Nov. 15, 1949 K. E. MOEHRL 2,487,888

WELL SCREEN

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Fig. 1

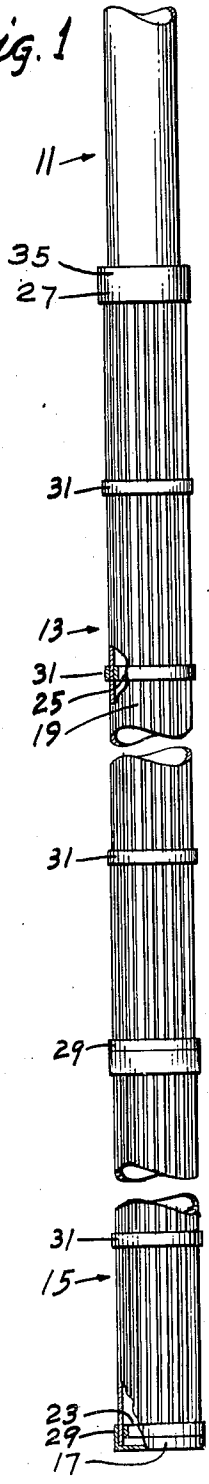


Fig. 2

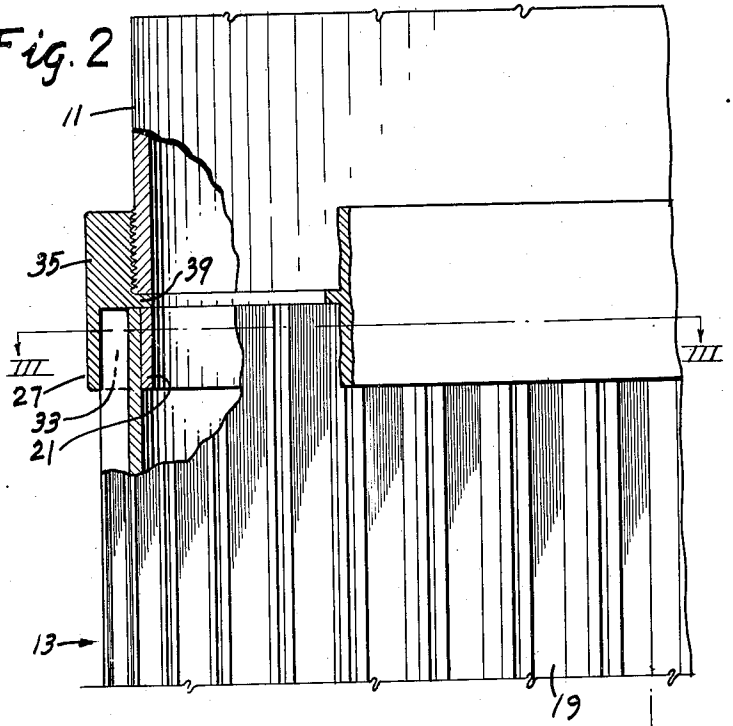


Fig. 4

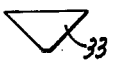


Fig. 5

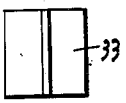


Fig. 3

Fig. 6

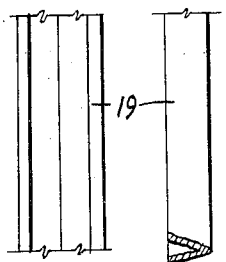


Fig. 7 Fig. 8

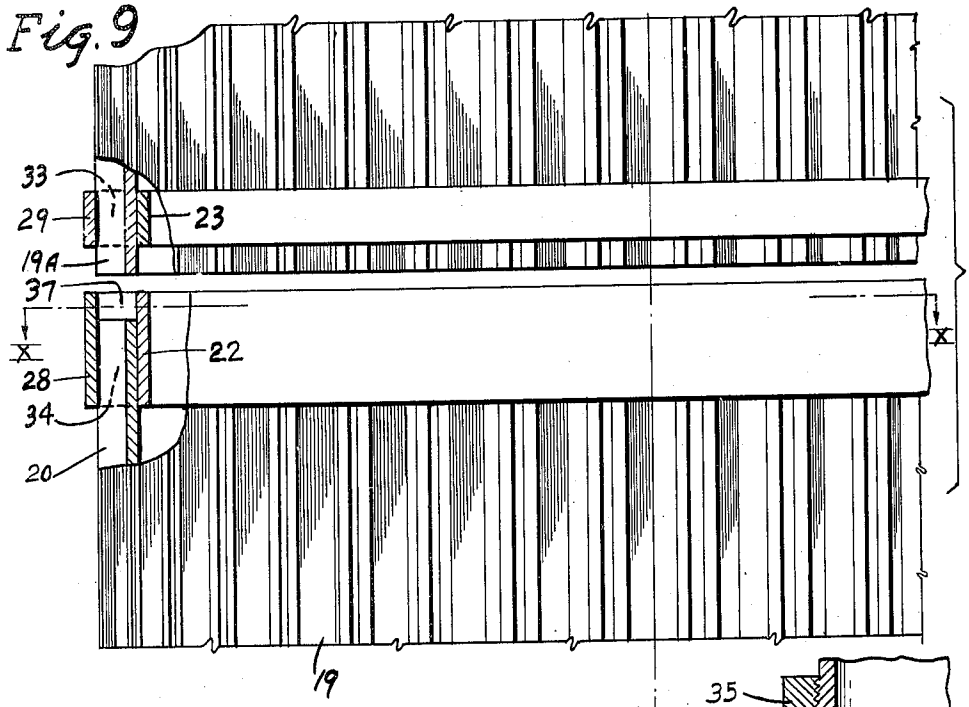
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WELL SCREEN

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Fig. 9



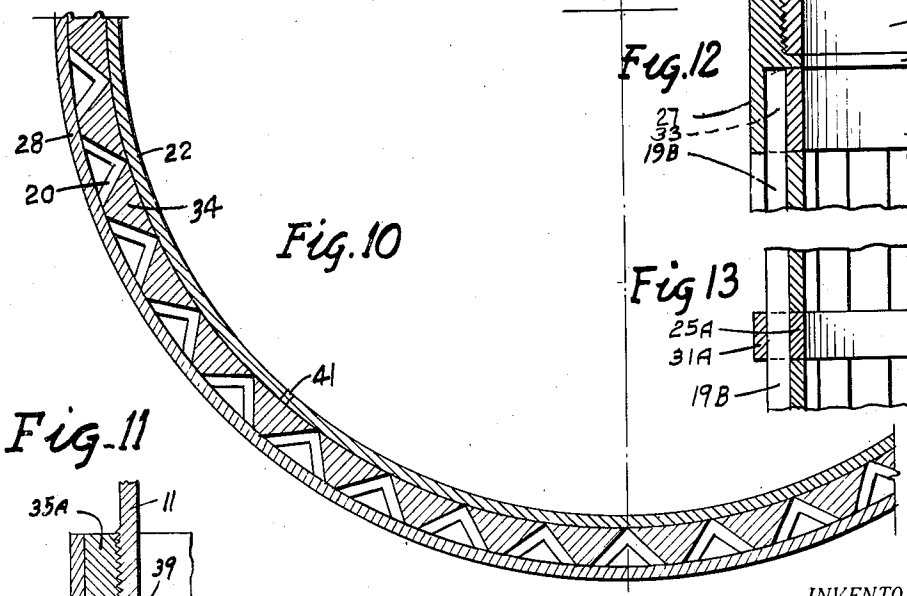


Fig. 10

Fig. 11

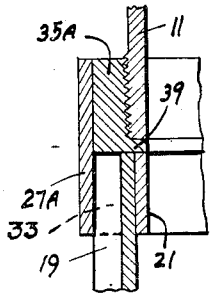


Fig. 12

Fig 13

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WELL SCREEN

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Application June 6, 1944, Serial No. 538,947

1 Claim. (Cl. 166—5)

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This invention relates to well screens, and preferably to such screens formed substantially in their entirety of plastic material, the various parts being secured and integrated together by plastic adhesive, either through the application of heat or by chemical softening to permit the parts being adhesively joined.

In the construction of screens, metal has largely been used, but nearly all such screens are more or less subject to attack by alkalies or acids encountered from time to time in waters of various types, the presence of deleterious elements in the waters often not being discovered until serious damage has been done or actual destruction has occurred, and suggestions have been made that plastic be used, but so far as known, all such attempts have included metallic frameworks of some sort through which the structure has been accomplished.

In wells, the bore not only varies, making it necessary to keep in stock a number of screen sizes to meet the ordinary run of conditions, but also the nature of the sands which are to be held back, the quantity of water available as compared to that which it is desirable to withdraw, and possibly other factors, make it necessary, or at least extremely desirable, from time to time to vary the size of opening through which water enters into the well casing, and set up conditions which often are difficult to meet.

In order to meet the first of these conditions, namely, that of corrosion, the use of plastics seems definitely indicated. In order to meet others of the conditions, the use of material which can be readily adhesively joined is extremely advantageous, and here again the use of plastics is of advantage.

In order to meet desired variations in screen diameters, and slot sizes with a minimum of stock sizes and shapes, it is advantageous that the screens be of a construction that can be built up from a repetition of unit members.

Insofar as variations in slot size is concerned, the construction hereinafter set forth is of great advantage, whether the material used be metal or plastic.

The objects of the invention are:

To make a well screen constructed of individual elements which may be readily secured together under varying conditions of relative spacing to accomplish varying conditions of size and spacing;

To provide a well screen formed of plastic material consisting of individual elements integrated together into a unitary structure;

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To provide a well screen made up of a plurality of individual elements, each respectively of which is of identical cross section throughout;

To provide a well screen made up of a plurality of elements which in groups are respectively of substantial identity and which are assembled together and integrated into a unitary structure.

The means by which the foregoing and other objects are accomplished, and the manner of their accomplishment, will readily be understood from the following specification upon reference to the accompanying drawings, in which:

Fig. 1 is an elevation showing the lower end of a well column with two sections of screen attached thereto.

Fig. 2 is an enlarged fragmentary section showing the attaching joint between the well column and the upper end of the first screen section, a portion of the view being broken away in section to show more clearly the construction.

Fig. 3 is a fragmentary sectional plan taken as on the line III—III of Fig. 2.

Figs. 4 and 5 are respectively plan and elevation of one of the spacing blocks used.

Figs. 6, 7 and 8 are respectively an end view and two elevational views of one of the triangular bars.

Fig. 9 is a fragmentary elevation, similar to Fig. 1, of the lower end of the upper section and the upper end of an adjacent lower section, and is typical of the lower and upper ends of such sections as they appear before nesting together and being integrated into a unitary structure; and

Fig. 10 is a fragmentary sectional plan taken on the line X—X of Fig. 9.

Fig. 11 is a fragmentary sectional elevation corresponding to the sectioned portion of Fig. 1, showing a modified form of connecting sleeve.

Fig. 12 is a fragmentary sectional elevation, also similar to Fig. 1, showing the inner surface of the inner ring flush with the bore of the well column and the apices of the bars; and

Fig. 13 is a similar section at an intermediate ring showing the same feature.

Referring now to the drawings in which the various parts are indicated by numerals:

11 is the lower end of a well column, and 13 and 15 are strainer sections carried by the well column and depending therebelow, such number of these sections being used as the thickness of the water bearing sands of the well requires. The lower end of the bottom screen section is preferably closed by a cap 17.

The screen sections each comprise a plurality of vertically disposed bars 19 of triangular cross section, here shown as angle bars, internal belt-like supporting rings 21, 23 spaced at or adjacent the ends of the bars, additional rings 25 spaced from time to time intermediate their lengths, external belt-like rings 27, 29 and 31 overlying and respectively complementary to the internal rings; and spacing blocks 33 at each belt location, equalling at each such location the number of bars used. The spacing blocks are of over-all triangular cross section, with their apices truncated.

The inner ring 21 at the upper end of the upper screen section 13 is preferably brought flush with the ends of the bars 19, and the outer ring 27 preferably forms an integral part of a collar 35 which is internally threaded for engagement with the lower threaded end of the pipe column 11. The blocks 33 preferably are of the same length or depth, as the widths of the rings 21 and 27, though such equality of length is not absolutely essential.

The intermediate rings 25 and 31 are spaced from time to time along the bars and may be narrower than the end rings. Blocks 33 are preferably used at each ring location.

The rings 23 and 29 and blocks 33 at the lower end of each section are spaced above such lower end to leave end portions 19A of the bars projecting therebelow and correspondingly the rings 22 and 28 and blocks 34 of the upper ends of the intermediate sections are spaced in part above the ends of the bars 20 to leave sockets 37 into which the projecting lower ends 19A of the bars of the adjacent overlying sections are nested.

The collar 35 through which attachment is made to the lower end of the column 11 may be formed as a single integral piece, as shown in Fig. 2, or, as shown in Fig. 11, may be formed of a collar portion 35A and a ring 27A which is of width to overlie not only the internal ring 21, but also the collar portion 35A, in which case the ring and collar portion 35A are subsequently integrated into a unitary structure. In either form the collar 35, or 35A, as the case may be, preferably has an internal annular rib 39 which underlies the end of the column 11 and overlies the ring 21.

In many cases it is preferable that the bore of the screens be substantially identical with that of the well column and free of interfering shoulders. In such cases, the apices of the bars, as the bars 19, are cut away so that the inner surfaces of the ring 21A, Fig. 12, may be flush with the bore of the column 11 and the apices of the bars, and the inner rings 25A, Fig. 13, and other inner belts may be flush with such apices also.

The rings, whether internal or external, are preferably formed of flat strips of material, of width conforming to the desired depth of ring, and whether of plastic or metal, are cut to proper length and rolled into circular form of desired diameter with their ends abutting and joined, as by welds 41, Figs. 3 and 10. If the material be of plastic, flat bars of desired width are formed by extrusion, these bars being cut to proper length and rolled into ring form, as the bars are extruded and before they have time to harden by cooling, and then, or later, the ends adhesively joined, or welded by thermo-plastic fusion.

The angle bars here used are similarly extruded and cut to desired length as are the spacing blocks. The coupling through which attachment is made to the well column and the cap for

the lower end of the strainers are molded, threads being preferably formed in the coupling during such molding, though they may be formed or dressed up by machinery if it be found necessary.

The bars are of isosceles triangle cross section with their equal lengths sides at right angles and are preferably angle bars, with equal length legs cut away at their ends, Fig. 6, to accomplish such triangular shape. The blocks are of complementary shape and substantially right isosceles cross section. They are made up in varying widths to give desired bar spacing, and are cut away or truncated along their apices to substantially the width of slot desired between the bars. It will particularly be noted that the use of individual blocks as contrasted with a notched collar for supporting the bars, permits use of such number of bars and blocks as may be necessary to establish the desired width of slot.

Whether the structure be of metal or of plastic, inner rings of desired diameter are placed adjacent the ends and at desired intermediate intervals along the length of the sections. The ribs and blocks are assembled around the rings, such number of bars and size of blocks being used, as will give the desired spacing of the adjacent bar edges. Outer rings exterior to the bars are used and are alined respectively over the inner rings.

In determining the number of bars, the outside diameter of the screen over the bars is determined from the diameter of the selected inner belt plus the thickness of two bars measured radially, the ring outer diameter being used where the apices abut, and the ring inner diameter where the bar apices are notched. The circumference is computed from this diameter and divided by the width of a bar and desired space. Since the number is usually fractional the nearest number may be used, though for ease of construction, an even number of bars is generally selected, one bar more or less having little effect on the slot width.

With the number of bars determined and the ring and outer diameters known, an encircling hardwood guide is made up, this being preferably in four to six sections for easier placing and removal. This hardwood guide comprises arcuate ring sectors corresponding in inner diameter to the inner diameter of the outer rings, as the ring 27 of Fig. 3, but ordinarily of much greater thickness to provide rigidity, and have spacers secured on their inner surfaces corresponding in cross section and spacing to the bars 19 of the same figure, the spacers used as a part of these sectors being usually separately made and glued or nailed to the inner surfaces of the sectors.

The guide sectors are assembled around an inner ring, as the ring 21, and are loosely clamped therearound and thereagainst as by an encircling ring, not shown. If the screen is to be a metal structure, the inner ring is usually of sufficient stiffness to require no bracing, but if the ring be of plastic it may be necessary to provide an inner support to prevent distortion.

So set up, the spacing blocks 33 are slipped into place between the spacers and the inner ring, until all are placed therearound, the clamp around the wooden guide sectors is tightened and if the screen is of metal, the blocks 33 are welded to the ring. If the screen is of plastic, securing may be done by thermoplastic integration, or the bases of the blocks may be coated with plastic cement before placing and the clamp subse-

quently tightened, this tightening firmly seating the plastically coated blocks against the ring, and being maintained until plastic adhesion of the blocks to the rings is accomplished. All of the ring and block assemblies to be used are similarly made.

After all the wedges are set, the clamp and wooden guide sectors are removed. It will be noted that only one encircling set of guides is required for all screens having the same diameter and width of screen opening.

When the various rings with blocks attached have been built up, two bars are placed in notches about ninety degrees apart, formed by the blocks around an end ring, and are secured thereto. The intermediate rings and opposite end rings, all with wedges attached, are placed and secured to these bars, and additional bars respectively roughly diametrically opposite these first bars are similarly placed and secured, establishing a skeleton set-up for the screen. After this set-up is made, if the bars are secured by welding or thermo-plastically, the remainder of the bars are similarly placed and secured and the outer rings are placed. All of the outer rings, with the exception of the starting ring, are preferably split rings in order that they may be easily brought to position, and after being brought to position over the inner rings are clamped therearound and completed by welding or thermoplastically joining their ends together. Subsequent to this securing of the ends to complete the outer rings, these outer rings are welded or thermo-plastically secured to the apices of the blocks and the outer edges of the bars.

If securing is to be by plastic adhesive, it is preferable, after the skeleton set-up is made, to place the outer ring at one end, coat the bars adjacent one of their ends, the side surfaces of the blocks and the inner surfaces of the rings, with adhesive and slip the bars endwise into place and let them set up.

The side surfaces of the blocks of the adjacent inner ring, and the side surfaces of the bars at such ring are then coated, a clamp placed therearound and tightened, and the operation progressively repeated toward and at the opposite ends of the bars. Subsequently the outer surfaces of the bars and the apices of the blocks are coated, the split outer rings are coated on their inner surfaces and ends and clamped around the bars and blocks with their ends abutting and so held until adhesive integration takes place.

Sections are joined by nesting the projecting bars of one section in the complementary sockets of the adjacent section, the projecting bar ends of the sections to be adhesively joined, being first coated with plastic cement, or otherwise being secured by thermo-plastic fusion or welding.

The outer ring for the upper section of the screen may be an integral part of the coupling through which attachment is made to the well column, or it may be a plain ring which is

adapted to overlie such coupling, in which case the coupling is seated in and integrated with the ring by plastic cement or by heat, as the case may be.

The material used in these structures is preferably a vinylidene chloride resin plastic, or a polystyrene resin plastic, such resin plastics being manufactured under various trade names and being tough, abrasion resistant, and of a high order of endurance against fatigue. Both of these resins are thermoplastic; that is, they can be melted and formed to any desired shape and remelted as often as desired, and may be welded by the direct application of heat and pressure, and the latter in particular is readily secured to like materials by an adhesive cement of which a number of satisfactory types are available.

I claim:

In a well screen which includes a plurality of similar strainer screen sections, a said section consisting of a plurality of vertically disposed bars of equal size and length, said bars being uniformly spaced apart adjacent their opposite ends by blocks of uniform cross section to form strainer slots; a first inner ring adjacent one end of said bars in underlying relation thereto and to the adjacent said blocks, a first outer ring adjacent the same end of said bars in overlying relation thereto and to said blocks, said bar ends being equally projected beyond said rings; a second inner ring adjacent the opposite end of said bars in underlying relation thereto and to the said blocks adjacent said opposite end, a second outer ring adjacent the latter said bar ends in overlying relation thereto and to the latter said adjacent blocks; said bars, blocks, and rings being integrally united; said second rings projecting equally beyond the latter said bar ends in a direction opposite to the said projection of the first said bar ends, the latter said blocks projecting with said second rings beyond the latter said bar ends a distance equal to the projection of the said second rings, the said projections of said latter blocks and said second rings establishing an annular group of uniformly spaced sockets adapted to receive the projecting bar ends of a similar strainer screen section.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
203,900	Eich	May 21, 1878
415,607	Boone et al.	Nov. 19, 1889
869,288	Baldwin	Oct. 29, 1907
880,597	Syze	Mar. 3, 1908
1,800,642	Johnson	Apr. 14, 1931
1,862,838	Willers	June 14, 1932
1,950,202	Willers	Mar. 6, 1934
2,101,537	Every	Dec. 7, 1937