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2,599,265

ACCURACY SHOOTING REST WITH RECOIL ADSORBING MEANS

Filed June 27, 1950

4 Sheets-Sheet 1

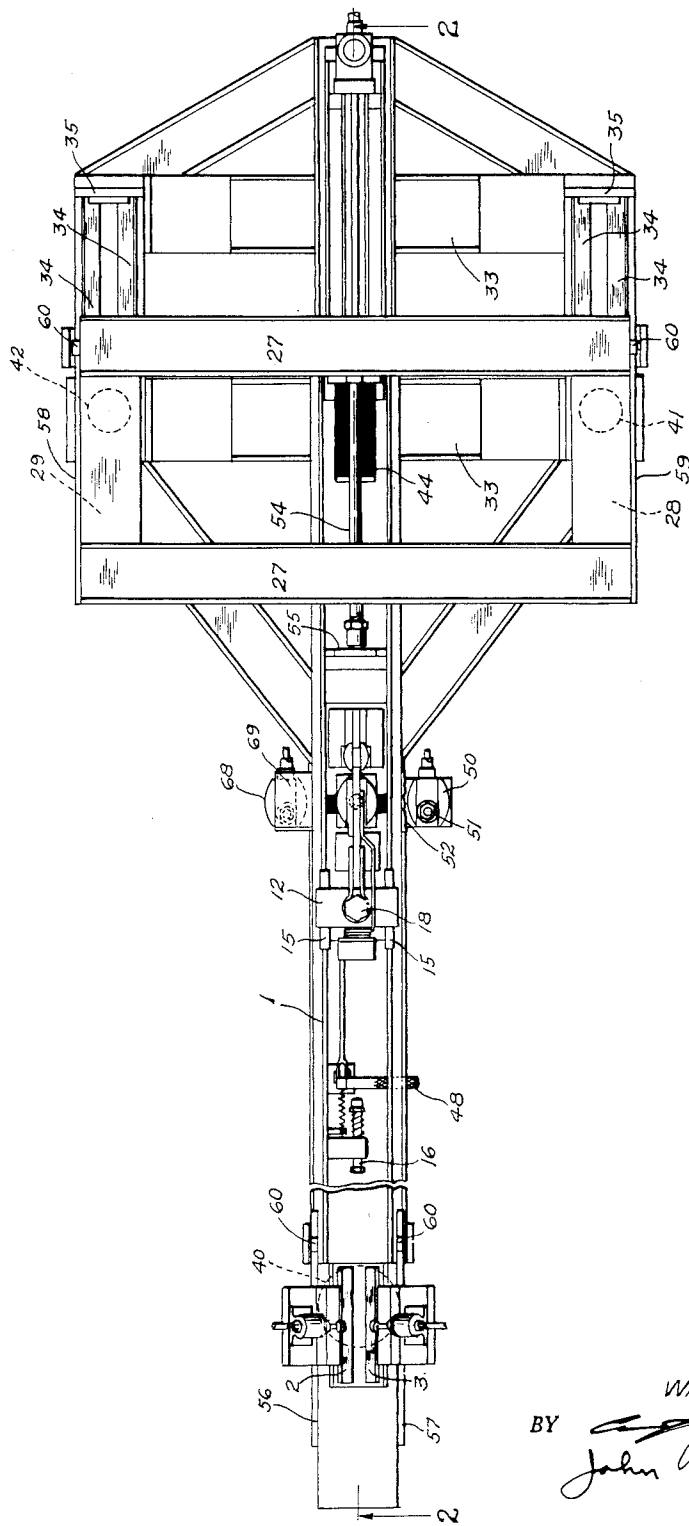


Fig. 1

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4 Sheets-Sheet 2

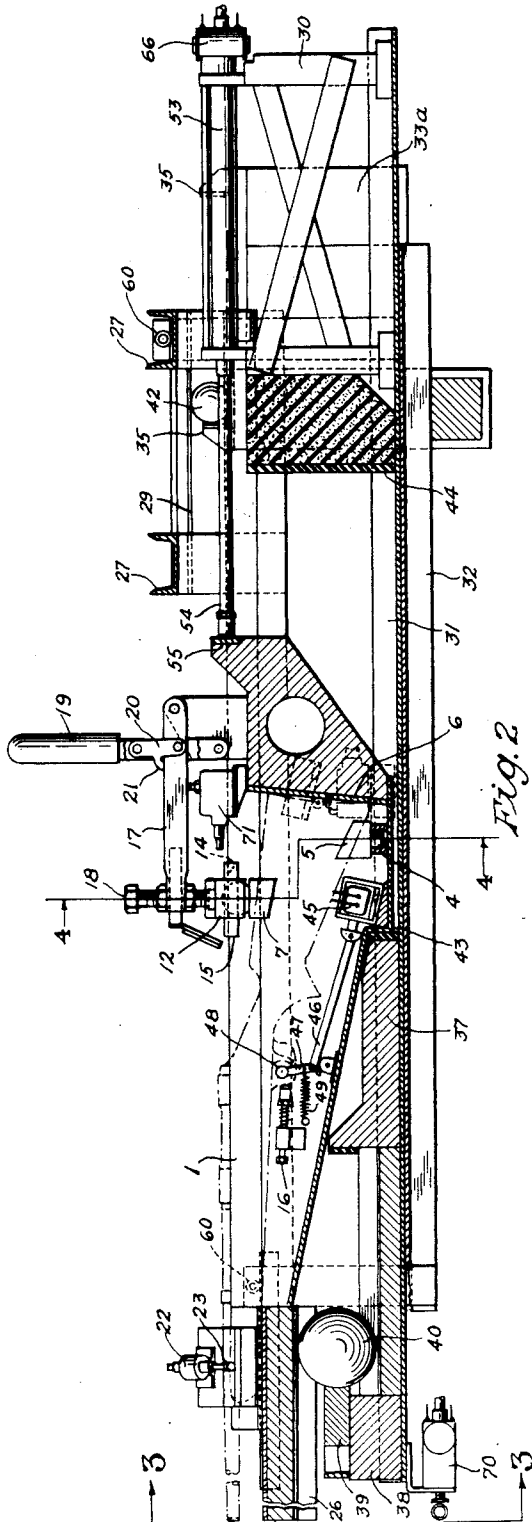


Fig. 2

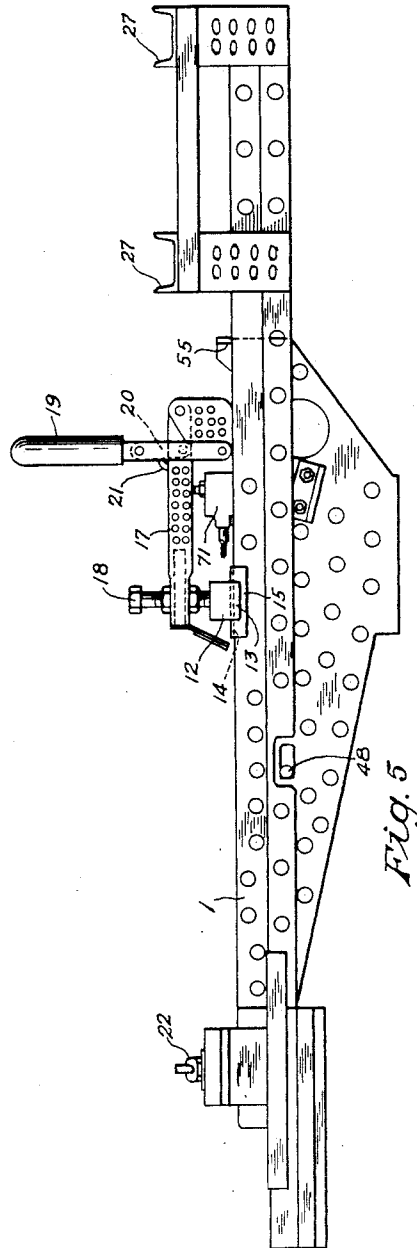


Fig. 5

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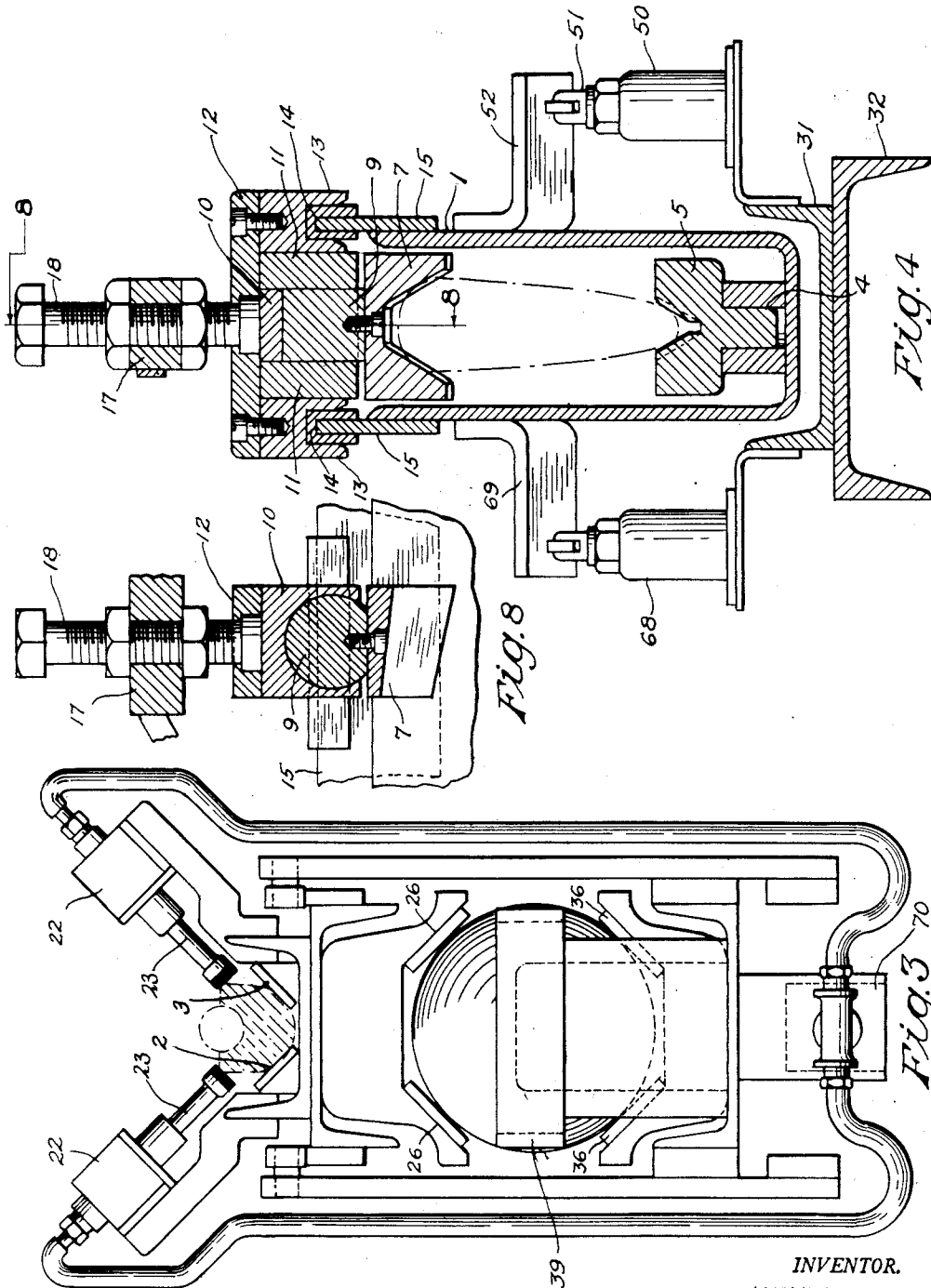
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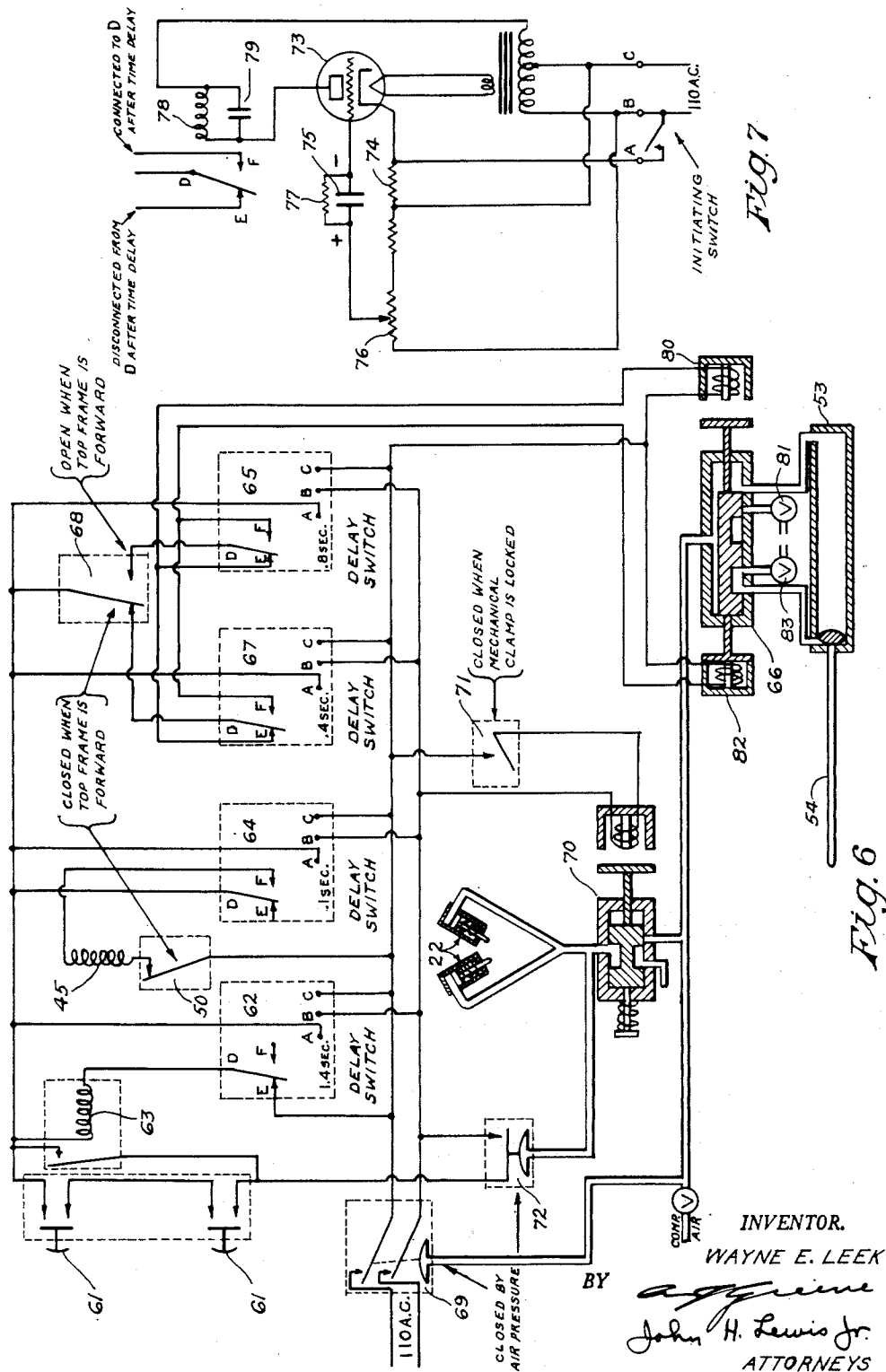
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ACCURACY SHOOTING REST WITH RECOIL ABSORBING MEANS

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4 Sheets-Sheet 4



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ACCURACY SHOOTING REST WITH RECOIL
ABSORBING MEANS

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Application June 27, 1950, Serial No. 170,590

18 Claims. (Cl. 89—43)

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This invention relates to a device for testing the accuracy of firearms and has particular application to the final inspection testing of finished newly manufactured firearms.

As the final stage in the functional testing of finished firearms, particularly rifles, it is desirable to fire a number of rounds of ammunition to determine that the arm will shoot accurately and consistently. Any functional defect in barrel, action, or stock will usually be reflected in the size of the group such shots make upon a target. When accuracy shooting is done by a human shooter, many errors and inconsistencies enter the picture. Being human, the shooter is subject to fatigue and as he becomes fatigued both his judgment and his shooting ability are lessened. Particularly with high power center-fire rifles, an accuracy shooter must be limited to firing not more than about ten tests an hour or his work will be absolutely unreliable.

Human errors in shooting have also required many rounds of firing before significant results could be obtained to serve as a guide for gun and ammunition designers in standardizing ammunition characteristics and in studying the effect of design changes, of barrel vibrations, and the influence of the bedding of a rifle in the gun stock.

Previous attempts to eliminate the human factor have all been doomed by the fact that the mechanical rests utilized introduced their own errors due to the method of clamping the arm and, in all cases, the machine rest shooting characteristics of a rifle were radically different from the characteristics noted when fired in the normal way. As a result, human shooters have usually been used for accuracy testing of finished rifles.

By reason of the difference in human and prior machine rest shooting characteristics, it has also been the usual practice for an expert shot to fire a number of shots and appropriately adjust the sights to make the point of impact and the line of sight coincide. A shooting rest in which a gun might be supported and fired without shifting its normal point of impact would obviously permit the gun to be fired for five to ten rounds to establish the center of impact of its normal group, and with the rifle still so held the sights might be adjusted to cause the line of sight to pass through the center of the normal group.

The object of this invention is to produce a firearm testing device into which a firearm may be inserted and in which it may be fired repeat-

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edly without shifting in the device and without requiring re-aiming.

It is a further object of this invention to produce a firearm testing device in which a firearm may be fired with results and grouping characteristics practically identical with those which will be secured by the best human shooters in the best physical condition.

An additional object which is practically a prerequisite to the attainment of the other objectives is the provision of such a device which does not subject the firearm to any unusual stresses or strains which might tend to distort or even fracture gun stocks or tend to cause the firearm to shift in its supports.

I contemplate that these objectives may be best achieved by clamping the gun at buttstock and fore-end rigidly to a light weight rigid frame which is supported for recoiling movement upon balls rolling in V-tracks. During the period in which the bullet is passing through the barrel the recoil of this frame is opposed only by the forces of inertia and friction. Thereafter, the frame is gradually decelerated and returned to its original position.

The exact nature of the invention as well as other objects and advantages thereof will more clearly appear from consideration of the following specification, referring to the attached drawings in which:

Fig. 1 is a top plan view of my device.

Fig. 2 is a vertical longitudinal sectional view taken on the line 2—2 of Fig. 1.

Fig. 3 is a partial front end elevational view.

Fig. 4 is a partial vertical cross-sectional view on the line 4—4 of Fig. 2.

Fig. 5 is a side elevational view of the recoiling frame.

Fig. 6 is a schematic drawing of the electrical and pneumatic circuits employed.

Fig. 7 is a schematic drawing of the electrical circuit of a suitable time delay relay.

Fig. 8 is a partial cross-sectional view on the line 8—8 of Fig. 4.

Referring to the drawings by characters of reference, it may be seen that my invention comprises a recoiling frame 1, shown in Fig. 5, generally of channel form, in which a firearm may be received. At the forward end of the frame a pair of plates 2 and 3 are supported to define a V-channel in which the fore-end may rest. Toward the rear end of the channel a socket 4 is arranged to receive a V-block 5 in which the lower face of the buttstock may rest. To assist in accommodating various gun models, several

blocks 5 of different height may be provided. A cross plate 6 provides an abutment for the buttstock of the firearm and a top V-block 7 is provided to engage the upper face of the buttstock. Preferably, each of the gun engaging surfaces is provided with a firm slightly resilient pad, not shown, which will not mar any surface with which it comes in contact.

To assist in initially positioning the firearm in engagement with the cross plate 6, a spring-urged plunger 16 is mounted in the frame 1 in position to engage the forward face of the trigger guard as the arm is placed in the frame and exerts a spring force urging the butt plate of the arm into engagement with the abutment plate 6.

The top V-block 7 must be mounted in such a fashion that it can accommodate itself readily to variations in the contour of the upper surface of the stock but must be rigidly supported against lateral shifting. One means of providing this support is to rigidly attach the V-block 7 to a cylindrical block 9 which is snugly received in a bearing block 10 and confined therein by side plates 11 engaging the side faces of the block 9. The V-block is therefore free to have limited rotation about the axis of the block 9 but has no freedom for movement parallel to that axis. In turn, the assembly of bearing block 10 and side plates 11 is rigidly secured within a saddle 12 which is provided with depending legs 13 in each of which a groove 14 has been formed and accurately fitted to engage blocks 15 mounted on the edges of the frame 1. By these means the V-block 7 is supported against any lateral movement relative to the frame.

The V-block 7 is clamped down upon the stock by any convenient means which is adjustable for moderate variations in height. A convenient means has been found to be a quick release toggle clamp comprising an arm 17 swingably mounted on the frame 1 and carrying a screw 18 which has its head secured in a floating mounting in the saddle 12. A clamping lever 19 is also swingably mounted on the frame 1 and is connected by a toggle 20 to the arm 17. As the clamping arm 17 approaches the horizontal position, the toggle 20 goes through a center position and comes to rest with the stop 21 engaging the upper surface of the arm 17 just over center. In this position the toggle cannot be reversed by upward force applied to the arm 17. In use, the lever 19 may be brought forward and the screw 18 adjusted to stop free motion of the lever just before the toggle goes through center. Further movement of the lever then applies an additional force to compress the pads in the jaws of the V-block and rigidly clamp the buttstock.

It will be noted that all standard buttstock shapes taper to the front in a side elevational view. Thus, any force tending to move the buttstock forward in the frame exerts a wedging force upon the clamped V-blocks and tightens the effective grip.

To secure the fore-end in the V-channel defined by plates 2 and 3, a pair of air clamps 22 are mounted on the edge of the frame 1. In effect, these air clamps are small, spring returned air motors each provided with a plunger 23 with a suitably padded tip arranged to engage the edge of the forestock of a firearm. Preferably, air pressure will be applied to these cylinders from any convenient source under the control of an electrically operated valve 70. Conveniently, the valve may be controlled by a micro-switch 71 mounted on the arm 17 and shifted by comple-

tion of the over-center motion of the toggle into position to actuate the air clamps. The operation of the air and electrical systems will be more fully described in a later discussion of Fig. 6. For the present, it will suffice to note that the air clamps in conjunction with the buttstock clamps provide a means of rigidly clamping the gun stock at the normal gripping points and without distorting the stock or exerting any other force upon the barrel or receiver which could tend to vary the normal shooting characteristics of the firearm.

Beneath the forward end of the frame 1, a pair of hardened and accurately ground steel plates 26 are mounted to define a V-track substantially parallel to the line in which the barrel of the firearm is supported.

At the rear end of the frame 1 a pair of cross bars 27 are secured and rigidly braced to the frame. At the left hand end of the cross bars 27 a pair of hardened and accurately ground steel plates 28 are mounted to define a V-track parallel to that formed by the plates 26. At the right hand end of the cross bars 27 a hardened and ground flat plate 29 is mounted in parallel relation to the V-track formed by plates 28. The two V-tracks and the flat plate are arranged to ride on steel balls which are supported in a base frame to be next described.

The base frame 30 is formed as rigidly as possible and may have as a foundation a pair of channels 31 and 32 mounted back-to-back to form an I-beam section which is provided with a pair of angularly braced cross bars 33. Braced stanchions 33a extend upwardly from the cross bars 33 and at the upper ends of the stanchions two pairs of hardened and ground steel plates 34 are rigidly mounted to define a pair of parallel V-tracks. Blocks 35 are provided to close the ends of each of the V-tracks and to serve as limit stops for the rolling movement of steel balls placed therein.

At the front end of the base frame 30 another pair of hardened and ground steel plates 36 are rigidly mounted to define a third V-track parallel with those just described. This track is closed at the rear end by an abutment block 37 and at the front end by a similar block 38 on which there is mounted a permanent magnet 39 arranged to engage the ball in the track and releasably retain it in its foremost position.

Steel balls 40, 41, and 42 are placed in the tracks of the base frame 30 and the top frame 1 is placed thereon with its V-tracks and one flat track riding on top of the balls. The rear end of the abutment block 37 serves as a stop to limit forward movement of the top frame by engagement with an abutment 43 formed on the depending portion of the top frame. In the normal forward position of the top frame the abutment 43 is in engagement with the block 37 and each ball is in the forward end of its track, the ball 40 being retained in that position by the magnet 39. At any normal angles of inclination there will be sufficient frictional resistance to slippage of the upper frame on the ball 40 to prevent displacement of the upper frame.

At the extreme rearward position a large rubber bumper 44 is positioned to absorb the impact in case of an over-travel of the top frame under the forces of firing extremely heavy loads.

An electrical solenoid 45 is positioned in the lower portion of the top frame and by means of a link 46 and lever 47 provides a movable mounting for a pin 48 which may be inserted in front of a

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gun trigger after the gun has been clamped in the upper frame. Obviously, energization of the solenoid will serve to pull the trigger and fire the gun, after which the spring 49 will reposition the pin clear of the trigger. The solenoid may be energized by appropriate means to be later described.

For testing the low and medium powered rifles it is unnecessary to provide any means to decelerate the top frame as the forces of friction and inertia will readily absorb the recoil. Rifles of such calibers as .22 Hornet, .222 Remington, and .257 Remington-Roberts may be so tested. Upon firing, the normal forces of recoil tend to move the top frame rearwardly and, for a small fraction of an inch, it will usually slide over the balls. Thereafter, the balls commence to roll and the ball 40, as soon as it rotates at all, pulls loose from the magnet. As a result of the sliding movement over the balls, they will reach their stops first when the top frame is returned, manually or otherwise, to its normal forward position. The top frame should be caused to slide back to its original position in engagement with the stop abutment 37.

To insure that the top frame is always in the same position upon firing, a switch 50 may be mounted on the lower frame with its actuating plunger 51 in position to be engaged by a cam block 52 supported on the top frame. If this switch is wired in series with the firing solenoid and is closed only when the plunger is depressed, it will be impossible to fire from any other than the foremost position.

For all the higher powered loads, it is essential to provide means in addition to the rubber block to decelerate the upper frame. For arms of any power it is convenient to have automatic means to return the top frame to its correct position after each shot is fired. These means can readily be combined in one unit by the utilization of a double acting air motor 53 positioned, preferably, in axial alignment with the barrel of a firearm clamped in the frame with the piston rod 54 arranged to impinge upon a plate 55 supported on the top frame.

In the preferable operating cycle the air motor will be started rearwardly slightly before the gun is fired and will continue to move rearwardly at a rate which is less than the normal recoil velocity of the firearm. Thus, the firearm which is accelerating rearwardly will overtake the air motor and in attempting to accelerate the air motor will dissipate much of the recoil energy, permitting a smooth shockless deceleration of the top frame. After the assembly reaches its rearmost position the air motor is reversed, returning the top frame to its normal forward position and holding it there by air pressure until just prior to the actuation of the firing solenoid for another shot. In either direction of motion the air motor is driven by air pressure acting on one face of the piston and the velocity attained is determined by the rate at which trapped air is released from the space behind the piston. The timing of the motion of the air motor is controlled by electrical circuit means which will be described in more detail by reference to Fig. 6.

In regard to the general features of mechanical construction, it is of importance that all units be as rigid as possible and that the weight of the recoiling upper frame be reduced to the absolute minimum. This latter end can be achieved by utilizing aluminum as the material of construction, all of the lightly stressed areas being skel-

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etonized to the maximum extent possible. A welded construction of built-up plate and channel sections is a convenient and economical mechanical form.

Although the recoil forces are resisted in direct line with the barrel, there appears to be an occasional tendency to muzzle jump with some arms which may tend to rock the upper frame about the balls on which it rolls. This tendency may be kept under control by mounting guard rails 56, 57, 58, and 59 on the upper frame and securing over each rail a roller bearing 60 fixedly mounted on the lower frame.

As has been noted, the lower frame should be made as rigidly as possible and the weight of this frame is immaterial except from a standpoint of ability to move it around. For a factory installation, it may be very heavy and should preferably be mounted with capacity for positioning in elevation, azimuth, and height above the floor or relative to the opening into a shooting range. Conveniently, it may be mounted upon a machine base having the type of controls and adjustments typical of industrial planers, radial drill presses, or some types of millers or grinders. Details of such a mounting are not disclosed for they form no part of the present invention.

Referring now to the air-electric circuits shown in Fig. 6, a brief functional review of the end to be accomplished may aid in understanding the detailed wiring diagram.

To insure that the operator must have his hands and body in a safe position, it is desirable to provide a suitably located operating station with two operating buttons 61 so spaced that the operator must use one hand for each button. Pushing these buttons should initiate the action of all electrical circuit elements and should lock in the circuit for the normal duration of the operating cycle through the agency of time delay relay 62 and contactor 63. Operation of the buttons should also immediately start the piston rod 54 to moving rearwardly. After a short time delay, approximately $\frac{1}{10}$ of a second, the firing solenoid 45 should be actuated by time delay relay 64 and after the arm has fired and the top frame has reached its rearmost position, the air motor may be reversed and returned by means including time delay relay 65 and double acting valve 66. In the event of a hangfire or misfire, time delay relay 67 is arranged to take control of the air motor and return the piston rod 54 to prevent a completely free recoil of the top frame. A switch 68 mounted on the lower frame and actuated by a cam 69 on the top frame is arranged to shift the control function from relay 67 to 65 when the gun fires and the top frame recoils.

The switch 50 previously referred to is wired in series with the firing solenoid 45 to prevent firing in case the top frame is in any other than its correct position.

To insure that the unit will not be operated without adequate air pressure, an automatic pressure switch 69 is arranged in the airline and controls the supply of power to all units.

The air clamps 22 on the forestock are actuated by a solenoid operated valve 70 which is energized as a result of closing the switch 71 when the buttstock clamp 19 is closed. As a further safety feature, an automatic air switch 72 is attached to the air line reaching the air clamps and this switch is arranged in series with the push buttons 61 to insure that the operating cycle will not be initiated unless all of the clamps are closed.

Considering the air-electric circuits in more detail, it may be noted that each of the time delay relays 62, 64, 65, and 67, may be of similar type selected or adjustable to secure the proper time delay for the particular operation. General Electric vacuum tube time delay relays, type CR-7504-A3, have proven to be highly satisfactory but could be replaced by any other convenient delay device capable of operating a single pole double throw set of contacts at a definite predetermined interval of time after the application of power to an initiating circuit. In Fig. 6 no attempt has been made to show the internal connections of the units; however, it may be noted that power to actuate the electronic elements is applied from the line through terminals B and C and that the connection of terminal A to terminal B through an external circuit initiates the timing operation. At the end of the predetermined time period the electronic relay functions to throw a contact arm on terminal D from the contact E with which it is normally closed to the normally open contact F. Fig. 7 is a wiring diagram of one of several appropriate types of time delay relays. All four units may be identical as to basic construction but their functioning in the circuit requires accurately fixed timing in appropriate units. In an illustrative installation, relay 62 has had a time delay of 1.4 seconds; relay 64—a delay of 0.1 second; relay 65—a delay of 0.8 second; and relay 67—a delay of 0.4 second.

For convenience in understanding the operation of the time delay relays shown in Fig. 6, reference may be made to Fig. 7 which shows in simplified form the electrical circuit of a typical time delay relay corresponding generally to the General Electric device above mentioned. The letters A, B, C, D, E, and F identify terminals having the same functions as those similarly identified in Fig. 6. When terminal A is not connected to terminal B through an external circuit, the cathode of triode tube 73 is connected to terminal C through the resistor 74. Capacitor 75 then charges with the polarity shown, by means of the grid current, to the peak of the voltage between terminal C and the movable contact of adjusting potentiometer 76.

When the external circuit between terminals A and B is closed, the cathode of tube 73 is connected directly to terminal B. The voltage at the grid of tube 73 then represents the summation of the A. C. voltage between terminal B and the movable contact of the potentiometer 76 and the direct current voltage to which condenser 75 is charged. When the external circuit is closed, the direct current voltage will always be greater than the alternating current voltage and the tube will not initially carry a current in its plate circuit. The capacitor 75, however, immediately commences to discharge through resistor 77 and after a definite time determined by the time constant of the combination of resistor 77 and capacitor 75, the direct current voltage at the grid falls below the alternating current voltage and the tube commences to pass current during every positive half cycle. The voltage levels, and hence, the time delay characteristics, may be adjusted over fairly wide limits by the potentiometer 76. The time intervals may be further increased by the use of a larger capacitor 75 or by connecting another capacitor in parallel therewith. Similarly, the substitution of a resistor 77 of less resistance or the connection of another resistor in parallel with 77 will decrease the time delay.

As soon as the tube 73 commences to pass cur-

rent, that current will pass through relay coil 78 and switch the movable contact on terminal D from terminal E and connect it to terminal F. The capacitor 79 supplies current to keep the relay from chattering during those half cycles of the alternating supply voltage in which the tube does not pass current.

Opening the external circuit between terminals A and B after the completion of the timing operation will reset the relay, returning the contacts to their original position and recharging the condenser 75.

In a general review of the operation of the system, it may be noted that the initial supply of air pressure actuates the air switch 69 and supplies power to all units. After a short delay determined by the warm-up characteristics of the relay tubes and the charging time of the condensers in the delay units, the rest is ready to function.

A firearm for testing may be placed in the rest with the forearm lying in the V formed by plates 2 and 3 and with the butt plate held back against abutment 6 by the plunger 16. The stock may then be firmly seated in V-block 5 and the clamp 19 swung over to draw upper block 7 down into contact with the upper edge of the stock. The mounting of these V-blocks insures the accurate placement and secure retention of the gun stock. When the clamp 19 is thrown over center into locking position, the microswitch 71 is actuated to complete the circuit through the solenoid of air valve 70 and the fore-end clamps 22 are operated. At the same time, the application of air to clamps 22 also operates an air switch 72 to close one gap in the firing circuit.

It will be recalled that the air motor 53 will be holding the top frame forward with the abutment 43 in engagement with the stop block 37 and that both top frame switches 59 and 68 will be in their normal positions as shown in Fig. 6. When both push buttons 61 have been pressed down, it will be noted that the external circuit for operating each of the relays will be closed and their timing cycles initiated. At the same time, a circuit is completed through the normally closed contact of time delay relay 62 and the coil of interlock relay 63 to close a circuit around the push buttons and maintain the firing circuit closed until time delay relay 62 times out, thus permitting the operator to release the buttons without disrupting operations.

Another immediate effect of the closing of the firing circuit is the completion of a circuit through micro-switch 68 and the normally closed contacts of time delay relay 67 to the air motor reversing coil 80 of valve 66 controlling the air motor 53. The piston rod 54 immediately withdraws from engagement with the top frame and travels at a velocity determined by the rate of escape of trapped air through the bleeder valve 81. Although the top frame is no longer supported in its forward position by the piston rod 54, it will be retained there at any normal angle of elevation by friction with the ball 40 which is gripped by magnet 39.

Since the top frame is thus retained in its forward position, the micro-switch 50 in the firing circuit will remain closed. When the time delay relay 64 times out at about 0.1 second, a circuit will be closed through contacts D and F, solenoid 45, and switch 50 to pull the trigger and fire the gun. As the gun fires the forces of recoil accelerate the top frame rearwardly and the initial phase of this acceleration is at a rate which

usually causes the frame to slide a short distance before the balls commence to rotate. The high powered loads will cause the top frame to recoil at a faster rate than the normal rate of the air motor and the piston rod will be overtaken.

In the event that either firearm or ammunition is defective and hangfire is encountered, it is preferable not to allow the top frame to recoil without opposition after the air motor has substantially completed its rearward excursion. Accordingly, it is the function of the time delay relay 67 to return the air motor before it reaches the rear limit of its movement in the event that the arm has not fired by the time 0.4 second has elapsed. Switch 68 remains in the position shown in Fig. 6 until the top frame has recoiled and when time delay relay 67 times out a circuit is completed through contacts D and F thereof to the actuating coil 82 of the air valve 66. This action reverses the air motor and it is returned by air pressure at a rate determined by the setting of bleeder valve 83.

If the arm fires normally and the top frame recoils the micro-switch 68 will transfer control of the air motor from time delay relay 67 to time delay relay 65 which does not time out until substantially 0.8 second has elapsed. In this length of time the top frame and the air motor under the combined urging of compressed air and the recoil forces of the top frame will have reached a rear-most position and come to rest. When relay 65 times out the air motor will be reversed to return air motor and carriage to a normal forward position. Valve 66 is preferably not of a spring return type and, hence, will remain in either position, after one coil has been de-energized, until the opposite coil is energized. This insures that the operation of switch 68, although occurring in mid stroke of the air motor, does not interfere with the smooth movement thereof.

Relay 62 preferably is adjusted to time out just after the top frame has been returned to forward position and releases the interlock relay 63, thus opening the by-pass around the firing buttons and resetting all relays. Since the valve 66 remains in the position to which it was last drawn, the air motor will continue to press the top frame forwardly against the stop block 37. It has already been noted that the top frame usually slides rearwardly on the balls before they commence to roll. As a result, when the top frame returns toward its forward position the balls reach their stops before the top frame does and the final forward movement of the top frame is a sliding movement. Thus, the return of the top frame to its identical starting position is not influenced by the possibility that foreign material may have accumulated on a face of a ball stop and prevented the ball from reaching its identical position. The only other possibilities of a non-identical firing position are practically ruled out by the fact that the balls have virtually line contact with the V-tracks in which they roll and are therefore self-cleaning; and by the fact that the clamps retain the arm against any shifting in the top frame.

After the gun has been clamped in the mount it may be fired as described above for as many rounds as desired, appropriate adjustments of the azimuth and elevation of the rest being made to center the group in the desired impact area. Generally, one round will suffice for initial location of the point of impact and four to ten rounds will conclusively establish the inherent grouping characteristic of the arm. If a rifle is

found to have a satisfactory grouping characteristic, the alignment of its sights with the observed point of impact may be checked and, if necessary, corrected without removing the rifle from the mount.

While I have quite specifically illustrated and described a preferred embodiment of my invention, it will be obvious that variations may be made therein without departing from the spirit of my invention. For an exact statement of the limits thereon, reference may be had to the appended claims.

I claim:

1. A machine rest for firearm testing comprising in combination a framework; means to clamp a firearm to said framework; a mounting for said framework including a track; rollable means engaged between said framework and said track supporting the framework with capacity for recoil from a predetermined starting position relative to said mounting; means to return said framework to said starting position after completion of said recoil; and electrical control means for said return means arranged to render said return means inoperative to oppose recoil of said framework at the instant of firing and during a free recoil period thereafter at least equalling in time duration the time required for a projectile fired from a firearm clamped to said framework to pass through the barrel of said firearm.

2. A machine rest according to claim 1, said clamping means being constructed and arranged to engage the buttstock and forestock of the firearm without contacting or straining the barrel of said firearm.

3. A machine rest according to claim 2, said framework and said mounting therefor being provided with opposed, parallel, cooperating tracks and with spherical balls received in said tracks upon which said framework is rollably supported.

4. A machine rest according to claim 3, and means associated with said mounting to decelerate and stop the free recoil of said framework after a projectile has passed through the barrel of the firearm.

5. A machine rest according to claim 4, said decelerating means incorporating a pneumatic cylinder, an exhaust outlet from said cylinder, a restricted orifice limiting the escape of air through said exhaust outlet from said cylinder, a piston reciprocable in said cylinder, and control means arranged to position said piston where it will be out of contact with said framework at the instant of firing and during said free recoil period and engaged by said framework at the conclusion of free recoil thereof and thereby propelled into said cylinder to compress the air therein and to force same through said restricted orifice.

6. A machine rest according to claim 5, including in addition a source of air under pressure and control valve means associated with said pneumatic cylinder arranged to close said exhaust outlet after said framework has recoiled and to admit air from said source into said cylinder to impart a counter recoil movement to said piston and thereby to return said framework to said predetermined starting position.

7. A machine rest according to claim 6 in which said pneumatic cylinder is a double action cylinder and in which said control valve means is constructed and arranged for positioning to admit

air from said source to move said piston in either direction; an operator for the control valve; means arranged to initiate an operating cycle by positioning said valve to move said piston in recoiling direction; and firing means mounted on said framework constructed and arranged to fire a firearm clamped to said framework only after said piston has started to move in the recoiling direction.

8. A machine rest according to claim 7, including time delay switching means arranged to be started by a manual operation and electrical operators for said control valve and said firing means, said switching means being constructed and arranged to energize said valve operator for positioning said valve means to move said piston in recoiling direction as soon as said switching means is manually started, thereafter to energize the operator for said firing means, and thereafter to energize the said valve operator for positioning said valve means to reverse said piston and thereby to return said framework to the predetermined starting position.

9. A machine rest according to claim 8, including an electric switch element in series relation with the operator for said firing means, said switch element being so positioned and arranged relative to said framework and said mounting as to interrupt the circuit to the operator for said firing means except when said framework is in the predetermined starting position.

10. A machine rest according to claim 9, including means arranged to prevent manual starting of said time delay switching means unless said means for clamping a firearm to said framework is fully operative.

11. A machine rest according to claim 10, including a switch operated by recoil of said framework from the starting position and an auxiliary time delay switching means arranged to be disabled by operation of said switch and arranged to energize said valve operator for positioning said valve means to reverse said piston if the framework does not recoil in response to firing of the firearm immediately after the operator for said firing means has been energized.

12. A machine rest for firearm testing comprising in combination a light weight rigid framework; means defining a V-groove in said framework arranged to receive the forestock of a firearm; clamping means arranged to engage the forestock of a firearm to retain same in said V-groove; abutment means in said framework arranged to be engaged by the buttplate of a firearm; opposed V-block means mounted in the framework and arranged to have clamping engagement with the upper and lower edges of the buttstock of a firearm; mounting means arranged to accurately position said framework in a predetermined position in which a firearm engaged therein may be fired; means arranged to accurately return said framework to said predetermined position after each time a firearm may be fired therein, and control means arranged to render said return means inoperative to oppose recoil of said framework at the instant of firing and during a free recoil period thereafter at least equalling in time duration the time required for a projectile fired from such firearm to pass through the barrel thereof.

13. A machine rest according to claim 12, said mounting means being provided with a plurality of substantially mutually parallel V-groove tracks; spherical balls received in said tracks for rolling movement therein; and cooperating opposed tracks on said framework adapted to be rollingly supported on said balls.

14. A machine rest according to claim 13, and a magnetic retaining device on said mounting arranged to releasably retain at least one of said balls in a position in the track corresponding to said predetermined position.

15. A machine rest according to claim 14, and pneumatic buffer means on said mounting arranged to be engaged by said framework during recoiling movement thereof and to decelerate and stop such movement.

16. A machine rest according to claim 15, a source of air under pressure; and pneumatic piston means operated by said air under pressure arranged to return said framework to said predetermined position after recoiling movement thereof.

17. A machine rest according to claim 16, said pneumatic buffer and said pneumatic piston means being combined in a single pneumatic cylinder mounted on said mounting means and provided with a piston arranged to be engaged by said framework; and valve means arranged to selectively restrict the escape of air from said cylinder during recoil of said framework and the piston engaged thereby or to admit air from said source into said cylinder to return said piston and said framework to said predetermined position.

18. A machine rest for firearm testing including in combination a framework arranged to support a firearm; mounting means for said framework arranged to support and guide said framework during recoil thereof in response to the firing of a firearm supported thereon; a decelerating piston arranged to be engaged by and to yieldably oppose recoil of said framework; means to initiate recoil movement of said decelerating piston at a rate less than the normal recoil velocity of the framework; and means on the framework to fire a firearm supported thereon after recoiling movement of the decelerating piston has been started.

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