No. 795,300. PATENTED JULY 25, 1905.

H. J. NICHOLS.

MACHINE FOR STRAIGHTENING GUN BARRELS.

APPLICATION FILED SEPT. 13, 1904.

4 SHEETS—SHEET 1.

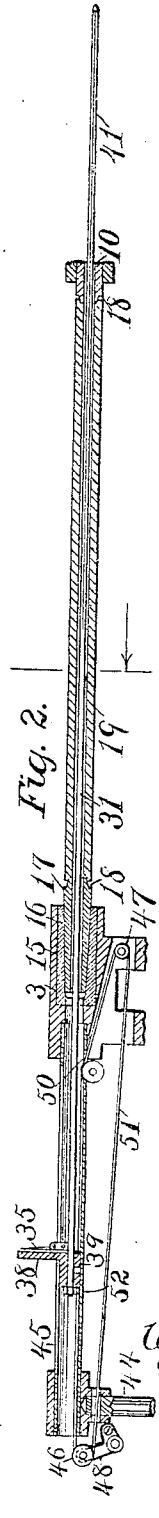


Fig. 2.

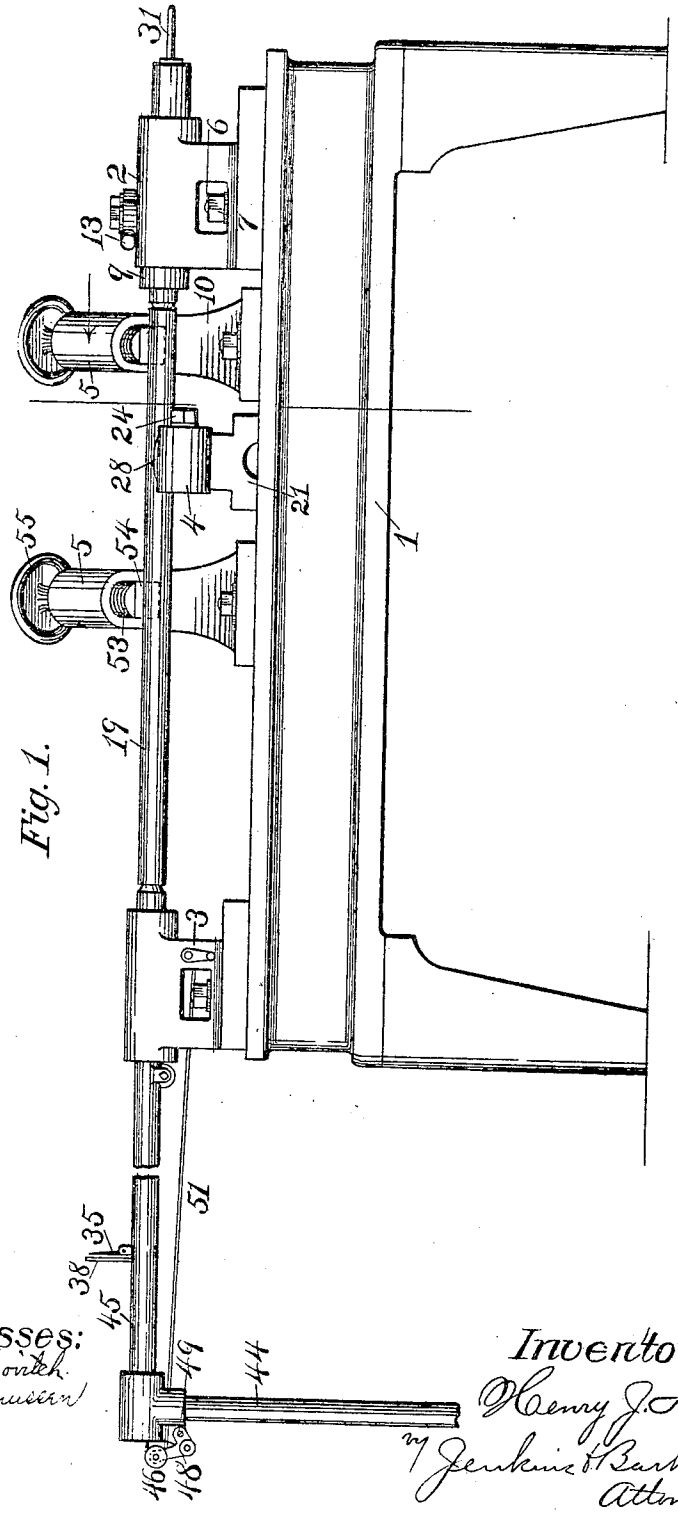


Fig. 1.

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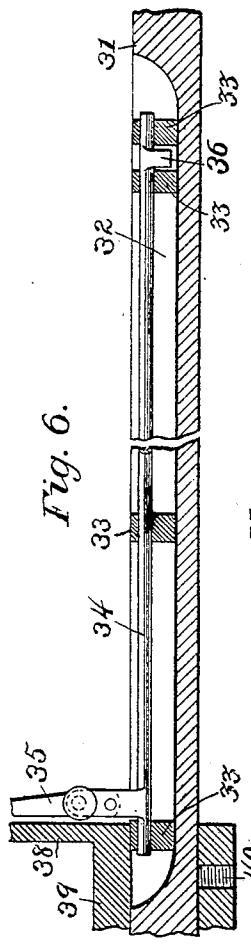


Fig. 6.

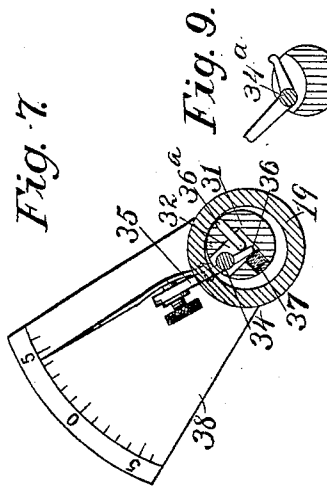


Fig. 7.

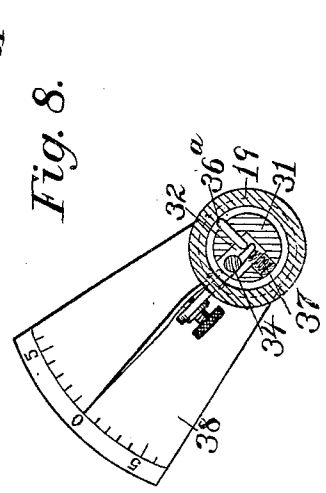


Fig. 8.

Fig. 9.

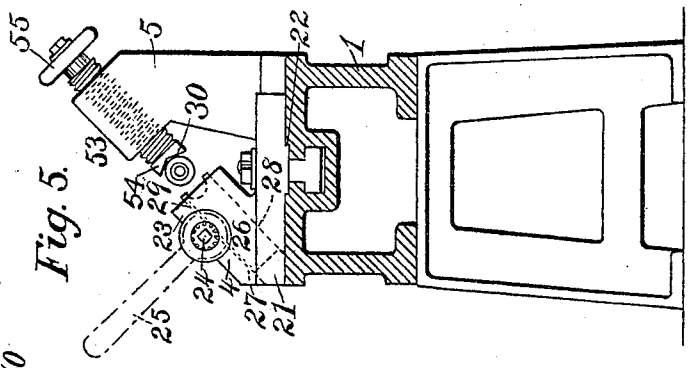


Fig. 5.

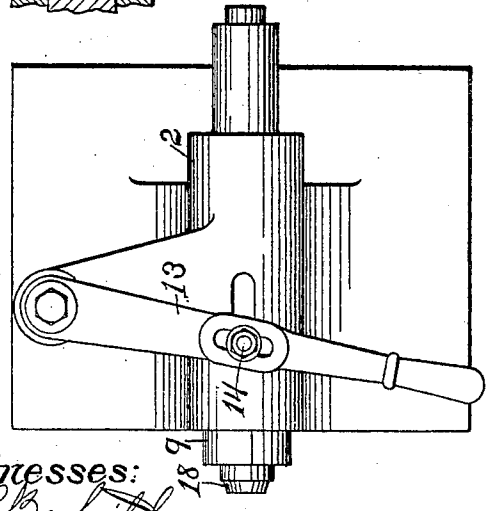


Fig. 4.

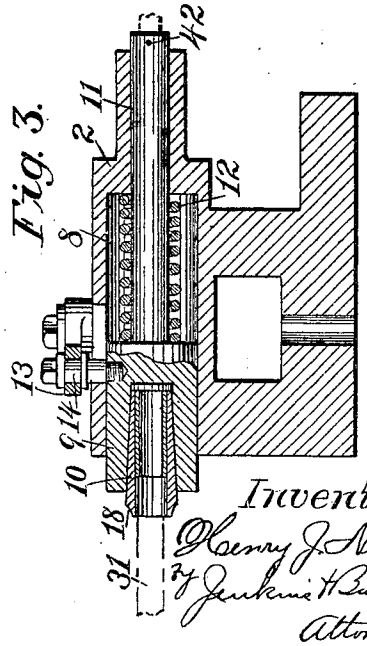


Fig. 3.

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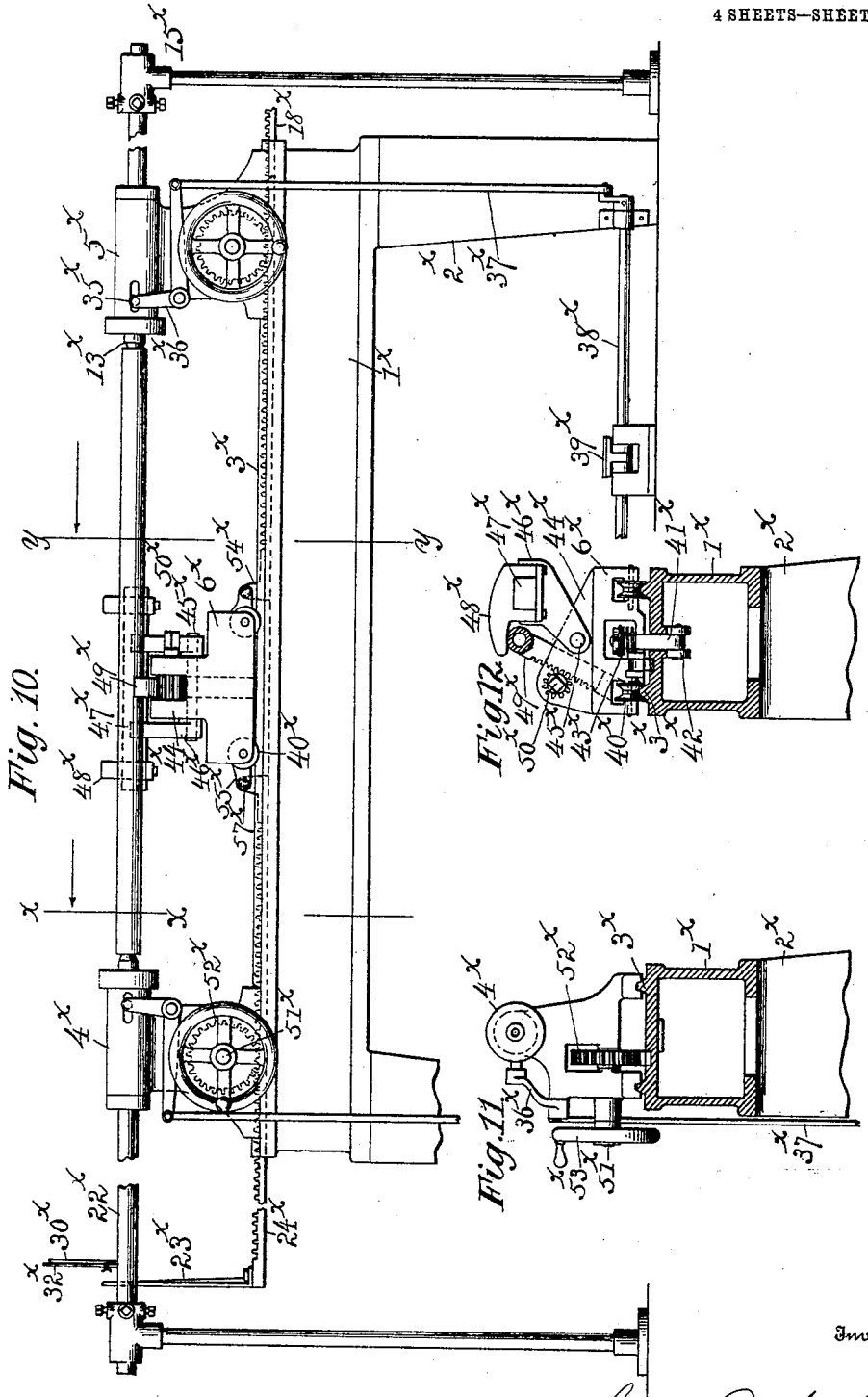


Fig. 10.

Fig. 12.

Fig. 11.

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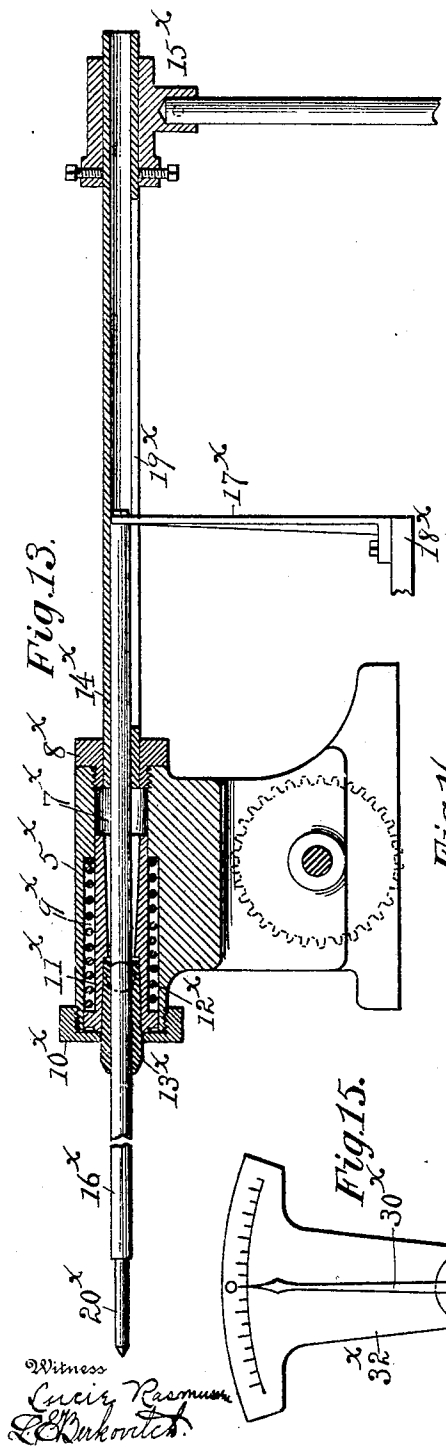


Fig. 13.

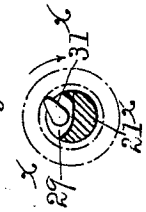


Fig. 16.

Fig. 15.

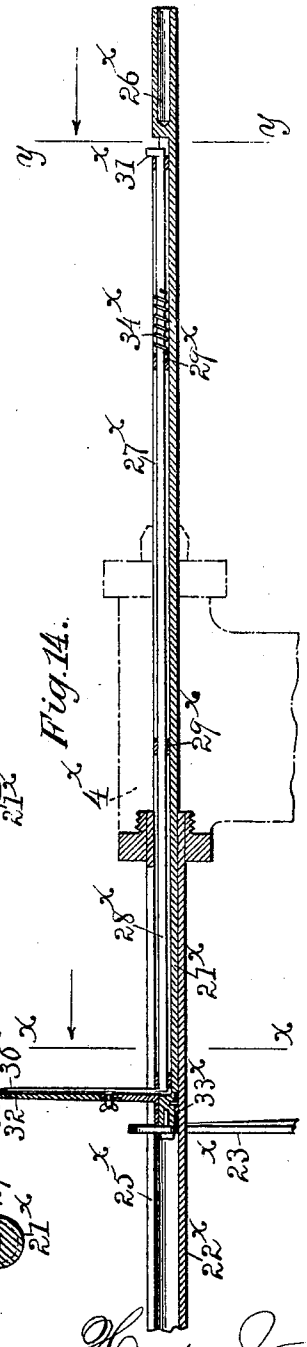


Fig. 14.

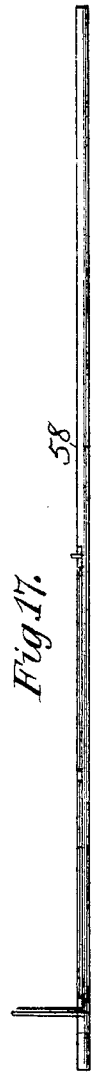


Fig. 17.

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UNITED STATES PATENT OFFICE.

HENRY J. NICHOLS, OF SPRINGFIELD, MASSACHUSETTS.

MACHINE FOR STRAIGHTENING GUN-BARRELS.

No. 795,300. Specification of Letters Patent. Patented July 25, 1905.

Application filed September 13, 1904. Serial No. 224,232.

To all whom it may concern:

Be it known that I, HENRY J. NICHOLS, a citizen of the United States, and a resident of Springfield, in the county of Hampden and State of Massachusetts, have invented a certain new and Improved Machine for Straightening Gun-Barrels, of which the following is a specification.

My invention relates to a machine more especially adapted for straightening tubes; and the object of my invention is to provide a device by means of which a tube, as a gun-barrel, may be straightened or trued up by the aid to a great extent of mechanical means; and a further object of the invention is to provide a device by means of which a tube, as a gun-barrel, may be expeditiously and accurately straightened; and a further object is to provide a device of this class that may be readily operated for the purpose of disclosing an imperfection of the character described and for remedying or removing such defect; and a further object is to provide a device in which the indicator may also be utilized as a factor in the straightening operation; and a still further object is to provide a device of this class in which the straightening device may be readily located with respect to the defect in the trueness of the gun-barrel.

A form of device in the use of which the above objects may be attained is illustrated in the accompanying drawings, in which—

Figure 1 is a view in front elevation of a machine embodying my invention. Fig. 2 is a detail view in section through a portion of said machine and showing a gun-barrel in place. Fig. 3 is a detail view, on enlarged scale, in vertical section through the head-stock. Fig. 4 is a top or plan view of the head-stock. Fig. 5 is a detail view, in vertical section, through the machine on the line indicated in Fig. 1. Fig. 6 is a detail view, on enlarged scale, in longitudinal section through the indicator-support. Fig. 7 is a detail view, on enlarged scale, in cross-section through the indicating device, showing the indicator-finger in abnormal position. Fig. 8 is a like view showing the indicator-finger in its normal position. Fig. 9 is a detail view in cross-section through the indicator-support and indicator, showing a modified form of the invention. Fig. 10 is a view in front elevation of a machine, illustrating another embodiment of my invention with parts broken away. Fig. 11 is a view in cross-section of the machine on the line X X of Fig. 1. Fig. 12 is a view in cross-section through the device on the line Y Y of Fig. 1. Fig. 13 is a view, on enlarged scale, in lengthwise section through one of the heads, showing the construction of the parts. Fig. 14 is a view in section, on enlarged scale, through parts appurtenant to the opposite head of the machine. Fig. 15 is a detail view, on enlarged scale, in section through the indicator-tube on line X X of Fig. 14 and showing the dial in elevation. Fig. 16 is a detail view, on enlarged scale, through the indicator-tube on line Y Y of Fig. 14, the gun-barrel being shown in dotted outline. Fig. 17 is a detail view showing a modified form of indicator-tube.

In the accompanying drawings the numeral 1 denotes the base of the machine, that may be supported in any usual and ordinary way, as upon legs, and upon this base are mounted the operative and movable parts of the device. These parts consist of a head-stock 2, a tail-stock 3, a straightener 4, and intermediate supports 5. The head-stock is mounted upon the base and is adjustable therealong, as by means of a bolt 6, extending through the head-stock and through the base, the lower end of the bolt being suitably headed and a nut 7 being employed for clamping the parts in place. The lower portion of the head-stock may be suitably formed to prevent lateral movement on its base or support and in any well-known manner common to devices of this class. The upper part of the head-stock has a shouldered recess 8, in which is located a center-bushing 9 for a center 10. The bushing is enlarged at that end toward the center of the machine, and the opposite end extends through an opening 11 from the recess 8. A spring 12 is located in the recess 8 and rests with one end against the wall of the recess and the other end against the shoulder formed between the reduced and enlarged portions of the bushing. The center 10 is accurately fitted within the bushing 9, this center being tapered at that portion located within the bushing, as shown in Fig. 3 of the drawings.

A lever 13 is pivoted at one end to the head-stock, at the upper edge thereof, this lever projecting laterally across the head-stock and having a pin 14 projecting through a slot in the stock and engaging the bushing 9. By

swinging this lever on its pivot the bushing may be forced backward against the tension of the spring 8.

In the tail-stock 3 a recess 15 is formed, in which is located a center-bushing 16 for the reception of a center 17. The construction of this center and bushing is much the same as that above described with relation to the center and bushing of the head-stock, except that in the present instance the bushing may be fixed within the tail-stock or movable in the same manner as in the head-stock. Each of the centers is tapered, as at 18, for the reception of a barrel 19, which is to be operated upon.

The straightener 4 includes a straightener-base 21, which is supported on the base 1 and constructed to have a movement thereon along, this base being provided with any suitable means, as a boss 22, for preventing lateral movement thereof. This straightener-base is preferably freely slidable along the base of the machine and may have devices, as shown, for clamping it in any desired position when required. A support 23 projects upward from the base, and in this support is mounted a shaft 24, to which is secured a bending-lever 25 and a gear 26. In an opening 27, extending through the support, is mounted a plunger 28, having a rack 29 in mesh with the gear 26. The front end of the plunger is adapted to engage a gun-barrel 19, and the lever is employed to exert a pressure upon the barrel to remove any bend which may exist therein.

The intermediate supports 5 may be located between the head and tail stocks and the straightener. These supports may consist of a base similarly formed as that hereinbefore described with relation to the head and tail stocks and the straightener, being provided with similar means for preventing lateral movement and for clamping them in position. Each of these supports may have a recess 30, within which the gun-barrel may lie, but in a position with some space between the wall of the recess and the outer surface of the gun-barrel.

An indicator-tube 31 is adapted to be located in the openings through the bushings 9 and 16 and also through the centers 10 and 17 and the gun-barrel supported thereon. This tube is provided at one end with an indicator-groove 32, in which is secured indicator-bearings 33. An indicator 34 is located within these bearings and is rotatable therein. One end of the indicator is bent or extended to form an index-pointer 35, located near the end of the indicator-tube, and the opposite end of the indicator is bent or extended to form a finger 36, which is adapted to rest against the inner surface of a gun-barrel supported in the machine. A pin 36^a extends through the wall of the indicator into the groove, its inner end lying loosely against the finger 36. A spring 37 is located within the groove in the indicator-tube, with one end pressing against the finger 36, as shown in Figs. 7 and 8 of the drawings, in a manner to hold the pin 36^a with its outer end pressing against the inner wall of the gun-barrel 19.

A dial 38 is supported on the end of the indicator-tube 31, the hub 39 of the dial having a set-screw 40 projecting through the hub and against the indicator-tube for the purpose of holding the dial in any position of adjustment. This dial is provided with suitable graduations in connection with which the index-pointer 35 is operated. In the preferred form of the invention, as shown herein, the zero-mark of the scale is located in the center of the dial, and the graduations are numbered from zero upward both to right and left of the zero-mark. The opposite end of the indicator-tube is provided with a guide-groove 41, in which is located a guide-pin 42, projecting through the head-stock 2 and bushing located therein, the end of the pin resting in the groove and preventing rotary movement thereof.

A standard 44 is located at any desired distance from the base of the machine, and an indicator-sleeve 45 has one end supported in a recess in the standard and its opposite end in the tail-stock 3. The hub 39 of the dial has a sliding fit within this sleeve, which is slotted at its upper side to permit passage of the dial 38 and the index-pointer 35. A pulley 46 is rotarily mounted on the standard 44, and a pulley 47 is also rotarily mounted on the tail-stock 3. The pulley 46 is mounted in a bracket 48, extending from the standard 44, and this bracket may be provided with adjusting-screw 49, fitting the screw-threaded surface of the bracket. The indicator-sleeve is also provided with a slot 50, in which a belt 51 projects, this belt passing around the pulleys 46 and 47 and being secured, as at 52, to the hub of the dial 38. The pulley 47 may be provided with a handle for the purpose of turning the pulley, and thus moving the indicator-tube lengthwise of the machine.

It will be noted that the axis of the indicator is located at one side of the center of the indicator-tube, and in use it is preferred that this indicator shall lie at one side of the center of the tube. With the indicator and tube in this position the finger 36 projects laterally from the indicator at an angle of about forty-five degrees to a vertical and a horizontal line. The dial 38 and the index-pointer 35 are so arranged that with the finger in this position the pointer shall register with the zero-mark on the dial. It will thus be seen that the gun-barrel and the indicator-tube both being centered on the centers 10 and 17 if the gun-barrel is true at the point of location of the pin 36^a the finger will

touch the inner surface of the gun-barrel at such point that the pointer will register with the zero-mark on the dial. If, however, the gun-barrel shall be bent at the point of location of the finger and the bend shall be in a downward direction, the index-pointer will be thrown to the right from the zero-mark as one faces the dial, (see Fig. 7;) but if the barrel be bent in the opposite direction then the index-pointer will be thrown in the opposite direction from the zero-mark. It may thus be ascertained at just what points along the barrel the latter is bent, and this point being determined the barrel is turned and the straightener 4 moved to the point to be straightened, and by use of the handle 25 the plunger 28 is forced against the barrel to relieve the latter of the bend therein.

If a barrel or tube of a size different from that just above described be placed in the machine, the pin 36^a will of course project to a greater or less degree, and the index-pointer would therefore be thrown to the right or left of the zero-mark. In order to cause the index-pointer to register with the zero-mark, the adjustment of the dial on the indicator-tube is provided. This will adapt the machine and the same indicator-tube and indicator for use with barrels of different size.

The intermediate supports 5 may be provided with a screw-threaded plunger 53, on the lower end of which is loosely mounted a rest 54, containing the recess 30. A hand-wheel 55 may be employed to locate the rest in any position with reference to a gun-barrel or tube placed in the machine.

In the modified form of the device shown in Figs. 10 to 17, inclusive, the numeral $1^\times$ denotes the frame or bed of the machine, that may be suitably supported upon supports or legs $2^\times$. This frame is constructed in any usual and ordinary manner and of any desired material, preferably of metal cast to form and leaving the interior hollow, as shown in Figs. 11 and 12 of the drawings, for the purpose of lightness. Upon this bed ways $3^\times$ are formed, and upon these ways are supported the heads $4^\times$ and $5^\times$ and the base $6^\times$ of the straightening mechanism. The heads and base of the straightening mechanism may be supported upon and moved along the ways and secured in place by any desired mechanism common to devices of this class; but in the preferred form I provide tapered ways fitting corresponding grooves in the under side of the supported parts. Clamps of any ordinary construction may be employed to hold the parts in proper position. Each of the heads is of the same construction, and detailed mechanism relating to one only has therefore been shown in the drawings and will be herein described. At the upper end of each head a recess $7^\times$ is formed, one end of which is closed by a headed plug $8^\times$, fitting a screw-threaded opening in the recess. The opening is enlarged, as at $9^\times$, and the opposite end of the recess is closed by a cap $10^\times$. A sleeve $11^\times$ is located in the recess, a spring $12^\times$, located in the enlargement, thrusting with one end against a wall of the recess and the other end against a head on the sleeve. A center $13^\times$ is borne by the sleeve, this center projecting outward through a central opening in the cap $10^\times$. An indicator-bar support $14^\times$ has one end located in the plug $8^\times$, and the opposite end is supported by a standard $15^\times$. This indicator-bar support is tubular, as shown in Fig. 13 of the drawings, and an indicator-bar $16^\times$ is movable lengthwise in the support, as by means of an arm $17^\times$, projecting upward from a rack $18^\times$ and through a slot $19^\times$ in the support. The inner end of this section of the indicator-bar is reduced, as at $20^\times$, for a purpose to be hereinafter described. The mechanism just above described is that of the head $5^\times$; but as the mechanism of the head $4^\times$ is of the same construction the above description will suffice for both heads. The section $21^\times$ of the indicator-bar is borne in a supporting-tube $22^\times$, mounted and held by a standard, as hereinbefore described and specifically referred to by the numeral $15^\times$, an arm $23^\times$ projecting from the rack $24^\times$ and extending over and down through a slot $25^\times$ in the supporting-tube, within which it is united to the indicator-bar. This section of the indicator-bar has a recess $26^\times$ for the reception of the reduced end $20^\times$ of the section $16^\times$ of the indicator-bar. A lengthwise slot $27^\times$ is formed in this bar, in which is located the indicator $28^\times$. This indicator is preferably a metallic rod rotatably mounted in supports $29^\times$ in the indicator-bar and having at one end a pointer $30^\times$ and at the opposite end a finger $31^\times$. As shown in Fig. 16 of the drawings, it will be noted that the indicator-bar is supported concentrically to the gun-barrel to be operated upon, the latter being shown in dotted lines in said figure, but that the indicator is eccentrically located with respect to the gun-barrel and that the finger $31^\times$ extends diagonally to a line drawn from the axis of the indicator $28^\times$ to that part of the outer surface of the bar approaching nearest to said axis. A dial $32^\times$ is mounted on a dial-support $33^\times$, secured to the indicator-bar $21^\times$, the dial being adjustably mounted on its support, so that the graduations may be changed with respect to the pointer $30^\times$. Referring to Figs. 15 and 16 of the drawings, when the barrel is true at that point engaged by the finger $31^\times$ the pointer $30^\times$ will be in the center of the graduations or at the zero-mark. In moving the finger $31^\times$ lengthwise along the barrel and rotating the latter it will be noted that if the barrel presents an untrue surface to the finger the finger will be moved downward or al-

lowed to move upward under the influence of the spring 34×, thus moving the pointer 30× to the right or left and denoting which way the barrel must be bent in order to true it. The means of adjustment of the dial 32× accommodates the device to use with different sizes of barrel, the dial being adjusted so that the pointer will register with the zero-mark before operations are commenced on barrels of any given size and with the finger 31× resting against the inner surface at the end of the barrel, at which point it may be assumed the barrel is true. Each of the sleeves 11× is connected, as by means of a pin 35×, with a bell-crank lever 36×, pivoted to the head. A rod 37× connects each of the bell-crank levers with a rock-shaft 38×, having a treadle 39×, by means of which the shaft may be rocked to cause movement of the bell-crank levers to operate the sleeves to move the centers 13× from engagement with the gun-barrel. The base 6× of the bending apparatus is mounted on the ways 3×, sheaves or rollers 40×, rotatably mounted in the base, permitting free movement of said base along the ways. A post 41× may project from the base downward through a slot in the bed, rollers 42× being pivoted to the post and a spring 43× holding the rollers in yielding contact with the under surface of the bed. Ears 44× project upward from the base of the bending apparatus, and in these ears is mounted a pin 45×, to which are secured brackets 46×, supporting a bar 47×. Abutments 48× are secured to the bar 47× at proper distances apart to resist the thrust of a plunger 49×, operated by means of a shaft 50× through the medium of a rack on the plunger meshing with a pinion on the shaft. The end of the shaft, as shown in the drawings, may be of angular form to receive a lever for operating the shaft. In each of the heads 4× and 5× is mounted a shaft 51×, having a pinion 52× meshing with the racks 18× and 24×. The shaft may be supplied with a hand-wheel 53× as a means of rotating the shaft to cause the racks 24× and 18× to be reciprocated longitudinally and through the arms 23× and 17× impart movement to the sections 16× and 21× of the indicator-bar. Each of the hand-wheels may be rotated simultaneously to cause the sections of the indicator-bar to separate or to be brought together, so that the reduced portion 20× will engage within the socket 26×. When the two parts of the indicator-bar are thus brought into engagement, the racks 18× and 24× will be brought into position so that the toes 54× of each of the racks will engage projections 55× on the base 6×. When in this position, a removable pin 57× will securely unite each of the racks with the base. It will be seen that when the two sections of the indicator-bar are thus brought together and engage and the racks 24× and 18× secured to the base 6× the plunger 49× will be located in a line diametrically of the gun-barrel with the finger 31× of the indicator, so that in case the indicator-finger shall denote any untrueness in the barrel the plunger 49× will be in proper position to exert force upon the barrel to remove the defect.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In combination with a support for a tube, an indicator wholly supported independently of but projecting within the tube, a finger supported by the indicator within the tube, indicating devices connected with the indicator outside of the tube, and means for exerting lateral force upon the tube.

2. In combination with supports for each end of a tube, an indicator wholly supported independent of but projecting within the tube, a finger supported by the indicator within the tube, indicating devices located outside of the tube and connected with the indicator, and means for exerting lateral force upon the tube.

3. In combination with end supports for a tube, an indicator projecting through one of said supports into but supported independent of the tube, a finger supported by the indicator within the tube, indicating devices located outside of the tube and connected with the indicator, and means for exerting lateral force upon the tube.

4. In combination with a support for a tube, an indicator to project within the tube and bearing a finger operating by contact with the inner surface of the tube to turn the indicator, indicating devices connected with the indicator outside of the tube, and means for exerting lateral force upon the tube.

5. In combination with supports for each end of a tube, an indicator projecting through a support into the tube, a finger borne by the indicator to turn the latter by contact with the inner surface of the tube, indicating devices located and connected with the indicator outside of the tube, and means for exerting lateral force upon the tube.

6. In a barrel-straightening device, supports for the ends of the barrel, an indicator projecting through a support, a finger to be located in the barrel and connected with the indicator and operated by contact with the inner surface of the barrel, an index-hand connected with the indicator outside of the barrel, a dial to operate in connection with the index-hand, and means for exerting lateral force upon the barrel.

7. In a barrel-straightening machine, a support for a gun-barrel, an indicator-support to project at each end of said barrel, means for sustaining each end of the indicator-support, an indicator mounted in the support, means operated by contact with the

inner surface of the barrel and connected with the indicator, indicating devices located outside of the barrel and connected with the indicator, and means for exerting lateral force upon the barrel.

8. In a barrel-straightening device, a head and tail stock to support each end of the barrel, an indicator-support mounted in the head and tail stock, an indicator mounted in the indicator-support, means mounted in the indicator-support to operate in connection with the inner surface of a barrel and with the indicator, an index-pointer connected with the indicator outside of the barrel, a dial mounted on the indicator-support adjacent to said pointer, and means for exerting lateral force upon the barrel.

9. In a barrel-straightening device, a head and a tail stock, centers for a gun-barrel supported on said stocks, an indicator-support mounted at each end in a stock, and projecting through said centers, an indicator mounted within the indicator-support, a finger to be located within the barrel and connected with the indicator, indicating devices located outside of the barrel and appurtenant to one of said stocks, and means for exerting lateral force upon the barrel.

10. In a barrel-straightening device, a base, head and tail stocks mounted on the base, a center mounted in one of said stocks, a center mounted in and movable longitudinally in the other stock, an indicator-support having each end extending through one of said stocks, an indicator mounted in the indicator-support and projecting through one of said centers, a finger connected with the inner end of the indicator, a dial located on the indicator-support, an indicator-hand connected with the indicator adjacent to said dial, and means for exerting lateral force upon the barrel.

11. In combination with a support for a tube, an indicator composed of sections to project and engage within the tube, a finger connected with the indicator within the tube, indicating devices connected with the indicator outside of the tube, and means for exerting lateral force upon the tube.

12. In combination with a support for a tube, an indicator consisting of two sections to project within opposite ends of the tube and engage therein, a finger connected with the indicator within the tube, indicating devices connected with the indicator outside of the tube, and means for exerting lateral force upon the tube.

13. In combination with a support for a tube, an indicator to project within the tube, a finger connected with the indicator within the tube, indicating devices connected with the indicator outside of the tube, means for exerting lateral force upon the barrel, and connections between the indicator and means for exerting lateral force.

14. In combination with a support for a tube, an indicator to project within the tube, a finger connected with the indicator within the tube, indicating devices connected with the indicator outside of the tube, a straightening device, racks connected with the straightening device, and connections between the racks and indicator.

15. In combination with a support for a tube, an indicator to project within the tube, a finger connected with the indicator within the tube, indicating devices connected with the indicator outside of the tube, a straightening device, and connections extending between the indicator and straightening device and detachably secured to the latter.

16. In combination with a support for a tube, a sectional indicator to project within the tube, a finger connected with the indicator within the tube, indicating devices connected with the indicator outside of the tube, a straightening device, and connections between said straightening device and the sections of the indicator.

17. In combination with a support for a tube, a sectional indicator to project within opposite ends of the tube, a finger connected with the indicator within the tube, indicating devices connected with the indicator outside of the tube, a straightening device, racks detachably secured to the straightening device, and connections between said racks and the sections of the indicator.

18. In combination with supports for a tube, means for simultaneously operating said supports, an indicator to project within the tube, a finger connected with the indicator within the tube, indicating devices connected with the indicator outside of the tube, and means for exerting lateral force upon the tube.

HENRY J. NICHOLS.

Witnesses:

ARTHUR B. JENKINS,

LENA E. BERKOVITCH.