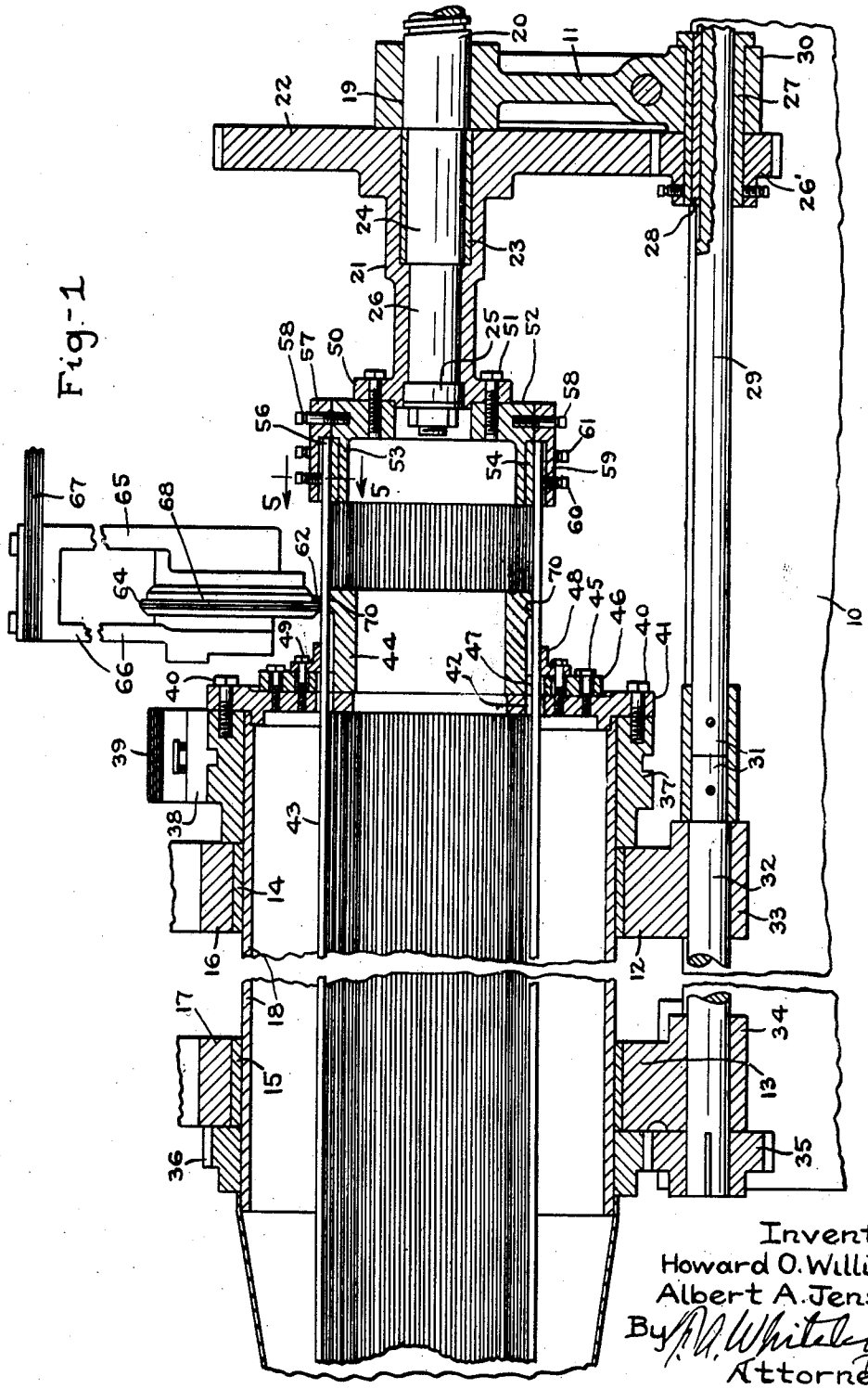
March 2, 1943. H. O. WILLIAMS ET AL 2,312,459

METHOD OF MAKING DEEP WELL SCREENS

Original Filed Aug. 1, 1938 2 Sheets-Sheet 1

Fig. 1



Inventors:
Howard O. Williams
Albert A. Jens.
By R. D. Whiteley
Attorney.

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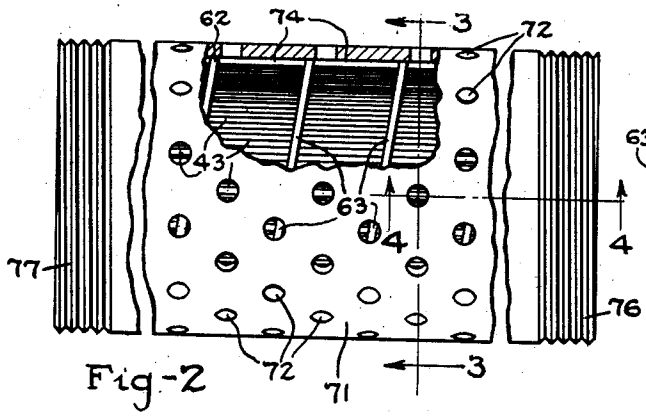

Fig-2

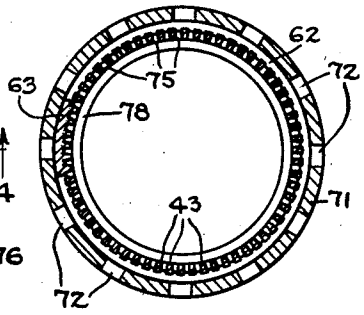

Fig-3

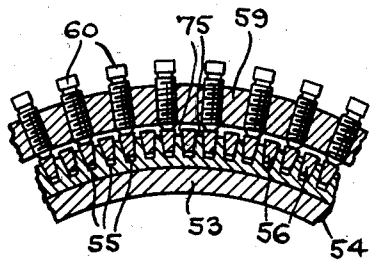

Fig-5

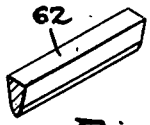

Fig-6

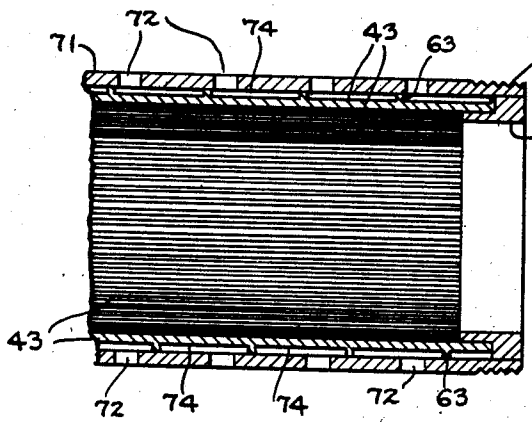

Fig-4

Inventors:
Howard O. Williams
Albert A. Jens.
By H. A. Whiteley
Attorney.

Patented Mar. 2, 1943

2,312,459

UNITED STATES PATENT OFFICE

2,312,459

METHOD OF MAKING DEEP WELL SCREENS

Howard O. Williams, Minneapolis, and Albert A. Jens, St. Paul, Minn., assignors to Edward E. Johnson, Incorporated, St. Paul, Minn.

Original application August 1, 1938, Serial No. 222,410. Divided and this application April 15, 1940, Serial No. 329,752

1 Claim. (Cl. 29—163.5)

Our invention relates to the method of making deep well screens, and has for its object to provide a method of making a well screen for use in very deep wells which is strong and sturdy enough to resist very great strains and pressure, including pressures of the liquid being screened, such as are frequently found in deep oil wells. It is well known that in putting down oil wells, particularly those of great depth, oil pressures are encountered which sometimes are so great as to rupture and destroy the straining means of deep well screens. To meet this condition it is an object of our invention to provide a method of making a well screen wherein the screening means proper is supported wholly within a perforated pipe base, and which is so constructed that helical channels conduct liquid from the perforations through said pipe base to drainage slots across said helical channels which are inwardly expanding, the members forming the helical coils being at the same time welded to the members which form the drainage slots at all crossing points thereof, and also held immovably upon the inside of the perforated pipe base.

It is a further object of our invention to hold a plurality of longitudinal screen forming elements such as wires having substantially flat tops and inwardly converging side walls so that the outer limits of said flat tops outline a cylinder, said elements being held closely spaced in parallel relation to provide longitudinal inwardly diverging drainage slots, and to weld to said flat outwardly turned faces of said longitudinal wires a supporting wire formed in spaced helical coils, said welding being to every crossing point of the helical coils and of the longitudinal screen elements; thereafter to shrink upon the outer screen surface thus formed a perforated pipe base in such manner that the helical coils are rigidly held to the inner surface of the pipe base so as to be substantially integral therewith and the inwardly diverging drainage slots extend directly across the drainage channels thus formed by the helical coils and the inner wall of the pipe base.

It is a further object of our invention to provide a method of making a screen of the type above mentioned wherein longitudinal elements in the form of a cylinder are closely spaced, with drainage slots between, and a helically wound wire with widely spaced helical coils is welded to the outside limits of said longitudinal rods at every crossing point to form an integrally united screen member, and to which a perforated pipe base is applied so as to be immovably united to the spaced helical coils.

It is a further object of our invention to provide a method of making a well screen embodying longitudinal elements with flat outwardly disposed tops and converging sides positioned so the flat tops form a cylinder with parallel inwardly diverging drainage slots between pairs of the longitudinal elements, and with helical coils of a supporting wire welded to said flat tops at every crossing point of the wire and said tops, together with a perforated pipe base surrounding said screen member and immovably united to the flat outer surfaces of the helical coils to form a helical drainage channel leading to the inwardly diverging drainage slots between longitudinal members.

This application is a division of our application Serial Number 222,410, filed August 1, 1938.

The full objects and advantages of our invention will appear in connection with the detailed description thereof and the features of novelty of the invention which produce the above noted advantageous results are particularly pointed out in the claim.

In the drawings illustrating an application of our invention in one form:

Fig. 1 is a longitudinal sectional view of means for making a screen member comprised of a multiplicity of longitudinal elements closely spaced to form drainage slots with means for welding helical coils of supporting wires to the outside surfaces thereof.

Fig. 2 is a side elevation view in part broken away and in section of a complete well screen made in accordance with our invention.

Fig. 3 is a sectional view taken on line 3—3 of Fig. 2.

Fig. 4 is a sectional view taken on line 4—4 of Fig. 2.

Fig. 5 is a fragmentary sectional view taken on line 5—5 of Fig. 1.

Fig. 6 shows the cross sectional shape of the helically wound wire.

As illustrated, there is supported upon framing 10, indicated diagrammatically, a number of standards 11, 12 and 13. Standards 12 and 13 are provided with bearing sleeves 14 and 15 within cylindrical bearing rings 16 and 17 and support a rotatable cylinder 18. Standard 11 is provided with a bearing portion 19 which receives a lead-screw shaft 20 adapted to rotate therein. An elongated hub 21 rigidly secured to a spur gear 22 is adapted to rotate on a bearing sleeve 23 surrounding an extension 24 of lead screw 20. A thrust bearing 25 at the end of a lead screw extension 26 enables the lead screw

to turn independently of hub 21 and to draw said hub forwardly while it and the parts connected with it are being rotated, as may be desired.

The spur gear 22 meshes with a pinion 26' fast on a sleeve 27 which is splined as indicated at 28 to a shaft 29 and which forms a bearing for said shaft within a cylindrical bearing portion 30 of standard 11. The shaft 29 is connected at 31 with a shaft 32 which is journaled in cylindrical seats 33 and 34 formed in standards 12 and 13. Fast on shaft 32 is a pinion 35 which meshes with a spur gear 36 fast on cylinder 18. The spur gears 22 and 36 and the pinions 26 and 35 are of the same diameters respectively, hence, when the two pinions are driven and in turn rotate the two spur gears and parts connected therewith the rate of rotation of each will be the same. Rigidly connected with cylinder 18 is an annular contact ring 37 which is engaged by a shoe 38 having thereon leaf-shaped electrical conductors 39 for carrying to shoe 38 and contact ring 37 a relatively large volume of electrical current. To the contact ring 37 is secured by means of bolts 40 an annular head 41 which is provided with a multiplicity of openings 42 properly spaced to have passed therethrough a corresponding number of longitudinal screen making elements 43. An anvil cylinder 44 is secured by bolts 45 extending through annular flange 46 on the anvil member to the annular head 41. The flange 46 is provided with guide apertures 47 corresponding in number and position to the guide apertures 42 of the annular head 41, also a guide ring 48 is secured to head 41 by means of bolts 49 and this guide ring comprises guide slots for guiding and holding the rods 43.

Upon the end of the elongated hub 21 is an integrally formed head 50. Secured to the head 50 by bolts 51 is an annular member 52 having thereon a drum extension 53, Figs. 1 and 5. Upon the drum extension 53, and secured thereto by swaging or other means as desired, is a securing drum 54 which is provided with a multiplicity of socket grooves 55, Fig. 5, into which extend the ends 56 of the longitudinal screen making elements 43, a collar 57 is bolted to the head 52 by means of bolts 58. This collar has a drum extension 59 overlying the grooved member 54. Threaded through the extension 59 are two circumferential rows of set screws 60 and 61. The set screws of each circumferential row are positioned in staggered relation so as to engage alternate ones of rod ends 56 and clamp them firmly in the wedge-shaped grooves 55, as clearly indicated in Figs. 1 and 5.

The annular head members 41 and 52 respectively are interchangeable with other similar head members and connected parts to make practical the formation of well screen of different diameters.

From the above it will be obvious that when the machine is operated, all of the screen making rods 43 will be held between heads 41 and 52 in narrowly spaced parallel relation and that as the machine is operated, the entire body of screen making rods so held, will be rotated through the operation of shafts 29 and 32, pinions 26 and 35 and spur gears 22 and 36. At the same time through the operation of lead screw 20, by means not shown but such as is fully described in Johnson Patent No. 2,046,461, the head 50 and all connected parts, including head 41 and cylinder 18, will be advanced at a rate determined by the spacing to be given the wire to be helically wound thereon.

This wire designated as 62 will be laid in helical coils, spaced as indicated at 63 of Fig. 2, and welded to the top flat surfaces of screen making longitudinal wires 56 in the manner and by substantially the same means as that disclosed in Johnson Patent No. 2,046,461. As here shown a rotary welding disc 64 has its supporting arms 65 and 66 in electric connection with leaf bar electrical connectors 67 for conveying a large volume of electrical current to and through welding disc 64. The disc 64 is provided with a groove 68 to which is fed the supporting wire 62. This supporting wall is wedged shaped as shown in Fig. 6 and is held and fed in the same manner as in the two above-noted Johnson patents.

It will be noted that, as here shown, the flat tops of longitudinal wires 43 receive the helical coils, and their wide spacing 63 is effected by the rapidity of advance of the whole assembly by lead screw 20. Electrical current between connectors 67 and 39 must pass through wire 62 as held in groove 68 and welding disc 64 and thence through the longitudinal rods 43, whereby sufficient heat is generated to cause the narrowed edge of the helically wound wire 62 to enter the surfaces of the flat tops of longitudinal wires 43 and be welded to and made integral therewith. The anvil cylinder 44 is provided with an annular anvil face 70 which contacts the narrowed edges of longitudinal wires 43 directly and transmits electrical current therefrom through anvil cylinder 44 and connected parts to leaf conductors 39.

The result of these operations is to produce a screening unit with a screen surface formed of longitudinal wedge-shaped elements having flat tops on the outside to which is welded the reduced edges of a wedge-shaped supporting wire laid upon said top surfaces in suitably spaced helical coils.

To finish the entire screen a pipe base 71 formed with suitably positioned and sized perforations 72 is produced having an internal diameter which, at room temperature, or the same temperature as the complete screen element above defined, is less than the diameter of the cylinder outlined by the outer faces of the spaced helical coils 63. In practice for assembly purposes the pipe base is sufficiently heated so that its diameter will be expanded to permit it to be slipped over the said helical coils. Or to produce the same result the screen member itself may be cooled (by dry ice, liquid air or the like) so as to permit it to be slipped within the pipe base at normal temperature. In either method when the temperatures of the two parts are equalized a shrinkage of the pipe base upon the helical coils 63 will cause the same to adhere immovably to the inner walls of the pipe base and become substantially integral therewith.

As shown in Fig. 4, every one of the longitudinal elements 56 is welded so as to be integrally connected with every one of the helical coils 63 of supporting wire 62. And the shrinking of the pipe base upon the helical coils 63 results in the formation of an extended helical channel or a series of inter-connected helical channels 74 between spaced helical coils of wire 62, and between the inner walls of pipe base 71 and the outer cylindrical surface formed by the screen-forming longitudinal elements 56. These channels, therefore, open through the wall of the pipe

base in openings or holes **72** and to the interior of the screen through longitudinal inwardly diverging slots **75**, Fig. 5, between adjacent pairs of the screen making elements **56**.

The pipe base **71** will normally be formed with threaded ends **76** and **77** and may be finished inside by means of a heavy flange collar **78**, as clearly shown in Fig. 4.

The advantages of our invention will be apparent from the foregoing description. The new type of screen resulting comprises an outer perforated pipe base of a sufficiently strong construction to resist stresses in sinking the well and high oil pressure under the ground. At the same time screening capacities by reason of the longitudinal screenage slots are provided far in excess of the inlet area of the perforations through the pipe base. Any grains of material small enough to pass the outer edges of the inwardly diverging screen slots will go through, other material collecting outside of the screen surface spaced as it necessarily will be will not have the effect of materially diminishing capacity. Also the screening surface proper, being within the heavy pipe base, is protected during the driving down and setting of the well screen, and the smooth outer surface of the complete screen formed by the pipe base itself facilitates these operations.

We claim:

A method of making well screens which consists in holding a plurality of separate and disconnected longitudinal elements so that the outer and inner limits thereof falling within a transverse plane vertical to the lengths of the elements will outline circles with said several elements held spaced apart in said plane distances less than their widths to provide drainage slots, causing said rods as a body to be simultaneously rotated and advanced longitudinally across said plane while being continuously held in said spaced position, causing a wire to be fed in said plane to the outer surfaces of said rods as they are rotated and advanced so that the wire will be laid in helical coils upon the outer limits of said rods so spaced as to produce helical channels outside the rods many times the width of the wire, welding said wire to the rods at every crossing point thereof to form a screening surface made up of parallel longitudinal slots and held positioned by the helical coils of wire with wide helical spaces between said coils, forming a perforated pipe base of an inner diameter slightly less at the same temperature than the diameter of the cylinder outlined by the outer limits of said helical coils, bringing the perforated pipe base and the screening member including the helical coils thereon to such different temperatures that the pipe base may be applied over the helical coils, applying the pipe base to the helical coils when the temperatures are at such differences so as to bring certain perforations in the pipe base over the channels between the coils of the helix and thereafter permitting the temperatures to equalize, whereby the pipe base and screen member are immovably united through said helical coils to form together a substantially integral well screen device with the screening member on the inside of the pipe base and with helical channels extending between the screening surface and the inner surface of the pipe base.

HOWARD O. WILLIAMS.
ALBERT A. JENS.