E. E. JOHNSON.

METHOD OF REINFORCING WIRE FORMED TUBULAR WELL SCREENS.

APPLICATION FILED OCT. 17, 1914.

1,287,031.

Patented Dec. 10, 1918.

3 SHEETS—SHEET 1.

FIG. 1.

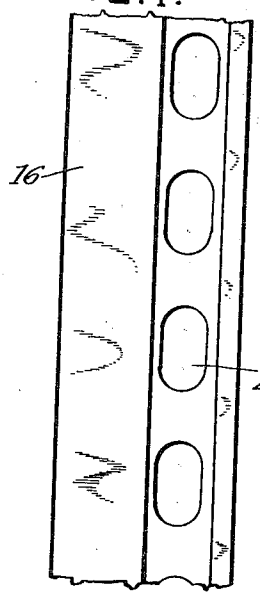


FIG. 2.

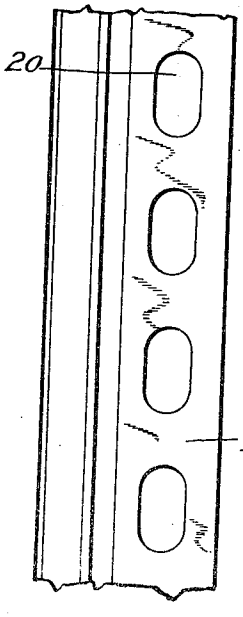


FIG. 5.

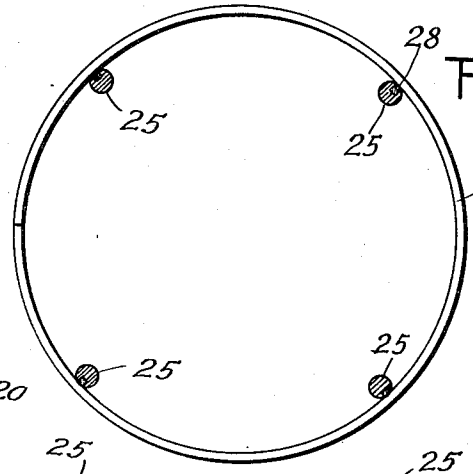


FIG. 3.

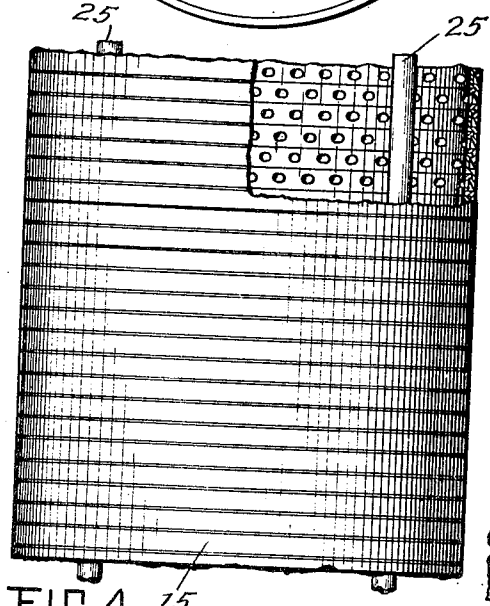


FIG. 4.

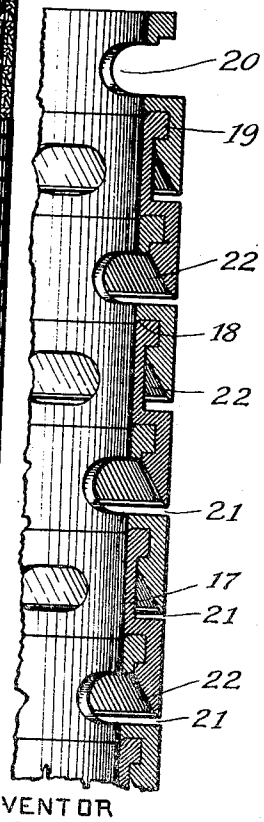
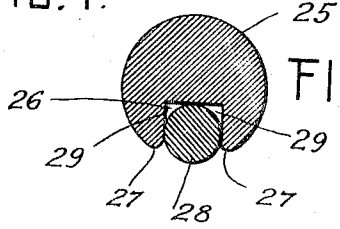


FIG. 6.



WITNESSES

J. D. Edwards:

H. A. Bowman.

INVENTOR

EDWARD E. JOHNSON:

BY P. A. Whitley

ATTORNEY

E. E. JOHNSON.

METHOD OF REINFORCING WIRE FORMED TUBULAR WELL SCREENS.

APPLICATION FILED OCT. 17, 1914.

1,287,031.

Patented Dec. 10, 1918.

3 SHEETS—SHEET 2.

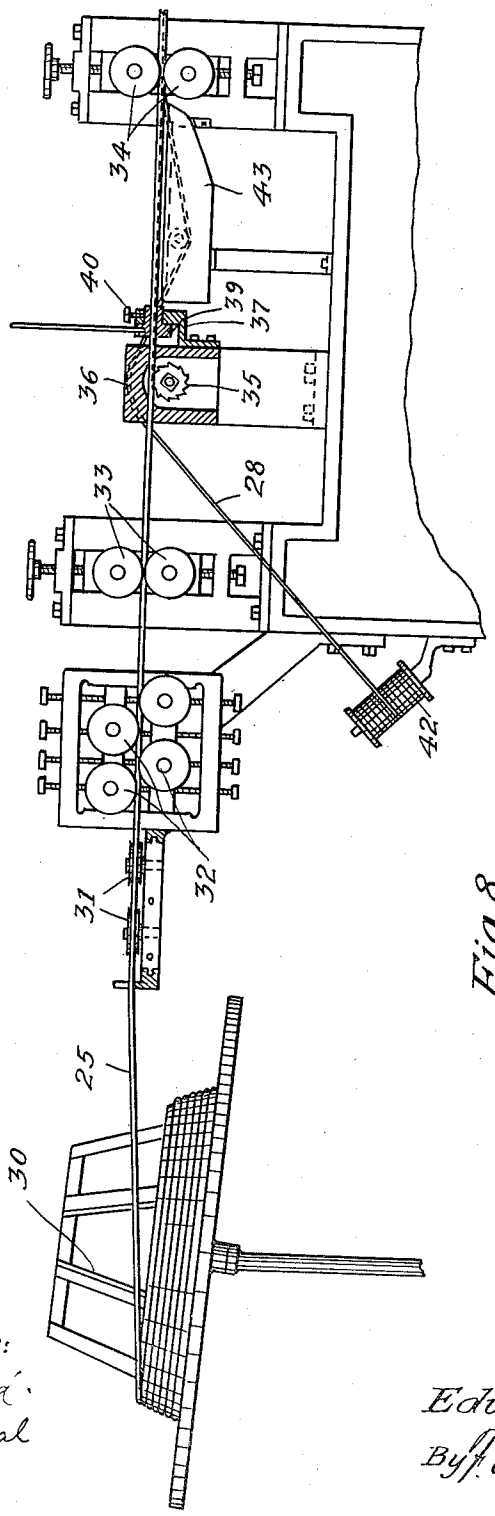


Fig. 7.

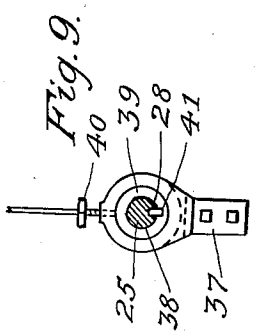


Fig. 9.

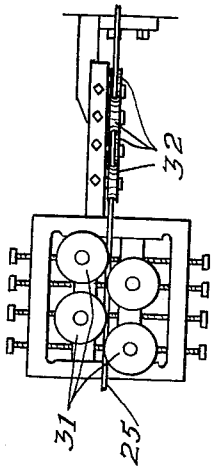


Fig. 8.

Witnesses:
Thos. Lagaard.
A. M. Royal

Inventor:
Edward E. Johnson.
By J. A. Whiteley
his Attorney.

E. E. JOHNSON.

METHOD OF REINFORCING WIRE FORMED TUBULAR WELL SCREENS.

APPLICATION FILED OCT. 17, 1914.

1,287,031.

Patented Dec. 10, 1918.

3 SHEETS—SHEET 3.

Fig. 13

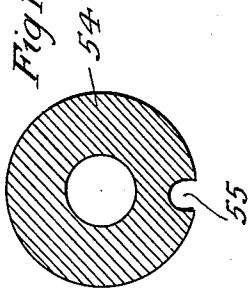


Fig. 14

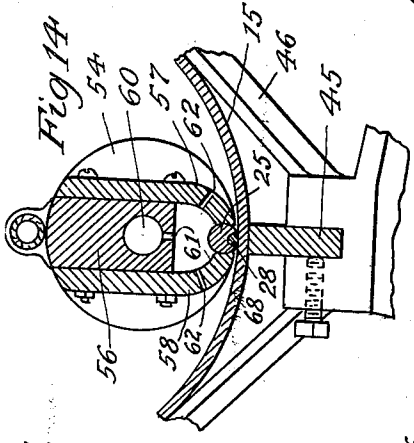


Fig. 11.

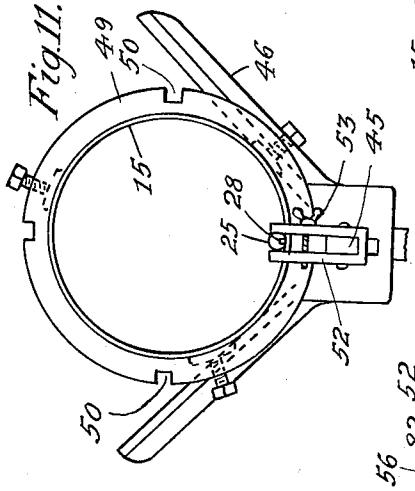


Fig. 10.

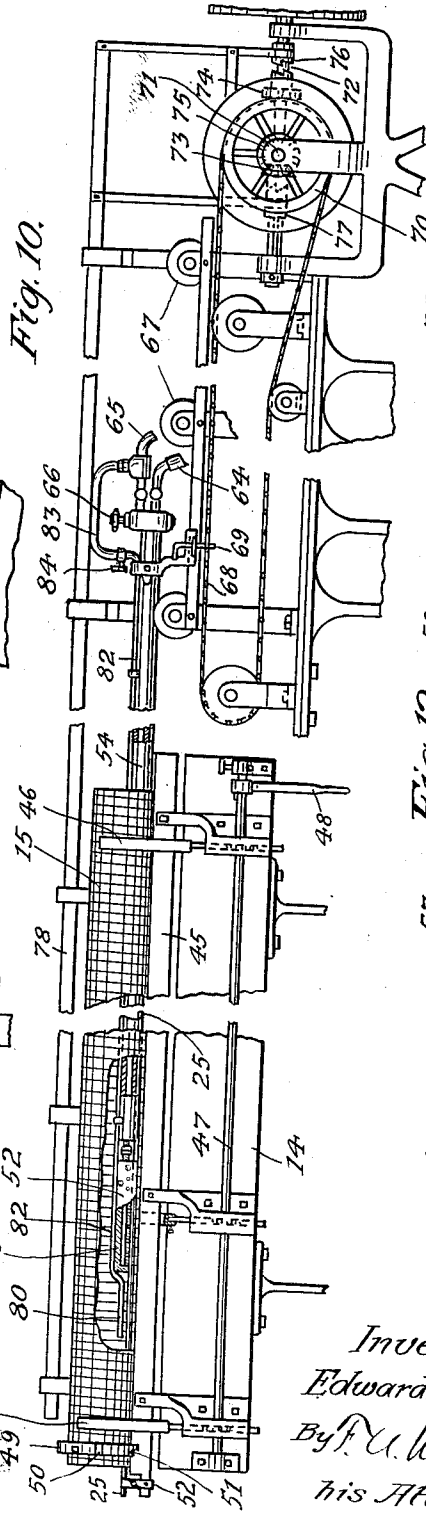
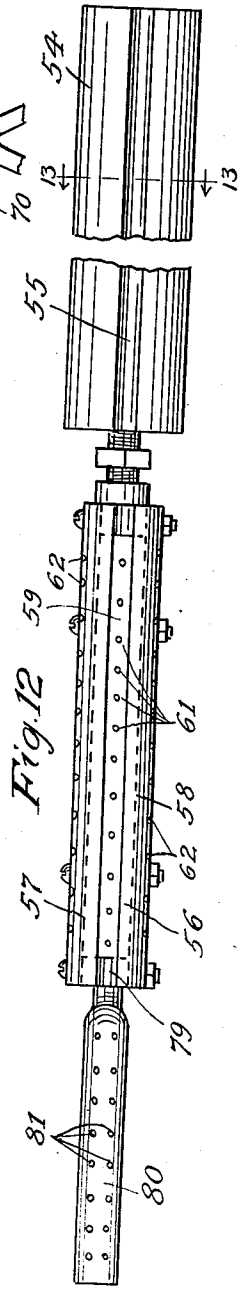


Fig. 12



Witnesses:
Theo. Lagaard
A. M. Royal

Inventor:
Edward E. Johnson.
By F. A. Whiteley
his Attorney.

UNITED STATES PATENT OFFICE.

EDWARD E. JOHNSON, OF ST. PAUL, MINNESOTA.

METHOD OF REINFORCING WIRE-FORMED TUBULAR WELL-SCREENS.

1,287,031. Specification of Letters Patent. Patented Dec. 10, 1918.

Application filed October 17, 1914. Serial No. 867,199.

To all whom it may concern:

Be it known that I, EDWARD E. JOHNSON, a citizen of the United States, residing at St. Paul, in the county of Ramsey and State of Minnesota, have invented certain new and useful Improvements in Methods of Reinforcing Wire-Formed Tubular Well-Screens, of which the following is a specification.

My invention relates to a method of reinforcing wire-formed tubular well screens, particularly of the type shown and described in Letters Patent of the United States issued to me September 22, 1908, Number 899,054. In this form of well screen the body of the tubular member is constructed of a series of coils of wire, the adjacent coils having overlapping convolutions interlocking with one another and forming a cylinder with inner and outer walls, perforations being formed in the wire at the inner wall and cracks or crevices appearing between the edges of adjacent coils on the outer wall communicating with said perforations. It is the object of my present invention to provide a method of bracing or reinforcing such a well screen by soldering a series of rods to each of the coils forming the tube along the inner wall thereof. The several steps of my process comprise: first, providing the rods to be soldered to the inner wall with a straight linear groove along an element of said rods and filling said groove with a strip of solder associated with some flux for chemically cleaning the surfaces to be soldered; second, fixing said rod within the screen tube and with said solder-filled groove turned down and straightening said rod so that the solder-filled groove will extend along an element of the inner cylindrical surface of the tubular well screen; third, heating the rod somewhat throughout its length so as to free the flux which is contained in the groove in a solid form and permit the cleaning action of said flux upon the surfaces to be soldered; fourth, progressively heating the rod alone to a temperature sufficient to melt the solder and permit the same to flow out of the groove and between the rod and the surfaces of the coils of the tube; and, fifth, immediately thereafter cooling the rod and the solder while the rod is held straight and down upon the coils of the pipe to cause the solder to set and secure the rod to the successive coils before the rod has time to warp or spring up after the solder is melted.

The full objects and advantages of my invention will appear in connection with the detailed description thereof and are particularly pointed out in the claims.

The drawings illustrate the character of well tube to which my reinforcing method is applied and suitable apparatus for practising my process.

Figures 1 and 2 illustrate on an enlarged scale the inside and outside of the wires which are coiled upon one another to form the strainer tube. Fig. 3 is a sectional view of an edge of such a tube also on an enlarged scale. Fig. 4 is a side view and Fig. 5 an end view of a tube having my reinforcing rods applied thereto, Fig. 4 being broken away in part to show the position of such a rod. Fig. 6 is a transverse sectional view on an enlarged scale of one of the rods which are soldered to the coils at the inside of the tube. Fig. 7 is a side elevation, partly diagrammatic, of a machine for forming a straight groove along an element of the rod and filling said groove with solder and flux. Figs. 8 and 9 are detail views of said machine. Fig. 10 is a side elevation, partly in section, of the means for holding the tubular member and of fixing and straightening the rod within the same so that the solder-filled groove extends along an element of the same and the means for heating and cooling the rod. Fig. 11 is an enlarged end view of the parts shown in Fig. 10. Fig. 12 is a bottom view of a straightening and heating device. Fig. 13 is a sectional view on line 13—13 of Fig. 12. Fig. 14 is a section of the burner mechanism in operation within the tube.

As described in my said Letters Patent No. 899,054, and referring to Figs. 1 to 5, the well screen tube 15 is formed by spirally coiling a shaped wire 16, the front and rear sides of which are shown in Figs. 1 and 2, and the cross-sectional characteristics of which, as the same appear in the pipe, are shown in Fig. 3. It will be seen that the inner portions 17 of the several wires, as shown in Fig. 3, closely contact and are turned over at the edge, as indicated at 18, whereby, through the flange portion 19 the several coils of wire are progressively locked together to form the screen tube, there being no frame or shaping member in connection with the screen tube. The openings through the inner portion of the tube wall consist of the holes 20 punched through the

portions 17 of the shaped wire. Admission to these holes from the outside is through cracks or crevices 21 which approach the closest at the outside surface of the screen tube and grow larger so as to embrace all of holes 20 by means of an inward beveling, indicated at 22. The cracks or crevices 21 thus provide the real screening element. These cracks cannot be clogged because any grain of sand which is capable of passing within the crevice 21 will immediately pass on through into the inside of the pipe, because the crevice 21 is narrowest at exactly the outside surface of the well tube. From the above it will be seen that although the tube is formed and held in position by the interlocking wire coils and therefore is a complete strainer tube without the use of any frame, yet the actual supporting elements of the tube are relatively thin, so that under strain there is danger of some of the wires at least buckling down and closing up the cracks 21. There is also danger of some coils of the wire being sprung out of position, thereby causing a buckling or bending of the entire strainer tube. It has been found, therefore, that in order to obtain the highest usefulness of screen tubes manufactured in accordance with my said patent, said tubes, especially of the larger diameters, should be reinforced and that the reinforcing rods or stays should be secured to practically all of the coils of which the tube is formed. The method which I employ to accomplish this reinforcement, and which is herein described and claimed, provides a means of securing reinforcing rods to the inside of a completed strainer tube of the desired length (from ten to eighteen feet long). This securing is done by solder and the rods are soldered to all of the coils which form the tube.

The rod to be soldered into the tubes, may be of any suitable diameter, from three-sixteenths to five-sixteenths of an inch being a generally satisfactory size. As above indicated, it is essential that the solder strip formed in this rod shall be perfectly straight along a linear element of the rod. As shown in Fig. 10, the rod, which is designated by the numeral 25, has a rectangular slot 26 cut along the side of the rod, the edges of said slot being rounded, as indicated at 27. The slot has set therein a wire 28 of solder, and surrounding this wire, and particularly in the angular corners 29 thereof, is fluxing material which is put into the slot at the same time as the solder wire 28. In Figs. 7 to 9 is shown a form of machine for making the slot 26 perfectly straight along an element of rod 25 and putting the solder and flux into said slot. The rod 25 may be originally provided in a continuous form coiled upon a reel 30. From this reel the rod passes through two sets of straightening rolls 31 and 32, respectively, in planes at right angles to one another by which the rod is perfectly straightened and all kinks taken out of same. The rod is fed forward by two sets of driven feeding rollers 33 and 34, respectively, located in advance of the straightening rollers and at each side of a cutter 35, which operates in an anvil or block 36 through apertures in which the rod 25 passes. Upon the side of the anvil 36 is bolted a bracket 37 having a central opening 38 in which is a sleeve device 39 held fixed in the opening 38 by means of a set screw 40. The sleeve 39 is provided with a guide 41 which exactly fits within the slot 26 in rod 25 and holds said rod from any oscillatory movement and so that the slot will be continuously cut along a linear element of the cylindrical surface of the rod. The solder wire 28 is fed from a reel 42 through a bath 43 containing the fluxing material, from which it passes to the rod 25 to be pressed into the slot 26 by feed rollers 34. The above described apparatus for cutting a straight slot along a linear element of the rod and placing therein the solder and flux is described herein as illustrative of one means of performing an important step of my process, but is not claimed in this application as patent protection for the machine will be sought in another application.

The next step of the process requires means for holding the tube 15 and rod 25 relatively positioned so that said rod will be held straight inside of the tube along a linear element of the cylindrical inner wall of the tube with the solder strip in the rod upon the tube-coil surfaces in said element. A means for accomplishing this is shown in Figs. 10 to 14, inclusive. As here shown, a table 44 supports a longitudinal bar 45 and also a series of crotched pieces 46 which are adjusted vertically by means of the shaft 47 operated by handle 48. By this means the tube 15 is held positioned so that an element along the lower portion thereof engages the edge of support 45. A ring 49 is secured to the tube 15 and, by means of notches 50 cooperating with a notched portion 51 of the rail 45, holds the tube 15 in the position desired for the attachment of a rod. The rod 25 is inserted through the tube and has the forward end thereof secured so that the solder strip 28 is down by means of a clamp 52 operated by thumbscrew 53. In this position the tube 15 will be correctly held and the forward end of rod 25 will be properly positioned; but, since the rod is flexible and in handling is apt to have kinks and bends in the same, it is necessary to straighten the rod throughout its length inside of the tube and hold the same down upon the surface to be soldered before the actual soldering operation can be undertaken. The straightening device comprises a tubular member 54

having a slot 55 in the lower portion thereof which extends in a straight line along a linear element of the member 54 and which is of a size to receive the rod 25. The tubular member has secured to the forward end thereof a burner 56 which comprises a pair of side plates 57 and 58, and which plates are spaced apart at their bottom a distance equal to the width of slot 55 and form, in effect, a continuation of said slot, as indicated at 59 in Fig. 12. The member 54 is placed upon the free end of rod 25 at the rear end of tube 15, so that rod 25 extends within the space 59 between plates 57 and 58 and into the slot 55 in member 54, and said member is moved forward through the tubular screen while resting upon the rod 25 therein. The member being held relatively fixed at one end and the rod 25 being fixed at the other end, this results in causing the rod to fall in a perfectly straight line within slot 55 and to be held down upon the inner surface of tube 15 by the weight of the member 54.

A means for effecting the third step of the process, to heat the rod throughout its length sufficiently to release the flux but not to melt the solder, as shown herein, may operate at the same time that the straightening of the rod takes place through action of the burner 56 as the same is moved forward through the straightener tube. This burner comprises the central block having a bore 60 with apertures 61 extending vertically downward from said bore, apertures 62 through plates 57 and 58 permitting escape of the gases of combustion from the burner chamber 63 which is located directly above rod 25 and into which rod 25 projects from its position between the inturned lips of plates 57 and 58. A mixture of fuel gas from a source of supply 64, and air from a source of compressed-air supply 65, is controlled by a valve 66, the mixture passing through tubular member 54 to the burner 56. During the inward movement of member 54 and burner 56, which is relatively rapid and effects the straightening of the rod 25 aforesaid, said rod is subjected to a rapid heating action by the burner which heats the rod sufficiently to release the flux but not enough to melt the solder. This flux runs out of the slot in the rod 25 and over the adjacent surfaces of rod and tube, where it has time to effectually clean the same for the soldering action before the return movement of the burner, which causes the solder to melt and flow between the rod and the adjacent surfaces of successive coils forming the tube, and this comprises a means for effecting the fourth step of the process.

Outside of tube 15 the member 54 is moved along a series of rollers 67. The member 54 is driven by a sprocket chain 68 to which it is releasably connected by means of a pin 69. The sprocket chain 68 is driven by a sprocket wheel 70 on a shaft 71, and the shaft 71 is driven from a power shaft 72 at either of two speeds, one being from a bevel gear 73 on the power shaft, and the other, or lower speed, being from a pinion 74 on the power shaft; the bevel gear 73 meshing with a bevel gear 75 on shaft 71 of small diameter, while the pinion 74 meshes with a side spur gear of relatively larger diameter. Connected clutch members 76 and 77 are operated by a hand rail 78 which extends throughout the length of the machine to the end of the strainer tube 15, and by means of which the operator may change the feed of tube 54 from fast to slow, or discontinue the same entirely. It will be noted that the above construction provides a means for feeding the member 54, carrving burner 56 rapidly in its outward or forward direction through the tube and slowly in its return or rearward movement.

The burner mechanism here shown and described directs the flame solely upon the rod 25. This concentrates the heat and said heat is transmitted through the rod to the solder and is not dissipated by the extended radiating surfaces of the tubular well screen. For this reason the heat of the burner can be nicely gaged without waste and no more heat be applied than just sufficient to melt the solder within the slot at the point where the rod is leaving the burner chamber. That is, as the burner is moved progressively along the rod a given point in the rod will be subjected to heat of the burner from the point where it enters the burner chamber at the rear end of burner to the point where it leaves the burner chamber at the front end of the burner and the heat will be just sufficient so that the solder will melt and run freely from the slot at the point where the rod passes out of the burner chamber and where the end of the burner is resting upon the rod, as indicated at 79 in Fig. 12.

Because of the fact that the well strainer tube is full of apertures through which the melted solder could run away, and because after the burner 56 and member 54 have been withdrawn from over any portion of the rod it becomes less firmly held down upon the surfaces of the coils and therefore may spring up, it is desirable, to insure soldering of the rod to each of the coils, that the rod and the solder be quickly cooled to set the solder and fasten the rod to each of the coils. A means for effecting this fifth step of my process consists in providing a blower tube 80 immediately in front of the burner 56, said tube being provided with a series of apertures 81 directed toward the top of the rod and the sides thereof. The blower 80 is connected by means of a tube 82 with the source of compressed-air supply 65, an offset 83 and valve 84 regulating the supply of

compressed air. By this means, almost instantly after the solder has melted and run out between the surfaces of the rod and of the successive coils of the strainer tube the rod and the solder are cooled and the latter is set, which insures the soldering of the rod to each of the coils of the tube.

It will be apparent, therefore, that by my process I am enabled to secure rods to each of the coils of a previously-formed strainer tube constructed and consisting entirely of convolutions or coils of wire progressively locked to one another. The rods are united to every coil of the tubular well screen along a narrow continuous line between the rod and the screen. The entire soldering action from the moment of melting the solder until the same is set, is so quickly and effectively performed that the solder does not have time to run away from the rod or flow out through the perforations and crevices in the wall of the well tube. The solder also will not flow out at the sides of the rod, but will secure the rod only at the point of contact with the screen tube so that a neat and very effective reinforcement is procured.

I claim:

1. A method of reinforcing wire-formed tubular well screens, which consists in applying to the inside of the screen tube normally separate and independent metallic rods each having a straight linear groove filled with solder and flux, holding said rod within and with the solder-filled groove in engagement with the surfaces of the wires forming the screen tube along an element thereof, and applying heat progressively to the rod alone within the tube whereby the solder and flux are melted and run between the engaging portions of said rod and screen tube so that upon cooling of the solder the rod is secured throughout its length to the coils forming the inner wall of said screen tube.

2. A method of reinforcing wire-formed tubular well screens, which consists in applying to the inside of the screen tube normally separate and independent metallic rods each having a straight linear groove filled with solder and flux, holding said rod within and with the solder-filled groove in engagement with the surfaces of the wires forming the screen tube along an element thereof, applying heat to the rod progressively from one end to the other to progressively melt the solder, and progressively cooling the rod and the solder immediately after the melting of the solder and while the rod is still held to set the solder and thereby secure the rod throughout its length to the coils forming the inner wall of said screen tube.

3. A method of reinforcing wire-formed tubular well screens, which consists in applying to the inside of the screen tube normally separate and independent metallic rods each having a straight linear groove filled with solder and flux, holding said rod within and with said solder-filled groove in engagement with the surfaces of the wire forming the screen tube along an element thereof, applying heat to the rod progressively from one end to the other to progressively melt the solder, and progressively subjecting the rod and the solder to a blast of air immediately after the solder has melted and while the rod is still held to set the solder and thereby secure the rod throughout its length to the coils forming the inner wall of said screen tube.

4. The method of reinforcing wire-formed tubular well screens, which consists in supporting the screen tube along an element thereof, providing metallic rods with a straight linear groove along an element of said rod said groove being filled with solder and a flux, straightening and holding said rod within and along an element of said screen tube above said support, and applying heat to the rod alone whereby the solder and flux are melted and run between the engaging portions of said rod and screen tube so that upon the cooling of the solder the rod is secured throughout its length to the coils forming the inner walls of said screen tube.

5. The method of reinforcing wire-formed tubular well screens, which consists in providing metallic rods with a straight linear groove along an element of said rod said groove being filled with solder and a flux, extending said rod within the tube and securing the same at one end with the solder-filled groove turned down and in engagement with the inner wall of the tube at the point where said rod is secured, thereafter straightening said rod and holding the same straight within the screen tube and with the solder-filled groove engaging the inner surfaces of the tube wires along the inside of the screen tube, and applying heat to the rod alone after the same is straightened progressively from the secured end of the rod to the other end to progressively melt the solder so that upon cooling of the solder the rod is secured throughout its length in a straight line to the coils forming the inner walls of said screen tube.

6. The method of reinforcing wire-formed tubular well screens, which consists in supporting the screen tube along an element thereof, providing metallic rods with a straight linear groove along an element of said rod said groove being filled with solder and a flux, straightening and holding said rod straight within and along an element of said screen tube above said support, applying heat to the rod progressively from one end to the other to progressively melt the solder, and progressively cooling the rod and solder immediately after the melting of the solder and while the rod is still held to

set the solder and thereby secure the rod throughout its length to the coils forming the inner walls of said screen tube.

7. The method of reinforcing wire-formed tubular well screens, which consists in providing metallic rods with a straight linear groove along an element of said rod said groove being filled with solder and a flux, straightening and holding said rod straight within and along an element of said screen tube, heating the rod moderately throughout its length so as to release the flux and permit the same to run between the engaging portions of the rod and screen tube, and thereafter heating the rod throughout its length to melt the solder so that upon cooling of the solder the rod is secured throughout its length to the coils forming the inner walls of said screen tube.

8. The method of reinforcing wire-formed tubular well screens, which consists in providing metallic rods with a straight linear groove along an element of said rod said groove being filled with solder and a flux, straightening and holding said rod straight within and along an element of said screen tube, heating the rod moderately throughout its length so as to release the flux and permit the same to run between the engaging portions of the rod and screen tube, thereafter progressively heating the rod from one end to the other to progressively melt the solder, and progressively cooling the rod and the solder immediately after the melting of the solder and while the rod is still held to set the solder and thereby secure the rod throughout its length to the coils forming the inner walls of said screen tube.

In testimony whereof I affix my signature in presence of two witnesses.

EDWARD E. JOHNSON.

Witnesses:

F. A. WHITELEY,

H. A. BOWMAN.