April 12, 1949. W. E. HARRINGTON 2,467,030

CUTTING TOOL

Filed Jan. 22, 1945 2 Sheets-Sheet 1

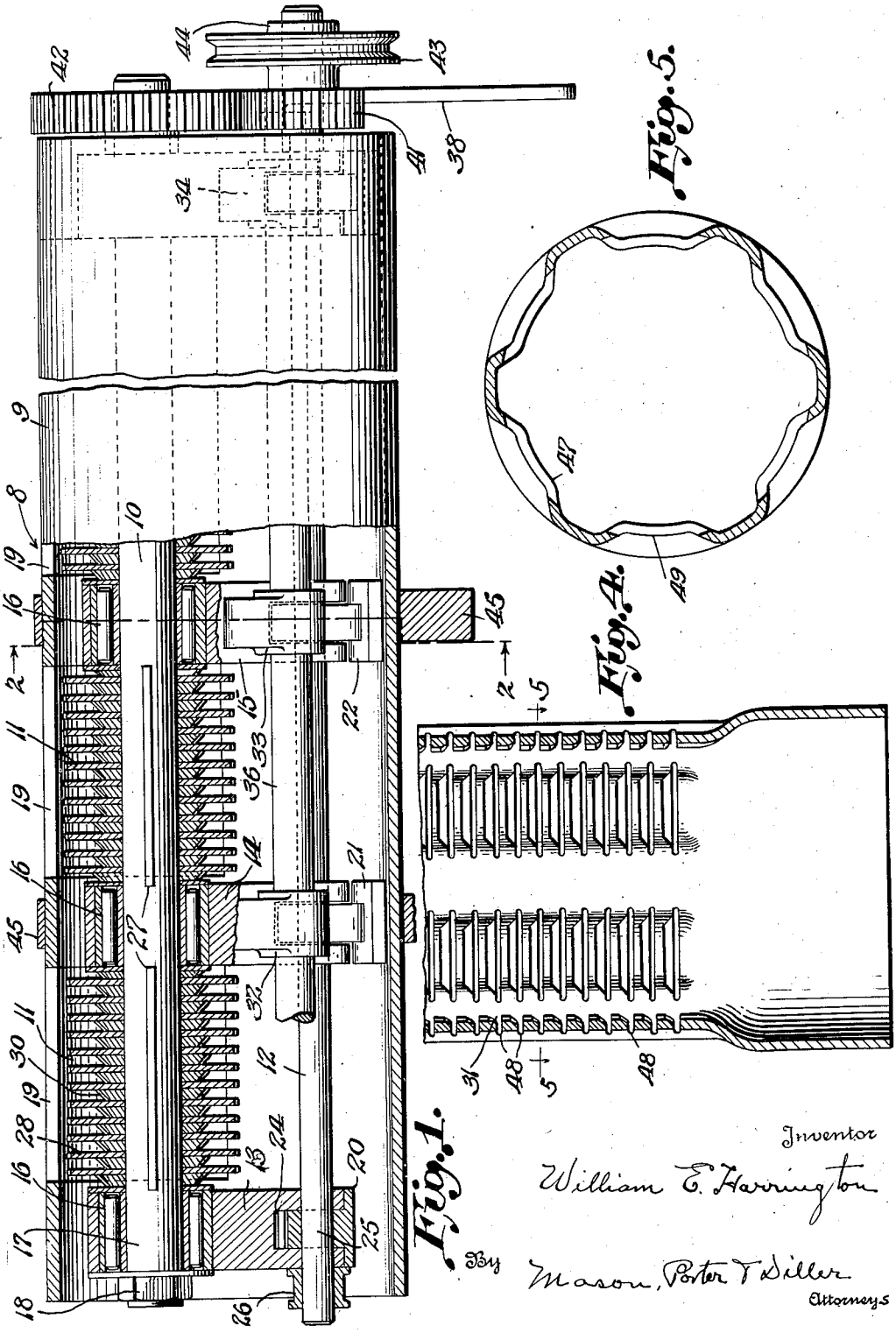

Fig. 1.

Fig. 4.

Fig. 5.

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Fig. 2.

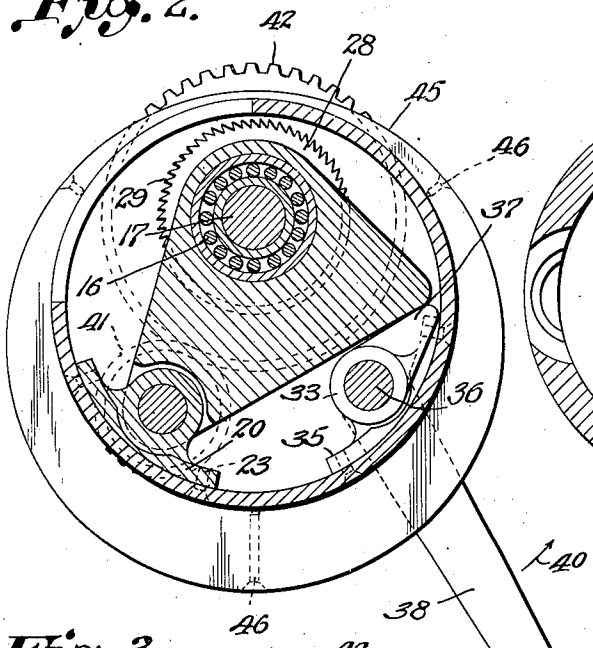


Fig. 7.

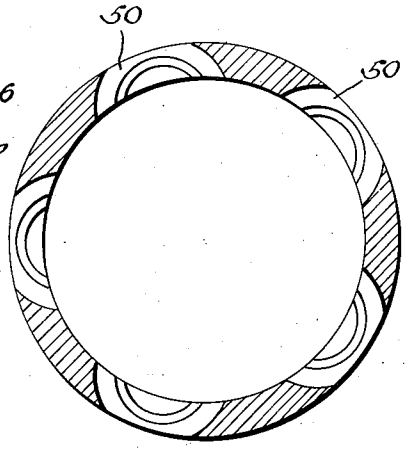


Fig. 3

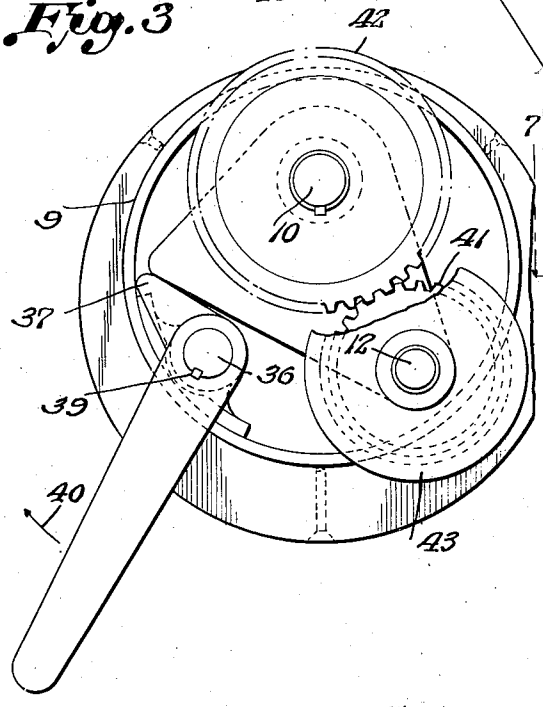
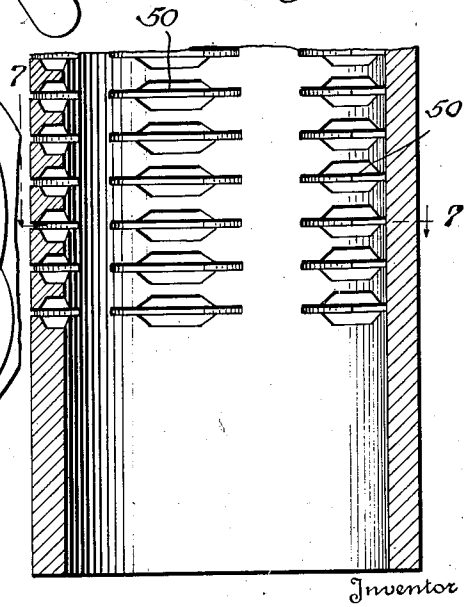


Fig. 6.



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CUTTING TOOL

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4 Claims. (Cl. 29—70)

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The present invention relates broadly to cutting tools and more specifically to such tools for cutting slots in tubular members such as well screens.

In my Patent No. 1,994,344 dated March 12, 1935, and the reissue thereof No. 20,648, dated February 1, 1938, there is disclosed a well screen embodying a formation of slots of such character and design that liquid entering therein has imparted to it a swirling or whirlpool movement which facilitates the operation of the screen and the ascent of the liquid within the well pipe.

The present invention has been designed primarily for use in the manufacture of the well screen of the above patents, and particularly for the formation of the slots therein, although it is to be understood that its use is not limited to this type of article.

It is, therefore, an important object of the invention to provide a cutting tool adapted to be positioned within a well screen or similar tubular member for cutting slots therein.

Another object of the invention is to provide a cutting tool for well screens or the like having a series of cutter elements mounted for rotation on a shaft with means for urging the cutter elements into cutting position relative to the well screen.

A further object of the invention is to provide a cutting tool of the above character wherein the cutter members are mounted for oscillatory movement as well as rotary movement, oscillation of the cutter being accomplished after rotation has been imparted thereto for urging said cutters into cutting position relative to the well screen.

The above and other objects of the invention will in part be obvious and will be hereinafter more fully pointed out.

In the drawings,

Figure 1 is a view partly in longitudinal section of a cutting tool embodying the features of the present invention.

Figure 2 is a transverse sectional view taken substantially on line 2—2 of Figure 1.

Figure 3 is an end view of the tool.

Figure 4 is a partial sectional view of one form of well screen after it has been slotted by the improved tool.

Figure 5 is a sectional view taken substantially on line 5—5 of Figure 4.

Figure 6 is a partial sectional view of a different form of well screen slotted by means of the improved cutting tool.

Figure 7 is a sectional view taken substantially on line 7—7 of Figure 6.

Referring to the drawings for a more detailed

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description thereof, the new and improved cutting tool is generally designated by the reference numeral 8 and comprises an elongated tubular member or housing 9 for housing the elements of the cutting tool. Extending longitudinally within the housing 9 there is a shaft 10 on which is mounted in spaced relation a series of cutter elements generally designated by the reference numeral 11, which cutter elements will be hereinafter more fully described.

Also, carried within the tubular member 9 and adapted for rotation therein is a second shaft 12, said shaft supporting a series of triangularly shaped bearing members 13, 14 and 15. These members each carry roller bearings 16 within which the shaft 10 is journaled, the end 17 of the shaft 10 being locked on the member 13 by means of the nut 18. As will hereinafter appear, the members 13, 14 and 15 are adapted to be oscillated for projecting the shaft 10 and its cutters 11 toward the slots or windows 19 formed in spaced relation in the housing 9. The shaft 12 rotates in supporting members 20, 21 and 22 which are riveted or otherwise secured to the housing 9 as indicated at 23 in Figure 2 of the drawings, while the bearing members 13, 14 and 15 are each bifurcated as indicated at 24 in Figure 1 of the drawings for connection with the supports 20, 21 and 22. The shaft 12 extends through said supports and the bifurcated ends of the members 13, 14 and 15. In Figure 1 of the drawings this form of connection is shown relative to the member 13, but it is to be understood that each of the supports and members are so related. The end 25 of the shaft 12 is secured in position on the member 13 by means of the nut 26.

The cutting elements 11 are splined by means 27 to the shaft 10 for rotation therewith and are positioned between each pair of members 13, 14 and 15. The cutting elements comprise individual circular cutters 28 having saw teeth 29 formed on the periphery thereof and separated by means of the V-shaped cutters 30. The cutters 30 serve not only to maintain the cutters 28 in spaced relation but are also adapted to cut or form that portion of the slot indicated at 31 in the well screen shown in Figure 4 of the drawings. Likewise the cutters 28 and the cutters 30 may be designed so as to cut slots of the form and shape shown in Figure 6 of the drawings. Furthermore, these cutters may be designed to cut slots of varying forms and shapes. It is to be understood that the cutting members are positioned on the shaft 10 adjacent the windows 19 so as to be projected through said windows, by

means to be hereinafter described, for cutting the slots in the well screen. It is also to be understood that any number of series of cutting elements and bearing members are to be positioned throughout the housing 9 within the meaning of the present invention.

Mounted within the housing 9 and spaced from the supports 20, 21 and 22 is a second series of supports 32, 33 and 34 riveted or otherwise secured to the housing as indicated at 35 in Figure 2 of the drawings. These supports carry a shaft 36 which extends throughout the housing 9, being disposed at an angle relative to the shafts 10 and 12. The shaft 36 carries cams 37 adjacent each bearing member 13, 14 and 15. Said cams are held in contact with said members and adapted to be swung thereagainst for oscillating said members on the shaft 12, to project the cutting elements 11 through the windows 19 of the housing 9. As is to be understood, the shaft 36 is capable of rotation within its supports and in accordance with the present invention the means for rotating the shaft comprises a lever 38 keyed thereto as indicated at 39. Upward movement of the lever in the direction of the arrow 40 will rotate the shaft, causing the cams 37 to be forced against the bearing members 13, 14 and 15 to swing said members and the cutting elements outwardly toward the windows 19.

Any means may be provided for driving the shaft 10, one means being shown in Figure 1 of the drawing which includes a gear 41 keyed to the shaft 12, and a second gear 42 keyed to the shaft 10, said gears being in mesh. The shaft 12 is driven from a suitable source of power through the pulley 43 held in bearing relation thereon as indicated at 44. As is to be understood, as the shaft 12 is rotated the meshing of the gears 41 and 42 will rotate the shaft 10 within the bearings 16, carrying with it the cutting elements 11.

The housing 9 is adapted to be inserted within a section of a well screen for forming the slots usually provided therein and in order to position the well screen on the housing 9, there is provided a series of eccentric plates 45, said plates adapted to be manually slipped over the housing 9 and are preferably positioned on opposite sides of the windows 19 as shown in Figure 1 of the drawings. Different sized plates 45 are to be used with different sized well screens. In other words, the outer diameter of the plates 45 is equal to the inner diameter of the well screen to be slotted by means of the cutting tool. Thus, the one cutting tool will be capable of slotting different sized well screens. The plates 45 are removably held on the housing 9 by means of countersunk cap screws 46.

In the use of the device and when desiring to form slots in a well screen of the type shown in Figures 4 and 5 of the drawing, which well screen in the fabrication thereof, is formed with inwardly extending ribs 47 in which the slots are to be cut, the plates 45 are first positioned on the housing 9. These plates will be of a size to accommodate the well screen which is positioned over the plates so as to bring one of the ribs 47 in alinement with the housing windows 19. Rotation will then be imparted to the shaft 10, after which the lever 38 will be moved in the direction of the arrow 40 causing the members 13, 14 and 15, through the cams 37, to oscillate on the shaft 12 for urging the cutters 28 through the windows 19 and into cutting engagement with the well screen ribs 47. The saw teeth 29 of the cutting members 28 will

form the slots 48 and by continuing the upward movement of the lever 40, the V-shaped cutters will be brought into engagement to form the enlargement of the slot 48 indicated at 31. The cutting elements are then withdrawn from the windows 19 and the well screen rotated to bring the adjacent rib of the well screen, for example, the rib 49, into position to be slotted and the operation repeated. This rotation of the well screen relative to the housing 9 after each slotting operation is repeated until the ribs 49 of the entire circumference of the well screen has been slotted.

Formation of the slots in the well screen illustrated in Figures 6 and 7 is substantially the same as that above described. In Figures 6 and 7, the well screen is shown as being of complete cylindrical contour, the ribs 47 and 48 being eliminated therefrom. However, the cutters 28 and 30 are brought into cutting engagement with the well screen to form the type of slot illustrated, and the well screen is rotated on the plates 45 in the manner previously described to form the slots 50. It may be preferred in slotting well screens such as a rib type screen as shown in Figures 4 and 5 of the drawings to rotate the housing 9 including the plates 45 relative to the well screen in the operation of the device. In such an event, the cutters would first be withdrawn from the slots 19 in the manner previously described but the slotting operation will be a continuous operation in that the housing 9 including the plates would be rotated a complete revolution slotting each rib of a well screen such as that shown in Figures 4 and 5 of the drawings or the like before the cutting elements are retracted or withdrawn from their normal extended cutting position through the windows 19 of the tubular housing 9, in other words, the cutting elements would slot by sawing through one rib and proceed to the next in extended position so as to cut slots of uniform width and length in each rib, thus, one complete revolution of said housing 9 and plates 45 would slot each rib in well screens having internal ribs by a continuous operation of the cutting tool, of course the well screen could be rotated one revolution and the housing remain stationary and produce the same result.

From the above description when taken in connection with the accompanying drawings, it will be readily apparent that there has been provided a cutting tool adapted to be positioned within a tubular member such as a well screen for cutting slots therein with a minimum amount of time and effort. The cutting tool is relatively simple in construction and easy to operate, and is capable of cutting slots in well screens or the like of practically any diameter.

It is to be clearly understood that various changes in the details and construction and arrangement of parts may be made without departing from the scope of the invention as set forth in the appended claims.

What I claim is:

1. A cutting tool of the character described for cutting slots in tubular members, comprising a housing, a shaft rotatable in said housing, cutting elements on said shaft, said housing having windows formed therein adjacent said cutting elements, means for mounting said shaft for rotary and oscillatory movement, said means comprising triangular shaped bearing members pivotally secured in spaced relation within said housing, and cam means pivotally mounted within said housing adapted to engage said bearing

members for moving said shaft to radially move the cutting elements through said windows.

2. A cutting tool of the character described for cutting slots in tubular members, comprising a tubular housing, supporting members mounted in spaced relation within said housing, a shaft carried by said members, triangular shaped bearing members pivotally mounted in spaced relation on said shaft, a second shaft rotatable in said bearing members, cutting elements fixed to said second shaft for rotation therewith, said housing having spaced windows formed therein, said cutting elements being positioned on said second shaft adjacent said windows, a third shaft mounted within said housing, and cam means operable by said third shaft for engagement with said bearing members to radially move the cutting elements through said windows.

3. A device for cutting slots in tubular members comprising a tubular housing having spaced openings formed therein over which is positioned the tubular member to be cut, supporting members mounted in spaced relation within said housing, a shaft carried by said members, bearing members pivotally mounted in spaced relation on said shaft, a second shaft rotatable in said bearing members, cutting elements fixed to said second shaft for rotation therewith, said cutting elements being located on said second shaft in spaced relation with said openings and normally retracted therefrom, and means for moving said second shaft to radially move said cutting elements through said openings whereby said cutting elements are brought into cutting engagement with the tubular member.

4. A device for cutting slots in tubular members comprising a tubular housing having spaced openings formed therein over which is positioned the tubular member to be cut, supporting members mounted in spaced relation within said housing, a shaft carried by said members, triangular shaped bearing members pivotally mounted in spaced relation on said shaft, a second shaft rotatable in said bearing members, cutting elements fixed to said second shaft for rotation therewith, said cutting elements being located on said second shaft in spaced relation with said openings and normally retracted therefrom, a third shaft mounted within said housing, and cam means operable by said third shaft for engagement with said bearing members to radially move said cutting elements through said openings into cutting engagement with the tubular member.

WILLIAM E. HARRINGTON.

REFERENCES CITED

The following references are of record in the file of this patent:

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