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SCREEN PIPE WITH FRAGILE LINING

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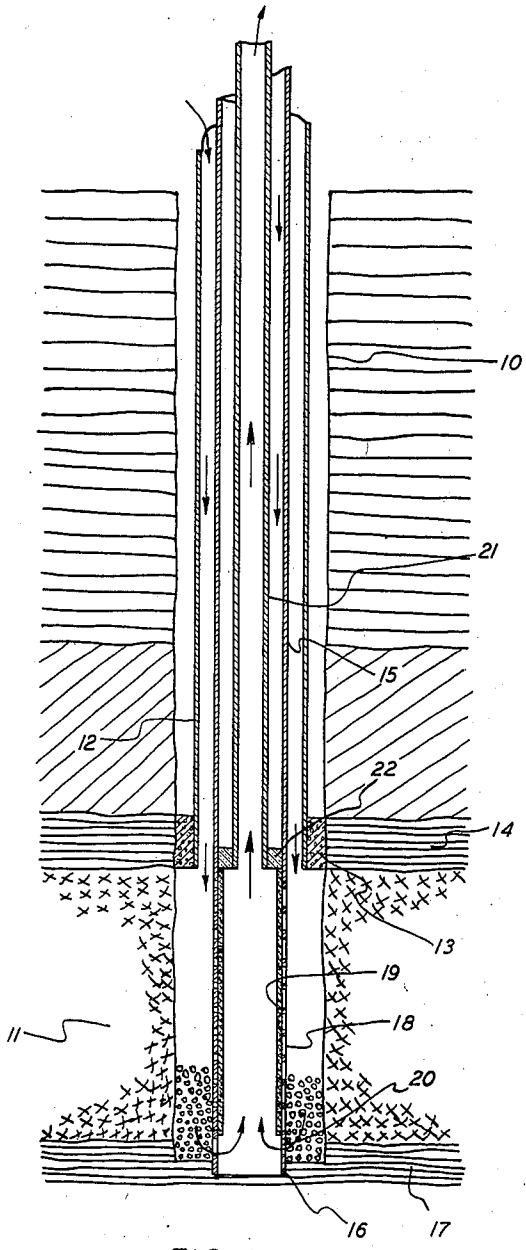


FIG. 1

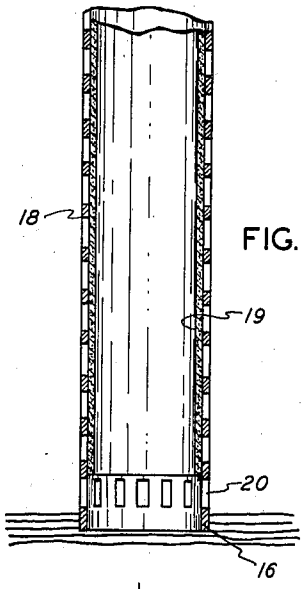


FIG. 2

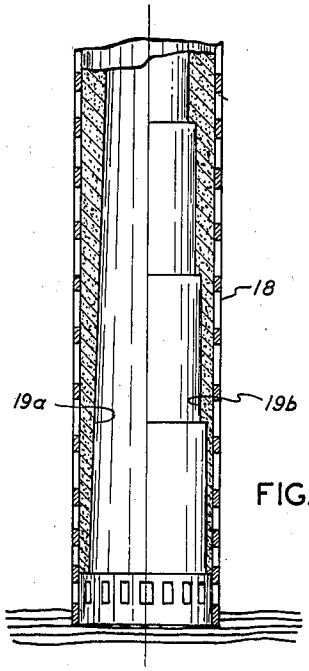


FIG. 3

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SCREEN PIPE WITH FRAGILE LINING

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3 Claims. (Cl. 166—1)

It is common practice to finish oil and water wells by placing a pack or filling of fine gravel between the perforated liner or screen pipe and the wall of the well within the producing formation. In this practice it is conventional to suspend the gravel in a stream of drilling mud which is pumped down through the casing and returns to the surface through the drill pipe. The screens used for this purpose are lined with a thin layer of cement, which may be drilled out after the job is completed, this cement layer closing all but the lowest perforations and forcing the circulating mud to the bottom of the hole where the gravel is deposited and accumulates outside the screen until a sufficiently deep annular body has been built up. The purpose in using the cement lining is to enable the operator to apply sufficient fluid pressure to the gravel bed to consolidate it and avoid shrinkage and consequent channeling when the pack is put to its intended use of filtering sand out of the fluid product and preventing choking of the perforations.

Owing to the fine mesh of the gravel useful for this purpose (which may for example be such as passes a screen of eight meshes to the linear inch and is retained on a ten mesh screen) and to the fairly high viscosity of the circulating fluid best adapted to this service, the back pressure due to the resistance to flow of the constantly increasing depth of gravel becomes very high before the entire bed is in place and is likely to become prohibitive.

We have discovered that this difficulty may be obviated by providing the screen pipe with an internal shell of relatively fragile material such as sand concrete, neat cement, or plaster of Paris so adjusted in thickness and strength as to collapse and thus relieve the external fluid pressure into the pipe when a predetermined optimum fluid pressure has been reached. In a modification of the invention the lining shell is graduated in thickness so as first to break away adjacent the lower end of the screen and progressively upwardly as higher differential pressures are reached.

The invention may best be understood with reference to the attached drawing, in which Fig. 1 illustrates in a diagrammatic manner the usual arrangement of the parts; Fig. 2 is a section of a liner with internal shell of uniform relatively slight thickness, while Fig. 3 illustrates a liner having a downwardly tapering section.

Referring first to Fig. 1, 10 is an earth bore or well which passes through an oil producing formation 11 and has an outer casing or "water string" 12 cemented at 13 into an impervious stratum 14 above the producing sand. A liner 15 is placed within the water string and is landed or cemented at 16. The lower portion of the liner is perforated as at 18 to form the screen and this portion is again lined with a relatively thin layer 19 of relatively fragile solid material such as concrete, the lowermost perforations being left open as at 20. The drill pipe 21 is run inside the liner and is packed to it as at 22, above the upper end of the screen.

The circulating fluid carrying gravel in suspension is introduced under pressure to the space between the water string 12 and the liner 15, at the upper end of the hole. The means for mixing gravel with the fluid and introducing the fluid into this space are conventional and are not illustrated. The suspension flows downwardly, as indicated by the arrows, deposits its burden of gravel on the bottom of the hole as at 23 and returns to the surface through drill pipe 21.

Referring now to Fig. 2, which is an enlargement of the lower portion of screen 18, the cement lining 19 covers all but the lowermost of the perforations 20, leaving these open for the return of circulating fluid to the interior of this pipe. The lining is shown as of the same thickness throughout its length, and this thickness is so adjusted, considering the strength of the particular cement paste used in forming it, that the lining will collapse before a pressure is reached which is excessive for the particular well in which the gravel is to be placed. This maximum pressure will vary from well to well over a very wide range and the thickness of the lining must be varied accordingly.

In Fig. 3 the lining shell 19 is shown as thicker at its upper than at its lower end. This progressive thickening, which causes the lining shell to collapse in stages as the gravel builds up outside the screen pipe may be a gradual taper, as shown at 19a on the left side of the figure, or a stepped thickening as indicated at 19b on the right side. The relative thickness of these linings is much exaggerated in the figures.

The fragile linings above described may be cast or spun into place, care being taken to avoid the passage of the paste into the perforations, from which it would be dislodged with difficulty. The perforations may be filled with a fusible material such as asphalt or paraffin prior to applying the lining, or the inner surface

of the screen may be covered with paper for the same purpose. It is desirable to prevent any strong adhesion of the lining to the metal of the screen, in order that when it collapses it may break away clean, an end which is served by the paper lining or which may be accomplished by lightly greasing the interior of the pipe before the fragile lining is applied.

We claim as our invention:

1. For use in gravelling wells by a method which includes forcing a mixture of gravel and a liquid vehicle down a well; a screen pipe provided with a substantially nonadherent and relatively fragile lining of a solid substance insoluble in said liquid vehicle, the strength of said lining being so adjusted that said lining will collapse, at least in part, under an externally applied pressure less than the maximum pressure tolerable in the well in which said screen pipe is used.

2. A screen pipe substantially as and for the purpose set forth in claim 1, in which the thickness of the lining is less at the lower end than at the upper end of said screen pipe.

3. A screen pipe substantially as and for the purpose set forth in claim 1, in which the thickness of the lining increases by steps progressively from the lower to the upper end of said screen pipe.

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