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FINAL PROGRESS REPORT

MODEL 700 BOLT ACTION RIFLE

JANUARY 1963

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REMINGTON ARMS COMPANY, INC.
ILION, NEW YORK

Model 700 Bolt Action Rifle

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PROGRESS REPORT

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Period:	October 1960 - April 1962
Project Number:	AD-700-2
Amount Authorized:	$110,300 Spent: $120, 822
Previous Progress Reports:	None
Notebooks:	None
Prepared by:	J. W. Blair

INTRODUCTION

In April 1962 Remington Arms announced the Model 700 customized high power bolt action center fire rifle. This rifle available in two grades, ADL and BDL, replaced the former Models 721, 722, and 725. The new model is the finest production rifle available today and culminates more than 85 years of successful bolt action manufacturing.

HISTORY AND BACKGROUND

Remington produced the first American designed bolt action rifle for military and sporting purposes. The Remington-Keene rifle was introduced in 1876 and discontinued in 1883 in favor of the Remington-Lee because the locking system was unable to handle the higher chamber pressures of smokeless powders.

The Remington-Lee Military Rifle and Carbine was introduced in 1880 and the Special Sporting Rifle in 1886. The outstanding features of these rifles were the first detachable box magazines and the half-cock safety system. This rifle was the forerunner of the famous Lee-Enfield rifle which was the standard of the British Army for more than fifty years.

The Model 30 was introduced in 1921 and the M/30S shortly afterwards. They became the first successful high powered bolt action rifles chambered for military cartridges to be placed on the American market. Until the war most shooters had preferred the lever or slide action. When the servicemen returned they were trained and proficient with bolt actions and demanded sporting rifles of similar design. Remington, who had produced over 1.5 million 1917 Enfields at Ilion and Eddystone, Pennsylvania, modified the design to a sporter and tooled up from the inventory of parts and machinery which remained from their government contracts. Early models had the Enfield cock on closing type bolt but were shortly replaced with the improved cock-on-opening cam which gave more positive and easier operation. These models were discontinued in 1940.

The Model 720 was introduced in 1941 but only a few were made available before production was curtailed due to wartime production. The M/720 was a revised version of the discontinued model 30S and was scheduled to resume production after the war. Improvements had been made in the stock design, the bolt handle and the sights; but the M/720 failed as a valuable contribution to the Remington line of quality rifles and was not continued after the war.

An exhaustive survey was conducted in 1944 to determine the likes and desires of the shooting public. Coupled with the objectives of better acceptability and lower cost, these public feelings lead to the reactivation of some experimental R&D design concepts previously deferred. Attention was focused on a new high-power bolt-action center fire rifle. This new rifle was to be light weight, highly accurate, rugged, appealing, easy to handle, and priced to compete with the Winchester '94.

The Model 721-722 was announced in 1948 and it offered the strongest actions ever built in a sporting rifle. The bolt incorporated a new concept in strength and safety, the encased or shrouded head. The cartridge case is enclosed in the bolt face and the bolt face is encased in the barrel which completely surrounded the cartridge case with steel. This protection to the shooter is possible because there were no cuts made in the bolt head for an extractor as in the Mauser and similar types. The Remington extractor is located entirely in the bolt face and is one of the patented features of the rifle.

The Model 721-722 exceeded all its goals, expectations and sales forecasts. It put into the hands of the general public a light, safe, and accurate rifle for less than $80.00. The original forecast was for 13,800 rifles per year based on a normal year of a twelve year span. Actual sales amounted to 32,334 the first year and a total of 421,756 during 1948-'62. The peak year was 1951 when 63,489 rifles were sold and the annual sale by years for 1948-1955 were:

1948	32,334	1952	61,143
1949	44,130	1953	54,424
1950	54,482	1954	14,019
1951	63,489	1955	22,218

In 1955 Remington introduced the Model 40-X Rim Fire Rifle to replace the M/37 and compete with the Winchester Model 52. It was the first target rifle Remington produced that successfully competed with the M/52 Win. and today, after only seven years of existence, it accounts for about 50% of all the rifles on the line at small bore matches.

As a result of the development work performed by Remington R&D for the Army Advanced Marksmanship Unit in 1958 and '59 it was proposed to produce the International Match Rifle. Since the volume of these match rifles would not justify the expense involved to produce this custom work, it was proposed to also produce the M/40X in a center fire action for varmit and bench rest shooters. A production of 500 combined units a year was anticipated based on a special single discount sales policy. Shortly after the introduction in 1960 the sales policy was revised to the standard dual discount policy. The sales volume has been about 300 annually. About 50% of the rifles on the line at varmit class bench rest matches are Remington M/40X.

Having successfully produced the moderate priced Models 721-722, indications pointed to bringing out a bolt action model with customized characteristics to challenge the field of the Winchester Model 70. The new model, designated the M/725, was to retain all the desirable features of the 721 action but would offer better appearance and handling plus other experimental design developments.

The M/725, introduced in 1958, was not enthusiastically received by the buying public and anticipated sales were never realized. One major reason for the unsuccessful sales was the lack of increased value for the $40.00 increase in sales price. With the 725 sales failing to meet expectations and 721-722 sales dropping due to outside competition and newer Remington models, it became evident that a new and distinct bolt action rifle was needed. The need for such a rifle culminated in the design and development of the Model 700, the subject of this report.

OBJECTIVE

Specifications were established to return Remington to as impregnable a competitive position as enjoyed during the late 40's and early 50's with the M/721-722. The specific desire was to competitively surpass the Winchester Model 70, Weatherby Mark V, and others in the deluxe high powered bolt action field. It was felt that this could be done by complying with the following objectives:

1. Appearance:	New stock configuration including an improved Monte Carlo cheek piece comb, custom checkering with large pleasing patterns, distinguished design of the bolt handle and knob plus a streamlined configuration of the barrel, receiver, and stock.
2. Cost:	Produce this new customized rifle and sell it for the price currently received for the M/721 and 725.
3. Weight:	Maintain the approximate weights of the 721 and 725, 6-1/2 pounds and up depending on the caliber.
4. Variety of Calibers:	Provide a range of calibers from the 222 Rem. to the 458 Win. Magnum.

SUMMARY AND CONCLUSIONS

Significant in the overall design and development of the M/700 was the independent development of several major supplementary projects. These outside developments, when coupled with the specific developments of the project, have led to an extremely successful acceptance of the model.

The outstanding characteristic of the new rifle as developed in Part I of this project was the styling of the stock and the improved appearance of the bolt. The two principal features of the stock styling were the more desirable Monte Carlo cheek piece comb and the close pistol grip. Features of the bolt were more pleasing lines and checkering on the knob.

Other important developments were initiated during the project as additional advancements. Included in this group were the revision of the extractor, the addition of the BDL model, adoption of the press or "custom checkering" and the announcement of the 7mm Rem. Magnum cartridge.

Part I of the project covered the expenditure of $19,300 for the design and development of the M/700 rifle. The original proposal was to supply one design similar to the present ADL Grade in stock design with hand checkering. It also included a slightly modified action, an improved safety, restyling on the bolt handle, and checkering on the top of the knob. It was suggested by R&D that the model be presented in five or six most common calibers including the 375 H&H Magnum and 458 Win. Magnum. For these two larger calibers it was proposed to supply the same action and receiver as the smaller calibers but supply a heavier barrel to help reduce recoil and a larger stock to complement the larger barrel.

Before Part II started, Sales added the requirement for the deluxe model known originally as the ADL and finally as the BDL. Sales also wanted the new model to be presented in a more complete series of calibers including a new magnum caliber, either a 300 or 350 Magnum. R&D counter-proposed the 7mm Magnum and soon the development of this cartridge was under way. The completion of this cartridge development in time to announce simultaneously with the new model has added to the acceptance of both the rifle and the cartridge.

There was a continued research interest in developing a new method of checkering stocks to give the quality of hand checkering produced in production methods. As the M/700 was being designed, there were two development programs for new methods of checkering. R&D was developing a machine to checker stocks using a multispindle pantagraph principle to reproduce from a master a hand checkering type design. A second development program was reactivated by the Engineering Research Division for reproducing designs by compression in a die utilizing pressure and heat. The successful conclusion of the latter method in time to be included in the announcement of the new model helped to present the M/700 as a new and distinct rifle, not just a dressed-up version of the Model 725.

The M/700 was designed with 20" length barrels on all calibers except the 264, 7mm, 375 and 458 Magnums. The selection of the shorter barrel was made after studying the comments of customers, requests of outstanding writers, and suggestions of manufacturers of accessory equipment. The shorter barrel provides for ease in handling in the field and has been readily accepted by the customer in all calibers except the 222 Rem. and 222 Rem. Magnum. Plans are now complete to change these two calibers to 24" barrels.

A late development in the M/700 bolt assembly was the modification and improvment of the extractor. Sales and Arms Service had received complaints from customers on the patented type extractor used in the Models 721, 722 and 725. These complaints were mostly from hand loaders who tend toward maximum or overloaded cartridges. Adaptations of the M/742-760 extractor were designed and added to the new model. Subsequently an investigation was completed comparing the M/700 extractor to the M/721 extractor and finally to competitive models. The M/700 extractor is about 14% stronger than the 721 and a minimum of 20% stronger than competitive models.

The proof of the work performed on the development and presentation of the M/700 is in the acceptance by the buying public. The 1961 forecast for the M/721-722-725 was 15,000 combined. The third year (1964) proposed forecast of the 700 in replacing its predecessors was to be 25,000. From its announcement in April to the end of December 1962 sales have totaled 43,000 rifles. Of this total approximately 12,300 were the new 7mm Magnum and another 12,100 were 30-06 caliber. Roughly 30% of all sales were in the BDL Grade.

The following table lists the available calibers and the current list prices:

ADL Grade	
222 Rem., 222 Rem. Mag., 243 Win., 270 Win., 280 Rem., 30-06, and 308 Win.	$114.95
7mm Rem. Mag. and 264 Win. Mag. (Stainless Steel Barrel and Recoil Pad)	$129.95
BDL Grade	
222 Rem., 222 Rem. Mag., 243 Win., 270 Win., 280 Rem., 30-06, and 308 Win.	$139.95
7mm Rem. Mag. and 264 Win. Mag. (Stainless Steel Barrel and Recoil Pad)	$154.95
375 H&H Mag. and 458 Win. Mag. (built in Muzzle Brake, Special Stock, and Recoil Pad)	$310.00

PATENT STATEMENT

No new inventions were made in the process of developing this rifle and no patent infringements will be involved in its manufacture, use, or sale.

Patented features relative to the bolt design of the M/721 rifle are used. The "custom checkering" developed on another project is also used in the production of this rifle.

FUTURE PROGRAM

6mm Remington

A new caliber, the 6mm Remington, is to be announced about March 1, 1963 for the M/700 in both the ADL and BDL Grades. This will provide a selection of ten calibers in ADL and twelve in BDL Grade.

A comparative test program was conducted by Ilion R&D to determine the proper rifling twist for the new caliber. A series of accuracy tests were fired using M/700's and M/40X's, each chambered for the 6mm and rifled in 8, 9, and 10 inch twist. Various weight bullets from 60 grains to 105 grains were hand-loaded and fired in comparison with the factory loads with 100 grain bullets. These tests were fired in all weights, all twists, and in both style rifles from the bench at 100 yards range. Results of the tests showed the 9" twist the most desirable. Each figure represents an average extreme spread of nine 5-shot groups at 100 yards:

Model 700			Ammunition	Model 40X		
8"	9"	10"		8"	9"	10"
1.69	1.20	2.07	60 Gr. Sierra H.P. 45.3 Gr. 4064	1.00	.92	.99
1.89	1.44	1.73	75 Gr. Sierra H.P. 42 Gr. 4064	1.08	.95	.98
2.05	1.75	1.72	85 Gr. Sierra P.S.P. 40 Gr. 4064	1.37	1.07	.95
2.13	1.58	2.51	105 Gr. Speer S.P. 43 Gr. 4350	.99	1.15	1.10
2.61	2.47	3.45	105 Gr. Speer Spitzer 43 Gr. 4350	2.15	1.69	2.19
2.95	2.53	2.57	Factory Load 100 Gr. Rem. P.S.P.	1.50	1.60	1.22
2.22	1.83	2.35	Average	1.35	1.23	1.22

New Caliber

A development presently under way is the 30 caliber bullet in the 7mm Magnum case. Pressure barrels have been made up for test firing at Bridgeport and some testing has been performed. Several custom rifles have been made for customers chambered in this caliber and more are presently on order.

New Grades

It has been recommended that the M/700 be made available in C, D, and F Grades. These rifles would be custom made by the Custom Rifle Shop of the Ilion Research Division as presently done for the BDL 375 and 458 calibers.

The "C" Grade rifle would be similar to the BDL 375 and 458 with hand made oil finished stocks, hand checkering, and a choice of the ADL or BDL magazine. The "D" and "F" Grades would have hand made oil finished stocks of high grade wood with hand checkering. The barrels and receivers would be engraved and gold inlaid depending on the grade.

EXPERIMENTAL DETAILS

Development of 7 mm Remington Magnum

Remington announced its new 7mm Magnum cartridge with the introduction of the M/700 rifle. The new caliber culminated a program to devise a high velocity center fire cartridge equal to or better than the .264 Win. Mag. It was desired by Sales to announce a new magnum caliber with the new rifle. A 300 and a 350 Magnum caliber were considered.

Ilion R&D felt that a cartridge as large as those under consideration would cause excessive recoil and stock breakage in a standard weight rifle. Ilion had previously done some work on 7mm Magnums and proposed that Sales consider the 7mm bullet in the 264 Magnum case. Initial work was performed using the 264 Magnum case in a M/721 chambered accordingly. Tests conducted in the first pressure-velocity barrel indicated that 264 Magnum velocities could be exceeded. In a joint effort between Ilion Research and the Bridgeport process engineers, the final development of the cartridge was completed.

Several names were suggested for the new cartridge including 280 Rem. Magnum, 284 Rem. Magnum, and the 7mm Rem. Magnum. Sales chose 7mm Remington Magnum and cartridge production was given first priority to permit an early 1962 introduction. Customer acceptance has exceeded expectations and has helped stimulate sales of the M/700. Sales records indicate the 7mm sold equal to the 30-06 and the two in combination accounted for about 25,000 of the 43,000 M/700 rifles sold.

Ballistic Information on 7mm Rem. Magnum

	Velocity - Feet Per Second					
Bullet Weight	Muzzle	100 yds.	200 yds.	300 yds.	400 yds.	500 yds.
150 grain PSP C-L	3260	3070	2880	2690	2500	2320
175 grain SP C-L	3020	2660	2340	2050	1790	1560

	Energy - Foot Pounds					
Bullet Weight	Muzzle	100 yds.	200 yds.	300 yds.	400 yds.	500 yds.
150 grain PSP C-L	3540	3140	2760	2410	2080	1790
175 grain SP C-L	3540	2750	2130	1630	1240	945

	Trajectory - Inches					
Bullet Weight	100 yds.	200 yds.	250 yds.	300 yds.	400 yds.	500 yds.
150 grain	+ 2	+ 2	0	- 3	-14	-30
175 grain	+ 1.8	0	-3.5	- 8.5	-24.8	-48.4

Revised Safety

A revised version of the M/721 Safety was established for the M/700. The Safety in the M/721 was rather stiff and was difficult at times to get the Safe engaged. Customers had complained that the Safety was located so that it was unhandy to manipulate and that it could be moved from Safe to Fire by brush and other obstructions.

The Safety (lever) was lengthened and formed around the side of the receiver. The radius between the pivot and the detent ball was shortened to improve detenting. The angle on the sear camming surface was modified to improve the mechanical advantage. There was an additional cut added in the fabrication of the receiver as clearance for the modified Safety. This design change improves the appearance of the pistol grip area and makes the safety button more easily operable.

A different bolt stop spring was devised and modifications were made to the receiver to allow lowering the tang and improve the streamlining.

Custom Checkering

The two-fold purpose of checkering on a gun stock is to aid the shooter in gripping and to enhance the appearance. The introduction of the M/700 incorporated a new method of "custom checkering" developed by the Engineering Research Division. The development of this unique and novel method of decorating the stock and fore-end of both rifles and shotguns provides a customized appearance using a production process.

The new method used to produce this custom decoration is not checkering in the true interpretation since the design is not cut into the wood with a tool. The new process uses the combination of heat and pressure to mold the design into the wood. When the heated die is pressed into the wood for a short duration, the wood fibers are bent and displaced from their natural position by the die configuration. The normal moisture content of the wood provides sufficient plasticizing to "set" the design.

The old method of machine checkering requires an extensive capital investment since each machine is custom built for a particular model and pattern with little interchangeability. "Custom" or molded checkering can be performed on the same machine by changing dies and fixtures for each stock or pattern style. This allows changes from model to model and even pattern modifications with less investment and increased versatility.

Development of the BDL Grade

When the Part I study was completed for design and development of the single grade Model 700, Sales requested the design be expanded to a standard and a deluxe (ADL) grade. The following modifications or additions were made to the standard grade in developing the deluxe grade:

1. The M/725 type trigger guard and magazine floor plate were modified for the M/700.

2. A new checkering pattern was developed for the new grade.

3. The black fore-end tip and grip cap with white spacers were added.

4. The top of the receiver was grit blasted.

5. Attachment of the quick detachable swivels and sling was made standard equipment.

6. The standard grade was redesignated the ADL and the deluxe grade became the BDL.

A special BDL grade was established for the 375 H&H Magnum and 458 Win. Magnum calibers. To reduce recoil and strengthen the rifle the following modifications were incorporated:

1. A heavier, larger diameter and longer barrel with a built-in muzzle brake was adapted for these larger calibers.

2. A larger and longer stock with two reinforcing pins in the receiver area was devised to accommodate the larger barrel and strengthen the stock against recoil.

3. The stock is hand checkered instead of molded "custom checkered" and is oil finished in place of standard lacquer. Since the stock is larger, hand checkering is considerably more economical.

4. The sights were modified to accommodate the changes made in the diameter and length of the barrel.

Stock - ADL and BDL Grades

The stock was designed to combine symmetry of lines and comfort in handling. The fore-end was reduced in size and made shorter than the M/721 and the Monte Carlo cheek-piece comb was added. The trigger was moved 1/4" toward the grip to prevent the hand from contacting the swept-back bolt handle during recoil.

The grip is so designed that when grasping it the trigger finger is in a relaxed position, that is, the lower joint of the fore-finger is in prolongation of the forearm reaching the trigger with ease. The curve of the grip and its height with relation to the bottom line of the stock add a custom feel to the M/700. This is accomplished by having a slight parabolical curve toward the rear of the grip with plenty of finger room just behind the trigger guard. The grip has an almost full oval cross section with a comfortable circumference. Pressed into its sides and top is the complimentary checkering pattern conforming with the comfortable and pleasing shape of the grip.

The Monte Carlo cheek-piece is thick enough and properly sloped so that it fits snugly and it is comfortable even with cartridges having large recoil. Its large flat surface provides a positive and controlled method of canting the head thereby lessening the time required to line up the eye with the sight (iron or telescopic) and providing a firmer and more uniform hold.

The comb is properly placed on the stock so that when the grip is grasped for shooting the base of the thumb is supported. This is done by locating the comb over the center of the grip. The fluted comb is artistically cut so that it runs parallel with the lower edge of the stock - not cut downward at a sharp angle. The rear portion of the undercut blends into the surface of the stock with no perceptible angle.

The Buttstock is full and rounded to about a half circle just behind the grip and narrows in a straight taper toward the toe to conform with the butt plate. The upper edge is thick and full and tapers in the same manner as the cheek-piece toward the front. The pitch and drops are designed so that when the rifle is brought up for a quick shot it is done with ease and speed. When the rifle is fired it will deliver the recoil through the center of its form clinging to the shooter's shoulder and not sliding up or down.

The fore-end is comparatively full and long having lines in balance with the rest of the stock and slightly swelling over the magazine blending into the grip. Pressed into the fore-end is the checkering pattern on the sides and bottom, having its outlines parallel to the edges of the fore-arm. The BDL stock is capped off with a well proportioned black fore-end tip having a white plastic spacer between it and the walnut stock.

The recoil pad added to the stock on all magnum calibers was developed by experimentation to provide a maximum recoil absorption without bottoming out. The design of the pad and the selection of material were devised to allow a full cushioning effect of the higher recoil characteristics of magnum loads.

New Extractor

Sales and Arms Service have received complaints from customers about failures of the M/721 type extractor. These complaints have come mainly from hand loaders shooting "hot loads". The usual source of these failures was blown primers or ruptured cases allowing gas to escape in the bolt head. The result was the case was expanded in the bolt head, crushing the extractor. Instead of replacing the damaged extractor most shooters continued to fire and when the damaged extractor failed to work properly, a complaint was forthcoming.

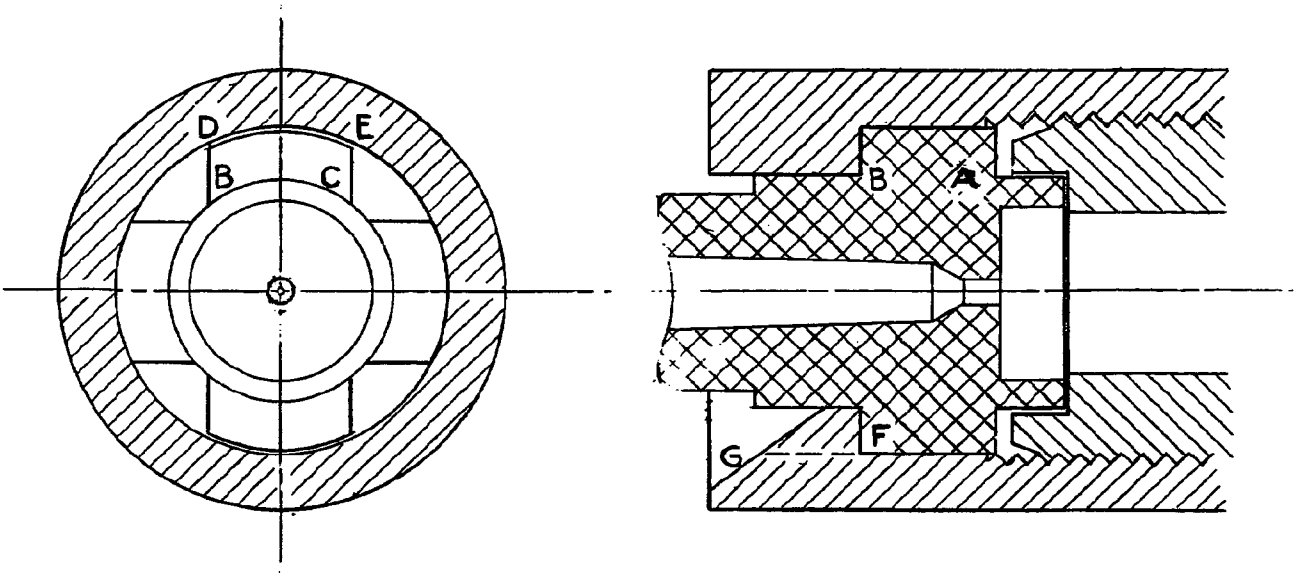
Sales requested an investigation into the possibility of supplying the M/700 with a new extractor. A new design, based on the M/760 extractor, was made up with a thicker cross section in both the spring and claw. Comparative blow-up tests were conducted and the 721 type extractor became inoperative while the 760 type was not deformed.

Subsequent to the release of the M/700 a study was conducted to determine the comparative extracting quality of the new extractor, the former design and certain competitive models. A test fixture was made up to subject the extractor to the force of a compressed spring mounted on a threaded rod attached to a chambered cartridge case. The spring was compressed against the muzzle and the spring force was gauged. There was no pull on the extractor until the bolt was opened against the extractor cam and engaged the extractor against the case rim. Three things could happen as the bolt was cammed open: (1) the extractor could hold its engagement in the cartridge rim, (2) the extractor could slide off the case rim, or (3) if the extractor were still engaged at about 350 lbs. the extractor would shear a section from the case rim.

The new extractor was compared to the M/721 type and withstood an additional 14% pull and when compared with competitive models withstood a minimum of 20% additional pull. Results of these tests show the following:

		Pounds of Load			
Make	Caliber	Min.	Max.	Ave.	General Comment
Remington M/700	7mm	310	385	349	Case rim failed
Remington M/700	30-06	300	350	323	Case rim failed
B S A	30-06	250	275	266	Extractor slipped off
Husqvarna	30-06	235	360	290	Case failed on Max.
Weatherby Mark V	30-06	250	250	250	Extractor slipped off
Weatherby Mark V	300 Mag.	250	--	--	Extractor broke
Winchester M/70	308	100	200	150	Extractor slipped off
Winchester M/70	264 Mag.	175	190	182	Extractor slipped off
Winchester M/70	458 Mag.	200	300	246	Extractor slipped off

Calculations for Strength of the Action



Materials Used

Bolt Head - AISI 8640
Receiver - AISI 4140
Barrel - 416 Stainless Steel or R A Spec 155

P = Pressure of Proof Load = 80,000 psi for 7mm
A = Area of case base (I.D. = .425)
M = Strength of Material (elastic limit)

AISI 8640 and 4140 = 150,000 psi
416 Stainless = 71,000 psi
RA Spec 155 = 75,000 psi

F = Force of Proof Load = P A

Stress on the Bolt Lugs

(1) In Shear

Area of Bolt Lugs (a_s) = 2 (lw)
= 2 (Arc BC) (length AB)
= 2 (.487) (.444)
= .433 in^2

l = .01745 rθ
= .01745 (.349) (80)
= .487 in.

Maximum allowable load in shear = .6 Ma_s
= .6 (150,000 psi) (.433 in^2)
= 39,000 pounds

Area of case base (A) = 3.14 $\left(\frac{.425^2}{4}\right)$

= .142 in^2

Force of Proof Load = P A
= 80,000 psi x .142 in^2
= 11,350 pounds

Factor of Safety = $\frac{\text{Maximum Allowable Load}}{\text{Proof Force}}$

= $\frac{39,000 \text{ lbs.}}{11,350 \text{ lbs.}}$

= 3.44

(2) In Compression

Area of Bolt Lugs (a_c) = 2 (lw)
= 2 (.490) (.143)
= .137 in^2

l = mean difference in Arc BD & Arc DE
= (.492 & .487)
w = 1/2 (dia. lugs - dia. bolt head)
= 1/2 (.990 - .703)

Maximum allowable load in compression = Ma_c
= 150,000 psi x 137 in^2
= 20,800 pounds

Force of Proof Load = 11,350 pounds

Factor of Safety = $\frac{\text{Maximum Allowable Load}}{\text{Proof Force}}$

= $\frac{20,800 \text{ lbs.}}{11,350 \text{ lbs.}}$

= 1.86

Stress on Receiver Lugs

(1) In shear the bottom lug is weaker than the top because of the loading ramp cut and the bolt lug is narrower than the receiver lug; therefore the bolt lug would tend to tear through the center of the receiver lug.

Area sheared out by bolt lug = width of bolt lug x length of receiver lug
+ twice the height of bolt lug x length of receiver lug.

$= w\ (.490) \times l(.280) + 2h\ (.143) \times l(.280)$
$= .137 + .080$
$= .217\ in^2$

Since one bolt lug has an area of 1/2 ($.433\ in^2$) or $.217\ in^2$ and the upper receiver lug is stronger than the lower lug, it is assumed the bolt lugs would shear before the receiver lugs.

(2) Stress in Tension of Receiver

Area of cross section = 3.14 (mean diameter) (wall thickness)
= 3.14 (1.212 x .147)
= $.262\ in^2$

Maximum allowable load in tension = Ma
= 150,000 psi ($.262\ in^2$)
= 39,225 pounds

$$\text{Factor of Safety} = \frac{\text{Maximum Allowable Load}}{\text{Proof Load}}$$

$$= \frac{39,225 \text{ pounds}}{11,350 \text{ pounds}}$$

$$= 3.46$$

Lamé's formula for high internal pressure assumes the pressure is static and makes no allowance for inertia; therefore the formula can not be used without modification. The formula for calculating low internal pressures comes close to actual figures determined by empirical methods and are used here to determine the overall strength of the action. (Note: Work is being done to modify the Lamé high internal pressure formula to agree with our application and a supplement is to be issued at a later date).

Since the barrel materials have an elastic limit near 70,000 psi as compared with the receiver material at 150,000 psi, assume the strength of both the barrel and receiver to be of the weaker material. The stronger material in the receiver will not add to the overall strength of the action unless the barrel material withstands an overload.

$$+ = \frac{dP}{2(s)} \quad : \quad s = .5\frac{dP}{+}$$

+ = Thickness of Wall
d = Inside diameter chamber (.513)
D = Outside diameter receiver (1.358)
P = 80,000 psi (pressure from within)
S = Stress
TS = Mean tensile strength of 416 stainless or R A Spec 155 = 115,000 psi

$$S = .5\frac{dP}{+}$$

$$= .5\left(\frac{.513 \times 80,000}{.679 - .257}\right)$$

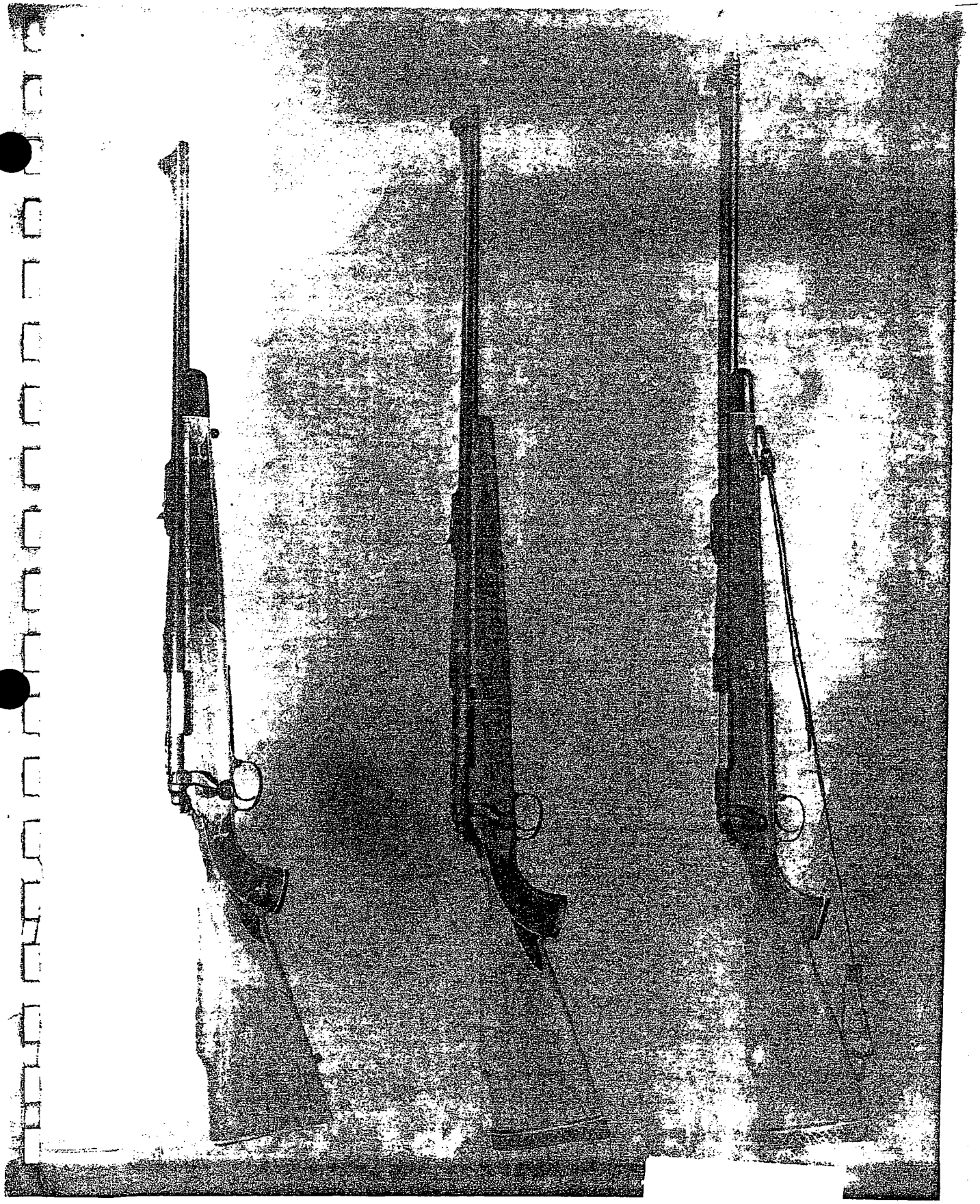
$$= .5\left(\frac{41,000}{.422}\right)$$

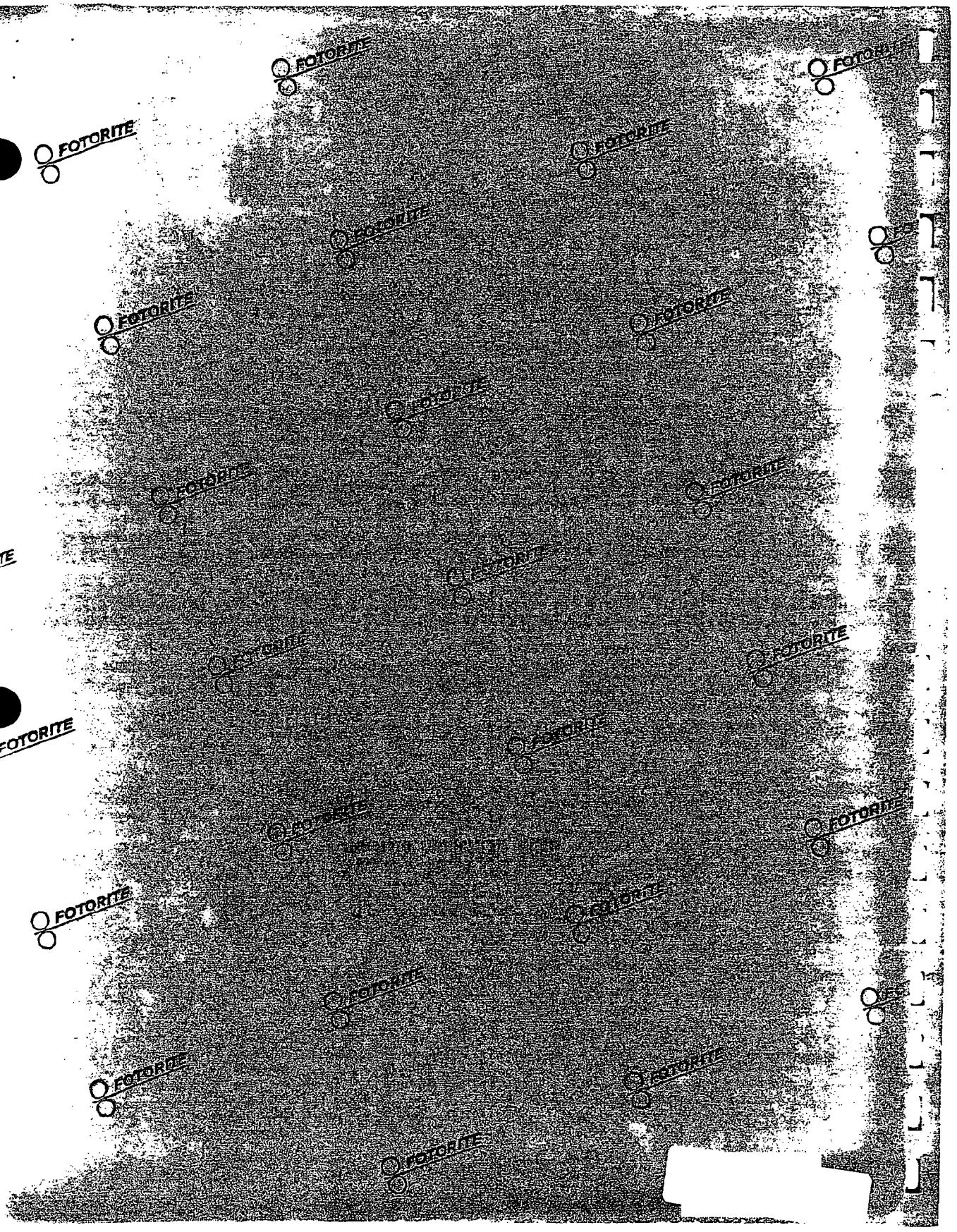
$$= 48,600 \text{ psi}$$

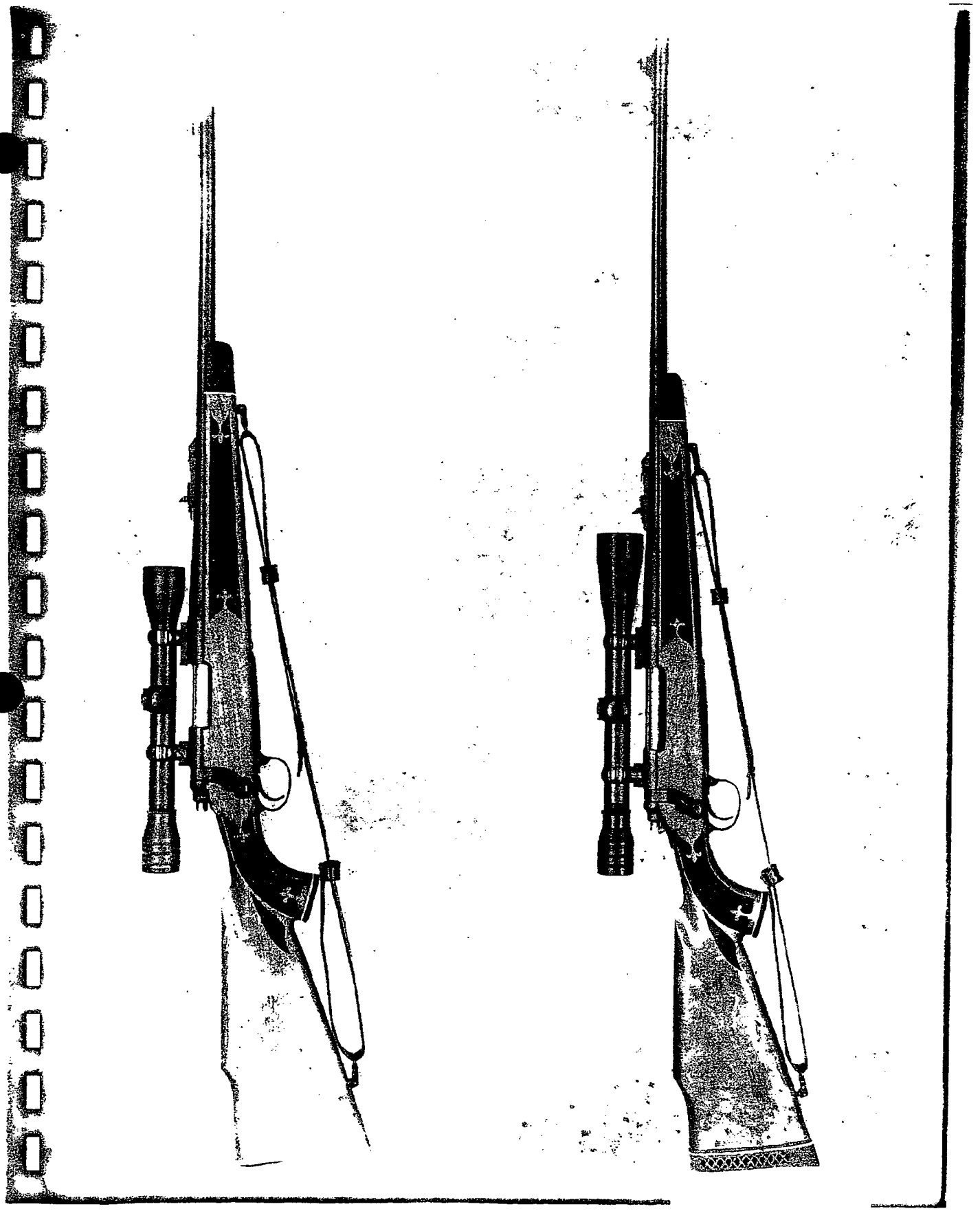
$$\text{Factor of Safety} = \frac{\text{Mean Tensile}}{\text{Stress}}$$

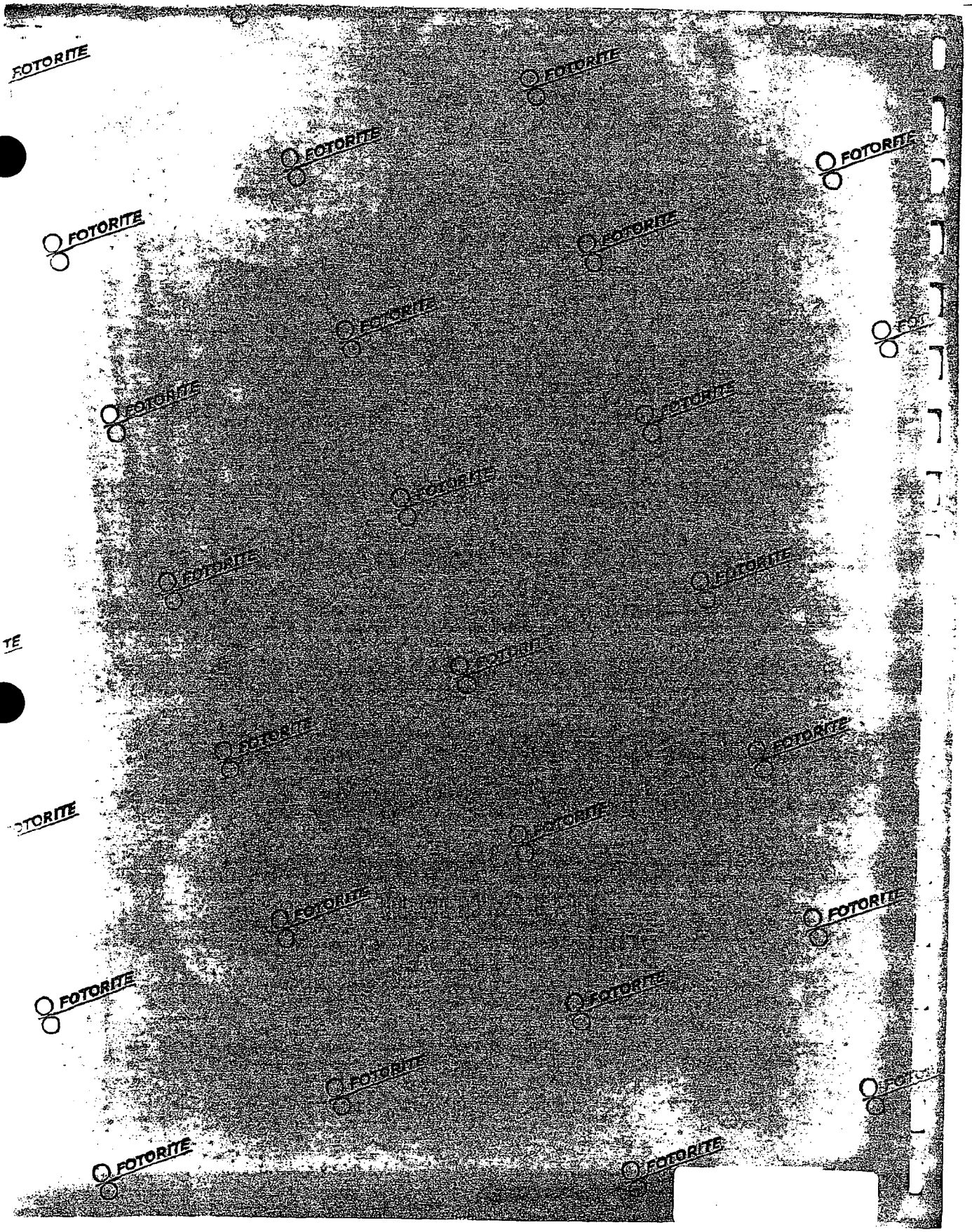
$$= \frac{115,000 \text{ psi}}{48,600 \text{ psi}}$$

$$= 2.37$$




FOTORITE

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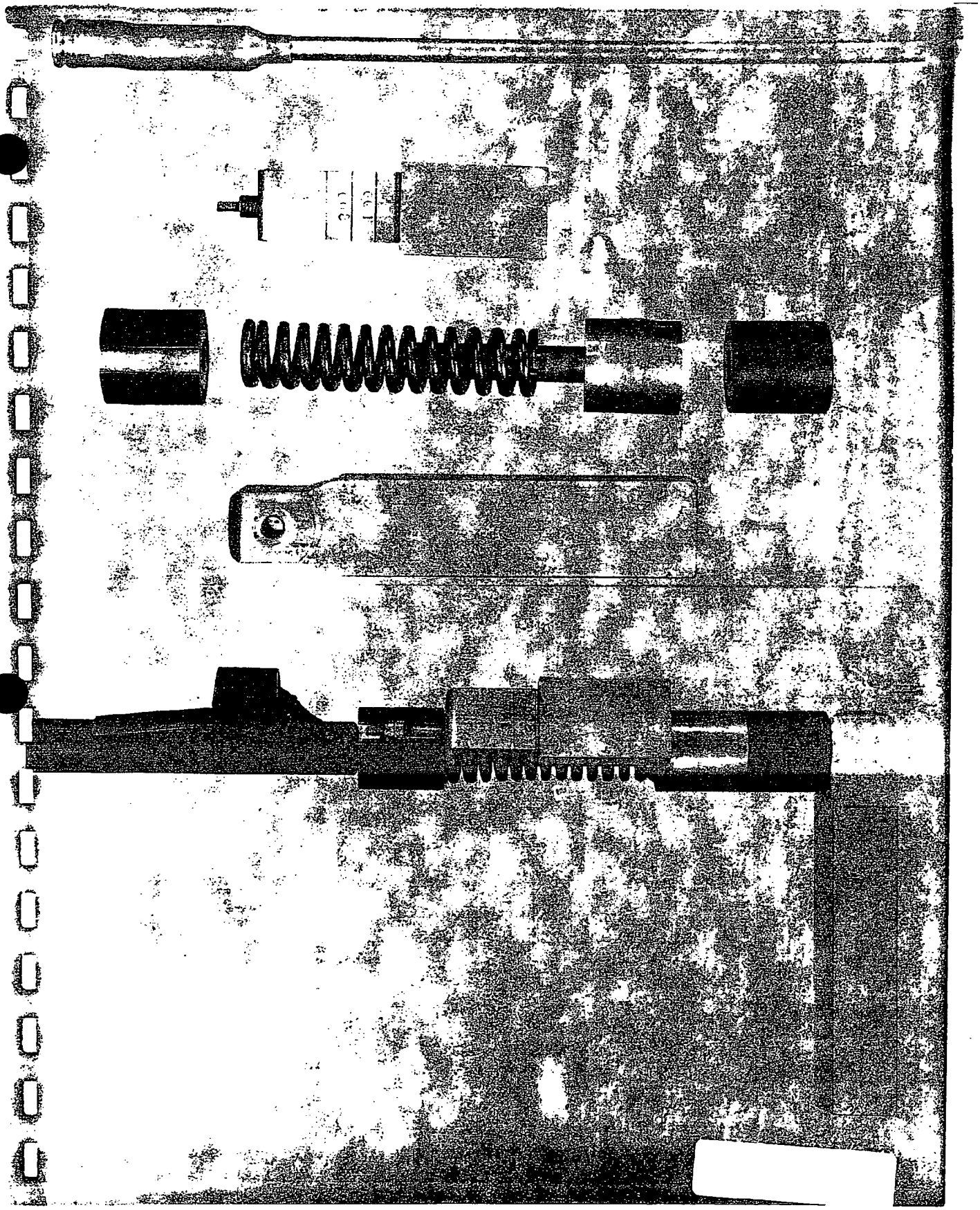
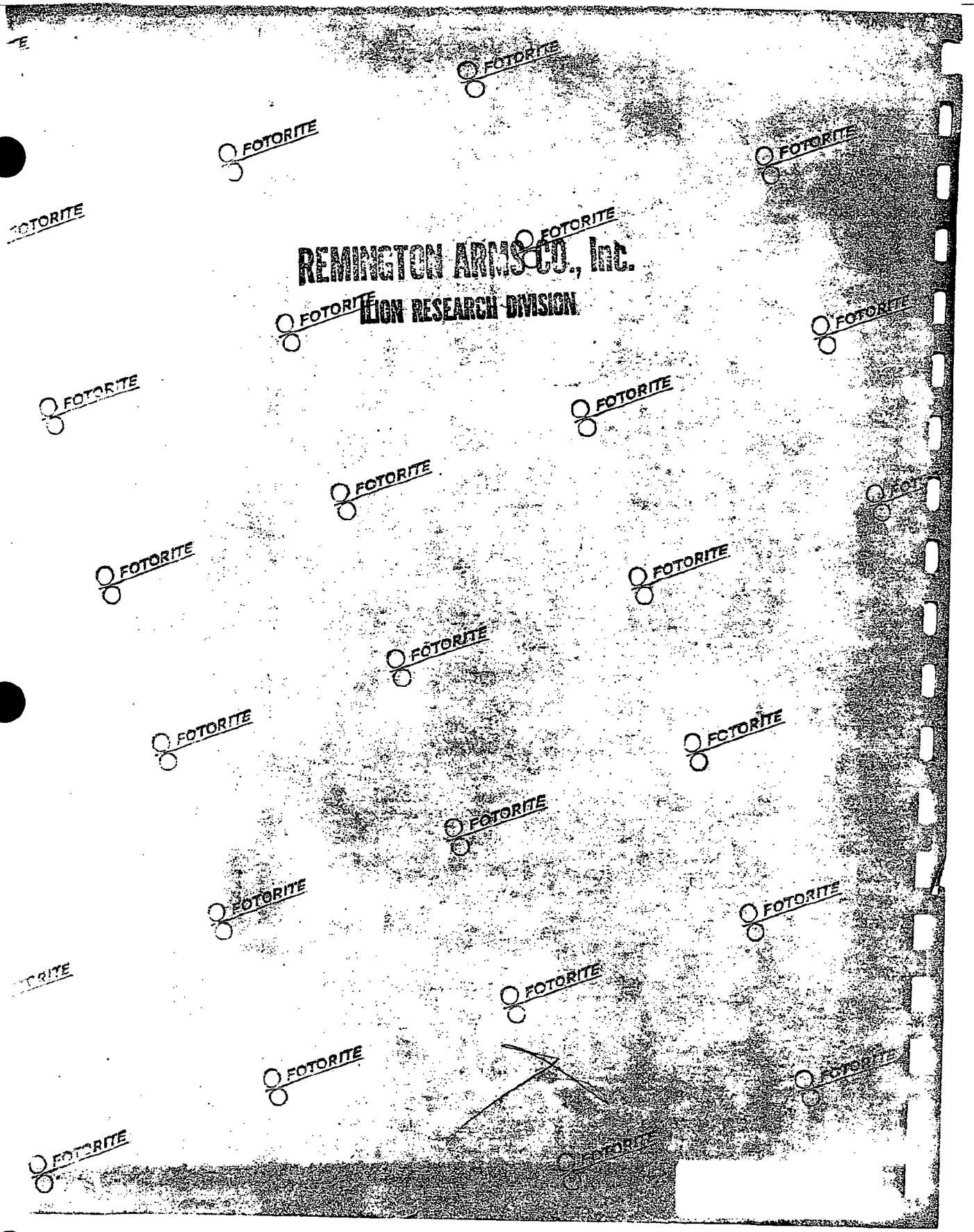
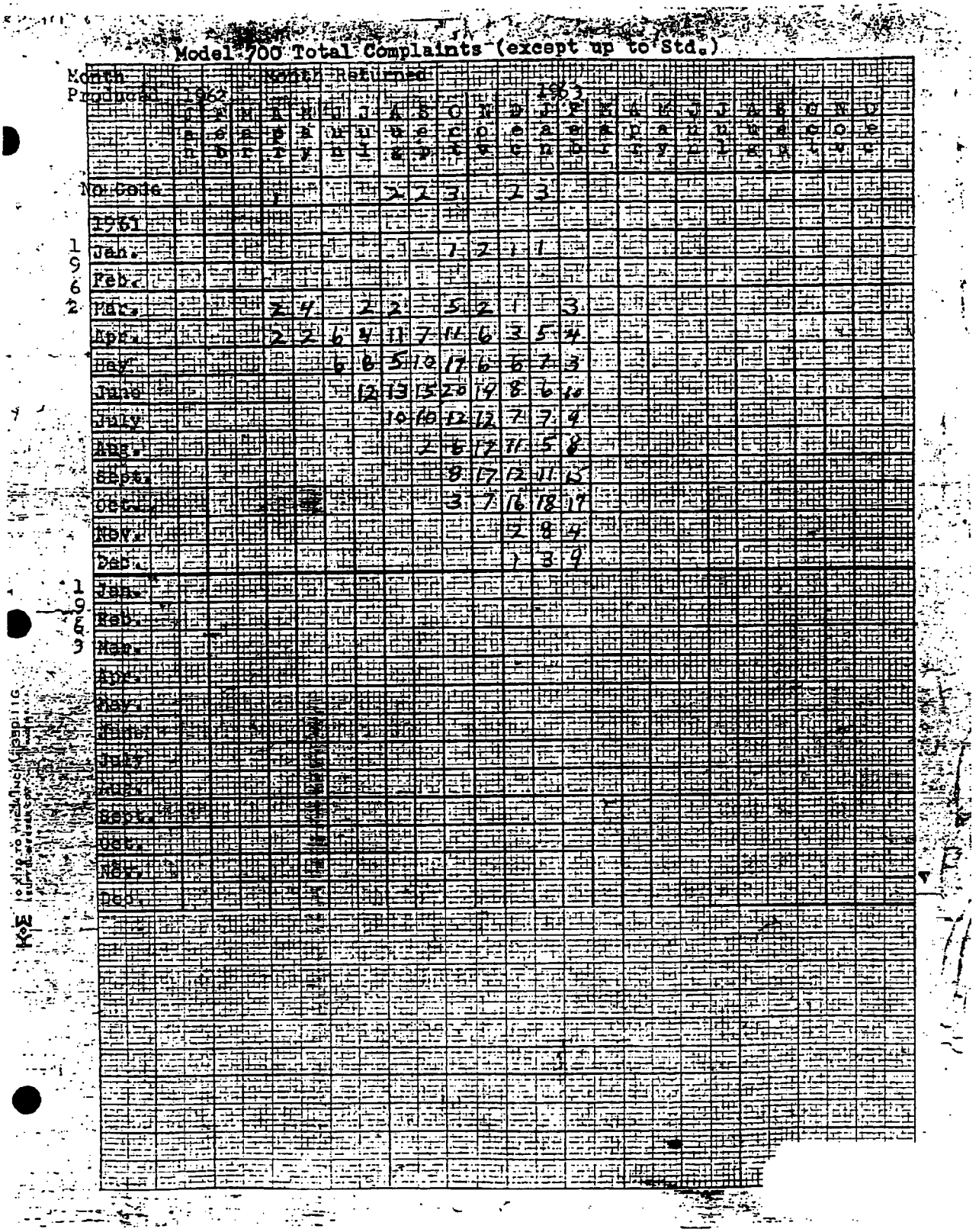
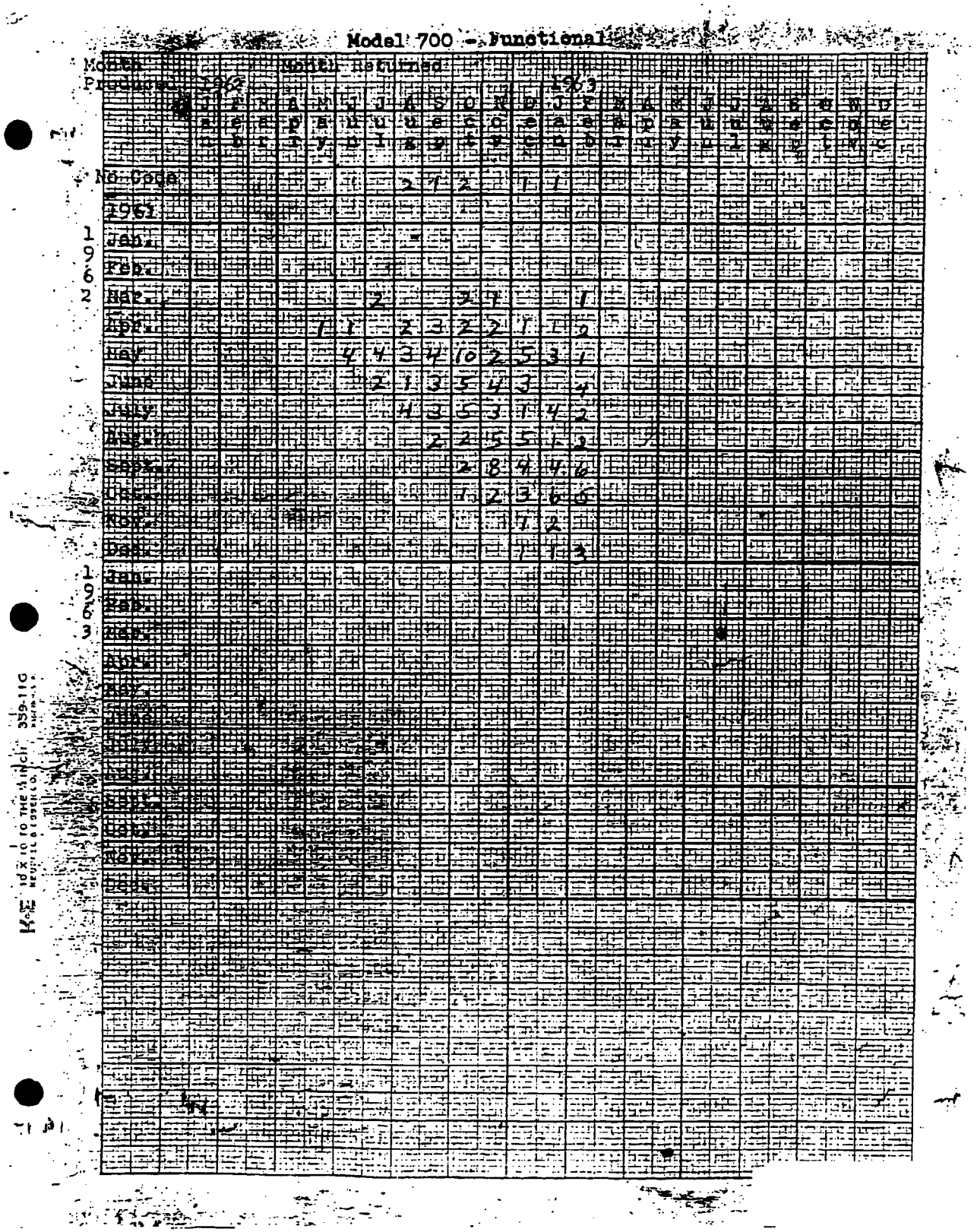



REMINGTON ARMS CO., Inc.
ION RESEARCH DIVISION


Model 700 Total Complaints (except up to Std.)
Month Produced
Month Returned
1962
1963
No Code
1961
1962
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
1963
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.



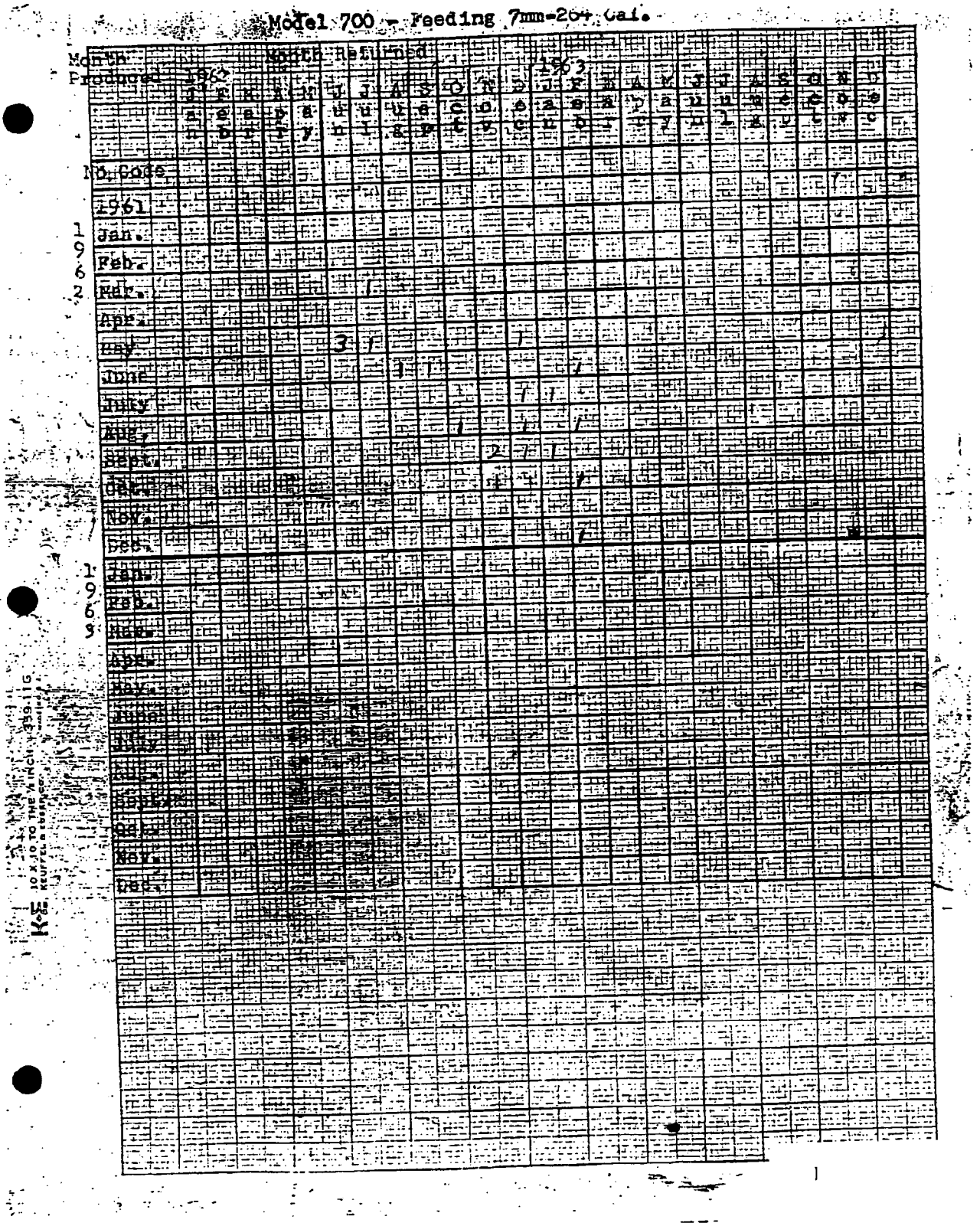
Model 700 - Functional

Month Produced	Month Returned																						
	1962											1963											
	Before	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Before	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.
No Code					2	7	2			1	1												
1961																							
Jan.																							
Feb.																							
Mar.				2		2	1				1												
Apr.		1	1	2	3	2	2	1		1	2												
May			4	4	3	4	10	2	5	3	1												
June			2	1	3	5	4	3		4													
July				4	3	5	3	1	4	2													
Aug.				2	2	5	5		2														
Sept.					2	8	4	4	6														
Oct.					1	2	3	6	6														
Nov.							1	2															
Dec.							1	1	3														
1963																							
Jan.																							
Feb.																							
Mar.																							
Apr.																							
May																							
June																							
July																							
Aug.																							
Sept.																							
Oct.																							
Nov.																							
Dec.																							

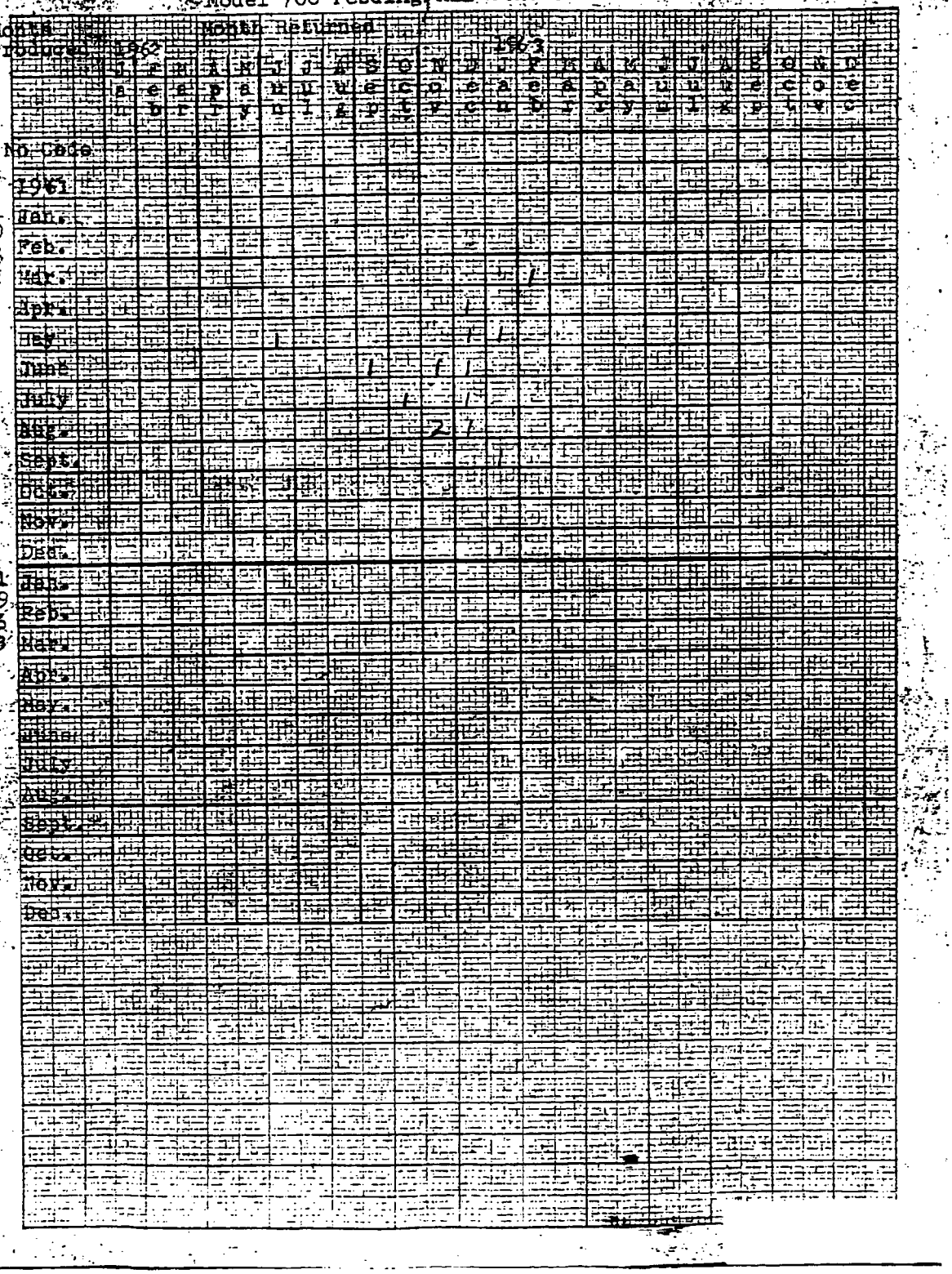
K&E 10 X 10 TO THE INCH 359-11G KEUFFEL & ESSER CO. MADE IN U.S.A.

Model 700 Feeding 222-222 M. Cal.

Month Produced	Month Returned 1962											1963									
	January	February	March	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September	October	November
No Code																							
1961																							
1962 Jan.																							
Feb.																							
Mar.																							
Apr.																							
May																							
June																							
July																							
Aug.																							
Sept.																							
Oct.																							
Nov.																							
Dec.																							
1963 Jan.																							
Feb.																							
Mar.																							
Apr.																							
May																							
June																							
July																							
Aug.																							
Sept.																							
Oct.																							
Nov.																							
Dec.																							

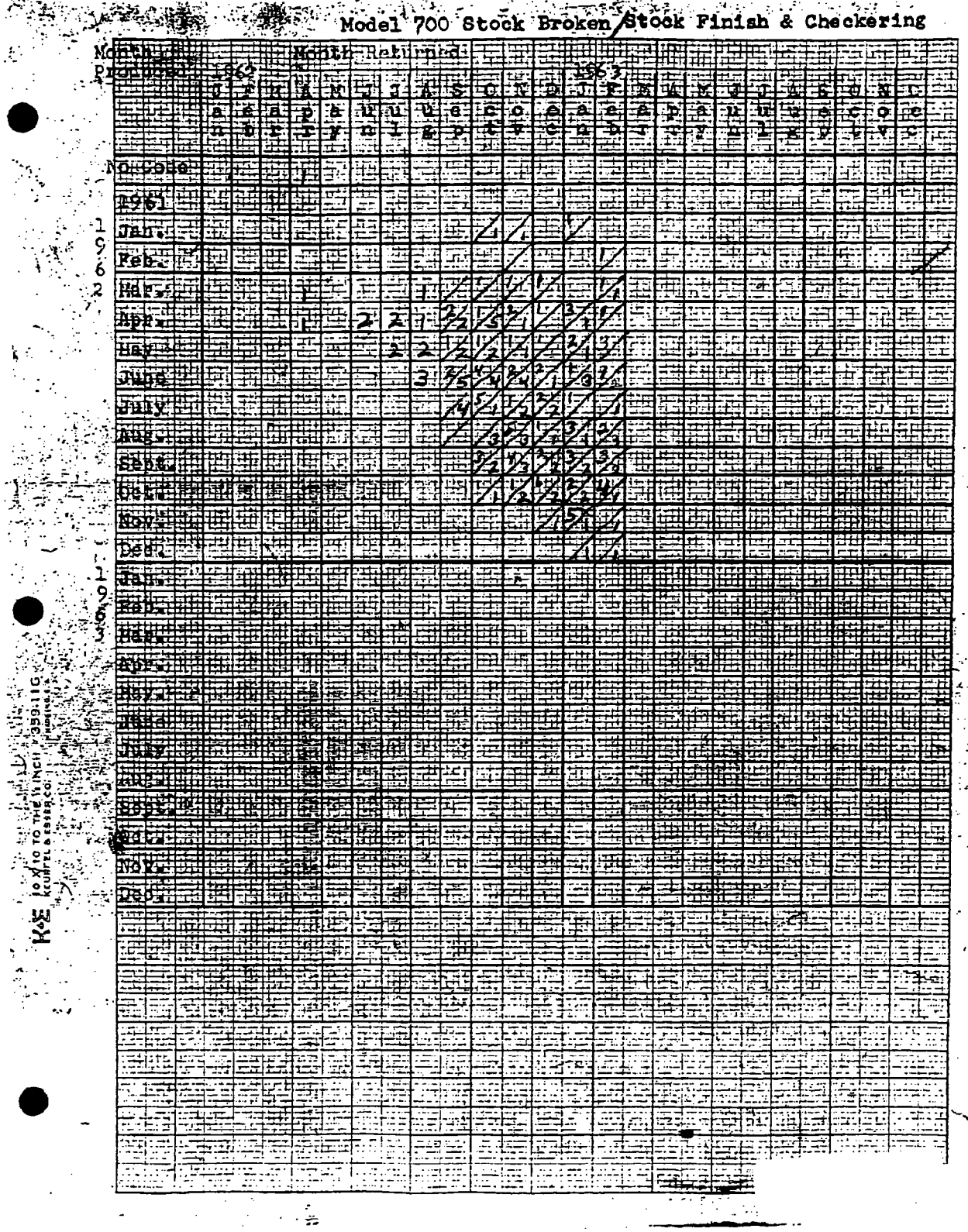


Model 700 Feeding, All Others



Model 700 Ejector Binds or Stuck in the Bolt

Month Produced 1962	Month Returned											1963									
	January	February	March	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September	October	November	December
No Code												1												
1961																								
1962 Jan.																								
Feb.																								
Mar.							1																	
Apr.																								
May						1	1																	
June																								
July																								
Aug.								1																
Sept.								1					1											
Oct.																								
Nov.																								
Dec.																								
1963 Jan.																								
Feb.																								
Mar.																								
Apr.																								
May																								
June																								
July																								
Aug.																								
Sept.																								
Oct.																								
Nov.																								
Dec.																								



Model 700 Stock Cracked at Barrel Groove

Month Produced	Month Returned: 1962											1963										
	February	March	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September	October	November
No Code																						
1961																						
1962 Jan.																						
Feb.																						
Mar.																						
Apr.																						
May																						
June																						
July																						
Aug.																						
Sept.																						
Oct.																						
Nov.																						
Dec.																						
1963 Jan.																						
Feb.																						
Mar.																						
Apr.																						
May																						
June																						
July																						
Aug.																						
Sept.																						
Oct.																						
Nov.																						
Dec.																						

K&E 10 X 10 TO THE INCH 359-11G KEUFFEL & ESSER CO. MADE IN U.S.A.

MODEL 700 - BROKEN STEEL PARTS

Month Produced	Month Returned																						
	1962											1963											
	D e c.	J a n.	F e b.	M a r.	A p r.	M a y	J u n e	J u l y	A u g.	S e p t.	O c t.	N o v.	D e c.	J a n.	F e b.	M a r.	A p r.	M a y	J u n e	J u l y	A u g.	S e p t.	O c t.	N o v.	D e c.
No. Cases												2													
1961																									
Jan.												1													
Feb.																									
Mar.																									
Apr.														1											
May										3	2			1											
June																									
July										1				1											
Aug.										1				1											
Sept.										1	1			1											
Oct.													3	2											
Nov.														1											
Dec.														1											
1963 Jan.																									
Feb.																									
Mar.																									
Apr.																									
May																									
June																									
July																									
Aug.																									
Sept.																									
Oct.																									
Nov.																									
Dec.																									

K&E 10 X 10 TO THE ½ INCH 359112 KEUFFEL & ESSER CO. MADE IN U.S.A.