C. E. LAPP & W. H. HARRISON.

CASING PERFORATOR.

APPLICATION FILED MAR. 11, 1909.

939,917. Patented Nov. 9, 1909.

Fig. 1.

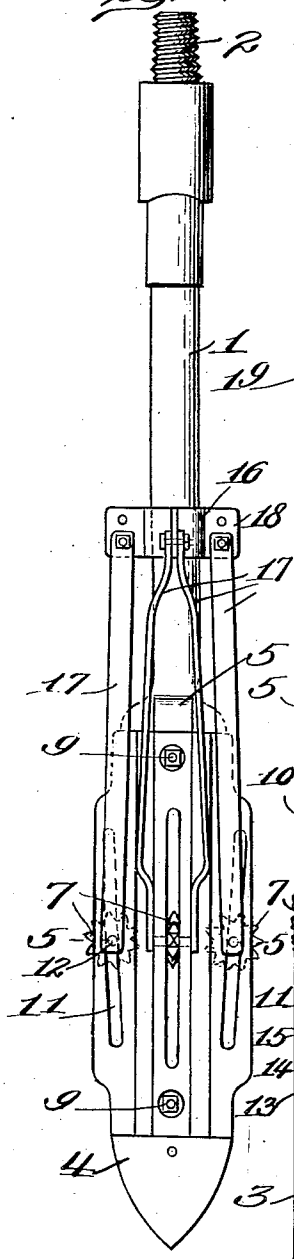


Fig. 2.

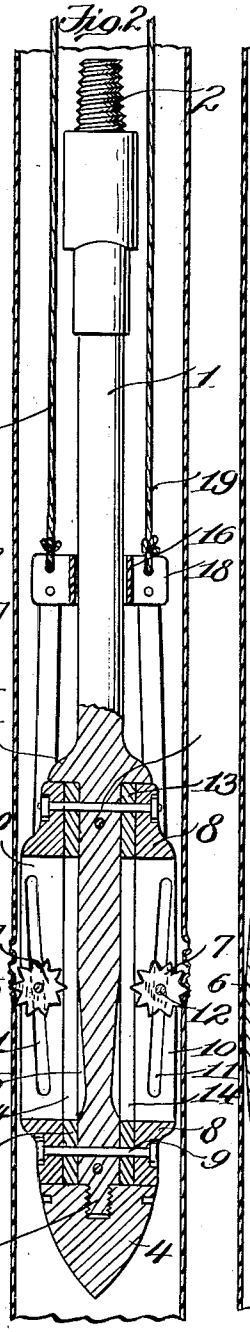


Fig. 3.

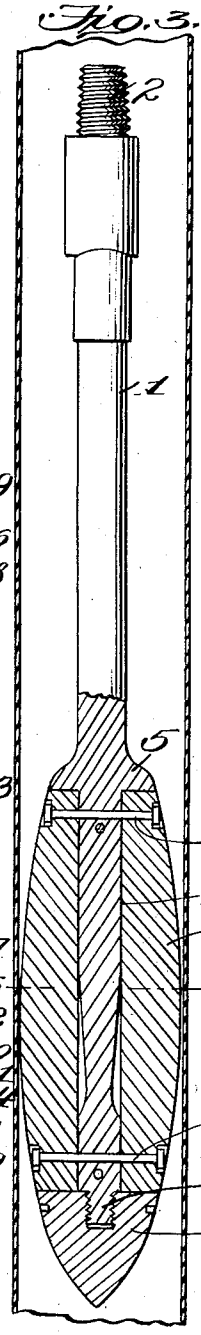


Fig. 4.

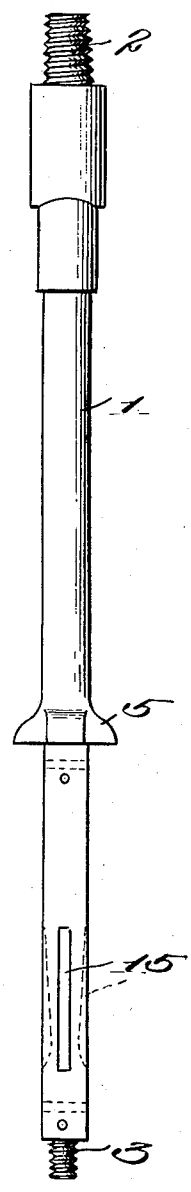


Fig. 5.

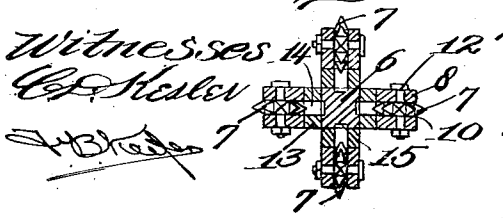
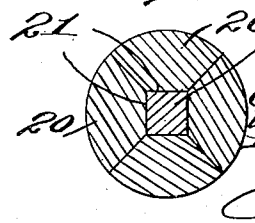


Fig. 6.



Witnesses.

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UNITED STATES PATENT OFFICE.

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CASING-PERFORATOR.

939,917. Specification of Letters Patent. Patented Nov. 9, 1909.

Application filed March 11, 1909. Serial No. 482,734.

To all whom it may concern:

Be it known that we, CLEMENS E. LAPP and WILLIAM H. HARRISON, citizens of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in Casing-Perforators, of which the following is a specification.

This invention relates to new and useful improvements in casing perforators for use in connection with deep well tubes and the invention includes also a tool bar of novel construction, whereby said bar may not only be employed in connection with the perforator elements but also in connection with swaging elements in a manner to be set forth.

The perforator includes generally a plurality of perforating wheels movable radially with respect to the tool bar and in connection with a structure of this general type, the invention has as a primary object the provision of novel means for automatically setting and releasing the perforating wheels, the parts being so organized that the jamming of the tool within the tube is rendered practically impossible.

The invention also includes novel means for adjusting the working diameter of the tool to correspond to the different diameters of the pipes which are employed in the practice of the art.

The invention also includes a novel organization of parts whereby the pressure during the perforating operation is placed upon the tube or pipe along, at least, four equidistant lines. This action tends to maintain the pipe of true annular cross section, whereas, in a number of devices known to the art, the arrangement of the perforating punches is such that the annular outline of the casing is distorted into a somewhat oval form during the perforating operation.

The structural details will be set forth at length in the following description which is to be read in connection with the accompanying drawings wherein is illustrated a preferred and advantageous embodiment of the invention, and the features which possess novelty and utility will be set forth in the formal claims succeeding the description.

In the said drawings: Figure 1 is an elevation of a casing perforator constructed in accordance with the present invention. Fig. 2 is a central longitudinal sectional view of the perforator showing in detail the construction of the novel tool bar. Fig. 3 is a similar view showing the manner in which the tool bar may be employed in connection with swage elements. Fig. 4 is an elevation of the tool bar *per se*. Fig. 5 is a horizontal section on the line 5—5 of Fig. 1, illustrating the relation of the perforator elements. Fig. 6 is a horizontal section on the line 6—6 of Fig. 3, illustrating the relation of the swage elements.

Similar characters of reference refer to corresponding parts throughout the several views.

The tool bar upon which all the working parts are assembled is indicated by the numeral 1 and has its upper end portion suitably threaded, as at 2, for attachment to a drilling tool. The lower end portion of the bar 1, as 3, is of somewhat reduced diameter and is threaded to engage in a heavy conical cap member, as 4, which, by virtue of its form serves as a guide to facilitate the movement of the tool axially of the tube and to prevent the tool from catching against any irregularities on the inner surface of the pipe when the tool is being lowered.

At some distance from its lower end the bar 1 is formed with a projecting flange, as 5, and the portion of said bar below said flange is of flat sided cross section, preferably square as shown at 6, in Figs. 5 and 6. A flat sided cross section is preferred because of the convenience it affords in assembling either perforator or swaging tool elements upon said bar and a square outline is preferred because the distribution of the pressure of the perforating punches along, at least, four equidistant lines, tends to maintain the true annular outline of the casing, as above intimated.

In Figs. 1, 2 and 5, the bar 1 is employed in connection with perforator elements, which are in themselves of novel construction and relation and which are assembled in a novel relation with respect to the bar 1. The perforating punches, as 7, are preferably in the form of toothed rollers and are mounted slidably, in supporting blocks, as 8, one of which is disposed adjacent each flat face of the bar 1. The blocks 8 are held in such relation by connecting pins or bolts, as 9, which extend through the bar 1 and connect the oppositely located blocks at the upper and lower ends thereof. Each block 8 is formed with a longitudinal slot, as 10,

between its outer and inner faces and with elongated, outwardly and upwardly inclined slots, as 11, between their side faces. The rollers 7 are disposed in the slots 10 and the pins 12 upon which said rollers are mounted are disposed in the slots 11 and project at each end beyond the sides of the blocks 8.

When it is desired to increase the diameter of the tool to correspond to the diameter of the casing, adjusting plates, as 13, are employed, the arrangement thereof being shown more particularly in Figs. 2 and 5. The plates 13 are interposed between each block 8 and the adjacent flat face of the bar 1, and are held by the pins or bolts 9 by means of which the blocks 8 are assembled. The plates 13 are each formed with a longitudinal slot 14 which registers with the slot 10 and into which the teeth of the rollers 7 project when said rollers are in certain positions. The bar 1 is formed in its lower portion with four equidistant longitudinal grooves, as 15, which register with the slots 14 and are provided to receive the teeth of the rollers when the latter are in their innermost and lowermost positions. Whether or not the teeth of the rollers will project into the grooves 15 will depend of course on the diameter of the rollers and on the presence or absence of the adjusting plates. It will be apparent that the plates 13 may be made of any desired thickness in accordance with the diameter of pipe for which the tool is to be adjusted or more than one of the plates 13 may be employed in connection with each block, if necessary, to obtain the desired adjustment.

It will be apparent that as the rollers 7 move upwardly in the slots 10, they will at the same time move outwardly and radially from the bar 1, by reason of the upward and outward inclination of the slots 11 which are in effect guides and through which are extended the axes 12 of said rollers. In like manner, as the rollers 7 move downwardly in the slots 10, they will at the same time move inwardly and radially with respect to the bar 1. Positive means is provided for accomplishing the upward or downward movements of the rollers 7 with respect to the bar 1, and such means preferably comprises a collar, as 16, slidably mounted upon the upper portion of the bar 1 and from which depend arms, as 17, arranged in pairs and at their lower ends carrying the pins 12. The collar 16 may be of any suitable construction, being made preferably in two or more detachably connected sections, for convenience of assemblage, and provided with radially extending wings, as 18, of which four are employed in the present instance. The arms 17 are pivoted in pairs to each wing 18 and have their body portions offset so as to pass into the spaces between the blocks 8. The pins 12 are detachably connected to the lower ends of said arms and said pins may be readily removed when it is desired to replace the rollers by others of larger or smaller diameter. The collar 16 is also connected to ropes, as 19, by means of which the axial movements of the collar and consequently the operative or inoperative positions of the rollers may be controlled.

In Figs. 3 and 6, the bar 1 is shown as employed in connection with swage elements, as 20, which are in the form of quarter segments and have their outer faces curved in cross section, as shown in Fig. 6, and longitudinally, as shown in Fig. 3. The curved faces of the segments 20 are flush with one another and also with the adjacent faces of the flange 5 and cap member 4 between which said segments are held by pins or bolts, as 9', which connect the oppositely located segments and extend through the bar 1, similarly to the pins or bolts 9. The segments 20 have their inner faces, as 21, flat and of the same size as the flat faces of the bar 1 against which the faces 21 rest. The provision of the flat faces 21 facilitates the convenient assemblage of the segments 20 and allows of the latter being readily centered with relation to the flat faces of the bar 1. When all the segments 20 are assembled a heavy swaging tool is provided which tapers toward its ends and which is of greatest diameter at its center. This outline allows of the ready movement of the swage through the casing and prevents the tool from catching against surface irregularities.

The construction of the bar 1 as herein described is of especial advantage in the practice of the art for the reason that the perforating and swaging operations are related, the latter operation usually succeeding the former. Consequently the advantage of the interchangeability of the elements which are assembled upon the bar 1 will be readily apparent, it being obvious that the removal of the bolts 9 and the collar 16 and the changing of the tool elements are all that is necessary to change the tool from a perforator to a swage and vice versa, from a swage to a perforator.

In using the perforator, the ordinary drilling tools with the perforator attached, instead of the bit, are lowered to the point at which the openings are to be formed. The ropes 19 are then secured and the perforator lowered. This results in spreading the rollers 7, the latter consequently perforating the casing as shown in Fig. 2, and when the upper ends of the slots 11 engage the pins 12, the rollers will be lowered with the perforator, revolving as they travel downwardly in the casing and punching a hole with each tooth. When the perforating operation has been completed, the tool is

raised and as the roller axes move toward the lower ends of the slots 11, the rollers 7 approach one another until they are free from the sides of the pipe.

The perforator may be employed with a full set of tools or an additional set of bars, if needed, and it will be understood that when the perforator is lowered and the ropes 19 secured so that a relative axial movement of the tool bar and the perforating wheels is produced the wheels are automatically caused to have an outward lateral movement to engage the casing and when the perforator is raised the wheels automatically disengage the casing. By virtue of this automatic engaging and disengaging action in the manner described, the jamming of the tool is rendered practically impossible.

The parts are of simple and inexpensive construction and may be readily and quickly set up, dismantled and interchanged.

Having fully described our invention, we claim:

1. As a new article of manufacture, a tool bar having flat faces and having apertures extending through the flat faced portion, combined with tool elements, individually seated against said flat faces and coextensive therewith and fastening bolts passed through said apertures and holding said tool elements assembled.

2. As a new article of manufacture, a tool bar having flat faces, combined with tool elements coextensive with the flat faces and means removably securing said tool elements upon said tool bar and seated against the flat faces thereof for removal laterally therefrom.

3. In a casing perforator, in combination, a tool bar, a plurality of radially disposed blocks mounted on said tool bar and provided with upwardly and outwardly inclined guide means, perforating means movably associated with each block and having a pin engaged in said guide means, a member axially slidable on said tool bar and arms connecting said member and said perforating means whereby the latter are moved by the former.

4. In a casing perforator, in combination, a tool bar, blocks assembled upon the tool bar, perforating means carried by the blocks, and means for adjustably positioning the blocks at desired positions radially away from the tool bar.

5. In a casing perforator, in combination, a tool bar, blocks assembled upon the tool bar, perforating means carried by the blocks and spacing and adjusting plates interposed between the bar and the blocks.

6. In a casing perforator, in combination, a tool bar having a flat faced portion provided with apertures, a radially projecting block disposed adjacent each flat face of said bar, perforating means associated with the block in a coincident radial plane and bolts extending through the apertures and connecting the oppositely located blocks.

7. In a casing perforator, in combination, a tool bar, a plurality of blocks mounted on said tool bar and provided with upwardly and outwardly inclined slots between their side faces and longitudinal slots between their inner and outer faces, perforating rollers disposed in the longitudinal slots, pins carrying the rollers and disposed in the inclined slots, a collar slidably mounted on the tool bar and provided with radially projecting wings and arms pivoted to said wings and carrying said pins.

8. As a new article of manufacture, a tool bar having a projecting flange, and a tool carrying portion disposed below the flange and provided with an enlarged conical end, a plurality of tool elements and means for assembling the tool elements on the tool carrying portion, between the flange and the conical end, for lateral removal from said portion.

9. As a new article of manufacture, a tool bar having a tool carrying portion, a plurality of tool elements assembled upon the tool carrying portion for removal laterally therefrom, and a conical cap member secured to the end of the tool carrying portion for removal therefrom independently of the tool elements.

10. In a casing perforator, in combination, a tool bar having a plurality of radially disposed blocks, each provided with an inclined guide slot, perforating rollers having axial pins disposed in the guide slots, a collar surrounding the tool bar for axial movement, and means operated by the collar for producing relative movements of the blocks and the pins to cause the simultaneous radial projection or retraction of the rollers with respect to the blocks.

In testimony whereof we have hereunto set our hands in presence of two subscribing witnesses.

CLEMENS ELMER LAPP.
WILLIAM H. HARRISON.

Witnesses:
ALBERT L. PARSONS,
JOHN W. EBERLE.