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PROCESS FOR SINKING SHAFTS

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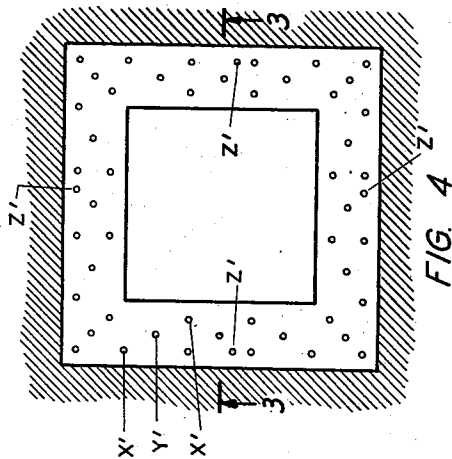


FIG. 4

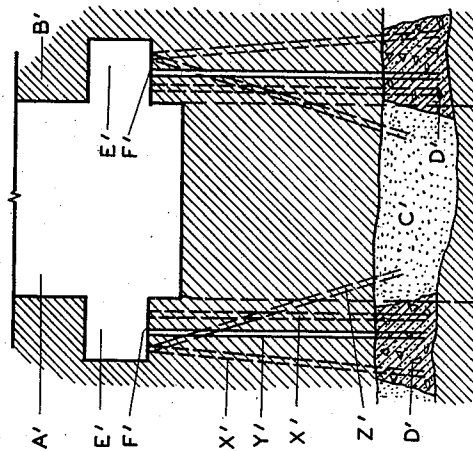


FIG. 3

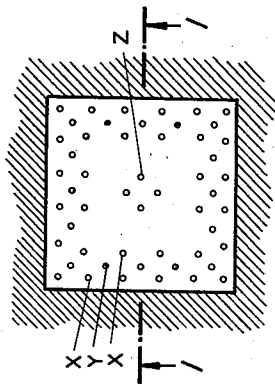


FIG. 2

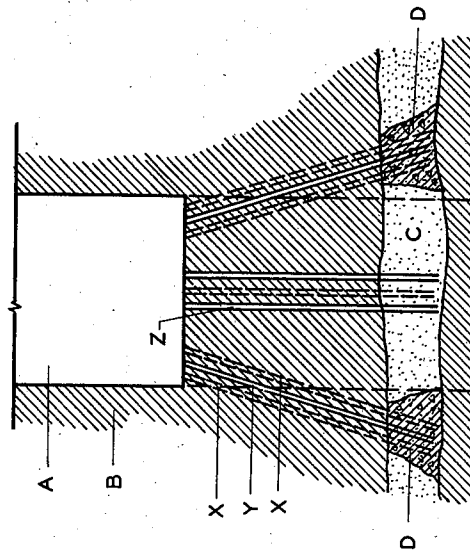


FIG. 1

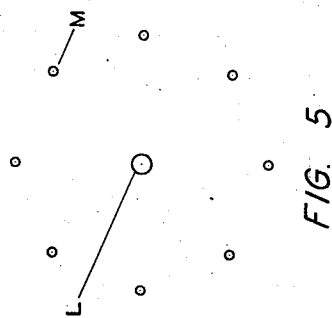


FIG. 5

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PROCESS FOR SINKING SHAFTS

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Application December 20, 1937, Serial No. 180,903

1 Claim. (Cl. 61—40)

The present invention relates to a method of sinking a shaft through formations containing gas, oil or water by cementing off the formations in the region surrounding the shaft. The method is especially applicable to the sinking of shafts through formations encountered in mining for oil, but also has many other applications.

One of the objects of this invention is to provide a means whereby the inflow of water from the water bearing strata and gas from the gas bearing strata can be checked and held under control so that the excavation can proceed. When sinking a shaft into the ground for any purpose, it sometimes happens that the shaft is inundated by an uncontrollable flow of gas and/or water from a gas or water bearing strata which is encountered. When this happens the shaft must either be abandoned or excavation continued at considerable expense.

This method aims to eliminate the problem set forth above by providing an inexpensive and effective means whereby a cement barrier can be formed around the shaft or excavation at the zone where it is intersected by the gas and/or water bearing strata, thereby cutting off the excess flow of water and/or gas.

Another object of the invention is to provide a method whereby the cementing medium introduced into the formation can build up to a greater thickness and thus form a better and more durable seal.

An additional object of this invention is to provide a method whereby the thickness of the protecting wall around the shaft, as formed by the cementing medium introduced into the formation, can be controlled and thus assure a seal of the necessary strength to hold the water or gas from entering the shaft.

Still another object of the invention is to provide a method whereby the cementing medium is introduced into the formation out of line with the main shaft passage, eliminating the necessity of stopping the sinking of the shaft while the cementing is in progress.

In the accompanying drawing, forming a part of this specification and in which like numerals are employed to designate like parts throughout the same,

Fig. 1 is a vertical sectional view through a partially excavated shaft showing the manner in which the process is utilized to seal a water or gas bearing strata which is encountered when sinking the shaft.

Fig. 2 is a plan view showing the bottom of the shaft.

Fig. 3 is a vertical sectional view of another method employed.

Fig. 4 is a plan view showing the bottom of the shaft disclosed in Fig. 3.

Fig. 5 is a plan view of a set of drill holes illustrating the general principle involved in the method herein described.

Referring to Figs. 1 and 2 of the drawing shaft A has been sunk through formation B to a point near a formation C containing a gas or fluid. At a suitable distance above C, operations in sinking the shaft are discontinued and holes X and Y are drilled from the bottom of shaft A into and through formation C at suitable angles so that the holes will pass through the formation C outside the limits of the shaft as it will be extended. The holes X and Y are drilled around the outer edge of the bottom of the shaft in rows. The outer and inner rows of holes X are for venting and the middle row Y is for the admission of cementing fluid to the formation C. Cementing fluid is pumped through holes Y into formation C and at the same time pressure is relieved through holes X. The cementing fluid is thus caused to flow from holes Y toward holes X, forming a solid wall D around the area through which the shaft will be sunk. By varying the angle, with the vertical, of holes X, the thickness of this wall can be controlled. The cementing fluid is pumped into holes Y until it rises in holes X. When the cementing fluid D has set, or when it has sealed off the gas or fluid in formation C, holes Z are drilled into the area through which the shaft is to be extended, to determine where there is any gas or fluid pressure remaining in the area, and to exhaust the gas or fluid before mining operations or the extending of the shaft is continued.

In Fig. 3, shaft A' has been sunk in formation B' to a point near the formation C' which contains gas or fluid under pressure. When the shaft A' is at a suitable distance from formation C', chamber E' is excavated in the sides of shaft A', of sufficient size that drilling can be carried on in the chamber. From the floor F' of the chamber E' holes X' and Y' are then drilled into and through formation C' while the sinking of shaft A' continues unaffected by the drilling. When holes X' and Y' are completed, cementing fluid is pumped into holes Y' and pressure is relieved through holes X', one hole at a time or simultaneously, the same as described for Fig. 1, thus causing the cementing fluid to flow from holes Y', through the formation C' where it builds up to form a barrier and then back through X'. The holes X' can be drilled at an angle with the ver-

tical which will cause a wall of cement to be formed of any desired thickness in formation C', this wall being outside of the area through which the shaft is to be sunk. By the use of this method gas or fluid bearing formations can be cemented off ahead of the sinking of the shaft and without interfering with the sinking of the shaft. Cementing fluid can be pumped into holes Y' until it rises in holes X'. When the cement fluid has set, or when it has sealed off the gas or fluid in formation C', holes Z' are drilled into the area through which the shaft is to be sunk, to determine whether the pressure on the area has been relieved, and to exhaust the gas or fluid from the same.

The arrangement of the holes X and Y in Fig. 2 and X' and Y' in Fig. 4 is only suggestive, the only requirement as to arrangement being that the principle shown in Fig. 5 be used. In Fig. 5, cementing fluid is pumped into the hole L and pressure is relieved through surrounding holes M, either on one hole at a time or on all holes simultaneously causing the cementing fluid to flow from hole L toward holes M. The holes in Figs. 2 and 4 can be arranged in any manner to use this principle.

The holes X, X' and M can be vented to the surface by suitable lines in shaft A or A' to keep gas or fluid from entering shaft A or A', or traps for catching fluid from holes X, X' and M can be provided. The holes Z and Z' can also be vented to the surface by suitable lines in shaft A or A'.

In either the method shown in Figs. 1 or 3 holes X and Y and X' and Y' respectively can be used for the introduction of various fluids for treating formations C and C' before the introduction of

the cementing fluid. Such treatment may be used for removing petroleum products from the same to increase the bond obtained by the cementing fluid when introduced, for increasing the porosity of the formation to aid the flow of the cement fluid, or for otherwise conditioning the formation.

It is to be understood that the form of our invention, herewith shown and described, is to be taken as a preferred example of the same, and that various changes of arrangements of parts may be resorted to, without departing from the spirit of our invention, or the scope of the subjoined claim.

Having thus described our invention, we claim:

In the art of sinking shafts, the process of sealing off a gas or water bearing strata which consists in boring holes which extend downwardly from the shaft through the strata and are arranged in two or more series around the shaft, filling one of the series of holes with a cementing fluid under pressure whereby it is caused to percolate into the gas or water bearing strata to form a cemented barrier around the periphery of the shaft allowing the other series of holes to vent gas or water coming from the strata, forcing the cementing fluid into the strata until the cementing fluid returns to the shaft through the other series of holes, controlling the size of the barrier of cemented material being built up in the strata by the distance the series of holes are spaced apart, and boring vent holes through the bottom of the shaft to vent that portion of the gas or water bearing strata which has been sealed off before drilling is resumed.

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