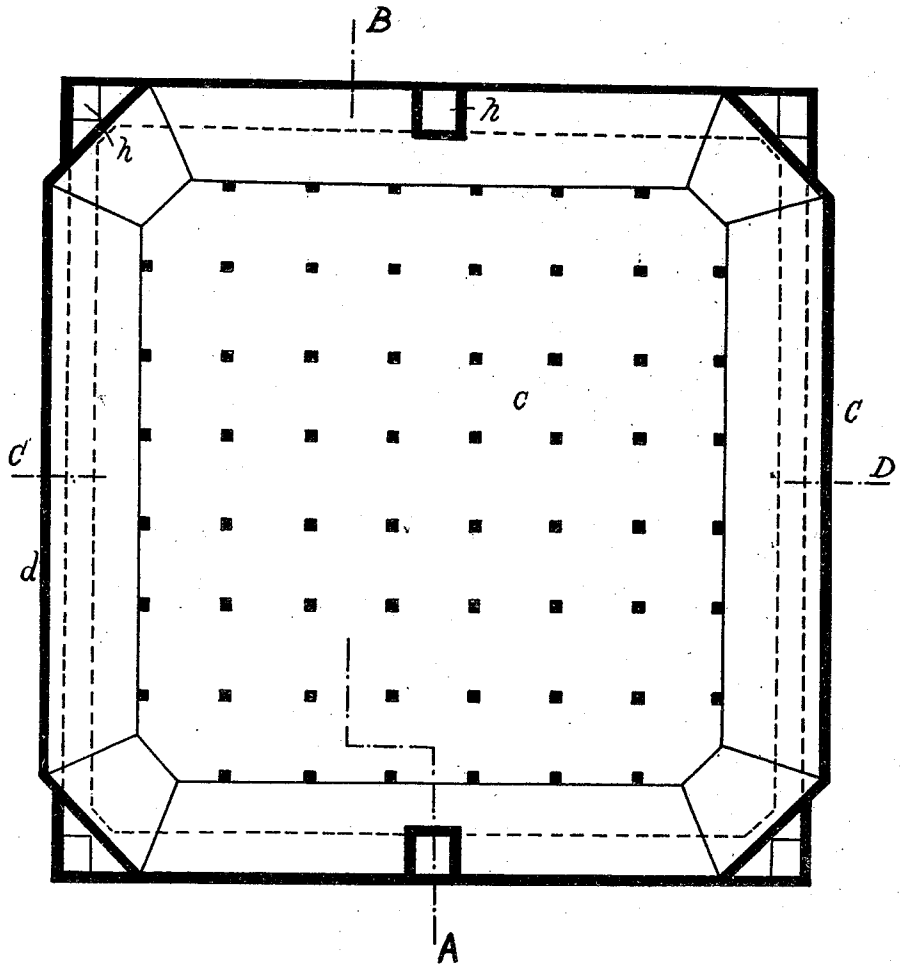
Sept. 9, 1924. 1,508,145

R. KOLWES

LARGE SIZED OIL TANK

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*Fig. 1*




*Inventor:*

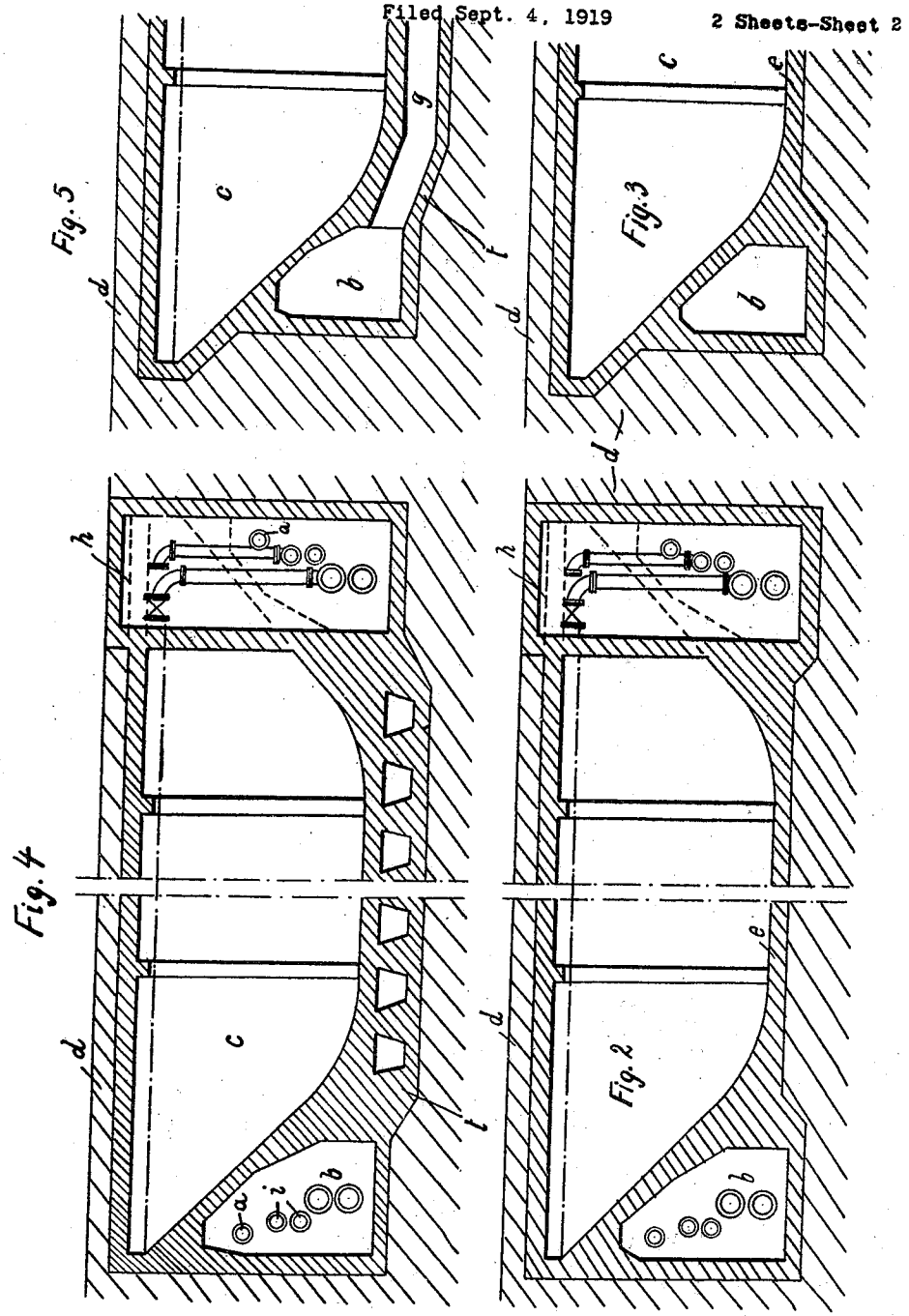
Rudolf Kolwes

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LARGE SIZED OIL TANK

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Inventor:

Rudolf Kolwes

Patented Sept. 9, 1924. 1,508,145

# UNITED STATES PATENT OFFICE.

RUDOLF KOLWES, OF BERLIN, GERMANY.

## LARGE-SIZED OIL TANK.

Application filed September 4, 1919. Serial No. 321,717.

*To all whom it may concern:*

Be it known that I, RUDOLF KOLWES, engineer, a citizen of the German Republic, residing at 7 Bachstrasse, Berlin, Germany, have invented certain new and useful Improvements in Large-Sized Oil Tanks, of which the following is a specification.

In recent times the storage of large quantities of light and heavy oils such as benzene, benzol, petroleum, tar oils of anthracite and bitumen, and the distillation products of coal, used for the propulsion of ships, aircraft and autocars, etc., has been obscured from view and protected against fire in underground concrete or reinforced concrete tanks capable of holding several thousand cubic meters of these oils. The tanks or vats protected against the action of oleic acid upon the concrete by some suitable lining such as acid-proof paint, tiles, or sheet metal, and for some oils they must be equipped with a heating device in order to keep the thick or viscous disengaged portions of the oils continuously ready for use, i. e. to maintain them in a thin liquid state. The temperature required for this purpose is between 60 and 80 degrees centigrade.

It is a well-known fact, that in large concrete walls cracks develop during the binding stage due to the contraction of the material, and these cracks, which cannot always be prevented by careful execution of the work and a strong iron reinforcement, are widened after the tank is used by the stresses caused by temperature fluctuations. One or several cracks will, however, result in large quantities of oil oozing away and since the underground tank is inaccessible from its outer side, these losses cannot be ascertained with certainty in the case of a tank with a single wall. In the case of a tank of this kind the earth pressure and oil pressure act simultaneously or singly upon the wall according as the tank is full, discharged, or the earth abutting against the wall from without is removed as in case of repairs. Thus the single wall must be capable of meeting every contingency and must therefore be made very thick and bulky.

The object of the present invention is to provide an improved form of underground tank which consists in a large oil vessel or holder with a heating appliance in which uneven stresses in the walls holding the oil and caused by fluctuations of temperature are obviated to the greatest possible extent by making the walls or bottom (or the walls and the bottom) double and by heating the interior chamber of the tank and the space between the double walls. Another advantage obtained by producing even temperatures in the walls of the interior vessel consists in the statical conditions (and hence the basis of calculation) being rendered clearer and simpler.

The invention is illustrated in the drawing in which two ways of carrying it out are illustrated.

Fig. 1 illustrates a plan view of a tank with double walls.

Fig. 2 shows a cross section through Fig. 1 on the line A—B in the case of a tank with a single bottom.

Fig. 3 represents a cross section through Fig. 1 on the line C—D.

Fig. 4 is a cross-section through Fig. 1 on the line A—B in the case of a tank with double walls and a double bottom and

Fig 5 is a corresponding cross-section through Fig. 1 on the line C—D.

In order to keep the oils contained in the tank—and above all the heavy oils—in a thin liquid state and constantly ready for use, they have to be heated up to a temperature of 60 to 80 degrees centigrade. For this purpose a system of pipes *a* of any known suitable kind, which is supplied with head from some exterior source, is provided. This heating system may consist of heating coils situated in the tank itself and of exterior feed and escape pipes, these latter being placed in the double wall hereinafter described, i. e. in the space between the oil vessel and the exterior wall. If necessary, branches from the supply pipes may also be inserted in the spaces or chambers in the bottom or sole of the tank. Two objects are accomplished by the heating device if the proper temperature is maintained and these consist firstly in the heat losses due to the cooling of the contents of the vessel being reduced because less heat is given off from within to without, and secondly in the uneven stresses set up by fluctuations of temperature and causing cracking of the inner walls, which must be kept tight under all circumstances being obviated through the prevention of differences of temperature. Besides, the temperature of the heated oil in the oil pipes *i* is kept steadier. Without

these measures oil vessels cannot be kept perfectly tight, because, if the contents have to be heated, the difficulties to be overcome are greater the larger the size of the vessel and the less elastic its substance (concrete) is.

Generally speaking, vessels situated underground are scarcely easier to construct than such a stand in the open above the ground. In the case of the latter the fluctuations of temperature and hence also the differences between the interior and exterior will on account of the variations of the outside temperature often are still greater than underground tanks, as ground is a better protection against the fluctuations of temperature than air. But in their tendencies to change their shapes tanks standing in the open do not have to contend with as many counteracting forces and are thus subjected to fewer internal stresses. It may be added that the advantages offered by tanks standing above the ground are practically the same as those obtained with underground tanks arranged according to this invention, but with the former of course such factors as the pressure exerted by the earth abutting against the tank, accessibility, and making provision for inspection need to be taken into account.

The spaces between the inner and outer walls may be partly or entirely filled with material whose insulating properties are superior to that of air and the inner and outer supporting members may be thus combined so as to form an entire single support.

The Figs. 2 and 3 show a vessel having a double surrounding wall that encloses a hollow space *b* and single bottom or sole *e*. In Figs. 4 and 5 the sole is also double and encloses a space *g* in the shape of a passage through which a person may creep. The earth surrounding and abutting against the tank is denoted in both cases by *d*.

The external temperatures in the case of underground vessels are generally nearly constant and hence the differences of temperature between their inner and outer portions do not change within such wide limits; but on the other hand the pressure of the abutting earth counteracts the tendencies of the vessel to change its shape and these counteracting forces vary considerably with the momentary condition of the earth due to frost or rain.

The principal requirement, viz, enabling thick walls to be built that will not be cracked by internal stresses, is met by the following expedient:

The principal parts of the tank, i. e. the walls and sole of the same, are divided as shown in the drawing into portions or double walls each of which (excepting the foundation upon which the tank rests) is subjected separately to the pressure of the oil or to the earth pressure respectively and to which the pressure is always applied in one and the same direction.

The uneven internal stresses which result from the different temperatures on the inner and outer sides of the vessel or tank are prevented by keeping the temperatures in the space *b* and in the interior chamber *c* practically equal; the space *b* is also heated when the oil chamber *c* is heated, this measure being easily carried out by means of the heating coils and pipes hereinbefore alluded to. The advantages of equal temperatures at both sides of the wall are secured for the outer structural portions or walls only when the space *b* is not heated; but for these portions the effect of heating is not nearly as important as for the portions subjected to the pressure of the oil. Cracks in the walls abutting against the earth are of no consequence because no oil can leak through them and become lost, and besides these cracks can be closed at all times.

Furthermore, by making provision for the temperatures existing on both sides of the principal carrying members or sole of the tank to be as equal as possible, internal bending stresses are avoided, and by providing the hollow space *b* the conditions with regard to the prevention of stresses due to temperature are altogether more favorable and the occurrence of cracks causing the leakage of oil is thus prevented. The member which resists the pressure of the oil is sufficiently capable of bending outwards and the member that resists the pressure of the earth is sufficiently capable of bending outwards to provide a simple basis for statical calculation.

The heating space *b* between the interior vessel *c* and the exterior wall, which also serves as a conduit for the heating pipes *a* and the oil pipes *i*, may be used for the additional purpose of continually and conveniently supervising the state of the principal carrying members of the tank and it renders unnecessary the provision of special conduits for the various pipes in the neighbourhood of the tank and finally, since it has to be closed at the top against the influences of the outside temperature and of the weather, its upper portion, say at *h* in Fig. 1, may be adapted for ventilation purposes and made to accommodate a vehicle for travelling along the tank without necessitating the perforation of the lid or cover of the tank usually resorted to. This greatly facilitates the provision of a bomb and fire resisting covering of the tank.

I claim:

1. An oil tank of large capacity sunk in the ground and comprising an inner concrete oil vessel with walls adapted to be subjected only to the pressure of the oil, an outer concrete shell with walls adapted to

be subjected only to the pressure of the earth, passages situated inside the outer shell and surrounding the side walls of the inner vessel, other passages located beneath the sole of the inner vessel, said passages being adapted to accommodate persons desiring to inspect the said walls, and heating devices arranged in the passages first named and adapted to keep the temperatures in the said passages and in the inner vessel practically equal, whereby uneven internal stresses in the said walls are diminished or prevented.

2. An oil tank of large capacity sunk in the ground so as to be obscured from view and comprising an inner concrete oil vessel; an outer concrete shell, the walls of the vessel being inclined to the upright standing walls of the shell that horizontal conduits for inspection purposes extending around the inner vessel are formed; long piers for supporting the sole of the inner vessel extending beneath the sole between it and the said shell; passages being formed by the said piers, the sole and the bottom of the shell which accommodate persons desiring to inspect the said sole; and heating devices in the said conduits for keeping the temperatures in the passages, conduits and the inner vessel practically equal, whereby uneven internal stresses in the walls of the said vessel are diminished or prevented: the outer concrete still being adapted to retain any oil that might escape from the said inner vessel.

In testimony whereof I have affixed my signature in presence of two witnesses.

RUDOLF KOLWES.

Witnesses:
FRED A. LÖTTER,
WILFDU SCHESSLER.