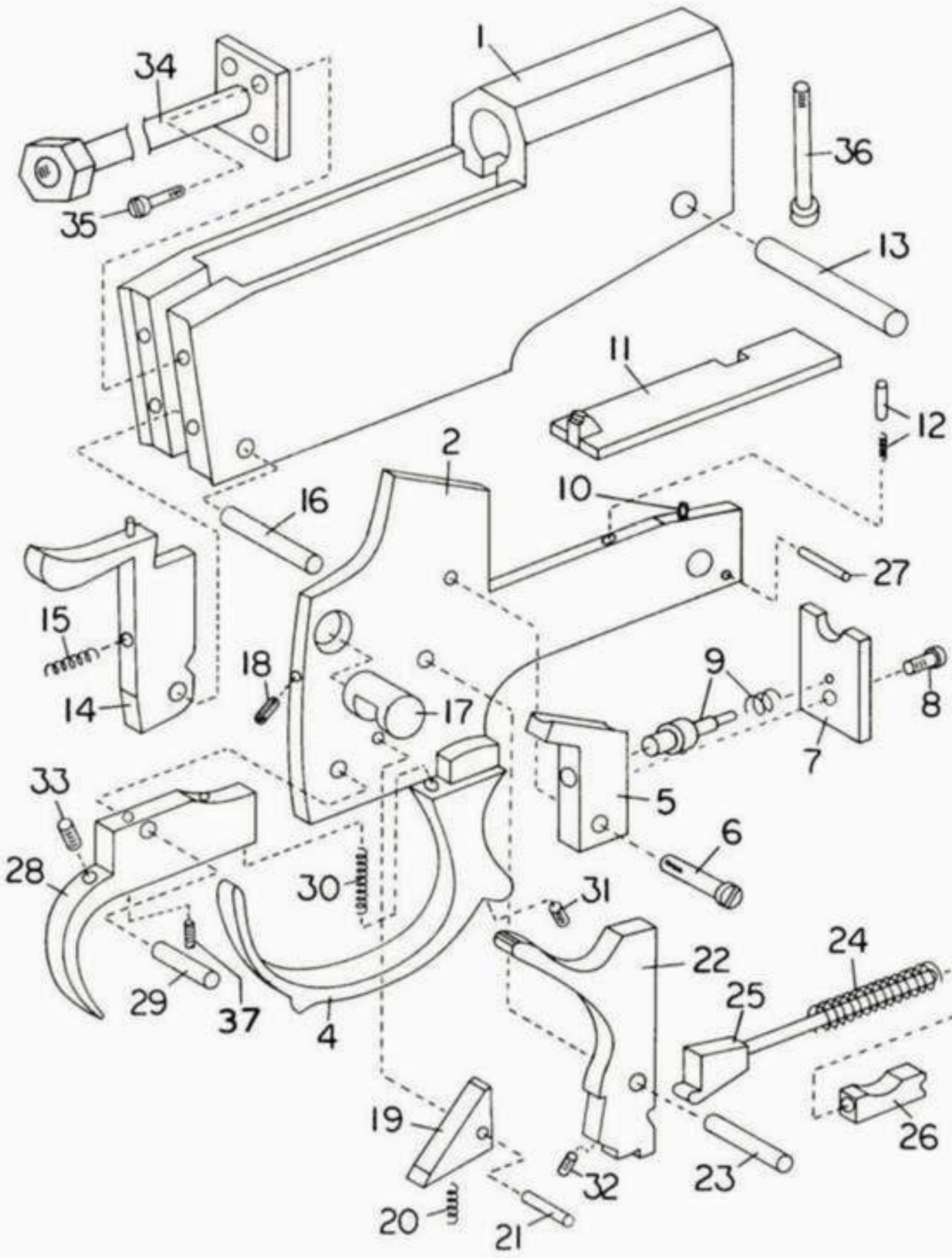


Fig. 5-D

Although the F.D.H. CHICOPEE C.F. action is somewhat long it is never-the-less trim and it can be stocked that way as this one is. Note the well curved pistol grip and the forearm which extends rearward under the front part of the receiver.

CAPTIONS for drawings and photos with some preliminary instructions for making the F.D.H. CHICOPEE C.F. action.

NOTE: All the drawings except Fig. 5-1 are made actual size and any dimensions not given can be taken from the drawings.



COMPONENT PARTS

1. Receiver
2. Left breech block side
3. Right breech block side (not shown)
4. Trigger guard
5. Firing pin block
6. Firing pin block retaining screw
7. Breech face
8. Breech face retaining screw
9. Firing pin and spring
10. Extractor activating pin
11. Extractor
12. Extractor plunger and spring
13. Breech block pivot pin
14. Locking lever
15. Locking lever return spring
16. Locking lever pivot pin
17. Lock cross bolt
18. Lock cross bolt retaining screw
19. Hammer safety lock lever
20. Hammer safety lock lever spring
21. Hammer safety lock lever pin
22. Hammer
23. Hammer pivot pin
24. Mainspring
25. Mainspring strut
26. Mainspring strut sleeve
27. Mainspring strut retaining pin
28. Trigger
29. Trigger pivot pin
30. Trigger spring
31. Trigger spring adjustment screw
32. Sear adjustment screw
33. Trigger overtravel screw
34. Tang
35. Tang screw (4)
36. Stock bolt
37. Hammer safety lock lever spring plug screw

Fig. 5-1 EXPLODED VIEW

This is the exploded view drawing, with all parts identified and numbered. It also shows the general shape of most parts and their relationship to each other. The parts in this view are not drawn to scale.

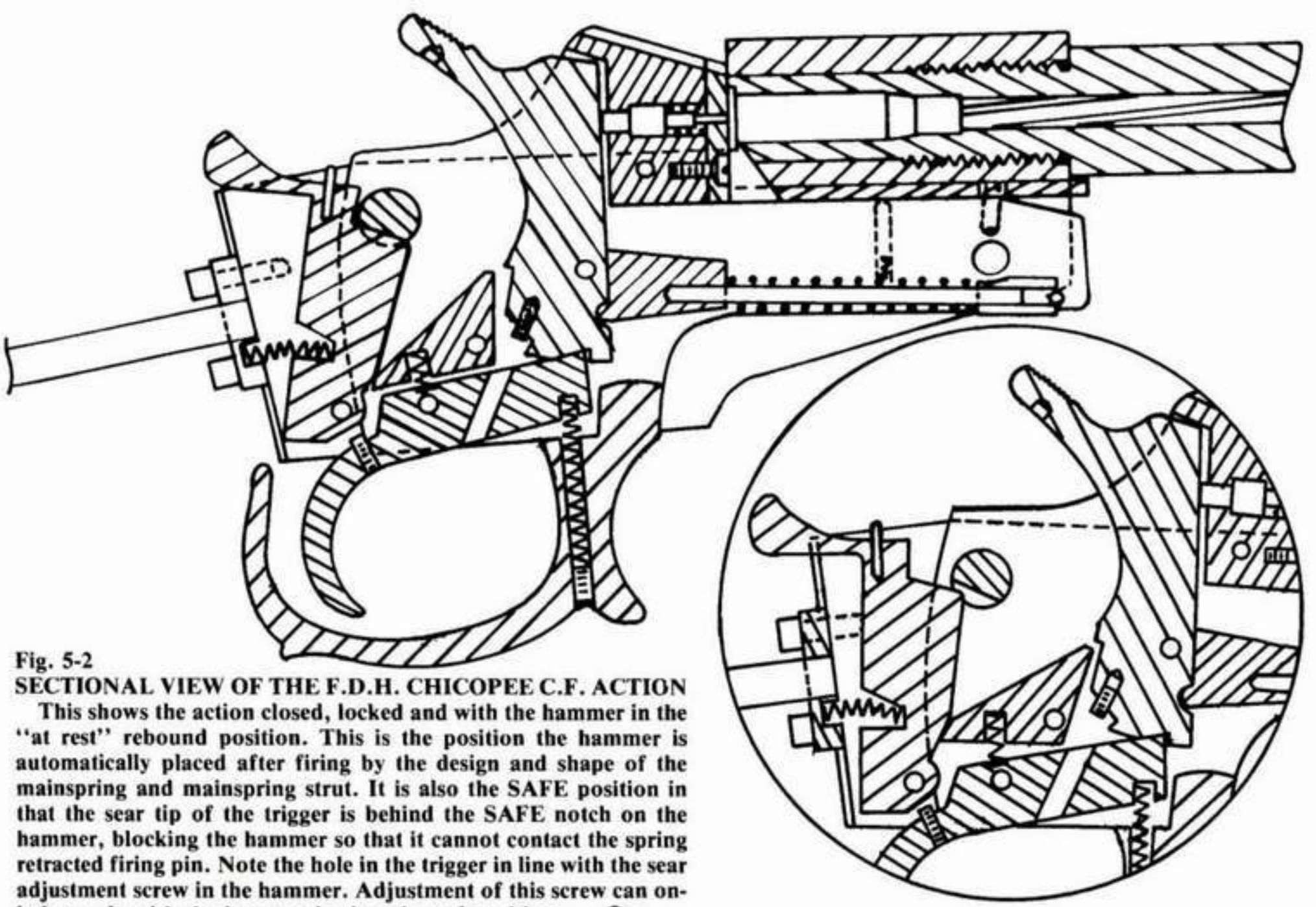


Fig. 5-2
SECTIONAL VIEW OF THE F.D.H. CHICOPEE C.F. ACTION

This shows the action closed, locked and with the hammer in the "at rest" rebound position. This is the position the hammer is automatically placed after firing by the design and shape of the mainspring and mainspring strut. It is also the SAFE position in that the sear tip of the trigger is behind the SAFE notch on the hammer, blocking the hammer so that it cannot contact the spring retracted firing pin. Note the hole in the trigger in line with the sear adjustment screw in the hammer. Adjustment of this screw can only be made with the hammer in the rebound position.

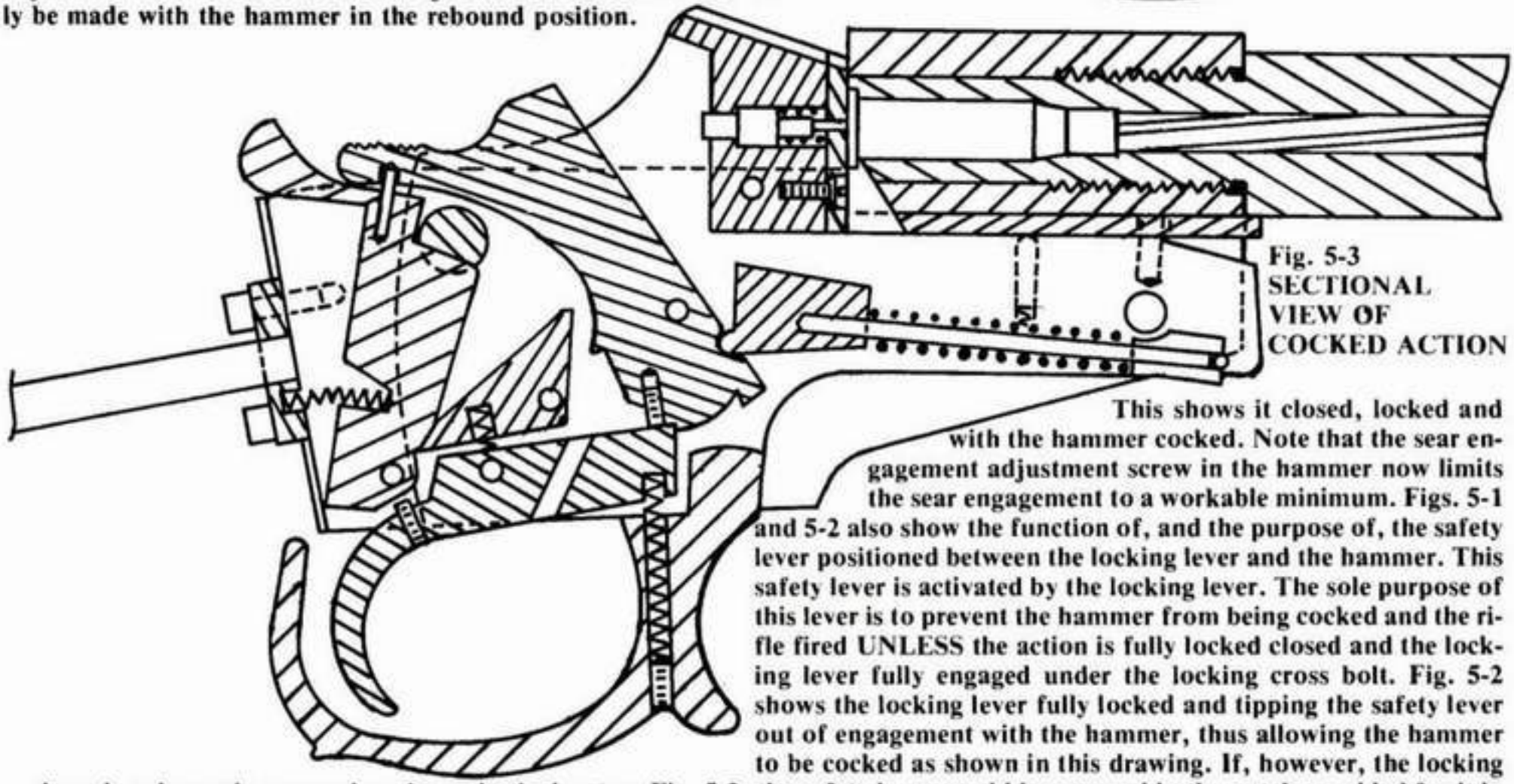


Fig. 5-3
SECTIONAL VIEW OF COCKED ACTION

This shows it closed, locked and with the hammer cocked. Note that the sear engagement adjustment screw in the hammer now limits the sear engagement to a workable minimum. Figs. 5-1 and 5-2 also show the function of, and the purpose of, the safety lever positioned between the locking lever and the hammer. This safety lever is activated by the locking lever. The sole purpose of this lever is to prevent the hammer from being cocked and the rifle fired UNLESS the action is fully locked closed and the locking lever fully engaged under the locking cross bolt. Fig. 5-2 shows the locking lever fully locked and tipping the safety lever out of engagement with the hammer, thus allowing the hammer to be cocked as shown in this drawing. If, however, the locking lever is only partly engaged as shown in the inset on Fig. 5-2, the safety lever would be engaged in the notch provided for it in the hammer and the hammer is blocked and cannot be cocked. Thus, it is an important safety device that prevents the rifle from being fired unless it is fully locked closed. DO NOT eliminate this part when making this rifle.

Also note in Fig. 5-2 and this drawing the small stud on top of the locking lever and the recess in the bottom of the hammer spur; this is also an important safety device that prevents the action from being unlocked or opened while the hammer is cocked. Do not eliminate it either.

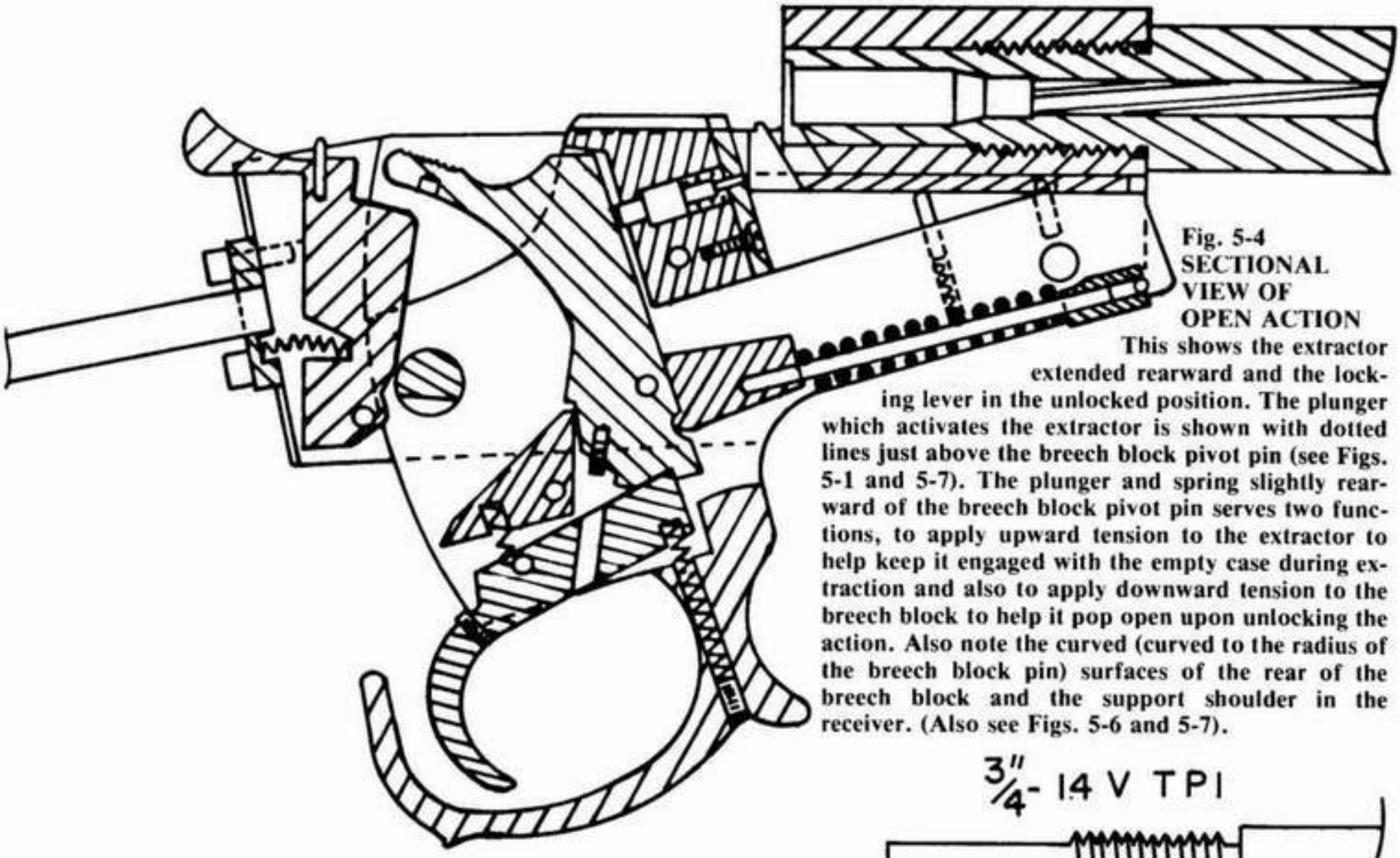
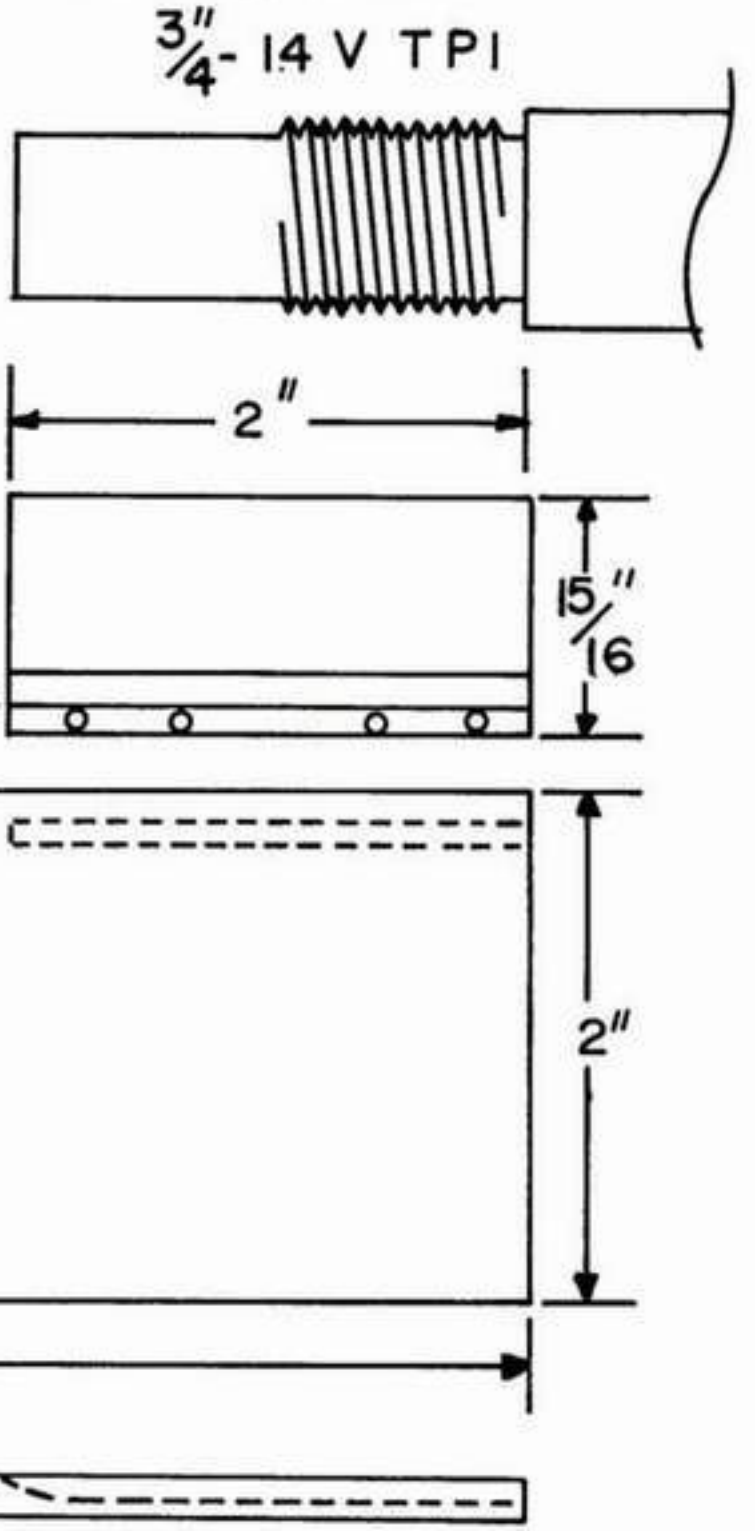


Fig. 5-4 SECTIONAL VIEW OF OPEN ACTION

This shows the extractor extended rearward and the locking lever in the unlocked position. The plunger which activates the extractor is shown with dotted lines just above the breech block pivot pin (see Figs. 5-1 and 5-7). The plunger and spring slightly rearward of the breech block pivot pin serves two functions, to apply upward tension to the extractor to help keep it engaged with the empty case during extraction and also to apply downward tension to the breech block to help it pop open upon unlocking the action. Also note the curved (curved to the radius of the breech block pin) surfaces of the rear of the breech block and the support shoulder in the receiver. (Also see Figs. 5-6 and 5-7).

Fig. 5-5 BASIC RECEIVER PARTS

This drawing shows the barrel shank and the parts which make up the receiver and the method the receiver is put together when silver brazing is used. The two receiver sides are tongue and grooved to the receiver ring and joined by silver brazing. The four small holes (four on each side) shown in the groove of the receiver ring are provided to hold short pieces of wire silver-solder prior to the silver brazing operation. Also see Fig. 5-6 for alternate method in lieu of silver-soldering.



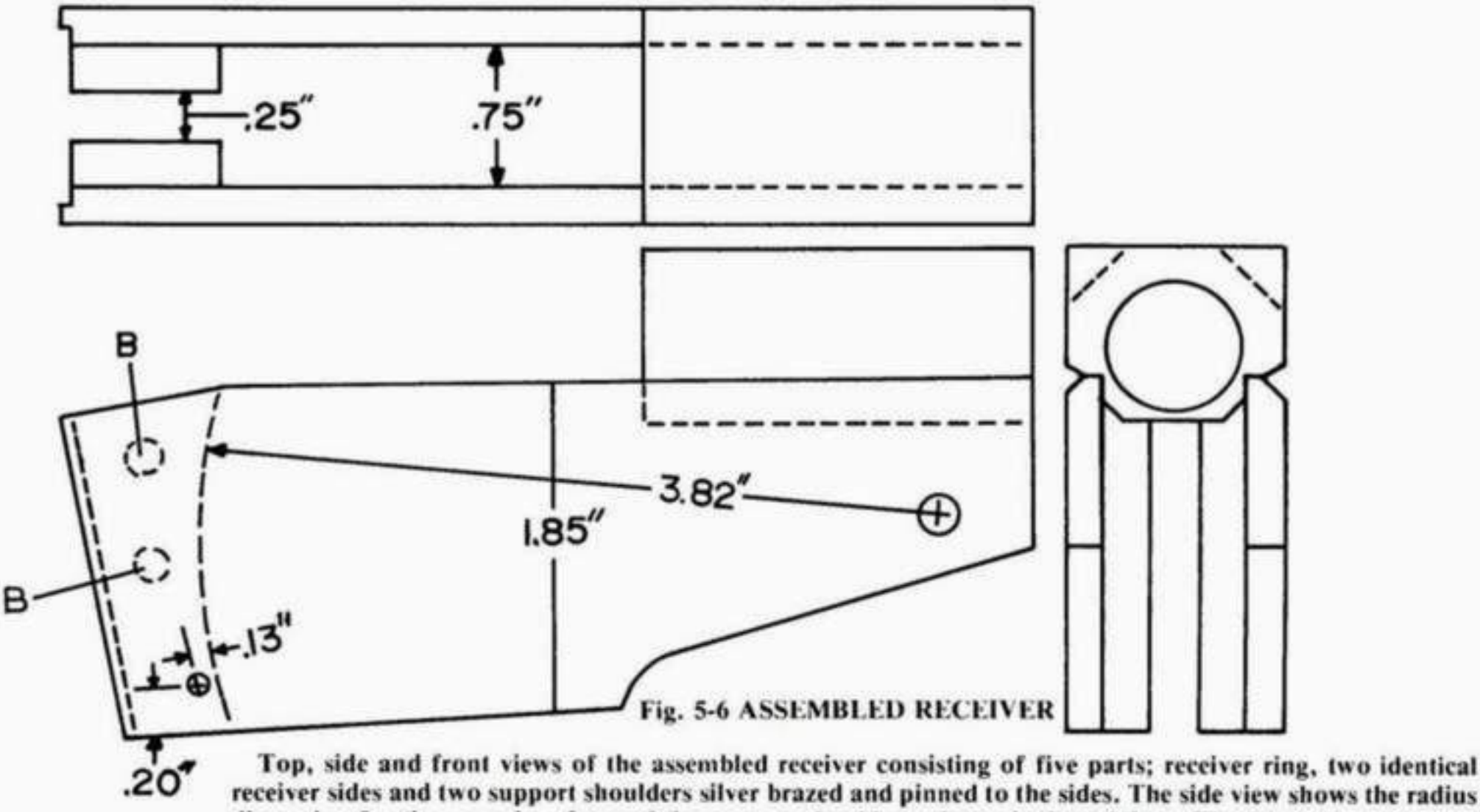


Fig. 5-6 ASSEMBLED RECEIVER

Top, side and front views of the assembled receiver consisting of five parts; receiver ring, two identical receiver sides and two support shoulders silver brazed and pinned to the sides. The side view shows the radius dimension for the curved surfaces of the support shoulders, shown in dotted lines. The front view shows an alternate method of preparing receiver ring and receiver sides if the sides are attached by oxy-acetylene or arc welding. See text for further details.

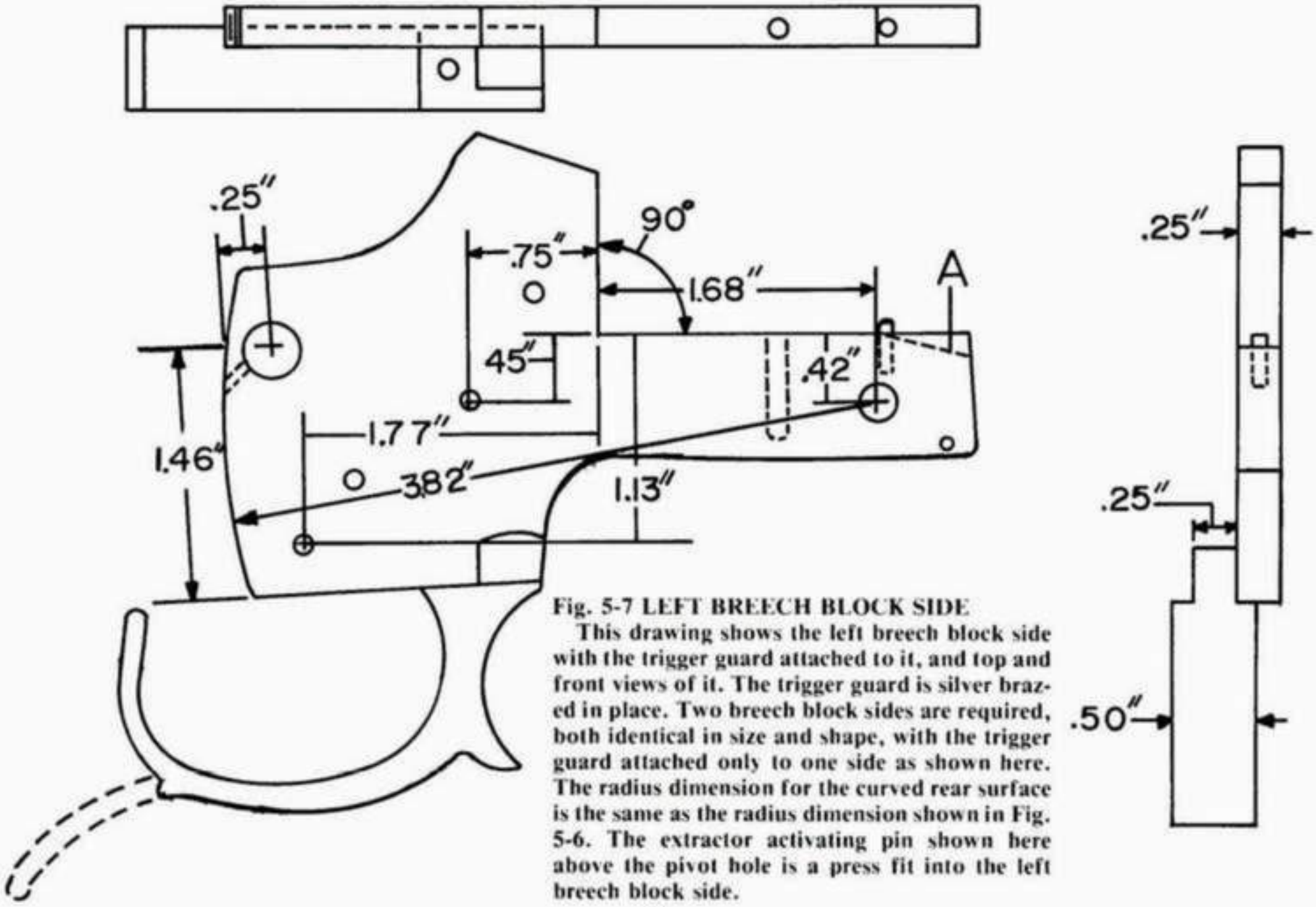


Fig. 5-7 LEFT BREECH BLOCK SIDE

This drawing shows the left breech block side with the trigger guard attached to it, and top and front views of it. The trigger guard is silver brazed in place. Two breech block sides are required, both identical in size and shape, with the trigger guard attached only to one side as shown here. The radius dimension for the curved rear surface is the same as the radius dimension shown in Fig. 5-6. The extractor activating pin shown here above the pivot hole is a press fit into the left breech block side.

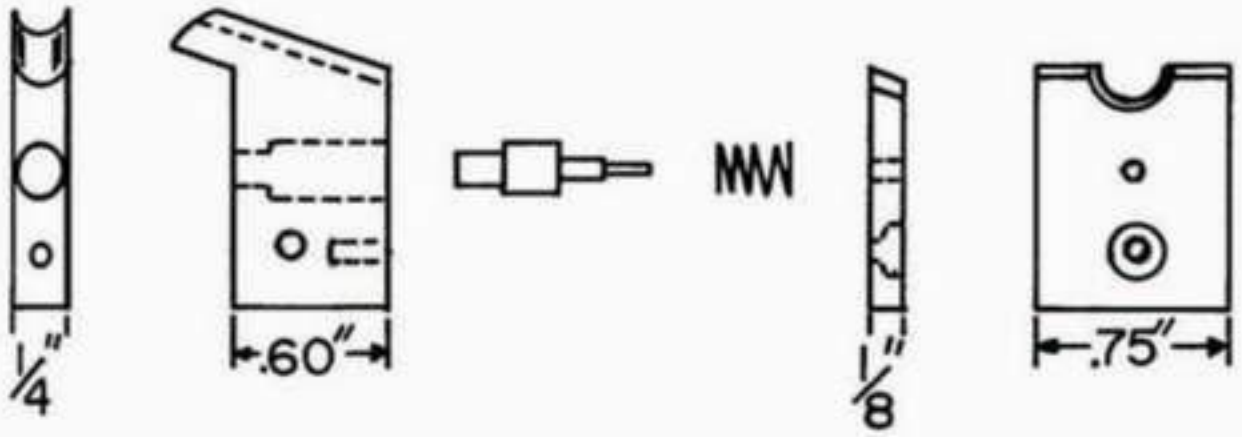


Fig. 5-8 FIRING PIN ASSEMBLY

The firing pin assembly, showing front and side views of the firing pin block, front and side views of the breech block faceplate and side view of the firing pin and retractor spring. The grooved top of the firing pin block serves as the loading platform. A Weaver scope mount screw is used to join the parts together as shown in the sectional drawings, Figs. 5-2, 5-3 and 5-4.

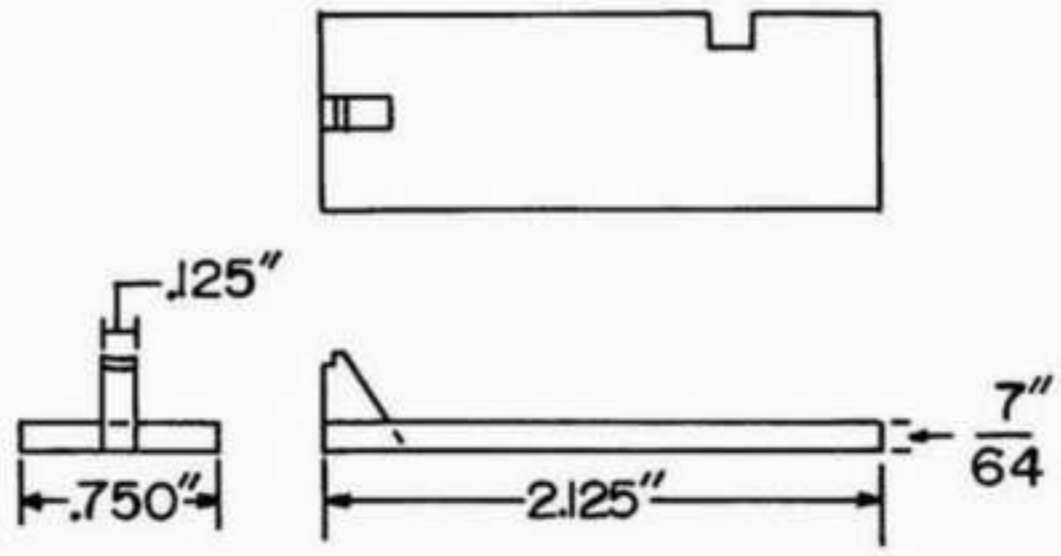


Fig. 5-9 EXTRACTOR

Rear, side and top views of the extractor. The extractor fits between the bottom of the receiver ring and the top of the breech block extensions. It functions equally well with rimmed or rimless cartridges due to the tension provided by the spring and plunger shown clearly in Fig. 5-4. This spring tension allows the extractor to snap down and back up behind the rim on rimless cases when the action is closed. The top view shows the notch provided for the plunger which activates the extractor rearward upon opening the action. (Also see Fig. 5-1)

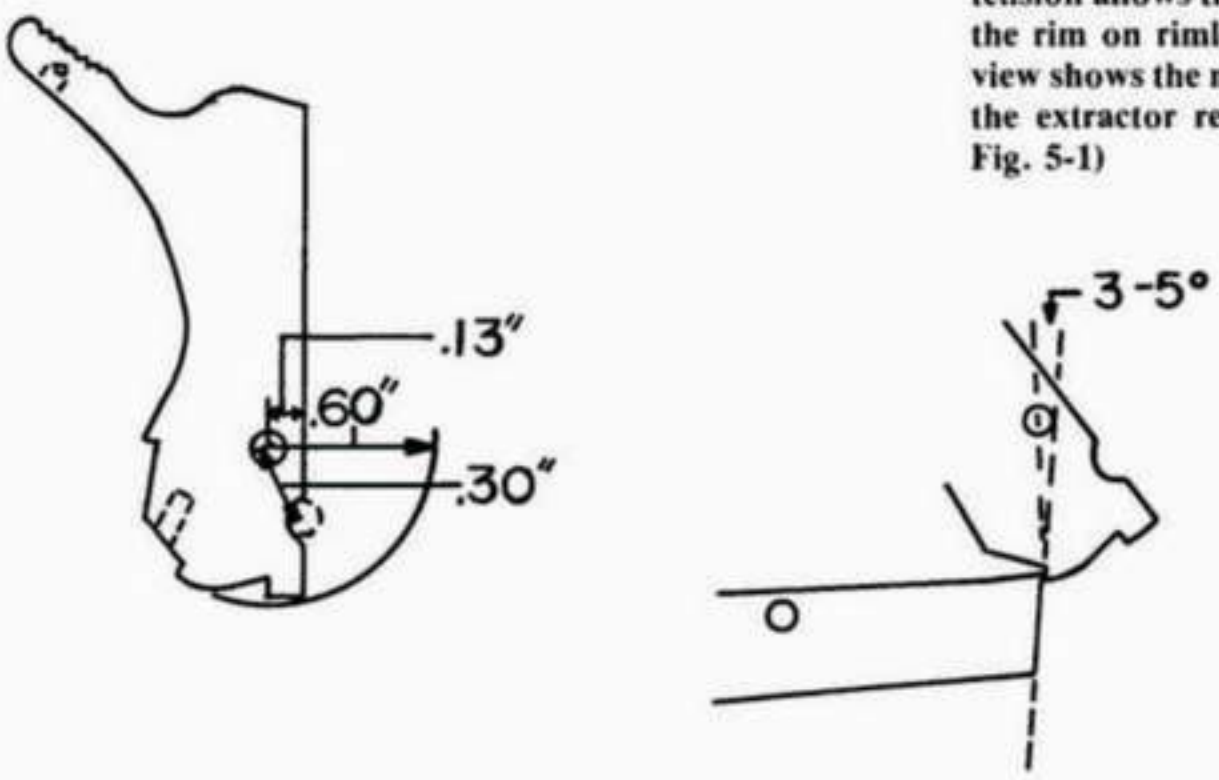


Fig. 5-10 HAMMER AND SEAR ANGLE DETAIL

The hammer of the F.D.H. CHICOPEE C.F. action. Further details are given in the instructions.

Fig. 5-11
HAMMER SAFETY LOCK LEVER

Side view of the hammer safety lock lever. The function and purpose of this part is shown in Figs. 5-2, 5-3 and 5-4 and fully described in Fig. 5-3.

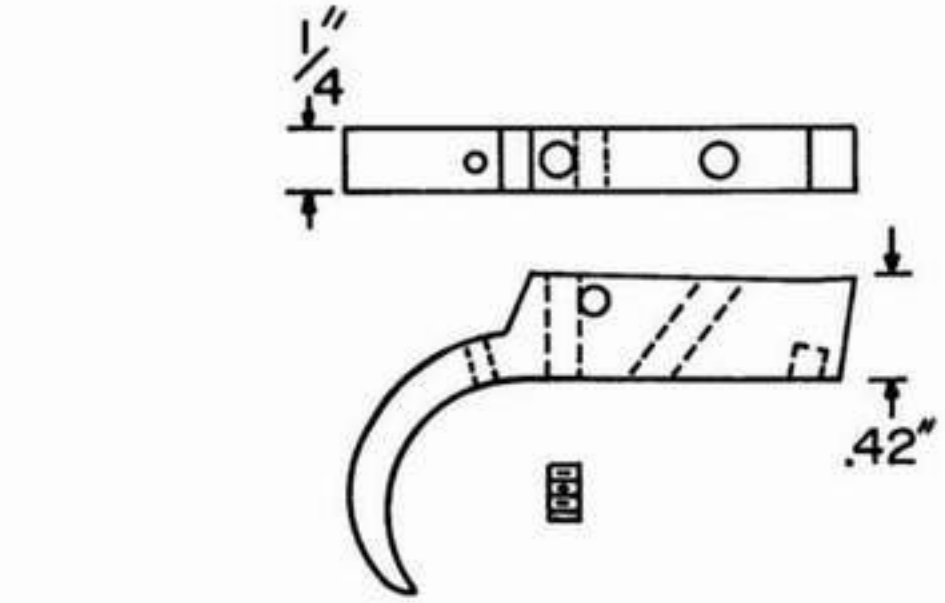


Fig. 5-12 TRIGGER
Top and side views of the trigger. See text for details.

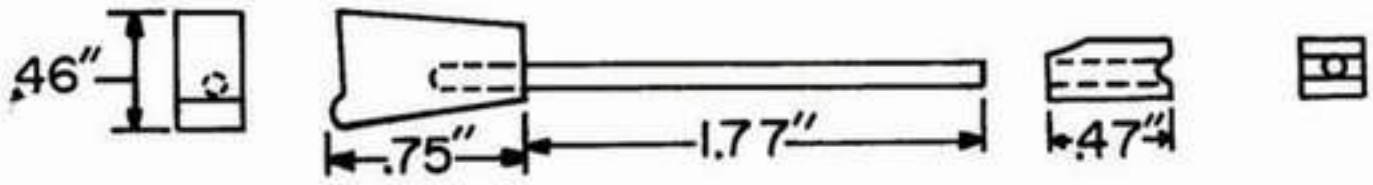


Fig. 5-13 MAINSPRING STRUT
Side and end views of the mainspring strut and strut sleeve.

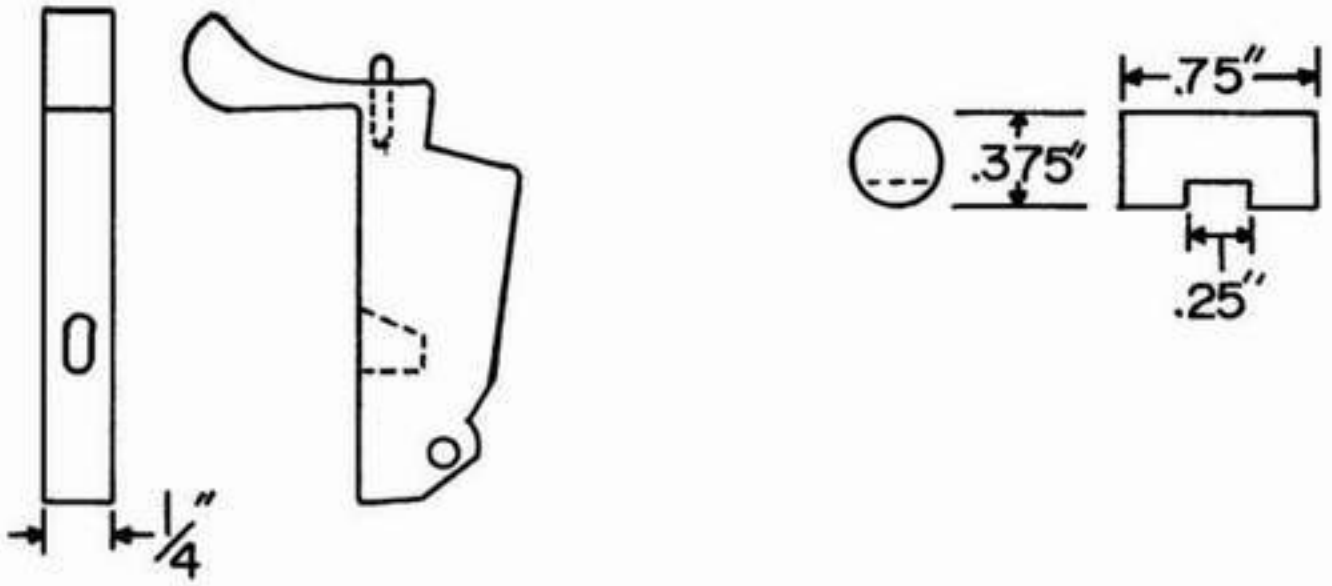


Fig. 5-14 LOCKING LEVER AND LOCK CROSS BOLT
Side and end views of the breech block locking lever and the lock cross bolt.

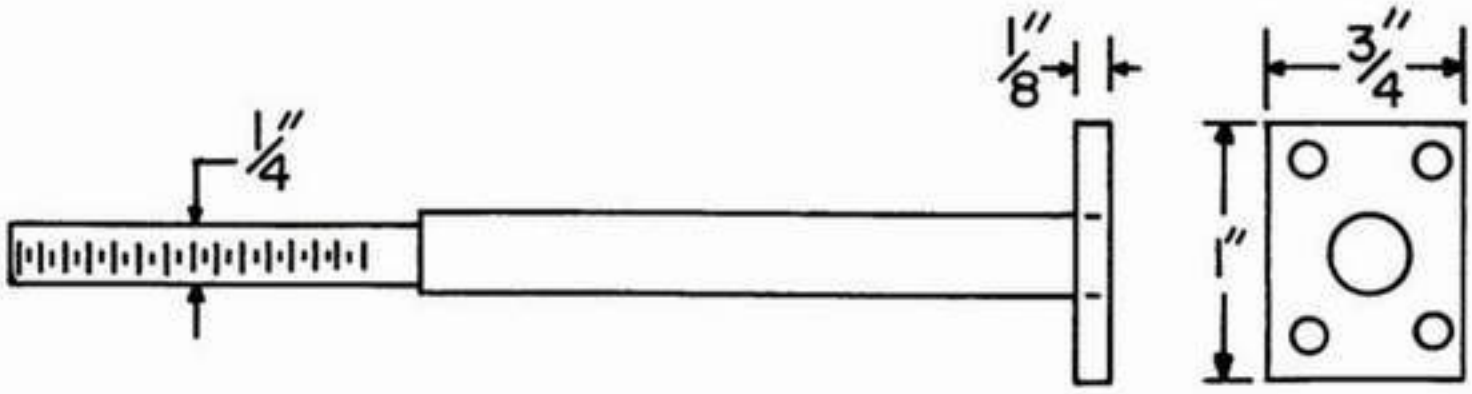


Fig. 5-15 TANG AND STOCK BOLT
Views of the tang and stock bolt.

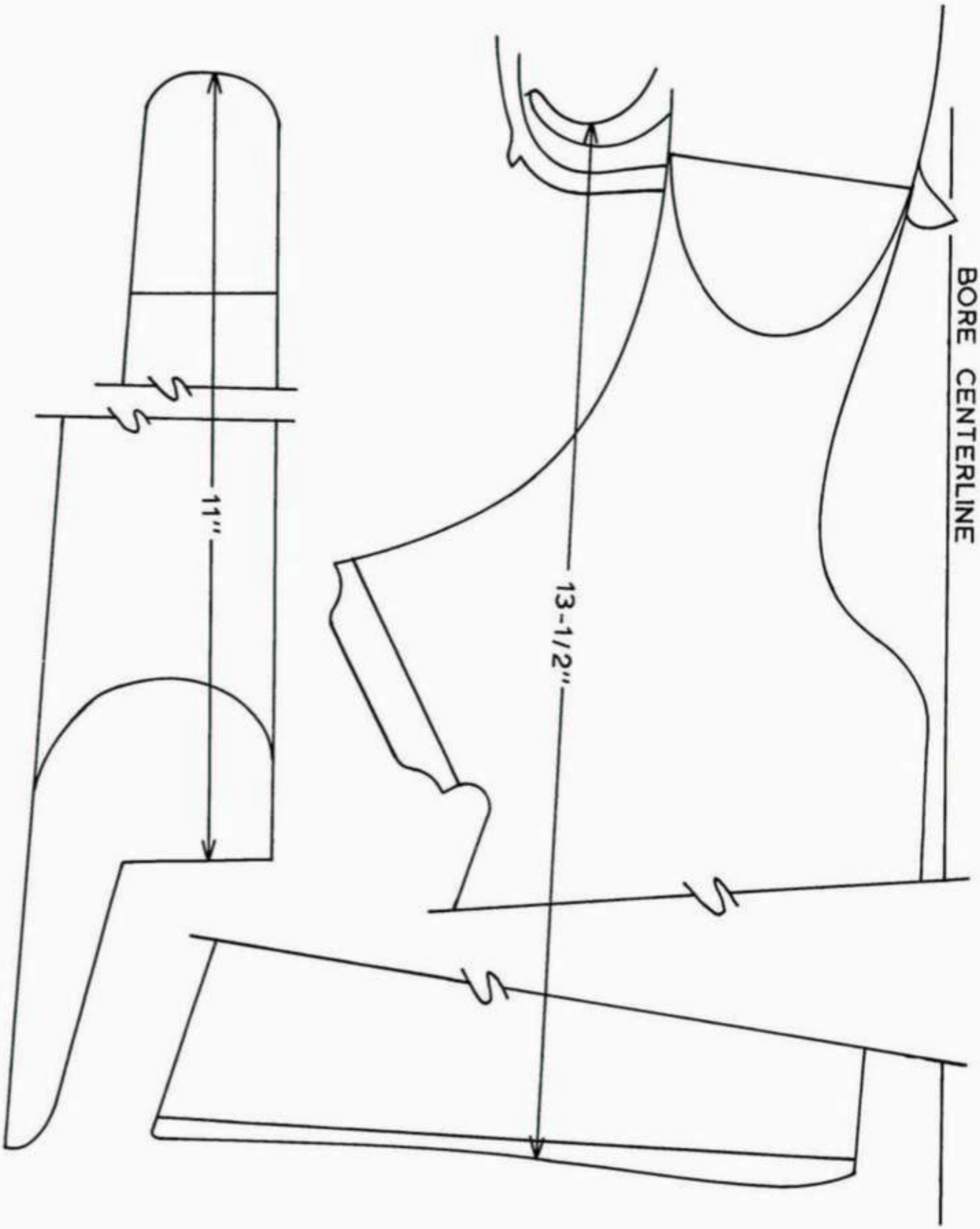


Fig. 5-16 STOCK AND FOREARM
Exact size outline drawing of the stock and forearm of the F.D.H. CHICOPEE C.F. rifle shown in this chapter.

Fig. 5-17
As described in the text, this photo shows the drillpress set-up to grind the radius surface on the rear of the breech block sides.

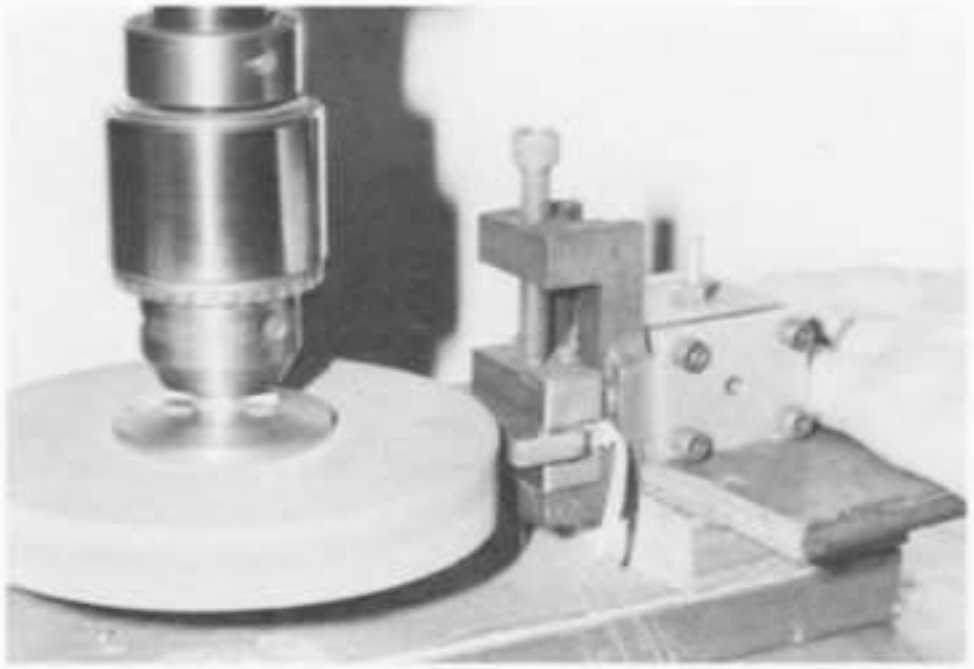


Fig. 5-18
This shows the drillpress set-up to grind the support shoulders. See text for further details.

Instructions and Sequence of Operations for Making the F.D.H. CHICOPEE C.F. Action

As you may already have noticed if you have examined the drawings, we have not provided you with every specification or all dimensions on most of the parts. We have done this purposely. If, for example, in Fig. 5-10 we had supplied all of the dimensions needed to make the hammer drawing a true mechanical drawing, it would have covered an entire page and one look at it and you surely would have thrown up your hands and given up on the entire project. Making such a drawing would have been very difficult, but far less difficult than it would be for you to make the hammer according to those dimensions. Instead, what we have done is to give only the most critical dimensions and the exact sized drawing of the parts so that you can shape each part to your own liking. In the cutting out and making of many of the parts, such as the hammer, we suggest you put masking tape on the piece of steel from which the hammer is to be made, and using carbon paper trace the outline of the hammer on it, spot the hammer pin hole and drill it and then rough saw and file the hammer to shape. Leave a little extra metal on it for the final fitting. If you do not like the shape of the spur on our hammer, then go ahead and shape it to your own fancy. Making the hammer and other parts in this way is far easier than making it according to a set of figures. And, if in the making of a part, you find that you have removed a bit more metal than our drawing or dimensions show, or you have a hole drilled a few thousandths off, it probably won't matter as you can compensate for it in the making and fitting of another part to it. For example, the hammer safety lock lever, once you understand what its function is and how it has to work it does not have to be made exactly as shown in the drawings or engaged with the locking lever and hammer in the exact place as we did. The entire design of the CHICOPEE action is such that there are few vital specifications to follow.

THE RECEIVER RING (see Fig. 5-5)

Make this part from cold rolled steel. You can use a standard tap to thread it if you have the means of starting the tap in correct alignment with the hole. The preferred method is to cut the threads in a lathe setup and in this case we would suggest going to 16 or 18 threads per inch. You can fit the barrel to this part at the same time. It is important that the unthreaded part of the barrel shank be a close fit in the receiver ring. A threaded portion 3/4" long is ample. Tighten the barrel in the receiver ring and turn off the breech end flush with the receiver ring. After fitting the barrel set it aside until it is time for the final fitting and chambering. If you are going to silver braze the receiver sides to the receiver ring (Fig. 5-5) use a 1/8" Woodruff keyway cutter to cut the grooves in the receiver ring, and also use it to cut the grooves in the receiver sides. The four small holes in each of the grooves in the receiver ring serve to hold short pieces of silver-solder wire during the silver brazing operaton. They need be only about 7/32" deep to hold 3/16" pieces of wire and of a diameter a bit larger than the wire you have. If you plan to steel weld these parts together prepare the receiver ring and sides as shown in Fig. 5-6. Steel welding with oxy-actylene torch or with an electric arc welder is the stronger method for joining these parts.

RECEIVER SIDES (see Fig. 5-5)

Use 3/16" thickness cold rolled flat stock. This steel usually has a hard scale surface that is rather unsightly and often pitted and we suggest that it be removed. This can be done quite well with a belt sander and emery cloth belt or with a disc sander. The best method, however, is with a surface grinder. If the parts are to be silver brazed together machine the tongue and grooves to match those in the receiver ring and shape them to the outlines as shown. The fit of the tongue and groove cuts in the receiver ring and receiver sides should be an easy sliding fit requiring little hand pressure to fit the pieces togther, with just enough looseness to permit silver-solder to flow throughout the entire area. After the tongue and grooves have been cut into the sides, shape both sides alike. If the parts are to be steel welded together, merely bevel off the cor-

ners of the joint to be welded as shown in the front end view of Fig. 5-6. Do not drill any holes in either side at this time. Your next job is to make the breech block sides.

BREECH BLOCK SIDES (see Fig. 5-7)

Use 1/4" thick cold rolled steel with scale removed. Two identical sides are required. We suggest you make a carbon tracing of the breech block side drawing on a piece of cardboard, cut that out for a pattern and then use it to cut out one side from the piece of steel. Now carefully spot and drill the hammer pin hole and the hinge pin hole, 7/64" for the hammer pin and 11/64" for the hinge pin. Clamp this drilled and roughly cut side to another piece of steel, drill it through the holes in the one side already drilled and pin the two together with snug fitting pins. You can use a piece cut off the drills used for these pins. These two holes are now your master guide holes for all the remaining operations on the breech block sides as these sides must be identical. Saw out the second piece to match the first. Mark each side in some way to indicate right and left sides.

Now you are confronted with two operations that are critical and must be done right. The first one is to file or machine the top of the breech block extension and the face (standing breech) of the breech block level and square to each other. The second critical operation is to grind or machine the radial surface on the rear of the two sides. This is quite easily done in a simple drill press setup (Fig. 5-17), especially so if your drill press is fitted with an Atlas compound feed accessory. Take a smooth and level board (a 1x4 one foot long will do) and drill a hole centered and 3" from one end of it into which you drive the guide pin used in the hinge pin hole. You should clamp this board to the drill press table or in the compound feed accessory and place the breech block sides on the pin so that the rear end of the sides project over the end of the board. Use a 1" wide by 4" diameter fine grit grinding wheel mounted on a short arbor and chucked in the drill press. Adjust things so that the rear of the breech block sides can just contact the surface of the grinding wheel. With the wheel turning at its correct speed and with one hand on the breech block sides to swing them in short arcs against the wheel, slowly feed the table towards the wheel. Grind until you have a smooth surface or until you have obtained the approximate radius of 3.82" as shown in Fig. 5-7. A similar setup can be used to grind the concave surfaces on the breech block support shoulders, this will be described later.

FIRING PIN BLOCK ASSEMBLY (see Figs. 5-1, 5-2 & 5-8)

Use 1/4" cold rolled steel to make the block and tool steel for the face. Making and partially fitting the firing pin block along with the 1/8" thick breech face is the next suggested operation. Use a 6x48 Weaver scope mount screw to attach the breech face to the firing pin block and use a No. 6 fillister head screw, 32, 40 or 48 thread, to hold the block in place and the breech block halves together. The hole for this screw should be drilled low so that it will be hidden by the receiver sides. Do not do any drilling for the firing pin hole at this time or to finish the top of this assembly. Make sure the breech block sides are perfectly aligned before and during the drilling and tapping of the firing pin block retainer screw hole.

ASSEMBLING RECEIVER SIDES

Before silver-soldering or welding the receiver sides to the receiver ring it is necessary to spot and drill one of the receiver sides for the hinge pin. You may have a different way of spotting this hole but here is the way we do it. Assemble the receiver ring and the left receiver side and hold them together with a C-clamp, and making sure that the threaded end of the receiver ring is toward the front and that the front ends of both parts are even. Now take the left breech block side with the firing pin block and breech face in place and place them on the receiver side. Now take the 7/64" thick piece of metal that you will later use for the base of the extractor and place it between the receiver ring and the breech block extension. Now push the breech block side up and forward so that it is firmly in place and then clamp it there. Now, using the hole already in the breech block side as the guide, drill the hole through the receiver side for the hinge pin.

Now prepare for the silver brazing if you choose to use this method (Fig. 5-5). Remove the clamps and the breech block. Remove any dirt and oil that may be on the areas to be brazed. Apply a thin coat of silver solder flux to the tongue and groove cuts on the receiver sides. Insert a short piece of wire silver-solder in each of the 8 holes provided and position the receiver sides in place on the receiver ring. Even up the ends of the receiver sides with the front of the receiver ring and clamp the three parts together. The clamp should not be very tight as we want the silver-solder to flow throughout the joint. If the clamping causes the receiver sides to come closer together at the bottom than at the joint, then you must place a proper length support between them during the brazing process. When you have it all aligned and clamped, place the receiver bottom down on open jaws of a vise and with a low flame from an oxy-acetylene torch heat the brazing area evenly to a dull red or until you see the silver-solder has flowed to the ends and sides of the seams. Let cool slowly.

An alternate method of joining the receiver sides to the receiver ring is by steel welding, either by the oxy-acetylene torch method or the electric arc procedure, preferably with the M.I.G. method. Either method will be satisfactory and the strength of the joints and the quality of the finished joints will depend on your skill or on the skill of the welder you choose to do the job. Much depends also on how well you have prepared the three pieces for welding and how well the three pieces are held together during the welding operation. As shown in Fig. 5-6, you must prepare both sides and the ring to make room to lay in a bead of steel weld and it is best done by beveling off the top outside corner of each receiver side and both corners at the bottom of the receiver ring.

The parts can be held and clamped together as described above for silver brazing. After the welding is partly done you can remove the spacer and clamp from the area that still needs more welding but leave in the spacer and the clamp on the rear part of the receiver until the welding is finished and the whole cooled. Afterwards you must dress down the excess weld.

Now assemble the breech block sides with the hammer guide pin and the firing pin block assembly in place, and with the extractor base in place, insert and clamp the breech block in place in the receiver. Snug it up firmly, forward against the receiver ring and up against it. Now drill the hole for the hinge pin through the hole already in the left receiver side and through the holes in both breech block sides and on through the right receiver side. If you wish you can finish this hole at this time, enlarging it to 3/16" diameter and provide a pin for it. Rather than drilling this hole to its final size, we suggest you use a pin reamer and ream the hole instead. A 3/16" pin

reamer is a good investment for this project as you will have another use for it later. This will assure perfect alignment of the four holes. As for myself, I prefer to use a tapered pin for the hinge pin. This also assures perfectly aligned holes, but in addition, realigns the holes anytime afterwards.

TRIGGER GUARD (see Fig. 5-7)

Making and attaching the trigger guard should be your next job on the CHICOPEE C.F. action. Make it from 3/8" or 1/2" square cold rolled stock or saw or machine it from that same thickness flat stock. In either case, shape it similar to the drawing, with or without the decorative lips, and with or without the spur. The front lip provides a good ending point for the trigger spring hole, and if you prefer not to have the spur, the rear lip provides a purchase point for your finger in closing the action. However you make it, make the base of it where it attaches to the breech block .250" thick or the same thickness as the firing pin block as these two parts are the only points that separate the two breech block sides. Drill and tap the hole for the trigger spring to accept a 6x32 or 6x40 socket head set screw, preferably the finer threaded one. Now drill three or four small holes about 7/32" deep on the left side of the base to hold pieces of wire silver-solder and silver braze the trigger guard to the left breech block side. This lever can also be steel welded in place or attached with a screw. However, before doing this, if with the breech block in place in the receiver the bottom of the receiver and the bottom of the breech block are not flush, make them flush by filing or machining.

SUPPORT SHOULDERS (see Fig. 5-6)

Use 1/4" cold rolled steel. The surfaces of these shoulders must be precisely and smoothly ground to the same radius as the rear end of the breech block sides. We suggest that you start with pieces of steel 1" wide and 1/8" or so longer than the depth of the rear of the receiver so that after you have the concave surface ground into one edge of each, just before the silver brazing operation, you can cut most of the surplus metal off. To grind the concave surface, we used a 4" grinding wheel on an arbor in a drill press and a holding fixture made of wood which pivoted on a pin on the drill press table (Fig. 5-18). A similar setup was used to grind the breech block sides. On this wood fixture we mounted a small drill press vise so that its jaws were square and horzontal with the table and wheel. The grinding operation for these shoulders has to differ from that used to grind the breech block in that when grinding the breech block the entire holding fixture was fed into the grinding wheel, where as in the shoulders grinding, the fixture must remain stationary except that it is pivoted and the shoulder pieces only fed into the wheel. This we did by grinding one shoulder at a time holding it in the vise and using thin strips of paper between the shoulder piece and bottom of the vise for the feeding movement increases. We first roughly filed in the concave before starting the grinding. The grinding had to proceed until a radius was obtained precisely the same as that of the breech block. This could be measured but we preferred to judge that by visual inspection; holding the breech block side and support shoulder together in front of a light, and stopping the grinding when no light can be seen between the pieces.

The radial surfaces on the rear of the breech block sides and the support shoulders can also be machined in by attaching them to the face plate of a lathe. Machine the two breech block sides together in one operation and the support shoulders in another operation.

Now comes the fitting of the shoulders to the receiver. First, using fine emery paper, polish the ground surfaces on the breech block sides and support shoulders. Install the breech block in the receiver and prevent it from swinging by also inserting the extractor base in place between the breech block extensions and receiver ring. Insert the two support shoulders in place with another piece of 1/4" thick metal between them and clamp them in place. Loosen the clamp a bit and make certain the shoulders are snug against the breech block and then tighten the clamp very tight. Now drill the two holes for the anchor or guide pins as indicated by the two dotted circles marked B in Fig. 5-6. We suggest using 3/16" drill rod for these pins, first drilling the holes undersized and then reaming them to size. Remove the clamp and you are ready to remove the surplus metal from each shoulder. As each shoulder is removed, mark it as you did the breech block sides so that they can be replaced on the correct side. With the surplus metal removed, drill 4 or 5 holes in the inside surface of each shoulder for the silver-solder wire. File and clean the contacting surfaces, put in the silver-solder pieces, flux and reassemble the shoulders and pins in their proper places. Remove the breech block. Lightly clamp the shoulders in place and apply the torch. Hold the receiver with pliers while heating it so that you can turn it over to watch the silver-solder flow to the edges. If necessary, add a bit of silver-solder here and there by touching the wire to the hot metal.

When the brazed areas have cooled, finish the job of dressing the support shoulder down. Also cut out the center sections of the pins flush with the inside of the shoulder and the ends of the pins with the outside of the receiver.

TANG & STOCK BOLT (see Figs. 5-1, 5-2 & 5-15)

Top view of the receiver (Fig. 5-6) shows the recess at the rear of the receiver. This recess could be milled into the rear end of each receiver side before they are attached to the receiver ring, and the support shoulders cut down to match after the shoulders are fitted with the guide pins but before they were silver brazed in place. Anyway, however, you do it, the recess should be there. The tang and stock bolt we used is a 1/4" bolt silver brazed to a 3-4" length of 5/16" or 3/8" round rod that is in turn silver brazed into the center of a 1/8" thick plate about 3/4" wide and 1" long. Four 6x48 Weaver scope mounting screws can be used to attach the assembly to the receiver, or better yet, four 6x48 socket head cap screws.

LOCKING LEVER & LOCK CROSS BOLT (see Figs. 5-1 5-2 & 5-15)

Use 3/8" drill rod for the lock bolt and 1/4" thick cold rolled steel for the locking lever, although tool steel can be used for this last part. Drill and ream a 3/8" hole through the breech block sides as shown in Fig. 5-7. Notch the piece of drill rod about one third to one half way through. Make the locking lever as shown in Fig. 5-11 but about 1/8" longer to take care of the hand fitting that you will have to do. Drill the hole undersized through it for the pin it will pivot on, and through both receiver sides as shown in Fig. 5-6. With the locking lever positioned in place, ream the hole to 3/16" diameter. Use drill rod for this pin. Now the locking lever must be hand fitted so its upper shoulder engages precisely under the locking bolt as seen in Figs. 5-2 and 5-3. Take your

time here. The locking lever must lock the action closed, meaning that it must hold the rear of the breech block up. We suggest that you fit the locking lever so that it engages under the lock bolt about half its area and then wait to do the final fitting for full engagement until you have the rest of the action almost finished. However, we will describe the final fitting here so you know what will have to be done. When you reach halfway engagement, start cold bluing the locking contact areas on the locking lever and lock bolt, force the locking lever back and forth a few times and the worn bluing will show you the high spots to dress down. You should end up with flat and highly polished locking surfaces and a full, tight engagement. When this point is reached, it is time to put in the lock bolt retainer screw. Do the drilling of the hole with the breech block in the receiver and the locking lever fully engaged. Drill right on down and part way into the lock bolt. Remove the lock bolt and tap the hole in the receiver side to accept a pointed 6x40 socket head set screw. Also, somewhere along the line you have to drill the blind holes in the back of the locking lever and in the front of the tang plate for the locking lever spring. Use a medium to heavy tension spring, drill the holes as deep as possible without going through so that the longest possible spring can be used. The lock bolt does not have to be hardened if it is made of drill rod. The locking lever needs to be hardened, especially the locking shoulder, and if it is made of cold rolled steel then case harden it using Kasenit. But it should not be hardened just yet.

At this point it is time to modify the breech block so that it can be swung open and closed with the extractor base in place. This is done by removing a bit of metal from the top front corners of the breech block extensions as shown by the dotted line A in Fig. 5-7. Only enough metal is removed to allow the breech block to swing open to bring the top of the breech block that contains the firing pin block to stop near the bottom edge of the chamber. The extractor base must be in place when this is done. After the chamber has been made, which should be the next operation, only then is it time to groove the top of the breech block and make the final adjustment on the front of the extensions to bring the grooved breech block in line with the chamber to serve as a loading platform. Remove metal from the corners sparingly, use inletting black as a spotting compound so that you can see what you have to do to get both extensions the same.

CHAMBERING AND EXTRACTOR (see Figs. 5-1, 5-2, 5-4 & 5-9)

If you have fitted the breech block so that its face contacts the breech end of the receiver ring, then the breech end of the barrel should also be flush with the receiver ring when it is turned in and set up tight. In any case, you should make the breeching up a square and precise fit; that is, the breech face of the breech block must be perfectly level, the breech end of the receiver ring and barrel also square and flat, so that when the breech block is closed and locked the two breech faces are in full and even contact with each other. All this fitting and checking must be done with the extractor base in place. Everything will not necessarily go as planned and if after all the work you have done so far you find that you can see light between the breech faces, then merely put in a thicker breech face, or if there is a gap on top and not on the bottom, you may have to file the face plate thinner to obtain even contact.

The chambering is best done with the barrel removed. All that is needed is a finish chambering reamer. For most small cartridges the chambering can be done by hand power with a tap wrench, or the chamber cut to nearly full depth in a lathe setup and finished by hand. Use a new empty cartridge case for the headspace gauge, cutting the chamber to a depth so that the head of the case is flush with the breech end of the barrel. Use plenty of cutting oil while chambering and be sure to clean all chips and oil out of the chamber before testing for headspace. If you happen to cut the chamber too deep, that is, if the case chambers more than .003" below flush, we advise refitting the barrel back a quarter or half a turn and then cutting the chamber so the case head is no more than .002" below the breech face. If, after replacing the barrel, the breech block won't close fully with a case in the chamber that may mean that the chamber isn't deep enough.

Now is the time to make and fit the extractor. Use the base that you already have been using, as it is of correct thickness since the breech block position has been determined by that thickness. The base should be approximately .750" wide and 2-1/8" long. Use the narrow edge of a 6" mill file to file the slot in the receiver ring and barrel for the extractor hook. This cut, or slot, should be made approximately at a 45 degree angle in the center bottom of the barrel and receiver ring breech face. As shown in the sectional view drawings, it has to be deep enough for the top of the extractor to engage the cartridge rim but no deeper. And it should be 1/8" wide. We did it this way: A piece of double-sided adhesive or scotch tape was placed on the bottom of the receiver ring and the extractor base positioned on it. Then holding it in place with one finger, the cut for the extractor hook was filed in through the base, receiver ring and barrel all at the same time. When the approximate correct depth was reached, which is just beyond the cartridge rim recess in the chamber, the base was removed and the notch in the receiver ring and barrel widened slightly and the corners squared. Now the base was repositioned and the slot in the base deepened a trifle but not widened and a small piece of 1/8" thick metal much larger than needed was fitted into that slot tight enough so that it would stay in place while silver brazing it. After silver brazing it in place, it was cleaned up and all of the surplus metal at the bottom was removed. Then we carefully removed metal from the front until the breech block could be fully and easily closed and locked with the extractor in place. Lastly, we shortened the tip of the hook to chamber level and with the extractor held in place the chambering reamer is used to cut in the rim recess to match the chamber.

Figs. 5-1 and 5-7 show the location of the extractor activator pin and the extractor plunger and spring. The latter serves to hold the rear end of the extractor up and allows it to slip over the cartridge rim. 7/64" diameter pins are adequate. A notch to match that of the foremost pin must be precisely cut into the side of the extractor base. Both the plunger and activator pin must be checked to see that they can be depressed sufficiently and are just short enough so as not to interfere with the closing of the action.

FIRING MECHANISM (see Figs. 5-1, 5-2, 5-3, 5-4 5-10, 5-12 & 5-13)

Since the firing mechanism in this action is almost identical to the one in the F.D.H. CHICOPEE R.F. action we suggest you carefully read the instruction in the preceeding chapter under the heading Firing Mechanism, as these instructions apply equally to the C.F. action and are more detailed.

The firing mechanism consists of the hammer, trigger, mainspring assembly and the pins and springs for these parts.

Let's start with the hammer, see Fig. 5-10. Use 1/4" cold rolled steel. Size and shape it as per the drawing, spot and drill the hole, but do not cut in the notches in the bottom or back. After drilling the hole, place the hammer between the breech block sides with the holes aligned and enlarge the hole for the hammer pin to 1/8". Make the strut next, using a piece of 1/4" cold rolled steel and a piece of tempered spring wire, .120" in diameter, the largest diameter spring wire in the Brownell wire spring assortment. Drill the hole slightly undersize and press the spring wire stem in place. We used 1/4" square rod to make the sleeve and 1/4" O.D. heavy tension spring for the mainspring. Shape the head of the strut so that with the mainspring in place, the strut will cause the hammer to rebound about 1/8" from the firing pin block.

Make and fit the trigger next. (Fig. 5-12) and make it from cold rolled steel. Make the sear tip a bit longer and farther forward than shown. The holes for the trigger pin as well as the safety lock lever can be drilled clear through both breech block sides but if this is done these pins will show when the action is open. If you want the pins hidden the holes can be spotted inside the receiver sides and drilled part way through. While doing the fitting also have the lock bolt and the firing pin block in place. Cut the metal behind the sear end of the trigger down slightly so that the hammer can swing over it. Now mark and cut the safety notch in the hammer. Leave the metal at least as thick as in the drawing. It is better to shorten the sear end of the trigger than to make the metal in front of the safety notch too thin. The sear tip must be sharp and remain so, and in order to prevent future damage to it from a possible accidental hammer blow or fall, the safety notch in the hammer must be so made that the sear tip does not come in contact with the bottom of the notch but that the front of the trigger just below the sear edge does the stopping (Figs. 5-2 & 5-4). Assemble the mainspring and strut and make further adjustments. What you want is a sufficient rebound of the hammer so that the trigger will fall into the safety notch and at the same time the nose of the hammer will be off of the firing pin, and cannot reach the firing pin if the hammer is pushed forward. The angle of the safety notch should be enough so that the trigger cannot slip out of it when the hammer is pushed or knocked forward.

The next step is to cut the sear notch into the hammer. It must be on the same radius as the safety notch. To locate where the sear notch has to be, cock the hammer so its spur is against the lock bolt and then mark the hammer where the trigger tip is. To do away with much of the work of cutting in a shallow sear notch as most hammer guns have, we make a deep step notch and provide a set screw to limit the trigger engagement with it. Cut the rear engagement surface of this step notch at an angle of about 3 to 5 degrees from the center of the hammer pin hole so that the trigger tends more to stay engaged there rather than slipping out of its own accord. See Fig. 5-10 for the suggested angles of the sear notch and the front of the trigger. Of course, the front surface of the trigger must be similarly angled, or even slightly more so. Strive for the maximum hammer swing and place the sear notch to achieve it, and it won't hurt if you undercut the underside of the hammer spur to get more swing. Drill and tap the hammer for 6x32 or 6x40 socket head set screw to limit the sear engagement and drill an access hole in the trigger to make the adjustment. Also drill a shallow hole in the front bottom of the trigger in line with the trigger spring hole in the trigger guard. Use a medium tension spring for the trigger. A trigger overtravel screw can also be installed in the trigger to contact the bottom of the locking lever. And now that you have the hammer made, it is time to install the small pin in the top of the locking lever as shown in Figs. 5-2, 5-3 and 5-14. A 5/64" pin will do and it must be a tight press fit in the locking lever. Lastly, drill a shallow hole 5/32" in diameter in the bottom of the hammer spur. The purpose of this simple arrangement is to prevent the opening of the action when the hammer is cocked.

After the action has been assembled you should test the firing mechanism to make certain the hammer can be cocked, stay cocked and that the hammer rebounds properly each time it is snapped to allow the trigger to engage behind the SAFE notch. If this does not happen then corrective steps must be taken.

HAMMER SAFETY LOCK LEVER OR BLOCK (see Figs. 5-1, 5-2, 5-3, 5-4 and 5-11)

This part can be made of cold rolled or tool steel. This is a small part, but a very important one. It must not be omitted. Its function is to prevent the rifle from being fired unless the breech block is fully locked. In other words, unless the locking lever is fully engaged under the lock bolt, the hammer cannot be cocked. Its function is shown in Figs. 5-2 and 5-3. It requires hand fitting and we can only suggest that you closely look at the drawings showing the parts involved and then duplicate everything as closely as you can. It does not have to be exactly the same as shown to work - it might work just as well if made a bit different. Mount it on a 3/32" pin and use a light tension spring between the trigger and the safety lock lever. One way of doing this is by drilling blind holes in both parts positioned directly above or close behind the trigger pin pivot hole as shown in Figs. 5-2, 5-3 and 5-4. The problem with this arrangement is to ascertain the correct length of spring to use and getting it in place in assembling the action. We made our rifle this way but later changed it as shown in Fig. 5-12 by placing the spring farther back and drilling and tapping a hole clear through the trigger just to the rear of the trigger pin pivot hole and using a plug screw in the bottom of this hole and drilling a matching blind hole under the safety lever. In this way the spring can be inserted into the hole and the plug screw turned in to adjust the spring no more than needed to move the locking lever. This spring should not substitute for the trigger spring even though it does supply some tension to the trigger.

FIRING PIN (see Figs. 5-1, 5-2 & 5-8)

Use a piece of 11/64" drill rod. Spot the firing pin tip hole in the breech face with a centerpunch through the flash hole of an empty cartridge case in the chamber. Remove the firing pin block assembly from the breech block and position it face up in a drill press vise and drill a 5/64" hole through the breech face and 1/8" or so into the firing pin block. Remove the breech face. Use a small center drill to funnel the shallow hole made by the previous drilling. Then with a 11/64" drill, carefully drill to 1/8" of going through. Then go on through with a 9/64" drill. Now make the firing pin to fit. The tip and the rear end, or base, should be made longer than needed to be shortened as required. When fully retracted the tip must be finished flush with the breech face and the base end protrude from .050-.055". Conversely, if fully depressed the tip will

protrude the same amount. Use a light retractor spring that is strong enough to reliably retract the firing pin. The most important requirement is to have the tip a close but bind free fit in the hole in the breech face and to have the tip smoothly rounded. We recommend that the firing pin be hardened and tempered.

STOCK AND FOREARM (see Figs. 5-B & 5-16)

The line drawing is an exact size divided outline of the stock and forearm on our rifle and it can be a guide in the making and shaping of the stock and forearm you may want on the rifle you build. The forearm is attached by one 8x32 fillister head screw in a brass escutcheon threaded into an anchor block which is in turn attached to the barrel by two 6x48 scope mounting screws. We shaped the stock and forearm where both contact the receiver to leave half-round panels to give the rifle a continental appearance. We also make it more continental in looks by adding an ebony forearm tip and fitting the stock with a pressed horn buttplate and pistol grip cap. This takes extra work but we feel it was worth it. However, you may want to make your stock and forearm differently, perhaps with a fuller forearm and pistol grip without the panels, or if you are making the rifle for a small person to make the stock shorter and the pistol grip shorter and closer to the trigger.

FINISHING TOUCHES

If you have used tool steel to make any parts such as the locking lever, hammer, etc., then these parts must also be hardened and tempered. If you have made these parts from cold rolled steel, then they must be case hardened. This is easily done using Kasenit. The entire hammer should be so treated once with the lower area of the sear notch done twice as directed on the Kasenit container. Only the sear end of the trigger need be done and that done twice for extra deep hardening. There are a few unfinished items so far not mentioned. Special attention should be given to the sear. Make sure than when the hammer is cocked, the trigger engages behind the sear adequately so that the hammer will positively not disengage from it unless the trigger is deliberately pulled. Adjust the sear engagement screw and the tension of the trigger spring to ensure a positive engagement every time the hammer is cocked. The trigger weight of pull ought not be less than 3 pounds. You may also want to have a set screw to hold the hinge pin from turning or coming out. We urge you do a lot of polishing on every surface, both inside and out of the action. Be sure to polish the parts that need case hardening before doing the case hardening and then polish them lightly afterwards. There may be some last minute fitting and adjusting to do such as increasing or shortening the hammer rebound to no more or less than necessary, to hone the sear faces and to lap the curved contact surfaces between the breech block and the support shoulders. You may also want to bevel some of the edges of the receiver to improve its appearance. Be sure to stamp the caliber on the barrel. Also stamp your name and the date if you are so inclined. And, if the rifle is one that you will be proud of, we won't mind if you stamp "F.D.H. CHICOPEE C.F." on the receiver ring.