C. W. SPONSEL.

MACHINE FOR CALIBRATING AND STRAIGHTENING GUN BARRELS.

APPLICATION FILED NOV. 3, 1915.

1,239,532.

Patented Sept. 11, 1917.

6 SHEETS—SHEET 1.

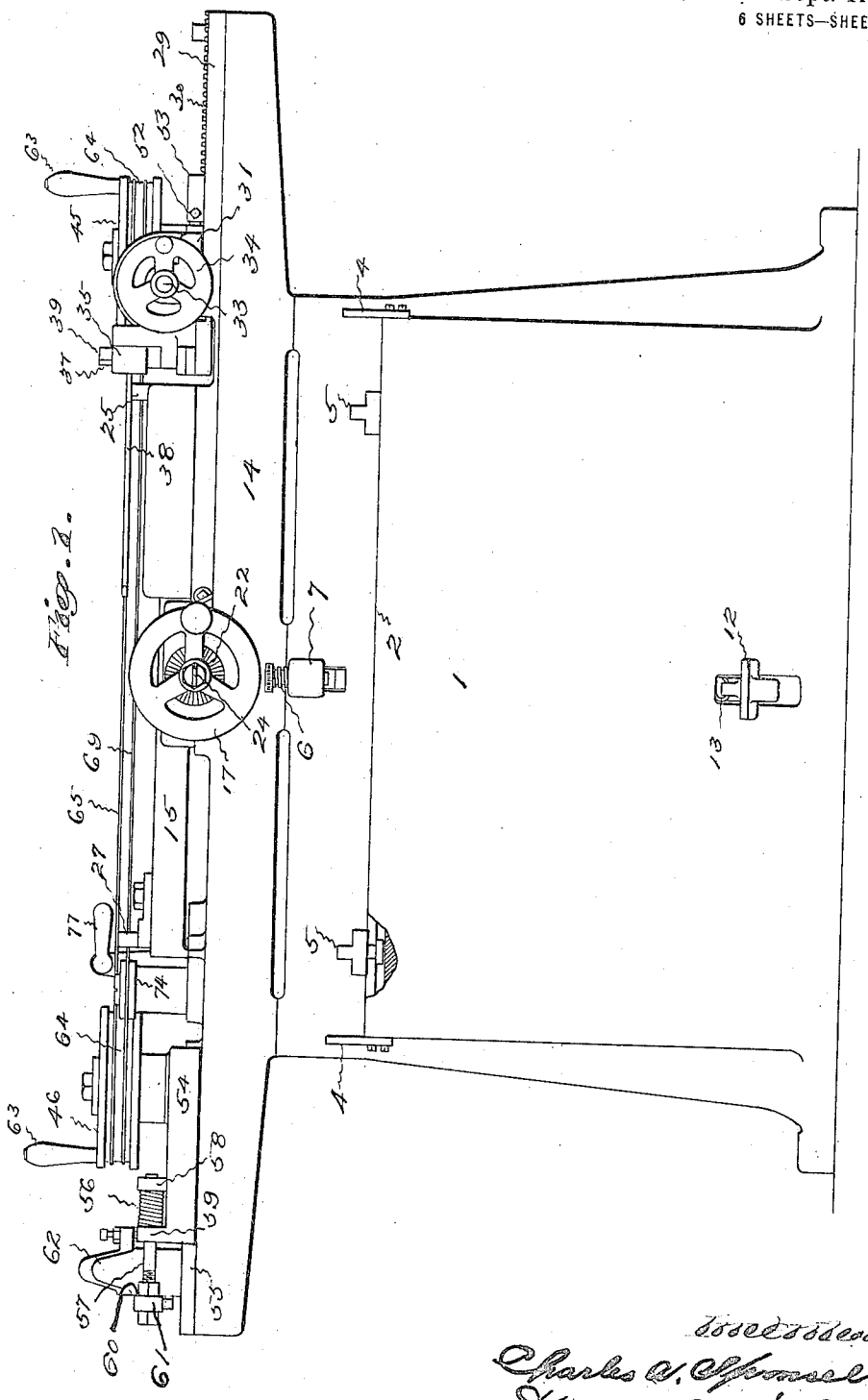


Fig. 1.

Witnesses:

Charles W. Sponsel by
Harry P. Williams
Attorney.

C. W. SPONSEL.

MACHINE FOR CALIBRATING AND STRAIGHTENING GUN BARRELS.

APPLICATION FILED NOV. 3, 1915.

1,239,532.

Patented Sept. 11, 1917.

6 SHEETS—SHEET 2.

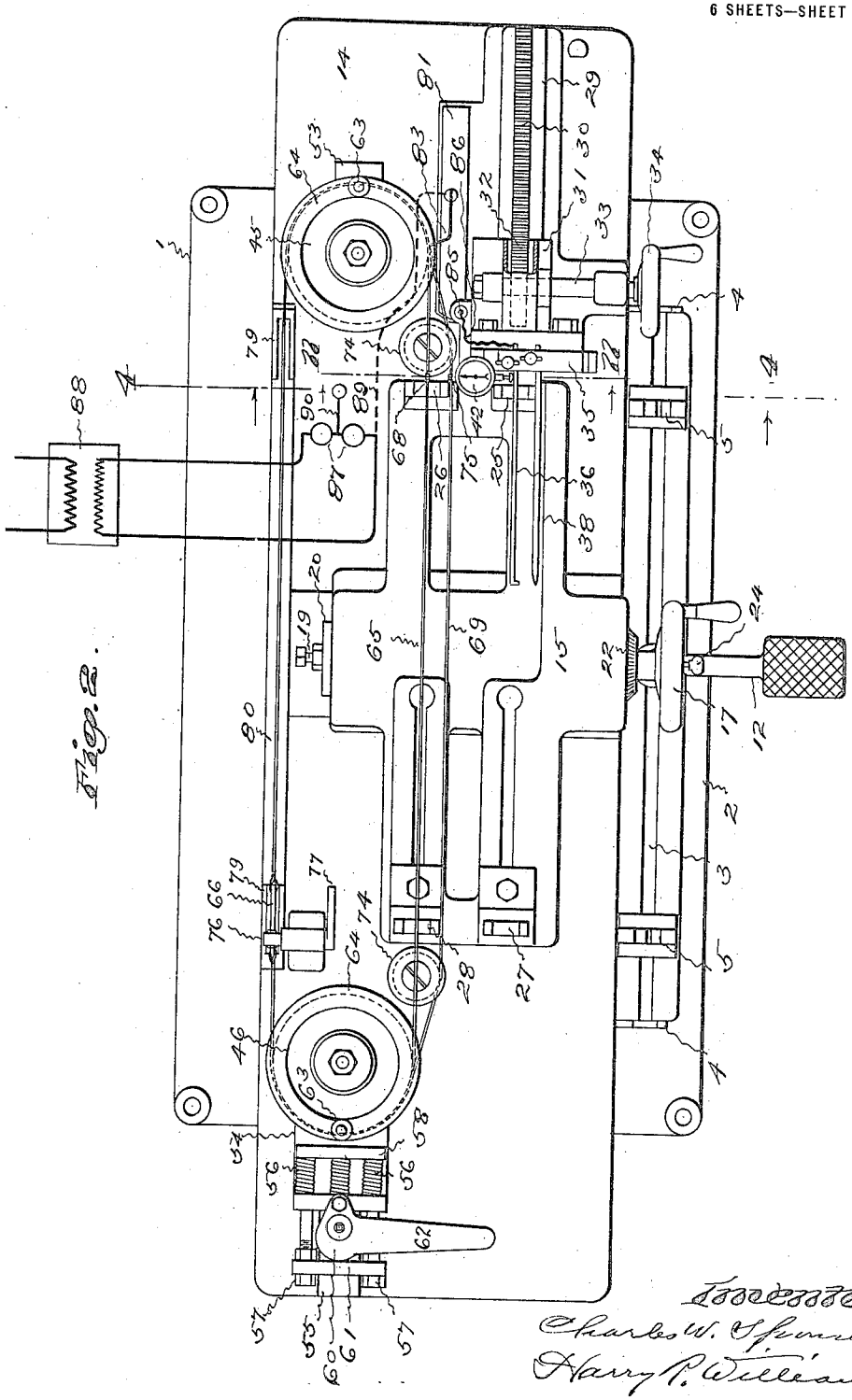


Fig. 2.

Witnesses:
Charles W. Sponsel by
Harry P. Williams
Attorney.

C. W. SPONSEL.

MACHINE FOR CALIBRATING AND STRAIGHTENING GUN BARRELS.

APPLICATION FILED NOV. 3, 1915.

1,239,532.

Patented Sept. 11, 1917.

6 SHEETS—SHEET 3.

Fig. 4.

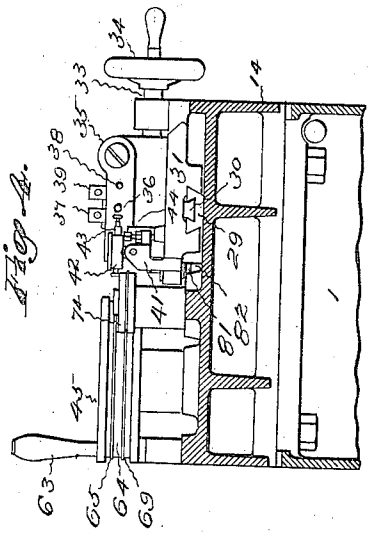


Fig. 5.

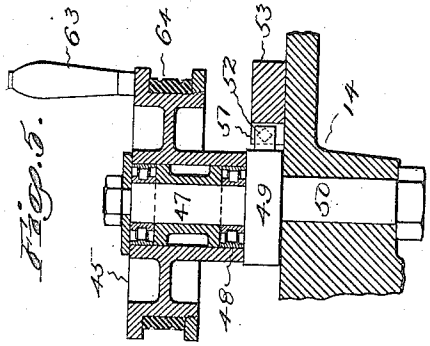
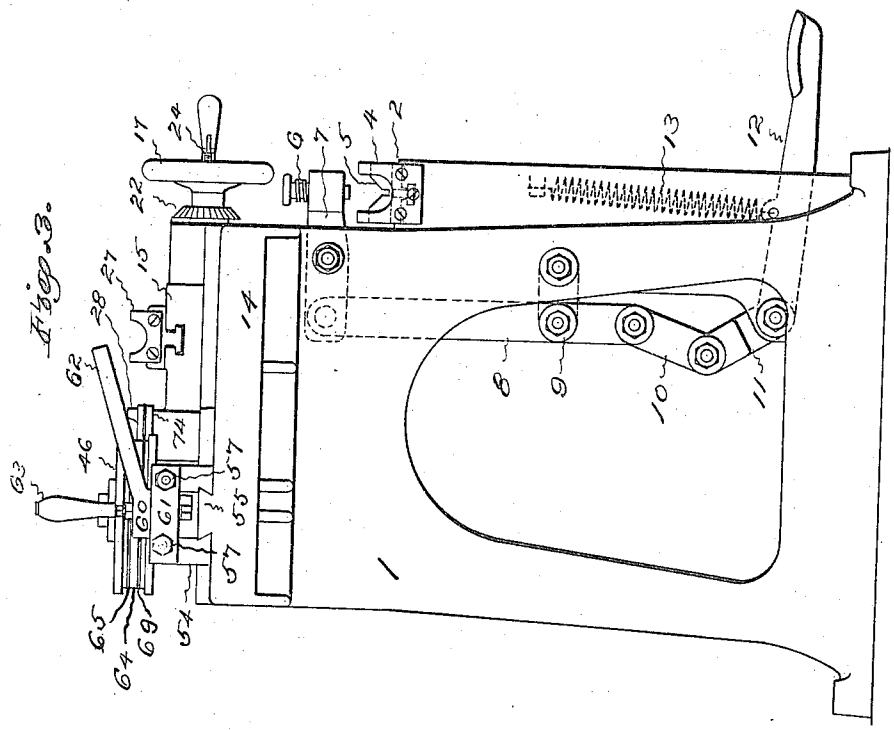


Fig. 3.



Witnesses:

Charles W. Sponsel by
Harry P. Williams
Attorney.

C. W. SPONSEL.

MACHINE FOR CALIBRATING AND STRAIGHTENING GUN BARRELS.

APPLICATION FILED NOV. 3, 1915.

1,239,532.

Patented Sept. 11, 1917.

6 SHEETS—SHEET 4.

Fig. 6.

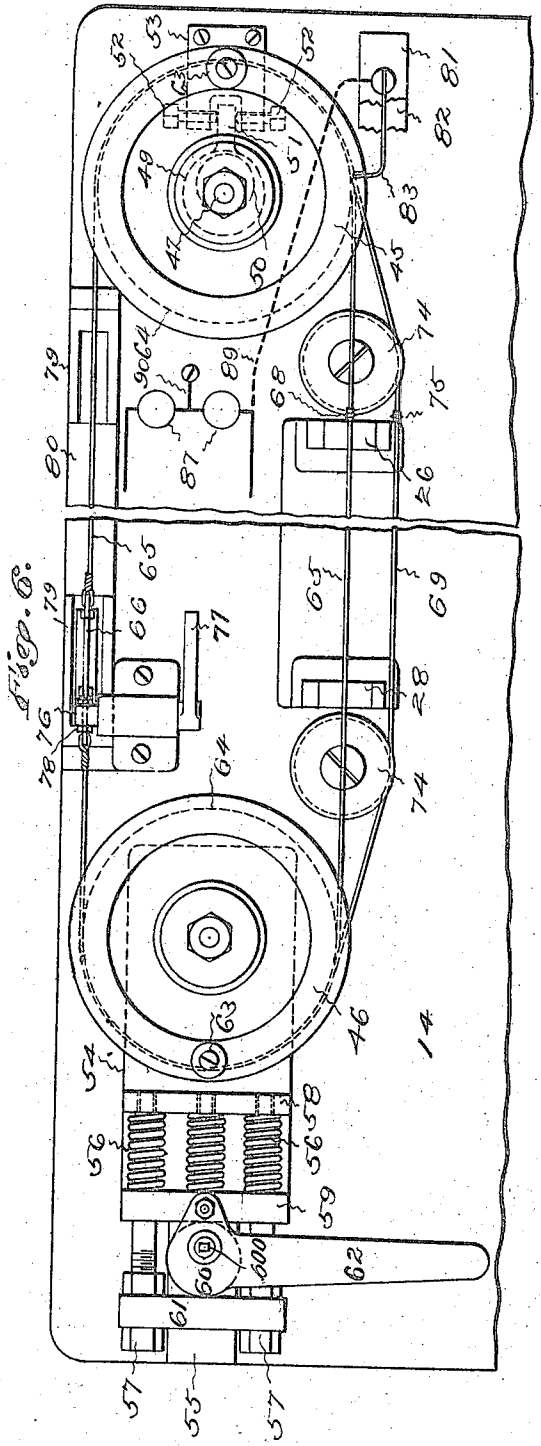


Fig. 8.

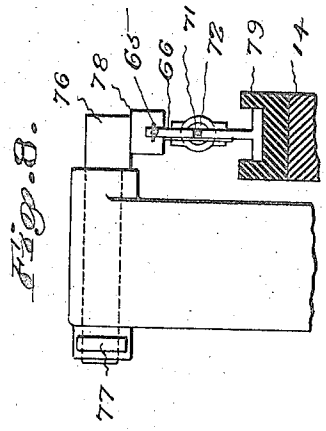
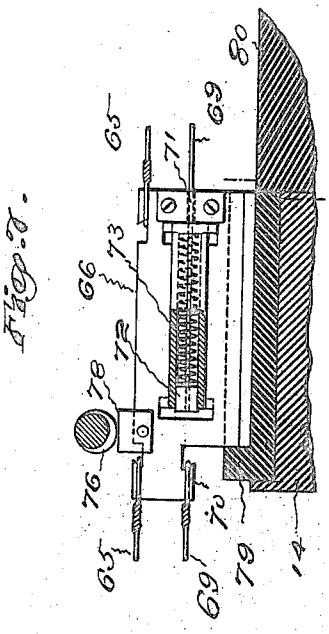


Fig. 7.



Witnesses.

Inventor.

Charles W. Sponsel by

Harry P. Williams

Atty.

C. W. SPONSEL.

MACHINE FOR CALIBRATING AND STRAIGHTENING GUN BARRELS.

APPLICATION FILED NOV. 3, 1915.

1,239,532. Patented Sept. 11, 1917.

6 SHEETS—SHEET 5.

Fig. 11.

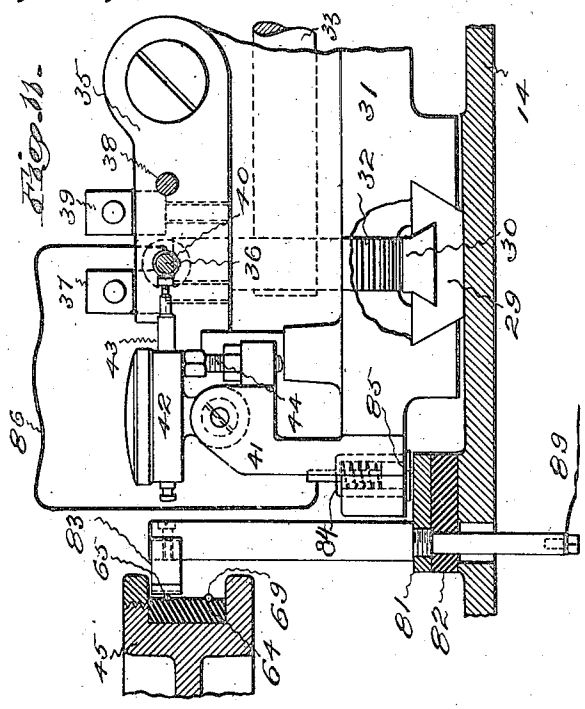


Fig. 10.

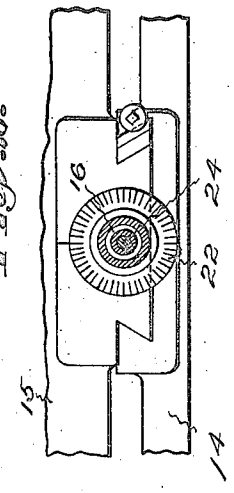
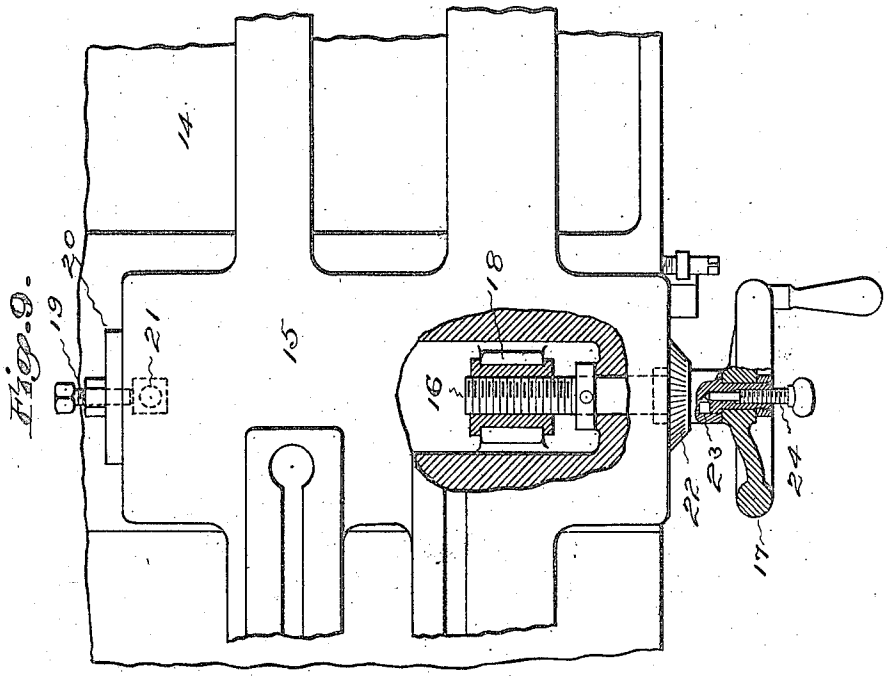


Fig. 9.



Witnesses

Charles W. Sponsel

by Harry P. Williams

Attorney.

C. W. SPONSEL.

MACHINE FOR CALIBRATING AND STRAIGHTENING GUN BARRELS.

APPLICATION FILED NOV. 3, 1915.

1,239,532.

Patented Sept. 11, 1917.

6 SHEETS—SHEET 6.

Fig. 22.

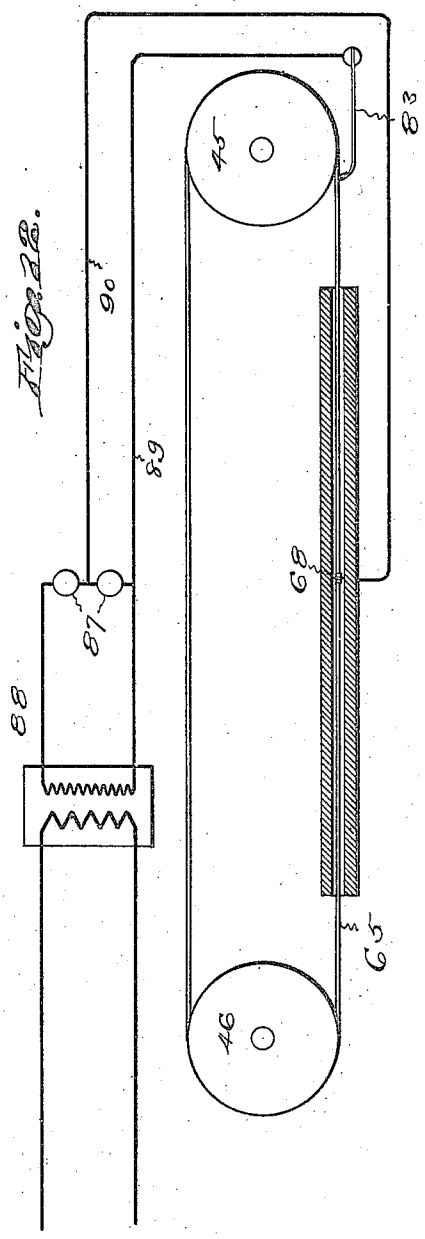
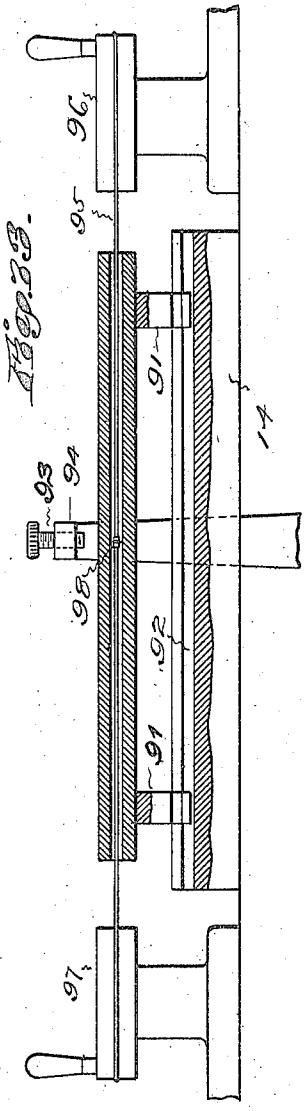


Fig. 23.



Witnesses:

Charles W. Sponsel by

Harry P. Williams

Atty.

UNITED STATES PATENT OFFICE.

CHARLES W. SPONSEL, OF HARTFORD, CONNECTICUT, ASSIGNOR TO THE SPONSEL COMPANY, OF HARTFORD, CONNECTICUT, A CORPORATION OF CONNECTICUT.

MACHINE FOR CALIBRATING AND STRAIGHTENING GUN-BARRELS.

1,239,532. Specification of Letters Patent. Patented Sept. 11, 1917.

Application filed November 3, 1915. Serial No. 59,361.

To all whom it may concern:

Be it known that I, CHARLES W. SPONSEL, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented a new and useful Improvement in Machines for Calibrating and Straightening Gun-Barrels, of which the following is a specification.

During the manufacture of barrels for rifles and machine guns, when the forged or rolled billet is being drilled for the bore, it frequently happens that owing to a variation in the hardness of the metal, or from other causes, the drill as it advances works off more or less to one side, with the result that the axis of the bore is not straight, but is somewhat curved between the ends of the barrel. This invention relates to a machine which is designed to detect and remedy any such inaccuracy in the bore of a gun barrel.

The object of the invention is to construct a machine, into which gun barrels can be quickly placed, having means that will electrically indicate deflections of the bores and mechanically measure the amount of variation from true, and having means by which the barrels can be bent and straightened so as to overcome the inaccuracy indicated by the electrical means and registered by the mechanical means.

The machine illustrated as embodying this invention has a contact in an electrical circuit containing lamps, which is adapted to be fed along the bore of a gun barrel, and means for moving the barrel sidewise with the electrical contact inside, and a gage for measuring the amount of such movement, the electrical circuit being so arranged that when the contact touches any point along the wall of the bore the circuit conditions will be changed in such manner that the lamps will show the altered conditions and the gage will measure the amount of variation from accuracy, there being associated with the indicating and measuring means, mechanism for bending the barrel and rectifying whatever error is shown. The bending means may be arranged to operate upon the barrel while in testing position, but for the sake of clearness, in the accompanying illustrations, that means is located below and in front of the testing means.

Figure 1 of the accompanying drawings shows a front elevation of the machine. Fig. 2 shows a plan of the machine. Fig. 3 shows an elevation of the left hand end. Fig. 4 shows a vertical section taken on the dotted line 4—4 on Fig. 2, looking in the direction indicated by the arrows. Fig. 5 shows a section of one of the insulated pulleys about which the charge wire carrying the contact that is adapted to be fed through the barrel, is passed, this pulley being adjustable toward the front and back to obtain parallelism of the contact wire and the barrel support. Fig. 6 shows on larger scale a plan of the two insulated pulleys about which the charged contact wire and the indicator wire pass, and the means by which the contact wire is held taut. Fig. 7 shows a front view, with parts in section, of the plate to which the ends of the contact and indicator wires are attached. Fig. 8 shows an end view of the wire attaching plate and the means for temporarily clamping it. Fig. 9 shows a plan of a part of the gun barrel supporting carriage and the means for moving and measuring the amount of movement of the carriage toward the front and back. Fig. 10 shows a front view of a part of the carriage and the measuring gage. Fig. 11 shows a section on the plane indicated by the dotted line 11—11 on Fig. 2. Fig. 12 is a diagrammatic illustration of the electric circuit by means of which discrepancies in the bore of a barrel may be visually indicated. Fig. 13 illustrates the arrangement of the mechanism when the bending mechanisms are so located as to act upon the barrel with a deflection indicator passing through it.

The machine illustrated is mounted upon a cast iron base 1. As stated, for simplifying the illustration and description the machine is shown with the bending mechanism which is provided for remedying the defects indicated by the calibrating means, arranged in front of and below the calibrating means. In this type of machine there is a shelf 2 on the front of the base, and in the top of this shelf and extending from end to end across the front is a T-shaped guideway 3. At each end of the guideway is a supporting yoke 4 for retaining the end of a gun barrel. Movable along the guideway on the top of the shelf are two grooved barrel holding blocks 5. At approximately the middle of the machine and projecting downwardly over the guideway is a stud 6 mounted in the front end of a lever 7. This stud is screw threaded so that it may be adjusted up

and down with relation to the guideway. The upper ends of two links 8 are connected with the rear end of the lever. These links are connected with the frame by links 9 and they have their lower ends connected with a link 10 that is hinged to the upper rear end of the arm 11 of the foot lever or treadle 12 which is pivoted to the frame and is normally lifted by the spring 13 (Figs. 1, 2 and 3). After the amount of deflection of the bore of the barrel has been determined the barrel is laid on the blocks 5 which are moved toward or from each other so as to support the barrel in the necessary position, and then when the treadle is depressed by the application of the foot, the toggle links force down the stud which has been adjusted to the necessary position and cause it to bend the barrel between the blocks the required amount to straighten it and rectify the defect which has been found.

The calibrating mechanisms are arranged on a table 14 mounted on the top of the base. Movable along a way on the top of the table toward the front and rear is a carriage 15. A fine feed screw 16 having on its front end a hand wheel 17 is arranged to turn in the carriage and in a nut 18 held on the table for moving the carriage forward and backward. A stop screw 19 turning through a plate 20 on the back of the carriage is arranged to engage a post 21 mounted on the table for determining the limit of forward movement of the carriage. On the feed screw back of the handle is a graduated dial-plate 22 designed to register with a zero mark on the carriage for showing the number of turns of the screw and indicating the amount of movement of the carriage. This dial-plate is desirably held in place by a wedge pin 23 mounted radially in the screw spindle and adapted to be forced out against the inner wall of the hub of the dial-plate by a thumb screw 24 that turns into the end of the feed screw spindle from in front of the hand wheel. (Fig. 9). By means of this mechanism the dial-plate can be adjusted and set to any desired position with relation to the zero mark. On top of the carriage at one end are two barrel supporting pillows 25 and 26. These are desirably fixed in position on the carriage. At the other end of the carriage are two barrel supporting pillows 27 and 28. These are arranged so that they may be adjusted along slots in the carriage, thereby enabling barrels of different lengths to be placed in and supported by the pillows.

On the top of the table near the right hand end of the machine is a guideway 29 provided with the fixed rack 30, and movable along this guideway is a slide 31. Mounted in this slide and engaging the rack is a gear wheel 32 on the end of a spindle 33 that at the front of the machine has a hand wheel 34. By turning this hand wheel the slide may be moved as desired along the top of the table toward and from the side.

A block 35 is hinged to the top of the slide. A feeler rod 36 has one end clamped in this block by a screw 37, and an indicator rod 38 has one end clamped in this block by a screw 39. When the block is lying down in normal position the feeler rod will be approximately in line with the axis of the bore of a barrel that is laid with its ends in the pillows 25 and 27, and the indicator rod will be parallel thereto at such a distance in front that it will extend along the outside of the barrel when the feeler rod is in the interior. The indicator rod is the same length as the feeler rod and is provided to show the location of the tip of the feeler rod when it is in the interior of a barrel. The clamped end of the feeler rod is mounted in an insulating bushing 40 so that the rod will be electrically insulated from the other parts of the machine (Fig. 11). When these rods 36 and 38 are not being used for determining variation in the bore of a barrel the block which supports them is turned on its hinge toward the front of the machine.

Hinged to the top of a post 41 that extends up from the slide is a common style of dial-gage 42. A set screw 44 is mounted on a portion of the post that supports the dial-gage so that when the gage is turned down to the position in which it is used it will be exactly horizontal and its contact stem 43 will point toward the axis of the bore of the barrel (Fig. 11). The ends of the barrel are first turned off so the outer surfaces will be concentric with the bore, then plugs may be inserted a short distance into the bore and allowed to project some distance beyond the ends. The barrel thus plugged is laid in the pillows 25 and 27 and rotated with the dial-gage stem against the plugs. By this means the plane of any curve in the barrel may be roughly ascertained. When the dial-gage is not to be used it is turned on its hinge over toward the back of the machine.

Pulleys 45 and 46 are mounted on the top of the table near each end of the machine. The pulley 45 turns on a stud 47, suitable anti-friction bearings 48 being interposed, which projects upwardly from a disk 49, that has an eccentric stem 50 rotarily supported by the table. Extending from one side of the disk 49 is an arm 51 that is held between screws 52 turning in a block 53 which is secured to the top of the table. By manipulating these screws the disk bearing the pulley arbor may be turned so that the pulley can be adjusted slightly toward the front or rear (Figs. 5 and 6). The other pulley 46 is mounted on an arbor which projects upwardly from a slide 54 that is movable sidewise of the bed back

and forth on a way 55 on the top of the machine. At the outer end of this slide is a wall 59, and loosely passing through perforations in this wall are bolts 57 that at their inner ends are secured to a cross head 58 and at their outer ends are secured to a cross head 61. Springs 56 are placed on the bolts 57 so as to thrust between the cross head 58 at the inner ends of the bolts and the wall 59 at the outer end of the slide. These parts arranged in this way form a yielding extension for the end of the slide. A cam 60 which is mounted on a fixed pivot 600 is adapted to engage a cross head 61 on the outer ends of the bolts, in such manner that, when its handle 62 is turned to one position, it draws the slide out with a stiff spring pressure, and when the handle is turned to the other position it relaxes the tension on the springs and permits the slide and pulley 46 to relax toward the pulley 45 (Figs. 1 and 6.) The two pulleys are desirably made of metal and they are mounted on suitable anti-friction bearings and provided with handles 63 by which they may be rotated. Each of the pulleys has on its periphery a ring of electrical insulation 64.

Extending around the pulleys is a wire or metal cable 65. This wire in passing around the pulleys runs in a small groove in the insulating ring, and one end is looped and hooked into one end of a plate 66, while the other end is looped and hooked into the other end of the same plate. The pulley 46 is drawn out by the springs as above described so as to hold this wire very taut. The front section of this wire is located so that it will extend through the bore of the gun barrel that is placed in the pillow blocks 26 and 28. If the wire in front is not exactly parallel with the axis of the bore of a barrel that rests in these blocks, the pulley 45 is by means of its eccentric support adjusted until the wire is parallel. In order to string the wire through the barrel the cam handle 62 is turned to the left so as to relax the tension of the springs against the slide. This releases the slide and the pulley 46 moves in and slackens the wire so that its end can be unhooked from the connecting plate. After this wire has been threaded through a gun barrel it is again carried around the pulley 46 and its end hooked onto the plate 66, and then the handle 62 is turned so that the cam will again put tension on the springs and cause them to draw back the pulley and take up all slack in the wire. On this wire near one end is a small contact disk 68.

A second wire 69 is passed around the pulleys below the first wire, and one end 70 is hooked into the plate 66, while the other end 71 is connected with a plunger 72 that is held by a spring 73 so that this wire will always be taut even when the pulley 46 is allowed to move in so as to slacken the other wire (Fig. 7). The lower wire is passed over insulating pulleys 74 which hold it out in front of the upper wire. This wire is designed to extend on the outside of the barrel and it has a small indicator disk 75 which is exactly opposite to the contact disk 68 on the wire that passes through the barrel and is for the sole purpose of indicating the position of the contact when that contact is in the interior of a barrel (Fig. 6). A cam 76 on a shaft provided with a handle 77 is arranged to be turned down onto an insulating block 78 on the upper edge of the plate 66 to which the wires are attached, for the purpose of holding that plate from movement when the pulley 46 is released to slacken the contact wire (Figs. 7 and 8). At each end of the travel of the wire attachment plate 66 is an insulating frame 79 which forms a guide and stop for the plate, and the plate travels in its movement from one to the other, on a strip of insulation 80 (Fig. 6).

As a result of this construction the contact wire 65 is electrically insulated from the rest of the machine, and when the handle of either of the pulleys is turned the wire runs around them and carries the contact 68 along the interior from one end to the other of a barrel placed in the pillows 26 and 28.

At the right hand end of the machine is a metal plate 81, preferably brass. This plate is fastened on to an insulating strip 82 so that it is electrically insulated from the rest of the machine. A spring contact finger 83 has one end connected to this plate, and has its other end bearing against the contact wire 65 that is designed to be passed through the bore of the barrel. A block 84 fastened to the slide 31 that moves back and forth along the right hand end of the machine carries a spring plunger 85 that is thrust down into contact with the plate 81. This plunger is insulated from its support, and a wire 86 leads from it to the end of the feeler rod 36 (Fig. 11).

A pair of electric lamps 87 may be mounted on the table and connected in series with a current transformer 88, or other source of power. The contact plate 81 may be connected by a wire 89 with the circuit on one side of the lamps. A wire 90 leading from between the lamps is grounded on the machine (Figs. 2 and 12). With these connections, when the contact on the wire 65 that passes through the barrel is not grounded on the machine by touching the barrel, or the rod 36 is not grounded on the machine by touching the barrel, current will flow through both lamps and keep them lighted. Whenever the live wire contact, or the end of the live feeler rod, is grounded on the machine, as for instance, through contact with the inner wall of a gun barrel, one of the lamps will be short circuited and all of the

current will flow through the other lamp, showing that either the contact on the wire or the tip of the feeler rod is touching the barrel.

In using this machine a barrel plugged as described may be placed in the pillows 25 and 27, and the plane of any deflection of the bore be roughly ascertained by the dial-gage. While this is being done the rods 36 and 38 are thrown over to the front. The dial-gage is then thrown over to the back, the plugs removed and the rods are turned down to normal position. The slide is moved up gradually and the rod 36 passes into the bore of the barrel. At various times as this rod is being passed into the bore of the barrel the main carriage which supports the barrel is moved back until the tip of the rod 36 engages the inner wall of the barrel, under which condition, as described, one of the lights will go out. From the gage on the carriage the amount of movement backward of the barrel is determined. Thus with this mechanism the distance that the barrel is moved back at the various points is measured and any curvature in the axis of the bore indicated. After this has been determined at one end of the barrel, the barrel may be turned around and by the same method the accuracy of the bore at the other end of the barrel may be determined.

After the barrel has been gaged and bent by the mechanism described, to overcome any curvature in the bore, it may be placed in the pillows 26 and 28. The wire 65, which passes around the pulleys is then threaded through the bore, the pulley 46 having been loosened so as to slacken the end of the wire and allow it to be readily unhooked and after threading rehooked onto the connecting plate. Then the pulley 46 is drawn back by the cam lever and either pulley turned so that the charged contact wire will carry the contact through the bore of the gun. If the bore is true the contact will travel through it without making any change in the electrical circuits. However, if the contact touches the wall of the barrel, as stated, one of the lamps goes out and then the carriage supporting the barrel can be moved by turning the hand wheel until the contact is broken and the lamp again lights, the distance of which movement is measured by the carriage gage so as to show the amount of the defect. The barrel is marked on the outside opposite the indicator, which is opposite the contact, so as to show on the outside where the contact engaged the wall of the bore. When the irregularities have been determined the wire is unhooked and the barrel taken off and placed in the straightener for bending. After the barrel has been bent it can if desired be again tested. With this mechanism very slight inaccuracies in the alinement of the axis of the bore of a gun barrel may be visually indicated by the electrical connections, and the exact spot and amount of deflection can be noted on the exterior. Thus the barrels can be readily trued so that the bore will be very accurate from end to end.

As shown in Fig. 13 the barrel may be bent for straightening it while the charged indicator wire is passing through it. In this case the barrel is mounted on pillow blocks 91 that are adjustable along a way 92 on the top of the table, and the bending stud 93 mounted in the upper end of the lever 94 that is capable of being forced down by the treadle, as shown in Fig. 3, is arranged above the barrel. The live wire 95 passing around the insulated pulleys 96 and 97 carries the contact 98 as previously described. The connections for electrifying the wire and this contact may be as represented by the diagrammatic illustration in Fig. 12. If the contact in being carried through the barrel touches the wall of the bore at any place the circuit is grounded through the barrel and the charge indicated by the lamps. The barrels are then bent until this deflection is remedied.

The invention claimed is;

1. A machine for calibrating gun barrels, having means for supporting a barrel, a wire bearing a feeler and adapted to be moved longitudinally back and forth in the bore of the barrel held by said supports, means for holding the wire taut, means for indicating the engagement of said feeler with the wall of the bore of the barrel, said means being controlled by such engagement, and means for showing on the exterior the point of contact of the feeler with the wall of the bore, said means being connected to move longitudinally with the feeler wire.

2. A machine for calibrating gun barrels, having means for supporting a barrel, a wire bearing a feeler and adapted to be moved longitudinally back and forth in the bore of the barrel held by said support, means holding the wire taut, mechanism for imparting relative transverse movement between the barrel support and the feeler so that the feeler may be brought into contact with the wall of the bore of the barrel, and means for indicating the engagement of the feeler with the wall of the bore.

3. A machine for calibrating gun barrels, having means for supporting a barrel, a wire bearing a feeler and adapted to be moved longitudinally back and forth in the bore of the barrel held by said support, means holding the wire taut, mechanism for imparting relative transverse movement between the barrel support and the feeler so that the feeler may be brought into contact with the wall of the bore of the barrel, mechanism for measuring the amount of

relative movement between the barrel support and feeler, and means for indicating the engagement of the feeler with the wall of the bore.

4. A machine for calibrating gun barrels, having means for supporting a barrel, a feeler adapted to be passed longitudinally into the bore of the barrel held by said support, mechanism for moving the barrel support transversely of the feeler, and means for indicating the engagement of the feeler with the wall of the bore of the barrel on the support.

5. A machine for calibrating gun barrels, having means for supporting a barrel, a feeler adapted to be passed longitudinally into the bore of the barrel held by said support, mechanism for moving the barrel support transversely of the feeler so as to cause the feeler to engage with the wall of the bore of the barrel, means for indicating the engagement of the feeler with the wall of the bore, and mechanism for showing on the exterior the point of contact of the feeler with the wall of the bore, said mechanism being connected to move longitudinally of the barrel with the feeler.

6. A machine for calibrating gun barrels, having means for supporting a barrel, a feeler adapted to be passed longitudinally into the bore of a barrel held by said support, mechanism for moving the barrel support transversely of the feeler, mechanism for measuring the amount of transverse movement of the barrel support, means for indicating the engagement of the feeler with the wall of the bore, and mechanism for showing on the exterior the point of contact of the feeler with the wall of the bore, said mechanism being connected to move longitudinally of the barrel with the feeler.

7. A machine for calibrating gun barrels, having means for supporting a barrel, a wire bearing an electrical contact adapted to be passed into the bore of a barrel, means for the relative sidewise movement of the wire and barrel, and electrically excited means arranged to indicate engagement of said contact with the wall of the bore of a barrel.

8. A machine for calibrating gun barrels, having means for supporting a barrel, a wire bearing, an electrical contact adapted to be passed longitudinally through the bore of a barrel, means for the relative sidewise movement of the wire and barrel, and electrically excited means arranged to indicate engagement of said contact with the wall of the bore of the barrel.

9. A machine for calibrating gun barrels, having means for supporting a barrel and moving the barrel transversely to its axis, an electrical contact adapted to be passed into the bore of the barrel, and electrically excited means arranged to indicate engagement of said contact with the wall of the bore of the barrel.

10. A machine for calibrating gun barrels, having means for supporting a barrel, mechanism for moving the barrel support transversely with relation to the axis of the barrel, mechanism for measuring the movement of the barrel support, an electrical contact adapted to be passed into the bore of the barrel, and electrically excited means arranged to indicate engagement of said contact with the wall of the bore of the barrel.

11. A machine for calibrating gun barrels, having means for supporting a barrel, an electrical circuit, a contact connected in said circuit and adapted to be passed longitudinally into the bore of a barrel, and an electrical lamp in said circuit adapted to be shunted by the engagement of said contact with the wall of the bore of the barrel.

12. A machine for calibrating gun barrels, having means for supporting a barrel, an endless wire bearing a contact adapted to be passed through the bore of the barrel located on the support, means for supporting the wire and means for indicating engagement of said contact with the wall of the bore of the barrel.

13. A machine for calibrating gun barrels, having means for supporting a barrel, an endless wire bearing a contact adapted to be passed through the bore of a barrel located on the support, means for supporting the wire, means detachably retaining one end of the wire so that it may be detached and passed through the bore of the barrel, means for tightening the wire after it has been passed through the bore of the barrel, and means for indicating the engagement of said contact on the wire with the wall of the bore of the barrel.

14. A machine for calibrating gun barrels, having means for supporting a barrel, an endless wire adapted to be passed through the bore of a barrel located on the support, means for supporting the wire, an electrical circuit, a contact connected in said electrical circuit fastened to said wire, and a lamp in said circuit adapted to be shunted by the engagement of said contact with the wall of the bore of the barrel on the support.

15. A machine for calibrating gun barrels, having means for supporting a barrel, a wire bearing a contact adapted to be passed through the bore of the barrel located on the support, a wire bearing an indicator adapted to extend along the exterior of the barrel located on the support, means for supporting the wires, means connecting the ends of the wires, one end of the contact wire being detachably fastened to said connecting means so that it may be detached and passed through the bore of the barrel, means for retaining the indicator wire taut when the

contact wire is released, and means for indicating the engagement of the contact with the wall of the bore of the barrel.

16. A machine for calibrating gun barrels, having means for supporting a barrel, a pair of pulleys with electrically insulated peripheries rotarily mounted on top of the machine, a pair of endless wires passing around said pulleys, one wire bearing a contact and the other wire bearing an indicator that shows the position of the contact, and an electrical circuit connected with the contact wire and adapted to be grounded whenever said contact engages the wall of the bore of the barrel.

17. A machine for calibrating gun barrels, having means for supporting a barrel, a pair of pulleys rotarily mounted on top of the machine, means for adjusting one pulley transversely of the barrel support, means for adjusting the other pulley longitudinally of the barrel support, an endless wire passing around the pulleys, an electrical contact carried by said wire, and an electrical circuit connected with said wire and adapted to be grounded whenever said contact engages the wall of the bore of the barrel.

18. A machine for calibrating gun barrels, having means for supporting a barrel, a pair of pulleys rotarily mounted on top of the machine, an endless wire passing around the pulleys, springs for drawing one of the pulleys so as to hold the wire normally taut, means for releasing the spring tension on said pulley, an electrical contact carried by said wire, and an electrical circuit connected with said wire and adapted to be grounded whenever the contact engages the wall of the bore of the barrel.

19. A machine for calibrating gun barrels, having a bed, pulleys mounted to rotate on the bed, a wire extending from pulley to pulley and supported thereby, a contact carried by the wire, an electrical circuit including a lamp with one terminal electrically connected with the wire and another terminal electrically connected with the bed.

20. A machine for calibrating gun barrels, having a bed, pulleys rotarily mounted on the bed, a contact wire extending from pulley to pulley and supported thereby, and an indicator wire extending parallel with the contact wire from pulley to pulley.

21. A machine for calibrating gun barrels, having a bed, a pulley rotarily mounted upon and movable forward and backward of the bed, means for adjusting the pulley toward the front and back, a second pulley rotarily mounted on and movable sidewise of the bed, means for adjusting the latter pulley sidewise along the bed, a contact wire extending from pulley to pulley and supported thereby, springs connected with the sidewise movable pulley for keeping the wire taut, and means for releasing the tension of the springs.

22. A machine for calibrating gun barrels, having means for supporting a barrel, a pair of pulleys rotarily mounted on top of the machine, means for adjusting one pulley transversely of the barrel support, an endless wire passing around the pulleys, an electrical contact carried by said wire, and an electrical circuit connected with said contact and adapted to be grounded whenever said contact engages the wall of the bore of the barrel.

CHARLES W. SPONSEL.

Copies of this trade-mark may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."