July 28, 1936. E. E. JOHNSON 2,049,206

METHOD OF FORMING WELL SCREENS

Original Filed April 1, 1929

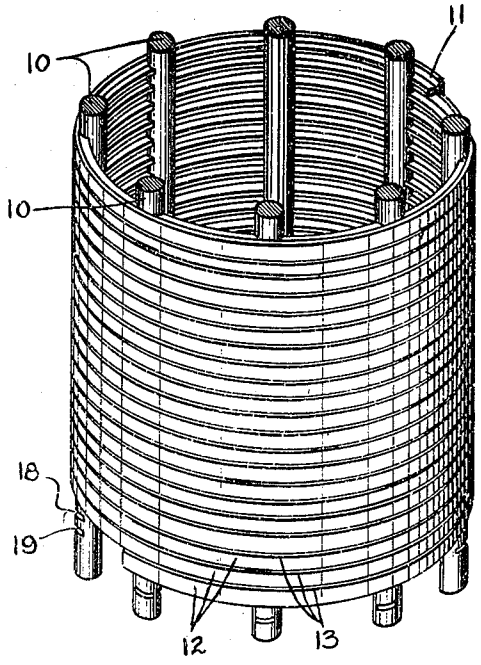


Fig. 1

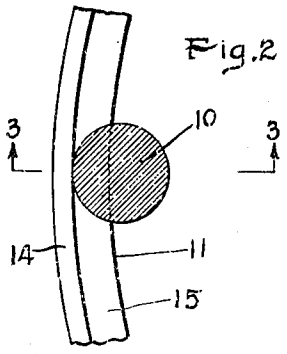


Fig. 2

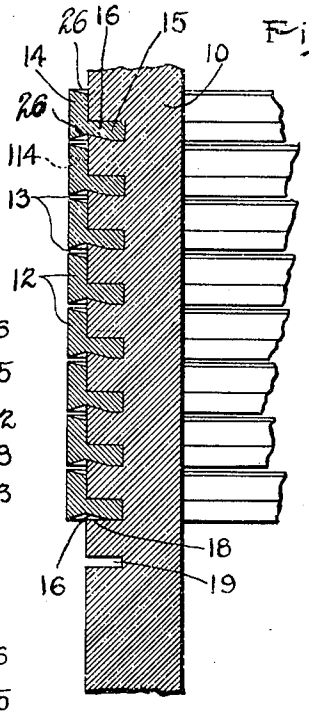


Fig. 3.

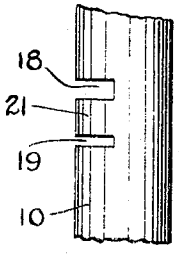


Fig. 4

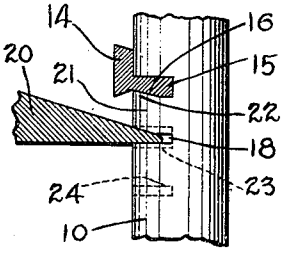


Fig. 6.

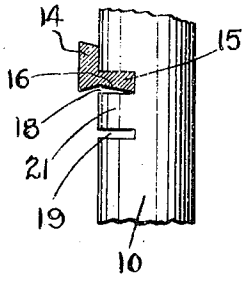


Fig. 5

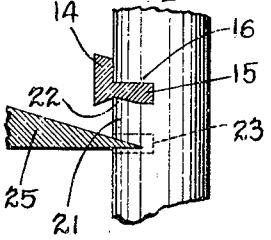


Fig. 7

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METHOD OF FORMING WELL SCREENS

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Original application April 1, 1929, Serial No. 351,691. Divided and this application January 21, 1932, Serial No. 587,921. Renewed July 22, 1935

20 Claims. (Cl. 29—163.5)

My invention relates to methods of constructing well screens and particularly to methods of constructing well screen wall constructions formed with adjoining elements having crevices therebetween through which the water may freely pass into the screen proper and from which the sand surrounding the screen is excluded.

This invention is a divisional application of my application for patent Ser. No. 351,691, filed April 1, 1929.

In the construction of well screens of the type referred to, the primary object is to provide an efficient construction by means of which the greatest percentage of active intake per unit of exposed area can be secured, and to further produce a structure in which the material is most effectively disposed to resist the stress involved.

An object of the invention is to provide a method by means of which a screen wall having these characteristics can be readily and easily fabricated.

Another object of the invention resides in providing a method by which a screen wall may be produced having a comparatively narrow outer face between slots and a comparatively great depth of element to resist pressure applied to the element between supports together with a method whereby the wall element can be effectively secured to the supporting member, the screen being constructed to form a continuous, direct, unobstructed and inwardly increasing water passageway.

An object of the invention resides in using a screen element with a dovetail web and in the method of flowing a portion of the supporting rod longitudinally and pivotally against the dovetailed web at the screen element to hold the same attached thereto.

Another object of the invention resides in using a screen element with a dovetailed web, and in the method of forming the well screen in which a portion of the body of the supporting rod is shifted bodily in a longitudinal direction against the dovetailed web of the spaced convolutions of the screen wall element to hold the same attached thereto.

A feature of my invention resides in the method of forming well screens in which a wedge is driven into the body of the rod adjacent a groove therein containing the web of the element to force a portion of the body of the rod into the undercut portion of the web of said element.

Another object of my invention resides in the method of forming well screens in which a second groove is cut in the rod adjacent the groove containing the wall element last placed, and in which said wedge is driven to force the portion of the body of the rod standing between said grooves longitudinally of said rod and into the undercut portion of the web of said element.

A still further object of my invention resides in the method of forming well screens in which the second groove is recut to receive the web of the next convolution of the screen element and in which the operation is successively repeated for each convolution added.

A still further object of the invention resides in the method of constructing well screens in which the metal of the rod is distorted solely from the exposed side of the element as the same is coiled about the supporting rod for the purpose of securing the screen element in place.

Other objects of the invention reside in the novel combination of steps and in the various ways of performing the steps, hereinafter more fully described.

In the drawing:

Fig. 1 is a perspective view of a section of a well screen constructed in accordance with my improved method.

Fig. 2 is a fragmentary elevational view of one of the supporting rods and a portion of the screen wall element attached thereto, and drawn to an enlarged scale.

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

Fig. 4 is an elevational view of one of the supporting rods showing the same grooved to receive a convolution of the wall element.

Fig. 5 is a view similar to Fig. 4 illustrating the grooved rod with one convolution of the wall element inserted therein.

Fig. 6 is a view similar to Fig. 5 showing the method of driving the standing portion of the rod lying between the grooves, laterally, with reference to the wedge and into the undercut portion of the web of the element.

Fig. 7 is a view similar to Fig. 6 showing another method of driving a portion of the body of the rod laterally into the undercut portion of the web of the element.

In the construction of a well screen, it is highly desirable to form the screen so that the interior of the screen is perfectly clear and devoid of pockets or shelves wherein the fine particles of sand and silt which may pass through the crevices of the screen may lodge and eventually clog the crevices between the elements of the screen wall

and reduce its capacity. At the same time, it is desirable to have a screen with maximum capacity for a given size and with sufficient rigidity to retain its form and the size of the crevices or openings between the convolutions of the screen wall element thereof. By my improved method a screen having these desirable characteristics can be readily manufactured and at an economical cost.

With my improved screen, a number of longitudinally disposed supporting rods 10 are employed which are usually arranged in cylindrical formation. Upon these rods is wound a formed element 11, the convolutions 12 of which, as indicated in Figs. 1 and 3, are uniformly spaced from one another to form a series of divergent crevices 13 through which the water may pass from the exterior of the screen and into the interior thereof. These divergent crevices serve to keep back the sand and at the same time admit of free passage of the water into the interior of the screen. Due to the form of the said crevices any fine particles of sand which enter the same are carried through with the water so as not to clog the screen wall and render the device inoperative.

The supporting rods 10 may be round, square, or hexagonal or may be shaped in any other suitable form by which sufficient rigidity will be procured to take care of the longitudinal stresses imparted to the completed screen structure. These rods, as will become evident, serve both to support the various convolutions of the screen element and to lend rigidity to the screen structure and form in conjunction with the screen element 11 a composite screen wall without the use of a supporting tube or other frame structure.

The screen wall element 11 of my invention is previously formed in the desired shape by drawing or rolling. This element as best shown in Fig. 3 is preferably formed of L-shaped cross section and is provided with a flange 14 having undercut edges 26 at the upper and lower portions thereof which, when the convolutions of the element are arranged adjacent one another, form the divergent crevices 13 previously referred to. The screen wall element 11 is further constructed with a web 15 issuing inwardly from the flange 14. This web is undercut or constructed in the form of a male dovetail designated at 16, the narrowed portion of which is attached to the flange 14. If desired, a T-shaped or similarly constructed element having a suitable dovetailed web may be employed instead of the L-shaped element.

My improved method of forming the well screen is carried out as follows: The various supporting rods 10 are first arranged in cylindrical formation and preferably equally spaced and are disposed upon some suitable support (not shown), said rods being held in proper position thereon by any suitable means. In constructing the screen the process is preferably carried on continuously and the ribbon comprising the wall elements is wound helically around said rods and is successively dovetailed to the same during the winding operation. In accomplishing this result each of the rods is successively grooved or notched laterally by sawing, milling or in any other suitable manner to form pairs of spaced grooves 18 and 19 which extend completely across said rods and partially through the same. These grooves are spaced apart a distance substantially equal to the pitch of the convolutions of the screen element. Groove 18 is preferably made with parallel sides and of sufficient width to allow the widest portion of web 15 to enter and be seated snugly in the bottom thereof. Each pair of grooves on each successive rod leads the grooves on the preceding rod so that when one round has been made, the second groove 18 on any rod is spaced from the first groove 18 on said rod a distance equal to the pitch of the helix.

As the cutting of the rods 10 progresses the element 11 is coiled about said rods and during such operation, the web 15 thereof is successively inserted into the successive grooves 18 on the various rods. The exact position of the element, when so disposed, is illustrated in Fig. 5. As the notching of the rods and the winding of the element proceeds, a wedge, diagrammatically indicated at 20 in Fig. 6, is driven into the groove 19 of the rod into which web 15 has last been inserted, which has the effect of forcing the intervening portion 21 of the body of the rod standing between the said grooves 18 and 19 over against the side wall of the web 15 and into contact with the dovetail portion 16 thereof, thus gripping the dovetail 16 of the web 15 and securely locking the element 11 to the rod 10 with the web thereof imbedded in the respective grooves. In winding and attaching the element to the rods, suitable means are employed for progressively spacing the grooves so that the successive convolutions 12 of the element are spaced apart to provide the crevices 13. The distance between the two grooves 18 and 19 is preferably substantially equal to the pitch of the convolutions of the screen wall. When the grooves are so spaced and a complete convolution of the element has been attached to all of the rods, the cutter for the groove 18 in the last rod will be directly in alignment with the groove 19 in the first rod. The two cutters will then cut the rod in positions immediately following the former position, as indicated in dotted lines in Fig. 6 at 23 and 24, to form two new grooves on each particular rod, following the preceding grooves 18 on the said rod. The web 15 of the element is then laid into this second groove and the operation is repeated to lock said web therein. In this manner, the element is progressively locked to the successive rods in helical formation by a metal-to-metal dovetail joint which operation is continuous for any length of screen desired, within the limits of the supporting device on which the screen is constructed.

It will be noted that the grooves 18 after the first convolution has been completed register with the grooves 19 of the previous convolution, and that the grooves 19 are narrower than the grooves 18. The groove 19 is of temporary use only and is for the accommodation of the wedge 20 in locking the dovetail web of the element to the supporting rod. This groove is purposely made narrower than groove 18 so that on the withdrawal of wedge 20 it still presents in cross section a distorted section of metal which will be completely cut away by the formation of the succeeding groove 18. I am thus enabled to lock the successive convolutions of the screen wall element to the rods by a dovetail joint completely encompassing that portion of the web of the element lying within the circumference of the rod.

For the purpose of securing greater stability to the joint I prefer to support the inner side of flange 14 of element 11 on the edge of rod 10 when it is locked in position as shown in Fig. 3. It will be seen from Figs. 1 and 2 that the supporting rod 10 lies wholly within the flange 14 of the wall element 11 so that the crevice 13 is open through-

out its entire length to receive the water and conduct the same into the screen proper.

If desired, the groove 19 may be dispensed with and a sharp edged wedge, such as designated at 25 in Fig. 7, may be employed instead of the blunt edged wedge shown in Fig. 6. In such case, the wedge 25 is bodily driven into the rod and serves to force the metal between its point of application and the preceding groove 18 against the dovetail 16 of the element 11. This tool is applied at a distance from the center of the groove substantially equal to the pitch of the convolutions so that the distorted part of the rod may be cut away to form a groove for the reception of the next following convolution, the same as in the other method. By the use of this method, the second cut is eliminated, though greater pressure is required in effecting the locking of the element in place upon the rod. Where the spacing of convolutions is great, the wedge may be driven into the support at a location intermediate the points of attachment of the convolutions to the support.

In the use of well screens, different widths of crevices are required to meet with the various soil conditions and the particular requirements of the user. Such varying widths of crevices may be procured by several different methods. In one method, the width of the flange 14 of the well screen element 11 may be cut down within certain limits as indicated at 114 in Fig. 3 so as to procure the desired spacing of the convolutions of the element without changing the pitch thereof. Screen wall elements may also be utilized in this method which have been previously formed of the right width to procure the desired spacing. In another method a screen wall element of one dimension is used and the pitch of the convolutions of the same varied by changing the lead of the coiling apparatus to procure the desired results.

Although I have described my invention as consisting in progressively dovetailing an element of the screen wall to a plurality of rods, yet I do not limit it to the development of a cylindrical form of screen as it is obviously applicable to the production of plane as well as cylindrical screen surfaces.

The method is highly advantageous in that an extremely rigid and substantial screen construction is produced. With a screen constructed by my improved method maximum capacity may be had for a given size of screen and with a minimum amount of material and labor. The method may be carried on progressively so that any length or diameter of screen may be constructed within the limits of the device on which the screen is made. With my improved method a relatively narrow outer flange for each of the convolutions may be used and sufficient undercutting given the inner edge of the flange of the element so that the lodging of particles of sand accidentally passing through the crevices between convolutions and the clogging of the screen are prevented. At the same time, a direct path for the passage of the water to the well pipe is had so that no pockets or shelves or other places are formed in proximity to the crevices in the screen on which particles of sand might lodge to eventually clog the screen wall.

Changes in the various steps of my invention as herein disclosed may be made within the scope of what is claimed without departing from the spirit of my invention.

Having described my improved method, the apparatus for performing the same and the resulting structure, what I claim as new and desire to protect my Letters Patent is:

1. The method of attaching a well screen wall element constructed with a dovetailed web to a supporting member, which consists in cutting a groove in the member in inserting the web of the element into the grooves, in cutting in said member a second groove adjacent said first groove, and in driving a wedge into said second groove, to force the intervening portion of the body of the member against the dovetailed portion of the element.

2. The method of attaching well screen wall elements constructed with dovetailed webs to a supporting member which consists in cutting a groove in the member, in inserting the web of an element into the groove, in cutting in the member a second narrower groove adjacent said first groove, in driving a wedge into said second groove to force the intervening portion of the body of the member against the dovetail portion of the element, and in recutting said second groove to the form of said first groove for the repetition of the operation.

3. The method of forming a succession of dovetails in a metal rod which consists in forming the rod with a parallel walled groove, in wedging metal from the rod adjacent to one of the walls of the groove toward the other wall of the groove, and in recutting the wedged-out portion to form the next succeeding groove.

4. The method of forming well screens which consists in arranging a plurality of longitudinal supporting rods in cylindrical formation, in cutting a plurality of spaced grooves in all said rods, in coiling a formed wall element above said rods, in directing a portion thereof into one of said grooves, and in shifting the metal of the rods longitudinally from another of said grooves to lock the wall element in its groove.

5. The method of forming helical well screens which consists in arranging a plurality of longitudinal supporting rods in cylindrical formation, in progressively cutting a helical groove of predetermined pitch in said rods, in coiling a formed wall element about said rods and inserting the same into said groove, in distorting the rods progressively at localities in advance of said groove and spaced from said groove distances substantially equal to the pitch of said groove to urge the metal of the rods against the screen wall element and in removing the distorted portions of said rod in the further cutting of said groove.

6. The method of forming helical well screens which consists in arranging a plurality of longitudinal supporting rods in cylindrical formation, in progressively cutting a helical groove of predetermined pitch in said rods, in coiling a formed wall element about said rods and inserting the same into said groove, in cutting a narrower helical groove in said rod in the path thereof and of the same pitch as said first groove and leading said first groove by a distance substantially equal to the pitch of said first groove, and in shifting the metal of the rods between the grooves away from the smaller groove and against the wall element in the first groove.

7. The method of forming helical well screens which consists in arranging a plurality of longitudinal supporting rods in cylindrical formation, in progressively cutting a helical groove of predetermined pitch in said rods, in coiling a formed wall element about said rods and inserting the same into said groove, in cutting a narrower helical groove in said rod in the path thereof and

of the same pitch as said first groove and leading said first groove by a distance substantially equal to the pitch of said first groove and in inserting a tool in the second groove to shift the metal of the rods between the two grooves against the wall element in the first groove.

8. The method of forming helical well screens which consists in arranging a plurality of longitudinal supporting rods in cylindrical formation, in simultaneously and progressively cutting two helical grooves of like pitch, in said rods, in coiling a formed wall element about said rods and in inserting the same into one of said grooves and in inserting the member into the other groove to shift the metal of said rods between said grooves against said wall element.

9. The method of forming helical well screens which consists in arranging a plurality of longitudinal supporting rods in cylindrical formation, in progressively cutting a helical groove of predetermined pitch in said rods, in coiling a formed wall element about said rods and inserting the same into said groove, and in progressively distorting the rods at localities in advance of said groove and spaced from said wall element to shift sections of the rod bodily against said wall element.

10. The method of forming a succession of dovetailed grooves in a metal rod which consists in forming the rod with a parallel walled groove adjacent the last formed dovetail groove, in distorting the metal of the rod beyond the parallel walled groove and at a distance from the end wall thereof greater than the minimum thickness of the metal of the rod between the dovetailed grooves to cause a movement of the metal between said wall and the locality of distortion toward the opposite wall of the groove, in cutting succeeding parallel walled grooves and in repeating the operation of distortion after the cutting of each parallel walled groove.

11. The method of producing a dovetail lock between a metal rod and a screen wall element which consists in forming a transverse groove in the rod, seating therein a dovetailed element having an inclined side, in partially separating from the body of the rod adjacent the groove, a portion defined by the wall of the groove next to the inclined side of the element and of substantially uniform thickness as measured from such face of the groove and in bending the portion so separated bodily about the base of the groove and against the inclined wall of the element.

12. The method of producing a dovetail lock between a metal rod and a screen wall element which consists in forming a transverse groove in the rod, seating therein a dovetailed element having an inclined side, in applying pressure longitudinally of the rod throughout the entire cross section of the portion of the rod adjacent the dovetailed element to bodily shift such portion substantially in a longitudinal direction and against said dovetailed element to lock the same in place.

13. The method of locking a screen wall element constructed with a dovetailed portion having an inclined wall transversely to a metal rod which method consists in forming the rod with a parallel walled groove, seating the dovetailed portion of the screen wall element therein and in forcing a metal wedge with its working face next to the element substantially parallel to the inclined wall of the dovetailed portion of the screen element into the body of the rod adjacent the groove, whereby the intervening portion of the rod is forced against the inclined wall of the dovetailed portion of the element.

14. The method of forming a dovetailed groove in a metal member having a straight wall and a planiform wall inclined throughout its extent which consists in cutting a rectangular groove in said member and in forcing a wedge, having one face substantially parallel to the inclined side of the dovetailed slot to be formed, into the body of the rod to substantially the depth of the wall to tip one wall of the groove inwardly and toward the opposite wall.

15. The method of forming a dovetailed groove in a metal rod which consists in forming the rod with a parallel walled groove, effecting a partial separation from the body of the rod of a portion of metal adjacent one wall of the groove of a depth substantially equal to the depth of the groove and in shifting said portion toward the opposite wall of the groove.

16. The method of producing a dovetailed lock between a metal rod and a screen wall element having a dovetailed portion which consists in cutting a transverse parallel walled groove in the side of the rod, seating the dovetailed portion of the element therein, effecting axial separation of a portion of the body of the rod standing adjacent one wall of the groove to substantially the depth of the groove and forcing the portion so separated over against the dovetailed portion of the element seated in the groove.

17. The method of attaching a well screen wall element constructed with a web having an inclined wall to a supporting member, which consists in cutting a groove in the member, in inserting the web of the element into the groove, in partially separating from the body of the member adjacent said groove a portion defined by the wall of the groove adjacent the inclined side of the element and of a thickness not exceeding the depth of the groove and of a height substantially equal to the depth of the groove, and in forcing the portion so separated bodily against the inclined wall of the element.

18. The method of forming a succession of dovetailed grooves in a metal rod which consists in forming a rectangular groove in the rod, in cleaving from the body of the rod adjacent to one wall of the groove a standing portion defined by one wall of said groove and by the act of cleaving said portion, changing said portion from a substantially rectangular cross section to a substantially rhombic cross section tipped toward the opposite wall of the groove, and in recutting the cleavage opening to form the next succeeding groove.

19. The method of forming a dovetailed groove in a metal rod which consists in forming a rectangular groove in the rod, in forming a second groove in the rod adjacent the first groove and in the act of forming said second groove, shifting the intervening portion of the rod into the first named groove.

20. The method of forming a dovetailed groove in a metal rod, which consists in forming a rectangular groove in the rod, and in shifting the metal adjacent one wall of the groove toward the other wall of the groove, said shifting being uniformly decreased progressive from the outer end of the groove to bottom thereof to cause the shifted wall of the groove to become planiform upon completion of the shifting of the shifted portion of the rod.

EDWARD E. JOHNSON.