Oct. 25, 1949. H. R. BILLETER 2,486,103

SIGNAL TYPE TORQUE INDICATING WRENCH

Filed Dec. 2, 1943

2 Sheets-Sheet 1

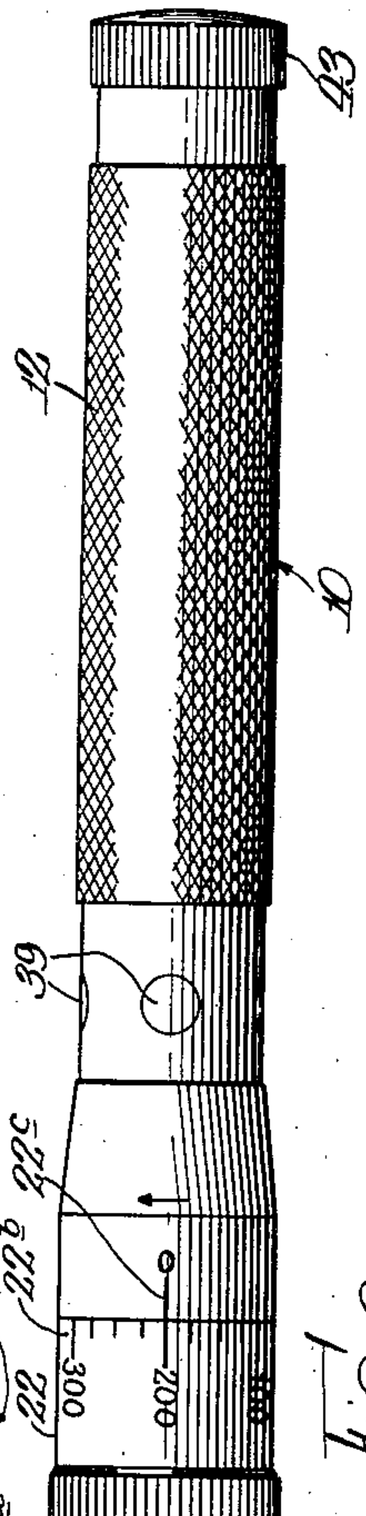

Fig. 1.

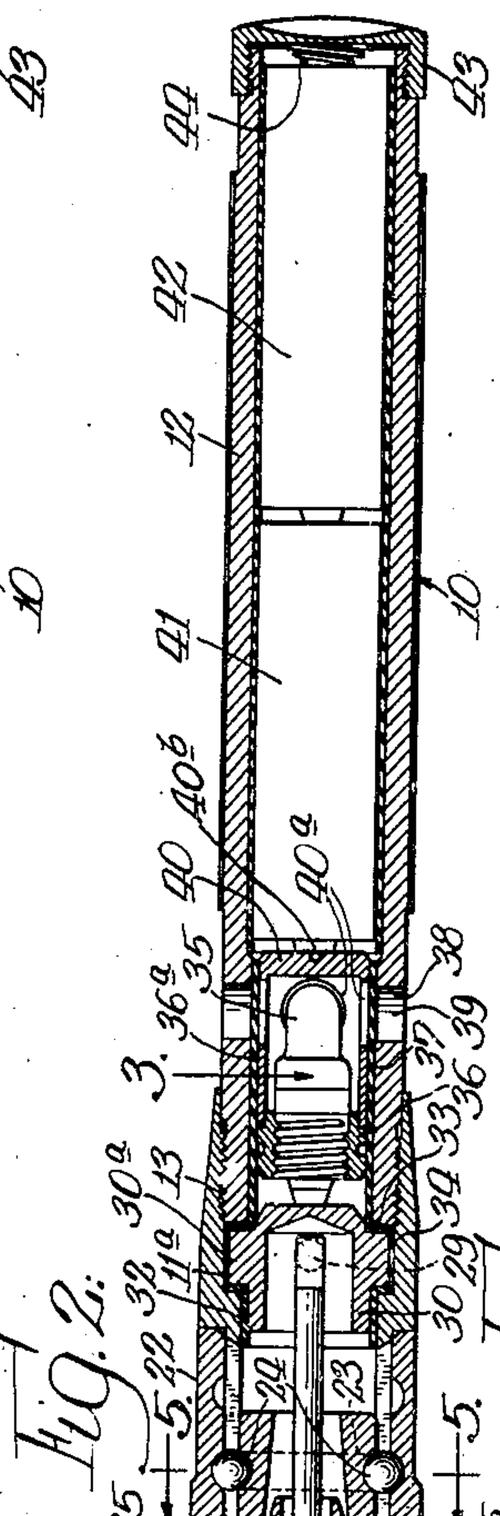

Fig. 2.

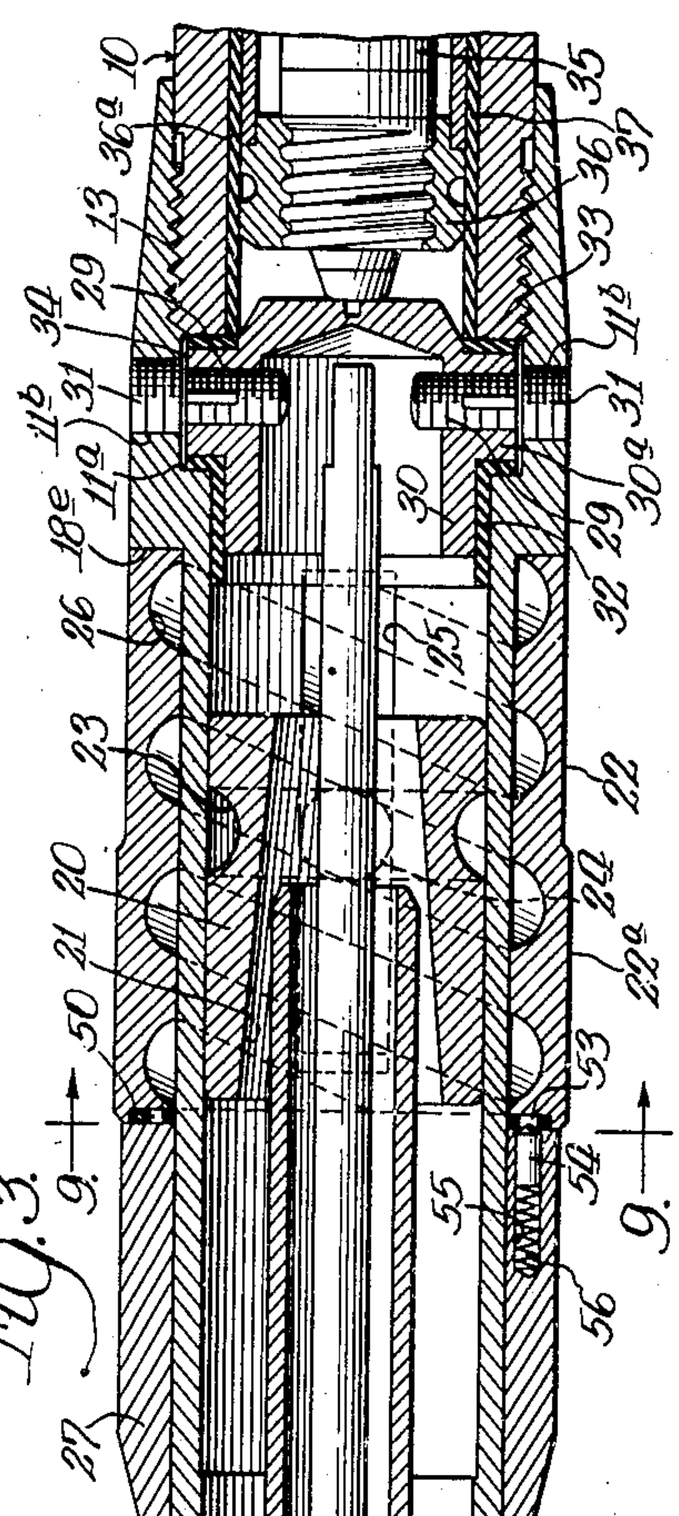

Fig. 3.

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Filed Dec. 2, 1943 2 Sheets-Sheet 2

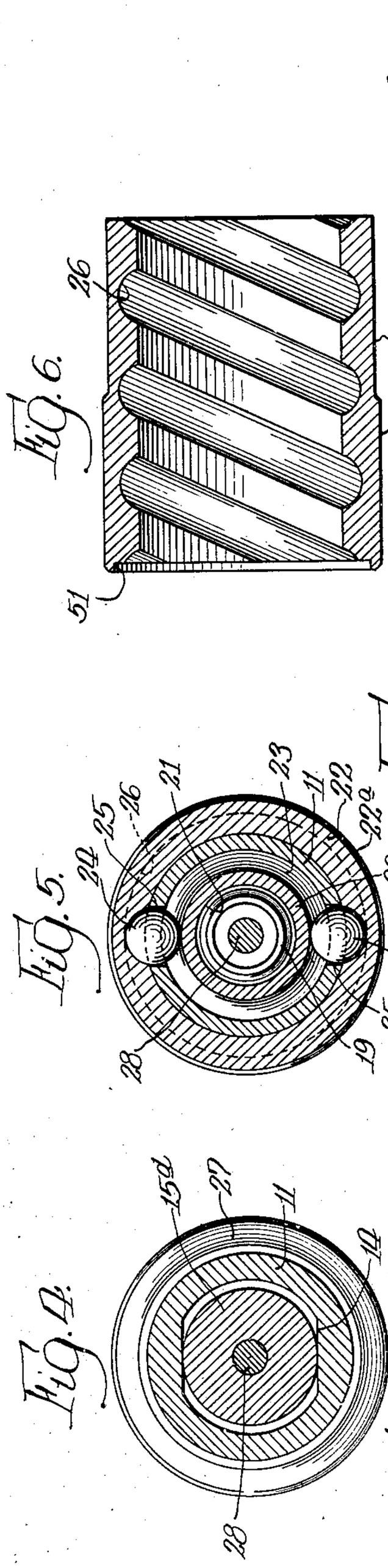

Fig. 6.

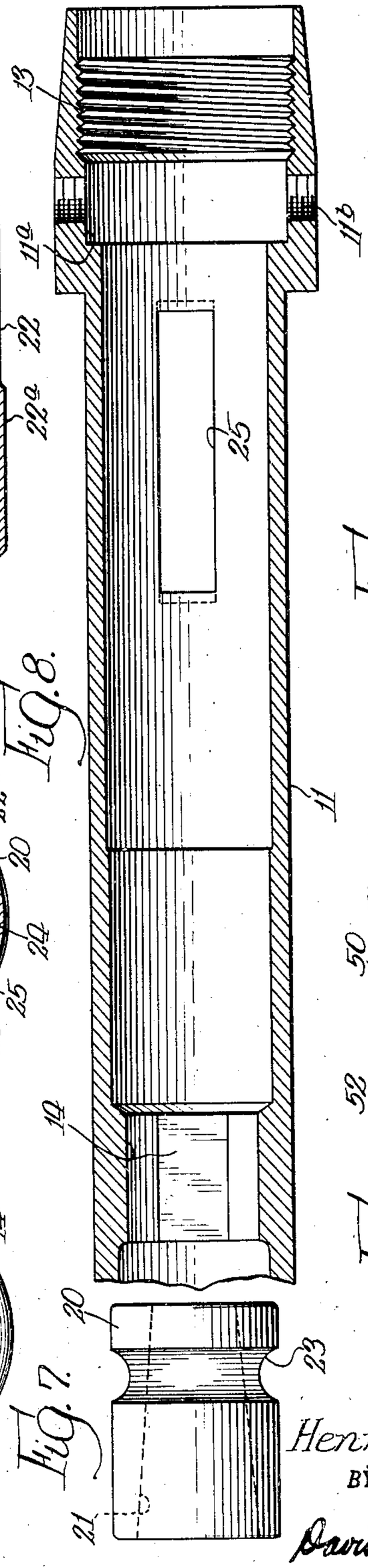

Fig. 8.

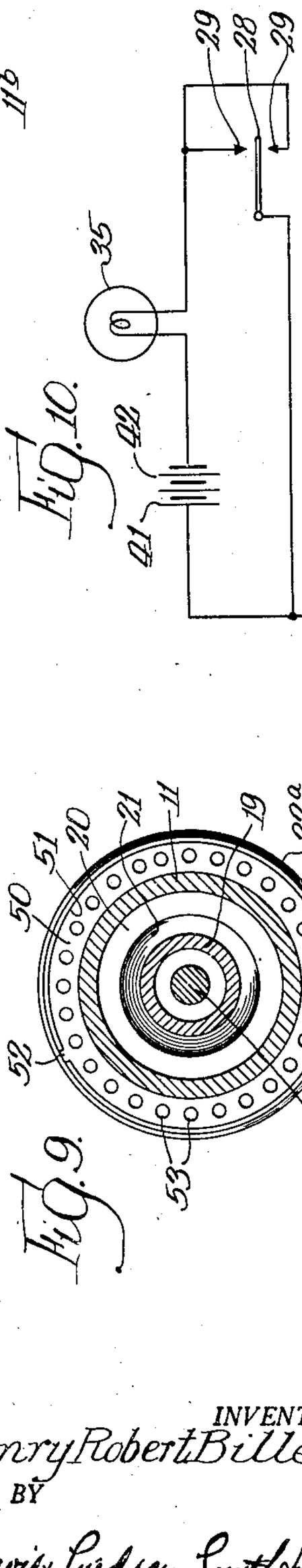

Fig. 10.

Fig. 5.

Fig. 9.

Fig. 4.

Fig. 7.

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2,486,103

UNITED STATES PATENT OFFICE

2,486,103

SIGNAL TYPE TORQUE INDICATING WRENCH

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Application December 2, 1943, Serial No. 512,560

22 Claims. (Cl. 81—52.5)

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My invention relates to torque indicating wrenches and it has to do more particularly with wrenches of the foregoing character adapted for indicating the force or torque applied thereby to work such as nuts, bolts, studs and the like.

One of the objects of my invention is to provide an improved torque indicating wrench of the foregoing character which is simple in construction, is compact, durable and of light weight, and which is adapted to indicate the force or torque applied in a highly accurate manner.

Another object is to provide an improved torque indicating wrench of the type wherein the application of a predetermined force or torque to the work is indicated by the giving of a signal such as the flashing of a light.

A further object is to provide an improved flash type torque indicating wrench wherein the entire wrench mechanism, including the flash signal means, is self-contained within a small and rigid casing.

Still another object is to provide an improved wrench of the foregoing character that may be easily and quickly adjusted to flash a signal upon the application of varying forces or pressures to the work, the arrangement being such that the operator may accurately preset the wrench to cause it to flash a signal upon the application of any force or torque to the work within a given force or torque range.

A further object is to provide a flash type torque indicating wrench having a minimum number of parts arranged to reduce wear to the minimum, thereby tending to insure uniform and accurate functioning of the torque indicating means at all times.

Another object is to provide a wrench of the foregoing character wherein wear, if it should occur, may be compensated for merely by adjustment of the indicating means thereby avoiding replacement of parts, and other repair work which would tend to take the wrench out of service for an appreciable length of time. This feature of my invention insures that the wrench will remain in service, functioning accurately, for a long time. By this feature of my invention I may also compensate for manufacturing inaccuracies, thereby facilitating the production of a highly accurate wrench in the first instance.

Still another object is to provide a torque indicating wrench of the flash type which may be easily and accurately calibrated to handle a large number of different pressure indications and which, once calibrated, will perform its torque indicating function accurately and in accordance with the calibrations initially made. In this re-

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spect my invention enables the use of an accurate, uniform scale which is easily read by the operator, thereby facilitating the adjustment of the wrench and inducing accurate handling thereof.

An additional object is to provide a torque indicating wrench of the foregoing character having a beam or spring bar member disposed between a pair of relatively displaceable members (one adapted to be engaged with the work and the other adapted to be grasped by the operator), the arrangement being such that the effective length of the beam or bar remains constant at all times in the operation of the wrench notwithstanding the adjustment of the wrench to indicate different or varied pressures applied to the work. This feature of my invention insures greater accuracy and avoids conditions tending to complicate calibration of the wrench.

A further object is to provide a wrench of the foregoing character wherein a signal is given when a predetermined force or torque is applied to the work by engaging a pair of relatively movable contact elements with each other to complete an electrical circuit, the arrangement being such that the force or torque at which the signal is given is varied solely by varying the distance the contact elements have to move to engage each other and complete the electrical circuit.

Still another object is to provide a wrench of the foregoing character wherein the extent of relative movement of the contact elements is determined by the extent of relative displacement of the relatively displaceable members which carry the contact elements, which latter relative displacement is determined by the extent of flexing of the constant-length beam or spring bar, the extent of flexing of which is determined by the force or torque or pressure applied to the work.

A more specific object is to provide a wrench of the foregoing character wherein the flexible bar or beam is fixedly secured at one end to one of the relatively displaceable members and its other end is adapted to engage an axially adjustable abutment on the other of the displaceable members, the arrangement being such that the relative movement of the contact elements to engage them is varied by shifting the beam or bar abutment axially without varying the effective flexing length of the beam or bar.

A further specific object is to provide a wrench of the foregoing character wherein the axially adjustable beam or bar abutment has a tapered surface adapted to be abutted by the free end of the beam when pressure is applied to the work, the arrangement being such that axial adjustment of the abutment relative to the beam varies

initial relative displacement of the displaceable members which carry the contact elements to thereby vary the relative movement of the contact elements required to engage them with each other when pressure is applied to the work.

A further specific object is to provide a wrench of the foregoing character wherein each of the relatively displaceable members carries an electrical contact element, which contact elements are normally spaced apart and which when engaged complete an electrical circuit for actuation of the flash means, the arrangement being such that the displaceable members are initially displaced to variable extents to initially space apart the contact elements to variable extents, to, in turn, vary the pressure at which the signal is given showing the application of a predetermined force or torque.

Further objects are to provide an arrangement of the foregoing character wherein at least one of the contact elements is adjustable relative to its support to predetermine an exact zero position of the wrench, and to vary the pressure at which the contact elements will become engaged in the use of any particular beam, and to compensate for wear, if any should occur, without recalibrating the wrench; to provide a wrench of the foregoing character wherein the beam, contact elements, and other operating parts are mounted in and retained in rigid alignment relative to a supporting casing or housing, thereby providing a compact self-contained unitary structure by which wear is reduced to the minimum and accuracy, notwithstanding rough handling and usage, is assured; to provide audible indexing means cooperating with the adjusting means for holding the latter in predetermined adjusted positions; to provide improved means for adjusting the bar or beam abutment axially of the beam, the arrangement being such that the accuracy of the wrench does not depend upon the fit of the abutment in its support, the abutment being capable of slight lateral shift movement under the pressure exerted by the end of the beam to seat such abutment uniformly at all times against its support when pressure is applied to the wrench; to provide a wrench of the foregoing character which always indicates and operates from an exact zero position; to provide a wrench having all of the foregoing advantages which is easy to assemble and disassemble in manufacture, repair, etc.; to provide a wrench of the foregoing character which is adapted to perform its functions in a highly efficient manner when the wrench is used to tighten either right-hand or left-hand work, the arrangement being such that when the wrench is applied to a piece of work it is operative to accurately register pressures applied either clockwise or counterclockwise; and to provide a wrench of the foregoing character which lends itself to the use of a simplified electrical circuit.

Other objects and advantages will become apparent as this description progresses and by references to the drawings wherein,

Figure 1 is a side elevational view of one form of wrench embodying my invention;

Fig. 2 is a longitudinal vertical sectional view of the wrench shown in Fig. 1;

Fig. 3 is an enlarged, partial plan sectional view of the wrench shown in Fig. 1 and is taken on line 3—3 of Fig. 2;

Fig. 4 is a section taken substantially on line 4—4 of Fig. 3;

Fig. 5 is an enlarged section taken substantially on line 5—5 of Fig. 2;

Fig. 6 is an enlarged separated longitudinal sectional view of the adjusting sleeve shown in Fig. 1;

Fig. 7 is an enlarged separated elevational view of the adjustable beam or bar abutment;

Fig. 8 is an enlarged separated longitudinal sectional view of the wrench casing section in which the beam or spring bar is mounted;

Fig. 9 is a section taken on line 9—9 of Fig. 3; and

Fig. 10 is a wiring diagram illustrating the electrical circuit embodied in the wrench shown in the drawings.

The wrench shown in the drawings comprises a cylindrical housing 10 (Figs. 2 and 3) having a forward or beam section or casing 11 and a rear or handle section or casing 12 rigidly and fixedly joined together as a single unit by a threaded connection 13. It is to be understood that this housing 10 may take any suitable shape but, preferably, cylindrical to provide a compact, lightweight and durable structure.

A so-called work-engaging member 15 is pivotally mounted in the forward end of the casing 11. The housing 10 and work-engaging member 15 are at times referred to herein as relatively displaceable members.

The work-engaging member 15 (Figs. 2–4) is provided with a parti-spherical head portion 15*a* which is adapted to seat at 15*b* against the wall of the casing 11 and which is retained pivotally within the casing by a pin 16 passing through an opening in the member 15 with its opposite ends journaled in suitably provided openings 17 in diametrically disposed portions of the casing 11. The forward end of the casing 11 is open and the work-engaging member 15 is provided with a forwardly projecting shank 15*c* which is adapted to receive a work-adapter 18 ((Figs 2 and 3). The shank 15*c* is provided with the usual spring-pressed ball adapted to seat in the inner end of either of two diametrically opposed openings 18*a* in the adapter 18 for latching the latter in place thereon. The adapter 18 is provided with a squared shank 18*b* of usual form having a spring-pressed ball adapted to latchingly secure a socket or other desired work-engaging means thereon. It is to be understood that the adapter 18 may take any suitable form necessary for carrying out the particular work for which the wrench may be used. For example, one may use an ordinary jaw-type adapter which is adapted to be engaged directly with the work without the use of further work-engaging means.

Relative rock movement or displacement between the work-engaging member 15 and the housing 10 is yieldingly opposed by a flexible beam when pressure is applied to the work. Specifically, the work-engaging member 15 is provided with a rearwardly extending arm 15*d*, which terminates in an integral tubular and flexible beam member 19. The end of the beam 19 opposite the work-engaging member 15 is free and is adapted to abuttingly engage an adjustable part on the casing when pressure is applied to the work thereby yieldably resisting relative movement of the work-engaging member and housing 10. The terms "pressure," "force" and "torque" are used synonymously herein.

The foregoing arrangement is such that, when pressure is applied to a piece of work through the wrench, the free end of the beam 19 is operably engaged with the casing 11 so that the pres-

sure applied to the handle 12 and casing 11 passes therefrom to the work-engaging member 15 solely through the beam 19. Whenever the pressure exerted is such, or the resistance offered by the work is such as to overcome the initial tension of the beam, the beam will flex, permitting relative displacement between the casing 11 and work-engaging member 15. However, in the normal or no-pressure condition of the wrench, and with the beam 19 disposed concentrically with respect to the casing, the beam is out of engagement with the casing and in the use of the wrench, when applied to a piece of work, a small displacement may be required between the members 11 and 15 to initially engage the beam 19 with the casing 11. In fact, when no pressure is applied to the wrench the free end of the beam 19 is more or less floating and it may assume any free position permitted within the casing; but whenever pressure is applied it is firmly engaged at its free end with the casing 11.

In carrying out my invention, the free end of the beam 19 is operably engaged with the casing 11 through an axially-adjustable sleeve 20 (Figs. 2, 3 and 7) mounted within the casing 11 and having an opening 21 which receives the free end of the beam 19. The sleeve opening 21 is of frusto-conical shape providing a beam-engaging wall tapering inwardly from the forward end to the rear end thereof. It will be seen that, by adjusting the sleeve 20 axially of the beam 19 the latter will have to be shifted to greater or lesser extent from a position concentric with the casing 11, dependent upon the direction of adjustment of the sleeve 20, to engage the free end of the beam or spring bar 19 with such sleeve and, in turn, operably engage the beam with the casing 11. With this arrangement, the spacing of electrical contacts (to be described hereinafter) carried by the work-engaging member 15 and the casing may be operably spaced apart to variable extents to indicate or signal different pressures—all without varying the effective flexing length of the beam 19.

The abutment sleeve 20 is operably connected to and adjustably shifted along the casing 11 by an adjusting sleeve 22 (Figs. 1–3, 6) having a knurled grip portion 22*a*. More particularly, the outer surface of the sleeve 20 is cylindrical and concentric with the inner wall of the casing 11, the same being of such size as to fit freely and slidably within the casing. The sleeve 20, intermediate its ends, is provided with an outer circumferential groove 23 in which are seated a pair of steel balls 24. The casing 11, at diametrically opposed points, and in a plane parallel with the axis of the work-engaging member 15, is provided with a pair of diametrically opposed slots 25 (Figs. 2 and 8) of sufficient width to snugly accommodate the balls 24 and of sufficient length to accommodate the range of adjustment of the sleeve 20. The balls 24 are of sufficient diameter to project through and beyond the slots 25 where they are seated in a pair of diametrically opposed helical grooves 26 formed in the inner wall of the adjusting sleeve 22. When the above-described parts are assembled, the groove 23 of the abutment sleeve 20 retains the balls 24 against axial displacement along such sleeve and, since the balls 24 are seated in the helical grooves 26, turning movement of the sleeve 22 propels the sleeve 20 forwardly or backwardly, dependent upon the direction of rotation of the sleeve 22. The sleeve 22 is confined against axial displacement by seating its rear end against a casing shoulder 18*e* and by confining its forward end by a collar 27 secured in position by a locking screw 27*a*.

When the adjusting sleeve 22 is rotated in the direction of the arrow of Fig. 1, the abutment sleeve 20 is shifted rearwardly relative to the free end of the beam 19, thereby increasing the distance that the free end of the beam 19 must be moved from a concentric position to engage the abutment sleeve 20; and when the sleeve 22 is rotated in the opposite direction, the distance referred to is decreased. In other words, when the adjusting sleeve 22 is rotated in the direction of the arrow of Fig. 1, the free end of the beam 19 is moved closer to the casing 11 in abuttingly engaging the abutment sleeve; and vice versa when the adjusting sleeve is rotated in the opposite direction. This arrangement, as will be more specifically pointed out hereinafter, spaces apart electrical contact elements on the work-engaging and casing members 15 and 11 to lesser or greater extents requiring lesser or greater flexing of the beam 19 to engage the contact elements with each other. Also, since the extent of flexing of the beam 19 depends on the pressure applied, the foregoing arrangement provides for adjustment of the wrench to signal various applied pressures without changing the effective flexing length of the beam 19.

The adjusting sleeve 22, forwardly of the knurled grip portion 22*a* thereof, is provided with a circumferential scale 22*b*. The wrench may be calibrated so that the scale lines are spaced to indicate inch pounds or foot pounds pressure in suitable increments from zero to the full capacity of the wrench. The scale lines are adapted to register with an indicating mark 22*c* on the casing 11, and the pressure which the wrench is set to indicate is that which is indicated by the particular scale mark that registers with the indicating mark 22*c*. The scale markings are uniformly spaced so that they may be easily read, this being possible because of my arrangement wherein different pressures may be indicated without varying the effective length of the beam 19.

It is desirable that the adjusting sleeve 22 be yieldably retained in adjusted position. I accomplish this by mounting an indexing ring 50 (Figs. 2, 3 and 9) between the sleeve 22 and the locking collar 27. More particularly, the forward end of the adjusting sleeve 22 is counter cut to provide a recess 51 that receives the ring 50 in concealed fashion, the ring 50 having one or more lugs 52 engaging slots in the sleeve 22 for causing the ring to rotate with the sleeve. The ring 50 is provided with a plurality of depressions 53, one for and corresponding to each mark on the scale 22*b*. These depressions 53 are adapted to receive the tapered nose of a pin 54 (Fig. 3) slidably mounted in an opening 55 in the locking collar 27 and yieldingly urged toward the ring 50 by a spring 56. With this arrangement, as the adjusting sleeve 22 is rotated, the pin 54 is engaged successively in the depressions 53, and any particular depression engaged corresponds to the scale mark registering with the indicating mark 22*c*. In this way, the adjusting sleeve 22 is not only held against accidental movement but an audible clicking sound is given when the sleeve is rotated, thereby aiding the operator in making any particular adjustment.

The contact elements hereinabove mentioned will now be described. The work-engaging member 15 carries a contact element which takes the form of an elongated rod 28 fixedly secured at its forward end to the arm 15*d* and extending

forwardly through the beam 19 beyond the free end thereof into the extreme rear end portion of the casing 11. The casing 11 is provided with a pair of diametrically opposed contact elements 29 at its extreme rear portion in alignment with the rearward end of the contact bar 28. These contact elements are disposed in a plane at right angles to the axis of the work-engaging member 15.

The contact elements 29 are adjustably mounted (Fig. 3). Specifically, the rear end of the casing 11 has its bore slightly enlarged to provide a shoulder 11*a* upon which is seated an enlarged annular flange 30*a* of a cup-shaped metallic contact carrier 30. The flange 30*a* of the contact carrier 30 is confined fixedly upon the shoulder 11*a* by the inner end of the handle section 12 which seats thereagainst. The contacts 29 take the form of metallic screws threaded into diametrically opposed openings in the carrier flange 30*a*, the outer ends of the screws or contacts being slit and slightly expanded so as to insure a tight gripping engagement between the screws and the carrier. The casing 11 is provided with openings 11*b* aligned with the outer ends of the contact screws 29, which openings are adapted to receive insulating screw plugs 31 protecting the contact screws and insulating the same at the ends thereof from the casing 11. Also, to insulate the contact carrier 30 from the casing and the handle, I provide annular insulating elements 32 and 33 disposed between the casing 11, handle 12 and carrier 30. The periphery of the enlarged flange of the contact carrier 30 is insulated from the casing 11 by making the same of slightly less diameter than the adjacent inner wall of the casing, providing thereat an insulating air gap 34. The free end of the contact element or rod 28 is flattened, and when it is engaged with either of the contact elements 29 an electrical circuit is closed and a lamp 35 is lighted. By providing two contacts 29, the wrench is adapted for signalling when it is operated in either a right or left hand direction.

The pressure at which the contact rod 28 will engage the contact element 29 depends upon the extent of displacement of the work-engaging member 15 and the casing 11 after the spring beam 19 is engaged with the sleeve 20 and, in turn, the distance that the free end of the rod 28 has to move in order to engage the contact element 29. That is to say, the distance that the contact element 28 has to move to engage the contact element 29, and thereby register a predetermined pressure, depends upon the extent of relative rock movement between the work-engaging member 15 and the casing 11 (after the beam 19 is engaged with the sleeve 20), which displacement is dependent upon the extent of flexing of the spring bar and the pressure applied. The inside diameter of the beam 19 and the outside diameter of the contact bar 28 are such that, giving the beam 19 its full deflection, the beam will not engage or interfere in any way with the contact bar 28.

The lamp 35 is mounted within the forward end of the handle 12. More particularly, the usual metallic threaded base portion of the lamp is screwed into a metallic ring 36 (Figs. 2 and 3) which is slidably received within a translucent plastic sleeve 37 that is snugly received within the forward end of the handle 12. This plastic sleeve 37 is preferably red in color and extends over openings 38 in the handle 12 and adjacent the

lamp 35. When the lamp 35 is lighted a red light, therefore, flashes through the openings 38. Preferably, to prevent dirt from getting inside the handle and upon the plastic sleeve 37, the openings 38 are plugged with a clear transparent or translucent plastic material 39.

The ring 36, with the lamp 35, is held in place by a cup-shaped sleeve 40, the open end of which embraces the ring 36, being seated against a shoulder 36*a* thereon. This sleeve 40 is provided with a plurality of openings 40*a* which align with the lamp 35 and handle openings 38 so that the flashing of the lamp 35 may be seen through the openings 38. The bottom of the sleeve 40 is provided with a kerf 40*b* so that it can be turned with a screwdriver or the like to properly align its openings 40*a* with the openings 38. The closed end or bottom of the sleeve 40 is engaged by a battery 41, upon which is seated a second battery 42, the entire group, including the batteries 41 and 42, sleeve 40, ring 36 and lamp 35, being urged forwardly and confined as a unit by a knurled cap 43 on the end of the handle and a spring 44 between the battery 42 and the cap 43. When these parts are urged forwardly as stated, the lamp 35, or the base portion thereof, is seated against the contact carrier 30. The plastic sleeve 37 insulates the lamp-retaining sleeve 40 and ring 36 from the handle 12.

When the parts are assembled as last described and as shown in Figs. 2 and 3, the following electrical circuit is provided for the lighting of the lamp 35 when the contacts 28 and 29 are engaged: The battery unit 41, 42 is grounded, as indicated in Fig. 10. The battery unit is connected on one side with the lamp 35 by way of the battery 41, sleeve 40, ring 36 and the base of the lamp. It is also connected with the contact element 29 through the lamp 35 and contact carrier 30. The battery unit is connected with the contact element 28 by way of the battery 42, spring 44, cap 43, handle 12, casing 11 and work-engaging member 15. So long as the contact element 28 is out of engagement with the contact element 29, this circuit is open, but when the contact elements 28 and 29 are engaged, the circuit is closed and the lamp 35 is lighted. That is to say, when the predetermined pressure determined by adjustment of the sleeve 22 is reached, the contacts 28 and 29 are engaged and the electric circuit is completed, the light is lighted, and the pressure is indicated.

It is desirable that relative displacement of the work-engaging member and the casing be limited to prevent over-flexing of the beam 19 as well as to protect the contact rod 28 and contacts 29 against excess pressure. To this end, the casing is provided with a thickened inner wall portion 14 adjacent the arm 15*d* of the work-engaging member. These parts are so arranged that the sides of the arm 15*d* are normally spaced but slightly (approximately .015 inch) from the wall 14. This spacing is sufficient to always insure full flexing of the beam 19 as well as engagement of the contact members 28 and 29 throughout the entire range of adjustment of the wrench. The spacing of the arm 15*d* will, of course, be varied to suit any particular size wrench.

In initially adjusting the wrench, the adjusting sleeve 22 is first rotated in the direction (indicated on scale 22*b*) of the arrow of Fig. 1 to the zero position. This positions the free end of the beam in the wider portion of the abutment sleeve 20. The work-engaging member 15 and casing 11 are then moved relatively to engage the free

end of the beam 19 with the abutment sleeve. When this is done, the contact element 28 should engage the contact element 29 if the wrench is properly set for zero reading on the scale 22b. If the contact elements are not then engaged, the contact 29 is adjusted to engage the contact 28 and when that is done the accurate zero position is established. It will be seen that adjustment of one contact screw 29 provides adjustment of the wrench for one direction of operation, and adjustment of the other provides independent adjustment of the wrench for the opposite direction of operation, and that when the two are correctly adjusted the wrench will function equally well in either direction of operation. The taper of the wall 21 of the abutment sleeve 20 is such that, upon adjustment of the sleeve 22 and axial shifting of the abutment 20, the beam end will engage at variable portions therealong corresponding to the increments of the scale 22b. The taper of the sleeve 20 and/or the increments of the scale may be varied to suit any desired condition of calibration.

In the use of the structure above described, the operator first determines the force or torque or pressure that he wishes to apply to the piece of work, that is, the extent to which he wants to tighten a piece of work. The adjusting sleeve 22 is then rotated to cause the pressure indicating mark on the scale 22b corresponding to the pressure to be indicated to register with the indicating mark 22c on the casing 11 (Fig. 1). The wrench is then applied to a piece of work, the handle is grasped and, if a right-hand thread is being set up, the wrench is rotated in a clockwise direction, as viewed in Fig. 3. The operator continues to set up the work, applying additional pressure as the work offers additional resistance, until he notes the flash of the lamp 35 through the openings 38 when the application of pressure is stopped. During the foregoing operation, when the sleeve 22 was adjusted, assuming that the sleeve 20 was in its zero position, the sleeve 22 was rotated in a direction opposite to that indicated by the arrow in Fig. 1, thereby moving the sleeve 20 forwardly upon the spring beam 19 and thereby spacing apart the contact elements 28 and 29, the extent of such spacing being dependent upon the pressure to be indicated as determined by adjustment of the sleeve 22. The pressure to be indicated is decreased by rotating the sleeve 22 in the direction of the arrow of Fig. 1, and vice versa when an increased pressure is to be indicated. The beam length remains constant at all times. Therefore, a greater flexing of the beam is required as the pressure is increased, and as the pressure is increased the members 15 and 11 are displaced to greater extents through the greater flexing of the beam. As the members 15 and 11 are displaced, the contact elements 28 and 29 are moved toward each other and they are finally engaged when the correct flexing and the correct displacement for the pressure set occurs. When the contact is made, the circuit is completed and the lamp 35 flashes, indicating that the predetermined pressure has been applied.

I believe that the construction and operation of my invention will be fully understood from the foregoing description. I also believe that those skilled in the art will readily appreciate, from the foregoing description, that my invention is fully capable of providing the advantages and accomplishing the objects hereinabove first stated.

I claim:

1. A torque indicating wrench comprising a pair of relatively movable members, one of which is a work-engaging member and the other a handle member, a resilient beam between said members and having one end fastened to and movable with said work-engaging member and its other end normally free and adapted to assume an abutting relation to said handle member upon initial relative movement of said members, means carried by said handle member and adjustable therealong relative to the free end of said beam for establishing the abutting relationship between said beam and handle member for transmitting an operating force from said handle member through the free end of said beam to said work-engaging member while maintaining a constant effective flexing length for said beam, a contact element carried by each of said members and adapted for engagement with each other beyond the free end of the beam when said members are relatively moved to an extent determined by the flexing of said beam subsequent to the free end of said beam moving into abutting relation to said handle member, adjustment of said force transmitting abutment means relative to the free end of said beam being adapted to vary the extent said contact elements must move to engage each other and, in turn, the pressure indicated.

2. A torque indicating wrench which comprises a pair of relatively displaceable members, work-engaging means associated with one of said members, a contact member and a resilient torque transmitting member each having one end free and the other end fixedly connected to one of said displaceable members, said contact and torque transmitting members being relatively movable, an adjustable abutment adjacent the free end of said torque transmitting member and the other of said displaceable members, the abuttable surface of said abutment being so shaped that said torque transmitting member abuts it upon relative movement of said pair of members at greater or lesser distances, dependent upon the direction of adjustment, while maintaining the effective length of said torque transmitting member constant, and a contact element on the other of said displaceable members adapted to engage the free end of said contact member beyond the free end of said torque transmitting member upon sequential relative displacement of said pair of members and relative movement of said contact member and torque transmitting member to extents determined by adjustment of said abutment.

3. A torque indicating wrench comprising a pair of members pivotally connected together, one being adapted for connection with the work and the other being adapted to have pressure applied thereto, a contact element carried by each of said members and adapted to be engaged with each other, a resilient beam secured at one end to said work-engaging member with its other end free, an abutment carried by said pressure member at a point between the pivotal connection of said members and the point of engagement of said contact elements and adjustable along said beam and adapted to be abutted by the free end of said beam upon relative movement of said members, the beam-abutting surface of said abutment being tapered so that, with said beam abutting said abutment, said beam must flex to greater or lesser extent to enable said beam and said pressure member to move as a unit to greater or lesser extent to cause the engagement of said contact elements.

4. A torque indicating wrench comprising a pair of members pivotally connected together for relative movement, one being adapted for connection with the work and the other being adapted to have pressure applied thereto, a contact element carried by each of said members and fixed against axial movement relative thereto and adapted to be engaged with each other upon relative movement of said members, a resilient beam fixedly carried at one end by said work-engaging member with its other end free, an adjustable abutment carried by the pressure application member for axial adjustment relative thereto and adapted to be abutted by and adjustable relative to the free end of said beam at a point between the pivotal connection of said members and the point of engagement of said contact elements when the wrench is engaged with the work and pressure is applied thereto, the beam-engaging surface of said abutment being tapered in the direction of the axis of said beam whereby adjustment of said abutment relative to the end of said beam operatively positions the pressure application member closer to or farther from the free end of the beam, in turn varying the relative movement of said work-engaging and pressure application members upon initial application of pressure to the work, in turn varying the distance said beam and pressure members must move as a unit to cause engagement of said contact elements, and in turn varying the pressure to be indicated.

5. A torque indicating wrench comprising a pair of members connected together for relative movement, one being adapted for connection with the work and the other being adapted to have pressure applied thereto, a contact element fixedly carried by each of said members and adapted to be engaged with each other, a resilient beam fixedly carried at one end by said work-engaging member with its other end free, an abutment adjustably carried by the pressure application member and adapted to be abutted by the free end of said beam upon relative movement of said members, which occurs when the wrench is engaged with the work and pressure is applied thereto, the beam-engaging surface of said abutment being tapered in the direction of the axis of said beam whereby adjustment of said abutment relative to the end of said beam operatively positions the pressure application member closer to or farther from the free end of the beam, in turn varying the relative movement of said work-engaging and pressure application members upon initial application of pressure to the work, in turn varying the distance said beam and pressure members must move as a unit to cause engagement of said contact elements, and in turn varying the pressure to be indicated, means carried by said pressure application member independently of said abutment for adjusting said abutment, and means for indicating the extent of adjustment of said adjustable means and, in turn, the pressure to be indicated.

6. A torque indicating wrench comprising a pair of members connected together for relative movement, one being adapted for connection with the work and the other being adapted to have pressure applied thereto, a contact element carried by each of said members and adapted to be engaged with each other, a resilient beam fixedly carried at one end by said work-engaging member with its other end free and located between the point of connection of said members

and the point of engagement of said contact elements, an adjustable abutment carried by the pressure application member and adapted to be abutted by the free end of said beam upon relative movement of said members, which occurs when the wrench is engaged with the work and pressure is applied thereto, the beam-engaging surface of said abutment being tapered in the direction of the axis of said beam whereby adjustment of said abutment relative to the end of said beam operatively positions the pressure application member closer to or farther from the free end of the beam, in turn varying the relative movement of said work-engaging and pressure application members upon initial application of pressure to the work, in turn varying the distance said beam and pressure members must move as a unit to cause engagement of said contact elements, and in turn varying the pressure to be indicated, means for adjusting said abutment axially of said beam, and means for yieldably retaining said adjusting means in adjusted position, said retaining means providing audible indication of the adjustment made.

7. A torque indicating wrench comprising a work-engaging member, a manually movable member movable relative to said work-engaging member, a pair of contact elements carried by the respective members and adapted to engage each other, a resilient tubular beam carried by said work-engaging member, and a sleeve carried by said manually movable member and having a conical interior surface engageable with the free end of said beam, said sleeve being adjustable longitudinally of the beam to vary the extent of flexing of said beam and consequently the load necessary to effect such flexing at the time of engagement of said contact elements, one of said elements comprising a bar extending through said beam and being engageable with the other element beyond the end of the beam.

8. A torque indicating wrench comprising a work-engaging member, a manually movable member movable relative to said work-engaging member, a pair of contact elements carried by the respective members and adapted to engage each other, a resilient tubular beam carried by said work-engaging member, and means carried by said manually movable member and engageable with the free end of said beam, said means being adjustable to vary the extent of flexing of said beam and consequently the load necessary to effect such flexing at the time of engagement of said contact elements, one of said elements comprising a bar extending through said beam and being engageable with the other element beyond the end of the beam.

9. A torque indicating wrench comprising a work-engaging member, a tubular manually movable member enclosing a portion of said work-engaging member and pivotally connected thereto, a pair of contact elements carried by the respective members and adapted to engage each other upon relative pivotal movement of said members, a resilient tubular beam rigidly connected at one end to said work-engaging member and extending generally centrally within the manually movable member, and a sleeve mounted within said manually movable member and having a conical interior surface engageable with the free end of said beam upon relative pivotal movement of said members, said sleeve being adjustable longitudinally of the beam to vary the extent of flexing of the beam and consequently the load necessary to effect such flexing at the time of

engagement of said contact elements, one of said contact elements extending radially within said manually operable member and the other comprising a bar rigidly secured at one end to said work-engaging member and extending through said beam with its free end adjacent said one element.

10. A torque indicating wrench comprising a work-engaging member, a manually movable member movable relative to said work-engaging member, a pair of contacts carried by the respective members and adapted to engage each other upon relative movement of said members, a resilient tubular beam carried by said work-engaging member, and a pair of abutment surfaces, one being provided on the free end of said beam and the other provided on an element carried by said manually movable member for adjustment longitudinally of the beam, one of said surfaces being conical whereby said adjustment varies the spacing of said contacts at the time said surfaces first engage, one of said contacts comprising a bar extending through said beam and being engageable with the other contact beyond the end of the beam.

11. A torque indicating wrench comprising a work-engaging member, a tubular manually movable member enclosing a portion of said work-engaging member and pivotally connected thereto, a pair of contacts, one carried by said work-engaging member and the other rigidly secured to and extending inwardly from the tubular member, a resilient tubular beam rigidly connected at one end to said work-engaging member and extending generally centrally within said tubular member, and a pair of abutment surfaces one being provided on the free end of said beam and the other being provided on a sleeve slidably carried by and within said tubular member for adjustment longitudinally of the beam, one of said surfaces being conical whereby said adjustment varies the spacing of said contacts at the time said surfaces first engage, one of said contacts comprising a bar extending through said beam and being engageable with the other contact beyond the end of the beam.

12. A torque indicating wrench comprising a work-engaging member, a tubular manually movable member enclosing a portion of said work-engaging member and pivotally connected thereto, a pair of contact elements carried by the respective members and adapted to engage each other upon relative pivotal movement of said members, a resilient tubular beam rigidly connected at one end to said work-engaging member and extending generally centrally within the tubular member, a sleeve slidably carried by and within said tubular member and having a conical interior surface engageable with the free end of said beam upon relative pivotal movement of said members, and a second sleeve rotatably mounted on the exterior of said tubular member for adjusting the first mentioned sleeve longitudinally of the beam to vary the spacing of said elements at the time said sleeve and said beam first engage, one of said elements comprising a bar extending through said beam and being engageable with the other element beyond the end of the beam.

13. A torque indicating wrench comprising a work-engaging member, a tubular manually movable member enclosing a portion of said work-engaging member and pivotally connected thereto, a pair of contact elements carried by the respective members and adapted to engage each other upon relative pivotal movement of said members, a resilient tubular beam rigidly connected at one end to said work-engaging member and extending generally centrally within the tubular member, a sleeve slidably carried by and within said tubular member and having a conical interior surface engageable with the free end of said beam upon relative pivotal movement of said members, a second sleeve rotatably mounted on the exterior of said tubular member, and means extending through said tubular member for connecting said sleeves to effect longitudinal adjustment of the first mentioned sleeve upon rotation of the second mentioned sleeve, the adjustment of said first mentioned sleeve varying the spacing of said elements at the time said first mentioned sleeve and said beam first engage, one of said elements comprising a bar extending through said beam and being engageable with the other element beyond the end of the beam.

14. A torque indicating wrench comprising a work-engaging member, a tubular manually movable member enclosing a portion of said work-engaging member and pivotally connected thereto, a pair of contact elements carried by the respective members and adapted to engage each other upon relative pivotal movement of said members, a resilient tubular beam rigidly connected at one end to said work-engaging member and extending generally centrally within the tubular member, a sleeve slidably carried by and mounted within said tubular member and having a peripheral annular groove, a second sleeve rotatably mounted on the exterior of said tubular member and having a helical internal groove, said tubular member having a longitudinal groove opening into said peripheral groove and said helical groove, and a ball positioned in all of said grooves whereby rotation of said second sleeve effects longitudinal sliding movement of said first sleeve, said first mentioned sleeve having a conical interior surface engageable with the free end of said beam upon relative pivotal movement of said members, the longitudinal adjustment of said first mentioned sleeve adapted to vary the spacing of said elements at the time said first mentioned sleeve first engages said beam, one of said elements comprising a bar extending through said beam and being engageable with the other element beyond the end of the beam.

15. A torque indicating wrench comprising a work-engaging member, a tubular manually movable member pivotally connected to said work-engaging member, a pair of contact elements carried by the respective members and adapted to engage each other upon relative pivotal movement of said members, a resilient tubular beam rigidly connected at one end to said work-engaging member and extending generally centrally within the tubular member, a first sleeve mounted within and slidably carried by said tubular member and having a conical interior surface engageable with the free end of said beam upon relative pivotal movement of said members, a second sleeve rotatably mounted on the exterior of said tubular member for adjusting said first mentioned sleeve longitudinally of the beam to vary the spacing of said elements at the time said first sleeve and said beam first engage, said second sleeve having a plurality of depressions in one of its end surfaces, and a collar fixed on said tubular member in face-to-face relation with said end surface and having a spring-pressed longitudinally movable pin engageable in said depressions to prevent accidental rotation of said

second sleeve and to provide an audible click upon intentional rotation thereof, one of said elements comprising a bar extending through said beam and being engageable with the other element beyond the end of the beam.

16. A torque indicating wrench which comprises a pair of relatively displaceable members, work-engaging means associated with one of said members, a resilient beam having one end carried by one of said members with its other end free, a pair of abutment surfaces one being provided on the free end of said beam and the other being provided on a part adjustably carried by the other of said members, and a pair of contact elements carried by the respective members, the contact element carried by said one member extending and engageable with the other contact element beyond the free end of the beam, one of said abutment surfaces being tapered whereby adjustment of the adjustable part varies the spacing of said contact elements at the time said abutment surfaces first engage.

17. A torque indicating wrench which comprises a pair of relatively displaceable members, work-engaging means associated with one of said members, a resilient beam carried by one of said members and having a free end, a pair of abutment surfaces one being provided on the free end of said beam and the other being provided on a part carried by and adjustable longitudinally of the other of said members, and a pair of contact elements one carried by said one member and engageable with the other contact element beyond the free end of said beam, the other contact element being secured to said other member against movement axially thereof, one of said abutment surfaces being tapered whereby adjustment of the adjustable part varies the spacing of said contact elements at the time said abutment surfaces first engage.

18. A torque indicating wrench which comprises a pair of relatively displaceable members, work-engaging means associated with one of said members, a resilient beam carried by one of said members and having a free end, a pair of abutment surfaces one being provided on the free end of said beam and the other being provided on a part adjustably carried by the other of said members, an adjusting member for adjusting the adjustable part and carried by said other member independently of said adjustable part, and a pair of contact elements carried by the respective members and engageable with each other beyond the free end of the beam, one of said abutment surfaces being tapered whereby adjustment of the adjustable part varies the spacing of said contact elements at the time said abutment surfaces first engage.

19. A torque indicating wrench comprising a pair of relatively movable members, one of which is adapted to be engaged with the work and the other of which is adapted to have pressure applied directly thereto, a resilient beam between said members, means for fixedly connecting said beam to one of said members with its other end normally free with respect to the other of said members, adjustable means for effecting an abutting relation between the free end of said beam and said other member upon initial relative movement of said members and for transmitting force from said beam to the other of said members upon relative movement of said members subsequent to the establishment of said abutting relation, said adjustable means including a first adjustable member adjustably carried by said

other member, a contact element carried by each of said members adapted to engage each other when said members are moved relatively a predetermined extent after said abutting relation is established and means, including a second adjustable member movably carried by said other member independently of said first adjustable member for adjusting said first adjustable means for varying the distance said members move relatively after the establishment of said abutting relation to engage said contact elements with each other.

20. A torque indicating wrench which comprises a pair of relatively movable members, one a handle member and the other a work-engaging member, a resilient beam carried by one of said members with one of its ends free and adapted to abut the other of said members for the application of pressure therethrough upon an initial predetermined relative movement of said members, a contact element carried by each of said members adapted to engage each other beyond the free end of said beam upon a further predetermined relative movement of said members after said initial predetermined relative movement, and means carried by one of said members and adjustable axially of said beam and independently of said contact elements for varying said initial predetermined relative movement of said members and, in turn, said further predetermined relative movement to vary the pressure indicated.

21. A torque indicating wrench including a tubular handle member having a tubular body portion, a tubular flexure member within said body portion pivotally connected thereto and having an exterior end adapted to be connected to a work head, an internally tapered sleeve encompassing the interior end of said flexure member and supported within said body portion for axially adjustable positioning relative to said interior end whereby the spacing between said interior end and said internal taper is varied within predetermined limits, said sleeve being connected to and movable with said handle member and providing an initial movement of said handle member without transmission of torque to said flexure member until said tapered member engages the interior end of said flexure member, subsequent movement of said handle member being operative to transmit torque load through said flexure member to said work head, signal means including relatively movable normally spaced elements, contact therebetween being operative to energize said signal means, one such element being movable with the handle member, said initial movement of said handle member being operative to decrease the normal spacing between said elements, and said subsequent movement being operative to close contact between said elements upon application of a predetermined applied torque to the handle member.

22. A torque indicating wrench comprising, a handle member having a relatively movable work head attached thereto, a flexure member of tubular form attached to said work head, spaced abutment means on said handle member engageable with said flexure member to transmit torque from the handle member to the work head, and signal actuating means including an electrical circuit closing element secured to said work head and extending axially through the tubular flexure member.

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