June 7, 1932. H. E. SEARLE 1,861,722

OIL WELL STRAINER

Filed Oct. 24, 1927 2 Sheets-Sheet 1

Fig. 1.

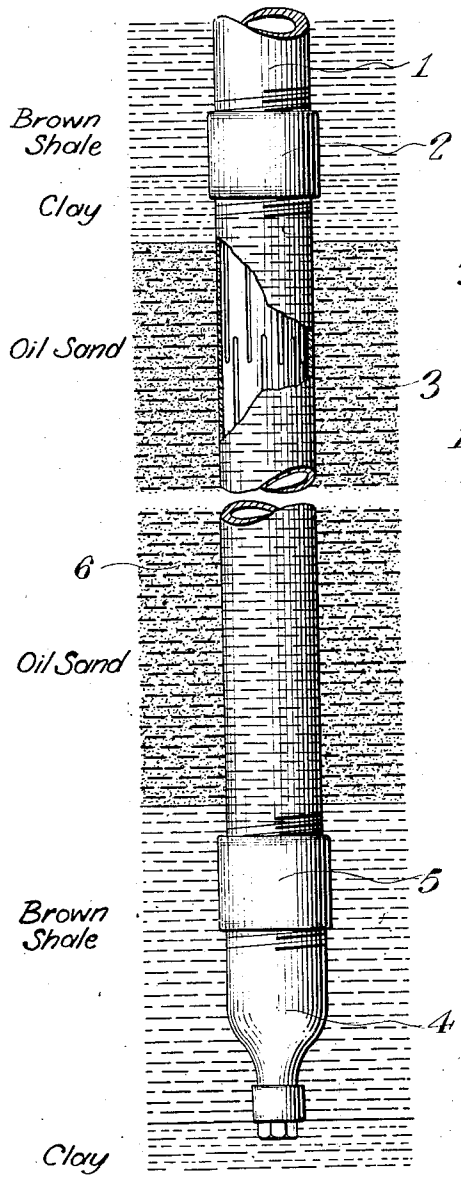


Fig. 2.

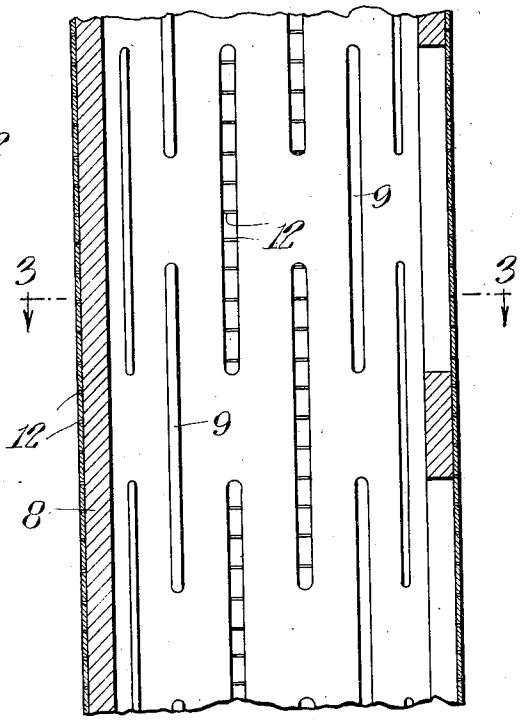
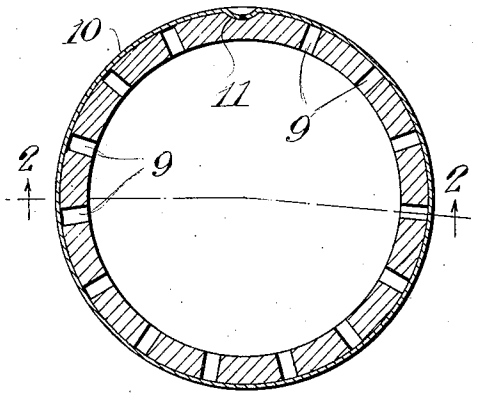


Fig. 3.



Inventor
Harold Edwin Searle

By his Attorneys
Byrnes, Kibbins and Parmelee

June 7, 1932. H. E. SEARLE 1,861,722

OIL WELL STRAINER

Filed Oct. 24, 1927 2 Sheets-Sheet 2

Fig. 4.

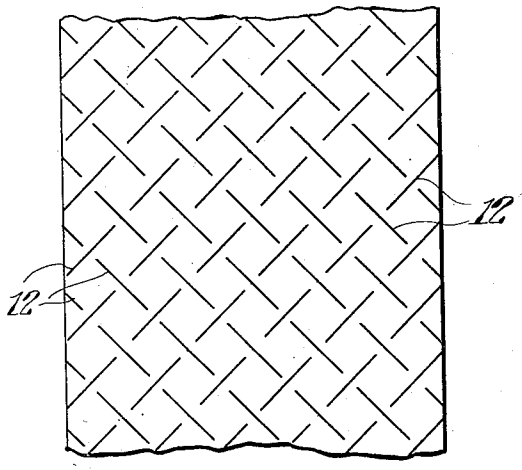


Fig. 5.

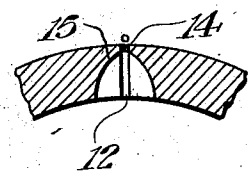


Fig. 6.

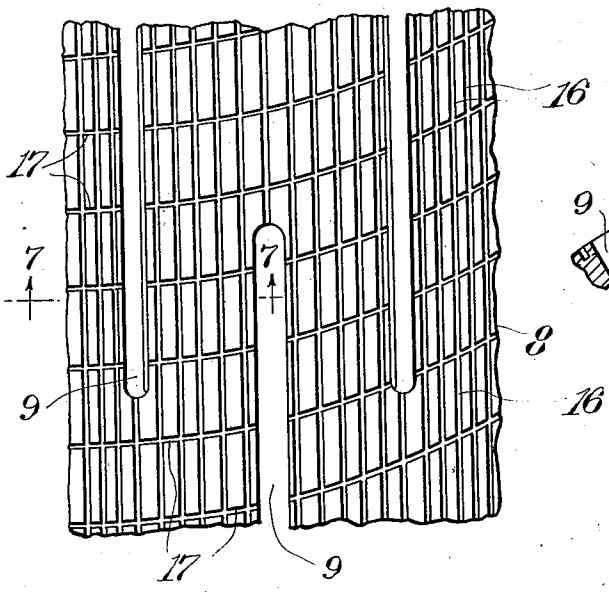
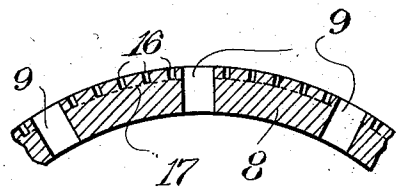


Fig. 7.



Inventor
Harold Edwin Searle

By his Attorneys
Byrnes, Stebbins and Parmelee

Patented June 7, 1932

1,861,722

UNITED STATES PATENT OFFICE

HAROLD EDWIN SEARLE, OF JERSEY CITY, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE INTERNATIONAL NICKEL COMPANY, INC., OF NEW YORK, N. Y., A CORPORATION OF DELAWARE

OIL WELL STRAINER

Application filed October 24, 1927. Serial No. 228,242.

The present invention relates to devices for separation of liquids from solids and more particularly to a strainer for oil wells and the like adapted to prevent sand particles from entering the oil well.

Strainers are used in oil wells, particularly in certain localities, to eliminate so far as possible the removal of sand with the oil and to prevent the accumulation of sand in the well. If the oil has sand in it when removed, it must be placed in settling tanks for separation thereof. This entails extra work and the sand itself is of no value. In addition the removal of the sand causes cavities under ground in the vicinity of the well and frequently occasions the caving in of the higher strata which in some cases destroys the well. The accumulation of sand in the well is highly objectionable due to the fact that it decreases materially the operating efficiency and necessitates shutting down the well at intervals for swabbing and bailing which are expensive operations, because of the loss of production during the shut-down and the labor required for the work. It also increases the wear on the pumps and other parts of the apparatus. It is, therefore, important to separate the oil from the sand prior to its entry into the well.

It has been customary to provide a strainer at the lower end of the casing to strain out the sand at this point. One form of strainer used is that known as the button type. Apertures are formed in the desired portion of a heavy walled tube, and buttons, usually brass, are peened or threaded into the apertures. A series of slots or perforations are formed in the buttons to act as strainers to permit crude oil to pass and to exclude particles of sand. Such strainers are expensive to manufacture and the brass to steel contact in the presence of salt water causes electrolysis which eats away the metal permitting the buttons to fall out. Then too, the sudden jars which are frequently encountered in setting and the resulting stresses set up in the casing cause the buttons to pop, that is, to jump from their seats, particularly where the joint has been weakened by corrosion or electrolysis. Naturally a few large holes such as those formed by the popping of the buttons will admit sufficient sand to render the operations very inefficient and hasten the time for bailing. There is no way of closing these defective apertures except by withdrawing the casing from the well. Under the most ideal conditions, the filtering efficiency of such strainers is very low.

Another type of strainer is that formed by means of apertures in a heavy-walled casing with a filtering wire wrapped thereabout. The wire may be T shaped in cross-section or otherwise. Great difficulty is experienced in setting or withdrawing casings having this type of strainer thereon, since the wire is not smooth and projections occasion derangement thereof and in some cases break the wire. In either instance the apertures in the casing are free to pass sand. If it becomes necessary to withdraw the casing from the oil well, and if the wire is broken, it is necessary to fish out the wire in the well before sinking again. The wires slip off not only when being set but frequently after use because of corrosion and the like. With such a strainer several failures in setting are encountered before success is really attained. This and the general construction of the strainer makes it very expensive in operation.

The present invention eliminates or minimizes the difficulties encountered with these and other types of strainers by providing a strainer formed from corrosion resisting metal which has smooth interior and exterior, and being fully capable of withstanding the jars and shocks encountered in the drilling operations. The strainer itself is comparatively inexpensive in construction and it is practically impossible to derange the parts or to damage them in any way by contact with the side of the well, and the like. There is nothing to catch and tear. The filtering efficiency is high and is not impaired by use since there is no corrosion present and the wear caused by the moving sand is reduced to a minimum.

An object of the present invention is to provide a comparatively inexpensive strainer adapted to overcome or minimize the difficul-

ties encountered with the present types of strainers.

Another object of the invention is to provide a strainer of maximum strength for resisting impacts, having no projecting parts so that contact with the side of the well or with projections will not be of serious consequence.

Another object of the invention is to provide a more efficient strainer having a smooth exterior, whereby the walls of the well will not be damaged thereby, and having a smooth interior to facilitate the swabbing and bailing operations.

A further object of the invention is to minimize the effects of electrolysis and corrosion and to eliminate all parts likely to be deranged in the setting operation.

Other and further objects of the invention will be apparent upon an understanding of the illustrated embodiment about to be described or will be indicated in the appended claims; and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

A preferred embodiment has been chosen for purposes of illustration and description and is shown in the accompanying drawings, wherein

Fig. 1 is a side view, with parts broken away to illustrate parts of the heavy walled tube, showing a strainer in accordance with the present invention embedded in oil sand;

Fig. 2 is a longitudinal sectional view along the line 2—2 of Fig. 3 of a part of the strainer illustrating the slots in the heavy walled tube and the perforations in the sheath;

Fig. 3 is a transverse sectional view along the line 3—3 of Fig. 2 illustrating the position of the slots and the attachment of the sheath to the tube;

Fig. 4 is a detailed view of another arrangement of the perforations in the sheath;

Fig. 5 is a detailed sectional view of another form of perforation in the sheath;

Fig. 6 is a perspective view of a portion of another form of heavy walled tube; and

Fig. 7 is a sectional view on the line 7—7 of Fig. 6.

Referring to the drawings there is shown an upper casing 1 attached by means of a suitable coupling 2 to a screen 3. At the lower end of the screen a short nipple 4 is attached by means of the coupling 5 to close the bottom of the screen. The casing and screen are here shown embedded in oil sand 6 as indicated in Fig. 1 of the drawings. It will be understood that the screen and casing may be set in the well in any suitable manner and the usual types of pumping apparatus (not shown) may be applied to the upper casing for pumping the oil.

The present invention relates more particularly to the screen and the preferred embodiment, and as here shown, comprises a heavy-walled tube or pipe 8 having a plurality of elongated slots 9 here shown longitudinally thereof, although they may extend in other directions. The casing, if desired, may be made of steel although commercial nickel or Monel metal is preferred due to its corrosion resisting qualities. The slots 9 are relatively narrow and preferably staggered both circumferentially and longitudinally. The greatest strains encountered are compressive strains in a longitudinal direction due to impacts in setting. The construction and arrangement of the slots is such that they do not impair the strength of the casing to a material degree, the actual effective cross-sectional area at any point being reduced only by a very small percentage.

Throughout the specification and claims the apertures in the inner tube are referred to as slots and the apertures in the sheath as slits or perforations to avoid confusion. There is no intention of limiting the invention by these terms. They are to be understood as applying to any form or shape of aperture however made.

Enveloping the heavy-walled tube 8 is a sheet of thin metal 10, preferably corrosion resisting, such as Monel metal or commercial nickel. The width of the sheet is such that the ends meet above a longitudinal channel 11 in the casing so that they may be welded together, soldered in position, or otherwise attached, without forming a projection or irregular surface on the pipe 8. Further, the longitudinal channel prevents any tendency of the outer sheath to twist out of position. The sheath is preferably perforated with long narrow slits 12 extending in a circumferential direction and sufficiently long to lap at least one of the longitudinal slots in the casing. Since the inner pipe is fully capable of withstanding the tensile or compression strains, the transverse or circumferential slits in the sheath are not of material consequence, that is, they do not weaken the structure. These slits or perforations, extending across the slots in the casing, form a very effective screen having a high efficiency.

Since the metals are alike in both sheath and casing there is no tendency for electrolysis and even with a steel casing, electrolysis can be disregarded since it is negligible and affects the entire surface of each rather than the screen openings. Reliance is placed primarily upon the perforations in the sheath for separating the particles of sand from the oil. The inner casing serves to give strength and to prevent collapse of the sheath. The slits or perforations in the sheath may be changed to conform to the best operating conditions depending upon the character of sand or gravel to be excluded. Generally they range from seven-hundredths

of an inch in width to seven-thousandths of an inch, but may be varied as desired. Each perforation in the sheath registers with at least one slot in the pipe. This improves the efficiency and facilitates quick flow of oil.

The preferred form of construction shows the perforations in the sheath extending circumferentially thereof and perpendicularly to the slots in the tube. Another convenient arrangement of the perforations is shown in Fig. 4 of the drawings. By placing the slits 12 at a small angle to the slots 9 the portion overlapping the slot is substantially longer and the efficiency of the screen is accordingly increased.

Where the sheath 10 is comparatively thick there is a possibility of particles of sand 14 becoming lodged in the perforations, if the sides are parallel as shown in Fig. 2. A construction is shown in Fig. 5 with the perforations 12 tapered toward the outside of the sheath. By forming the perforations narrow on the outside of the sheath, and relatively wider on the inside thereof as illustrated, clogging is minimized. In addition the wide parts 15 of the slots in the tube form channels for oil entering the portions of the slits removed from the slots so that it can more readily reach the latter.

The efficiency of the strainer can also be increased by the provision of small channels 16 extending longitudinally of the surface of the tube 8. A series of spiral channels 17 may be utilized to connect the longitudinal channels 16 with each other and with the slots 9. These form a meshwork of channels leading from the various portions of the slits 12 to the slots in the tube 8.

It will be seen that a comparatively inexpensive strainer has been provided which is adapted for use with any type of casing. There are no protruding parts to become deranged upon contact with the side of the well. A perfectly smooth surface is provided on both the interior and exterior of the strainer; hence swabbing of the pipe and other operations may be performed with ease. There is no danger of the side of the well being damaged or parts left therein when the casing is withdrawn. The high efficiency of the strainer permits a maximum amount of oil to be delivered and its effectiveness in preventing the entrance of particles of sand into the casing greatly prolongs the life of the well and minimizes bailing. Further, the casing and sheath are rigid in construction and securely fixed to each other to withstand the rough usage to which they may be subjected.

As various changes may be made in the above embodiment without departing from the spirit of the invention, it is to be understood that all matter herein is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim:

1. In a device for separating liquids from solids, the combination of a tube of relatively thick metal having elongated slots therein, and a cylindrical sheath of relatively thin metal having a smooth inner surface contiguous with and fitting about said tube and having elongated perforations at an acute angle to and in overlapping relation with the slots in said tube, one side of said perforations being wider than the other side thereof, said perforations and said slots being adapted to overlap irrespective of the relative positions of the sheath and tube.

2. In a screen for oil wells and the like, a substantially cylindrical sheath of thin metal having narrow elongated slits extending both longitudinally and circumferentially thereabout and adapted to exclude solid substances such as sand and the like, said slits being wider at one side than at the other, each of said slits having two perpendicular slits adjacent the ends thereof and two perpendicular slits adjacent the center thereof.

3. A screen for oil wells and the like comprising in combination, a tube formed of relatively thick metal, and having a longitudinal channel therein, a sheet of metal wrapped about said tube with the ends thereof meeting adjacent and being bent into said channel and means in said channel for securing the ends of said sheet together therein independently of said inner tube of relatively thick metal, said tube and said sheet having overlapping perforations of different sizes to form a screen.

4. A screen for oil wells and the like, comprising in combination, a tube having elongated slots extending longitudinally of said tube, a cylindrical sheath attached to and contiguous with said tube having perforations overlapping the slots in said tube and a plurality of channels in said sheath and other channels in said tube leading to said slots.

5. A screen for oil wells and the like, comprising in combination a tube having slots, a cylindrical sheath attached to said tube having elongated perforations overlapping the slots in said tube and extending circumferentially and longitudinally thereof, certain of said perforations being perpendicular to others, and a plurality of channels formed in the surface of said sheath and leading to said slots.

6. A screen for oil wells and the like, comprising in combination a relatively thick tube having slots therein, a relatively thin sheath attached to said tube having elongated slits extending circumferentially and longitudinally thereof, the side of said slits adjacent said tube being widened to form channels leading to the slots therein.

7. A screen for oil wells and the like comprising, in combination, a tube formed of relatively thick metal, said tube having a

longitudinal channel on the exterior thereof, a sheet of metal wrapped about said tube with the ends thereof bent to fit into said channel, means independent of the shape of the channel for securing the ends of the tube together in said channel, said tube and said sheet having perforations adapted to overlap irrespective of the relative positions thereof to form a screen, said tube having additional channels in the surface thereof to conduct liquids between the sheath and the tube to the perforations in the tube.

8. A screen for oil wells and the like comprising, in combination, a tube having elongated slots extending longitudinally of the tube, said slots being staggered with respect to each other in both longitudinal and circumferential directions, a channel extending longitudinally of said tube, a filtering sheath of relatively thin metal bent about said tube with the ends thereof secured together within said channel independently of the shape of the channel, said sheath having elongated perforations extending circumferentially thereof, said perforations being staggered with respect to each other and being adapted to overlap said elongated slots irrespective of the relative positions of the sheath and tube.

9. A screen for oil wells and the like, comprising in combination a relatively thick tube of Monel metal having a smooth inside surface with elongated slots therein extending longitudinally thereof, said tube having a channel extending longitudinally thereof, and a relatively thin sheet made of Monel metal to avoid electrolysis wrapped about said tube with the free ends thereof bent into and secured in said channel independently of the shape of the channel, said sheath fitting against said tube throughout its inner surface and having a series of elongated slits therein adapted to extend substantially transversely of said slots.

HAROLD EDWIN SEARLE.