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J. P. WHANN

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OIL WELL SCREEN

Filed March 25, 1929

Fig. 1.

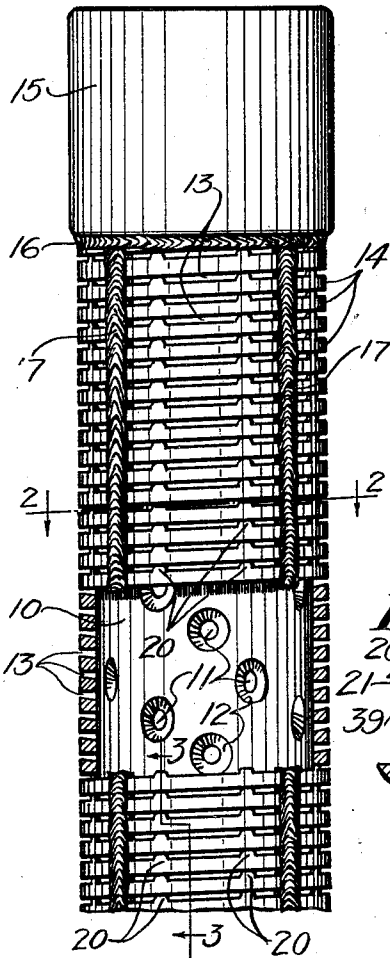


Fig. 2.

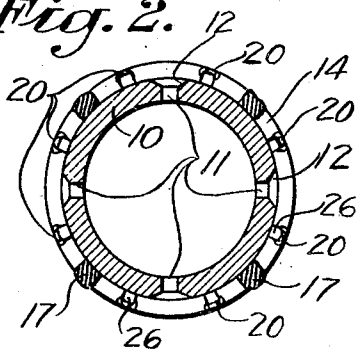


Fig. 4.

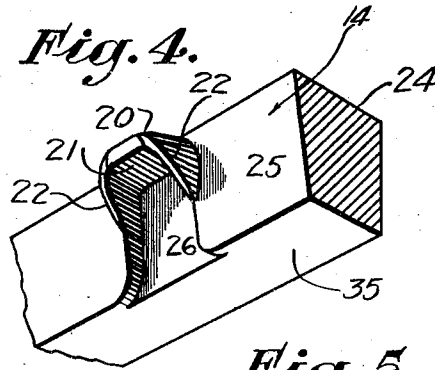


Fig. 5.

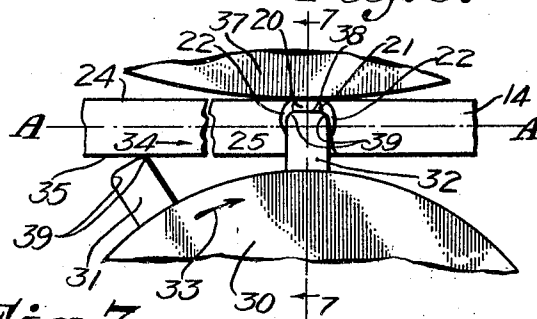


Fig. 7.

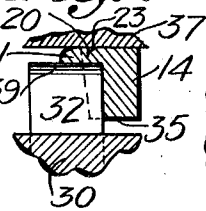


Fig. 3.

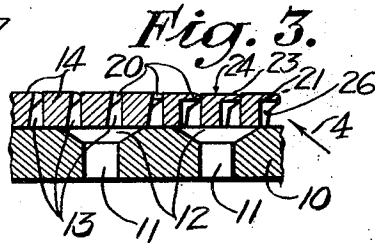
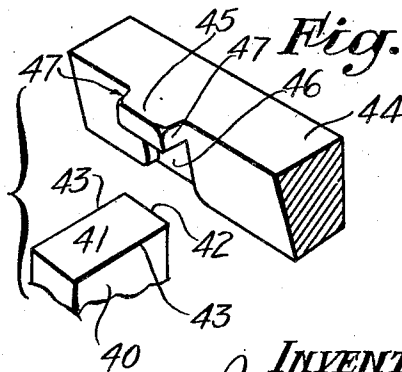


Fig. 6.



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OIL WELL SCREEN

Application filed March 25, 1929. Serial No. 349,612.

This invention relates particularly to oil well screen of the type generally known as wire-wound, which screen includes a perforated pipe having a wire or bar wound on the outer surface thereof and spaced apart so that screen inlet slots are left between the separate turns of the wire or bar, through which fluids from the earth formations may enter and by means of perforations in the pipe core of the screen structure, gain entrance to the interior of the screen.

It is an object of the invention to provide a screen of this character including a new and improved form of spacing lug for the bar or wire which is wound on the pipe, having ample strength owing to its construction and being of such formation that a practically accurate spacing or separation of the turns of the wire or bar on the pipe is accomplished.

A further object of the invention is to provide a bar for use on a wound screen of this character having a lug extending laterally from the upper edge thereof and being provided with a depression under such lug to compensate for the space occupied by the lug in its associated drainage channel formed between two consecutive turns of the bar on the pipe thereby permitting a substantially unrestricted flow of fluid through the drainage channel.

A further object of the invention is to provide on a bar for use in a well screen of the above character, a spacing lug or spacing bridge having an arched cross-section and having triangular shaped reinforcing webs which co-operate to provide a trussed spacing bridge of much greater strength than the simple lugs which are now punched from the upper edge portions of a bar or wire in the present methods of manufacturing wire wound screen.

A further object of the invention is to provide a bar for use in a well screen of this character, in which maximum resistance to breakage while on or being wound on the pipe is preserved, owing to the fact that the material removed from the main body of the bar in the formation of the spacing lugs does not weaken the outer portion of the bar where the greatest strains are placed during the

winding of, and as the result of the winding of, the bar on a cylindrical member such as the perforated pipe core.

Previously it has been customary to form a projecting lug in or on the side of a wire to be wound on a perforated pipe, by forcing a tool downwardly in the upper surface of the wire adjacent to the edge, thus forcing laterally a portion of the metal adjacent to the edge of the wire, thus leaving a depression in the upper surface of the wire in the space previously occupied by the metal displaced to form the lug. When a wire or bar lugged in this manner is wound on a pipe breakage often occurs at the lugs owing to the fact that the bending of the wire to conform to the curvature of the pipe, requires an elongation of the outer portion of the wire and a constriction of the inner portion of the wire.

The stress necessary for this elongation of the outer face and portion of the wire, in addition to the tension necessary to hold the wire tightly to the pipe during winding, often causes such rupture of the wire at the point or position of the lugs owing to the fact that the continuous extension of metal along the upper portion of the wire has been interrupted by reason of the cutting thereinto of the tool in the formation of the spacing lug, leaving a weak place at which a breakage is encouraged. My invention provides a lug which is formed from the original body of the wire or bar, such lug existing at or near the outer face of the bar when it is wound on the pipe, and which lug is formed without cutting into the outer surface of the wire so as to interrupt the continuous extension of metal along the outer portion of the wire, and thereby giving a much more satisfactory screen structure by reason of reducing to a minimum the possibility of a wire or bar breaking while wound in place on the pipe.

Other objects and advantages will be made evident throughout the following parts of the specification.

Referring to the drawing, which is for illustrative purposes only:

Fig. 1 is an elevational view of a portion of a screen embodying the present invention,

a portion of the bar winding of such screen being shown in section so as to disclose the perforations in the pipe forming the core of such screen.

Fig. 2 is a cross-section taken substantially as indicated by the line 2—2 of Fig. 1.

Fig. 3 is an enlarged fragmentary section through that portion of the screen indicated by the line 3—3 of Fig. 1, this sectional view being conventional in that it represents drainage openings not occurring on the line 3—3 defining the position of the section relative to Fig. 1.

Fig. 4 is an enlarged perspective view looking upwardly at a trussed lug formed in a screen bar, as indicated by the arrow 4 of Fig. 3.

Fig. 5 is a fragmentary detail illustrating the preferred method of forming the bridged lugs in a bar which is to be wound on a perforated pipe, such figure having the purpose of explaining the general characteristics of the form of lug shown in the preceeding figures by disclosing the method of forming such lugs.

Fig. 6 is a diagrammatic perspective view showing the form of flat spacing lug which is formed in a bar by the use of a tool having substantially sharp corners extending perpendicularly to the face or edge of the bar in which such tool forms a bridge or lug.

Fig. 7 is a fragmentary section on the plane represented by the line 7—7 of Fig. 5, this figure having the purpose of showing a side view of a lugging tool indicated in Fig. 5.

In disclosing a preferred form of my invention, I have in Figs. 1 and 2 shown a pipe 10 having perforations 11 therein which are counterbored at their outer ends as indicated at 12 so as to increase the gathering area of such intercommunicating holes 11 by flaring or enlarging them at their outer ends in such a manner that, as shown in Fig. 5, each hole will communicate with several of the drainage channels or screen inlet slots 13 formed between consecutive turns of a bar or bars 14 on the exterior of the perforated pipe 10. At the upper end of the pipe 10 I have shown the standard form of coupling 15 and have further indicated in Fig. 1, circumferential and longitudinal welds 16 and 17 by which the bar 14 is secured to the coupling 15 and held in properly spaced position on the pipe 10.

In Figs. 1 to 5, the wire 14 is shown spaced apart by the repeated use of a trussed lug member 20, which lug 20 consists of a flat web of metal 21, and downwardly curved side webs 22, as best shown in Fig. 4, projecting laterally from the side of the bar 14, with the upper surface 23 of the central web portion 21 of the lug 20 in substantially the same plane as the upper face 24 of the bar 14. The side webs 22 are of triangular form,

thereby serving as trusses or brackets of a character to co-operate with and reinforce the central web portion 21, giving the entire lug 21 maximum physical strength relative to the amount of metal employed therein. In the preferred form of the invention, the outer surface of the bar 14 and the outer surface of the lug 20 lie in the same plane, but this condition is not necessary to practise of the invention in its alternative forms.

The lug 20 shown in Fig. 4 projects laterally from the extreme upper portion of the side wall 25 of the bar 14 and a depression or pocket 26 is formed in the side of face 25 in position immediately underneath the lug 20. As will be seen in Fig. 3, the lugs 20 occupy a space at the upper portion of the drainage channels 13, this resulting in a reduction of the height of the channels at the positions of the lugs. The area which a lug 20 occupies in the cross-section or a drainage channel 13 is in a measure compensated for by the depression or pocket in the side of the bar 14 beneath the lug 20. Whereas the height of the drainage channel 13 is decreased by the presence of the lug under which fluid must flow in the drainage channel in seeking inlet into the pipe 10 through an opening 11, the area of cross-section of the channel 13 is maintained nearly constant by the widening of the channel where it passes under a lug 20, as the result of the lateral enlargement of the channel under each lug.

In Figs. 5 and 7, I illustrate my preferred method of making the trussed form of lugs and the channel enlarging depressions in the screen bar. 30 indicates a wheel or roller member having a plurality of rectangular prism tool bits 31 and 32 projecting therefrom in radial, equally spaced position, the lugging wheel 30 may be considered to rotate in the direction of the arrow 33, with the bar 14 at the same time moving in the direction of the arrow 34.

The tools 31 and 32, etc., are so positioned that they will engage the under face 35, Fig. 4, of the bar 14, being sufficiently offset relative to an edge of the bar 14 that when the tool indicated at 31 moves into the position of the tool 32, metal will be displaced from the side portion of the bar 14 adjacent to and including the face 25, this metal being forced upwardly toward the face 24 of the bar 14 and at the same time expanding laterally and being flanged outwardly and compressed between an anvil roller 37 and the outer end face 38 of the tool bit, as indicated at Fig. 5.

By rounding off the corners 39 of the tool bits indicated at 31 and 32, these corners being the outer corners of the tool bit which project perpendicularly or laterally relative to the face 25 of the bar 14, it is possible to produce as part of the lug 20 the side, triangularly shaped, webs 22 which have the especial utility of reinforcing the lug struc-

ture by reason of the fact that in this manner the entire lug is arched in a direction parallel or in alignment with the length of the bar 14.

5 In Fig. 6 I indicate a lugging tool 40 having a substantially flat end face 41, a cutting edge 42, and perpendicularly or laterally extending corners 43, which corners 43 are maintained substantially sharp, instead of being rounded off in the manner of the corners 39 shown in Fig. 5. When this tool is employed to punch a lug in a bar such as 10 the bar, a tongue-like lug 45 is formed, containing substantially all of the metal displaced from the area occupied by the depression or pocket 46. In this operation of lug construction there has been no dragging back of the metal at the edges of the lug in such 20 a manner as to form the truss webs 22, but instead of being provided with such webs the sides 47 of the lug 45 are left cleanly defined as shown. A distinct advantage in this form of lug is that the obstruction of the drainage channel or screen slot due to the presence of the lug in the upper part thereof, is kept at a minimum.

In Fig. 5 the neutral axis A—A of the bar 14 is indicated. When this bar is bent into curved form such as would be necessary in winding it on the pipe 10, the portion of the bar above the axis A—A elongates and the portion below the axis A—A shortens. Naturally the elongation and compression of the upper and lower portions of the bar produce strains in the bar in addition to the tension placed on the bar during the winding process for the purpose of holding the bar tightly to the pipe. As I have previously mentioned, 40 it has been customary in the lugging of wire for use on a screen of this character, to force a chisel-shaped tool down into the upper face 24 of the wire or bar such as indicated at 14, near the edge thereof, so that the action of the chisel will produce a forcing out of metal adjacent to the upper edge of the wire to form a laterally projecting lug in proper position for spacing consecutive turns of wire apart on a pipe. The chisel-shaped tool in 50 producing such a lug, cuts into the wire at that point where greatest strength should be maintained if the natural condition of elongation of the outer portion of the bar is to be taken care of without possibility of the wire breaking either during the winding operation or at some time after the wire has been wound in place on the pipe, as during the placing of the screen in a well. The breakage of wire 60 at such time is often disastrous, owing to the fact that the projecting end of the wire will catch on some obstruction in the well, causing a portion of the winding of the screen to be displaced or pulled from the perforated pipe forming the tubular core of the screen. In

my present invention I use a bar or large wire having a lug formed in the upper edge thereof from metal taken from the original body of the bar, but this lug in no way detracting from the tensional strength of the outer portion of the bar which must meet the strains of elongation during the winding of the bar on the pipe. The lug, projecting as I have described, from the upper portion of the bar has an accompanying feature consisting of 70 the depression or pocket in the bar under the lug, whereby to compensate for the reduction in height of the drainage channel between two consecutive turns of a bar on the pipe as the result of the presence of the lug projecting laterally from the upper portion of the bar. 80

I claim as my invention:

1. A well screen of the character described, including: a perforate tubular member; and 85 a bar wound on said tubular member, said bar having substantially continuous side walls extending approximately radially with respect to the axis of said tubular member and bridge lugs projecting from the upper portions of said bar for holding the separate turns of the bar apart, there being depressions in the side wall of said bar under said lugs of substantially the same length as said lugs. 90

2. A well screen of the character described, including: a perforate tubular member; and 95 a bar wound on said tubular member, said bar having substantially continuous side walls extending approximately radially with respect to the axis of said tubular member and bridge lugs projecting from the upper portions of said bar for holding the separate turns of the bar apart, there being depressions in the side wall of said bar under said lugs of substantially the same length as said lugs, and reinforcing webs extending down from the sides of said lugs to engagement with the side wall of said bar adjacent to the respective ends of said depressions. 100 105

3. A well screen bar for winding on a tubular frame, comprising a rod having an inner substantially flat face adapted to rest against said frame and an outer face opposite to said inner face, there being side faces connecting the edges of said inner and outer faces, said bar having a lug projecting laterally from one of said side faces and a depression under said lug of substantially the same length as said lug. 110 115 120

4. A well screen bar for winding on a tubular frame, comprising a rod having an inner substantially flat face adapted to rest against said frame and an outer face opposite to said inner face, there being side faces connecting the edges of said inner and outer faces, said bar having a lug projecting laterally from one of said side faces and a depression under said lug of substantially 125 130

the same length as said lug, and reinforcing webs extending down from the sides of said lug to engagement with the side face of said bar adjacent to the respective ends of said depression.

Signed at Los Angeles, in the county of Los Angeles and State of California, this 20th day of March, 1929.

JESSE P. WHANN.

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