

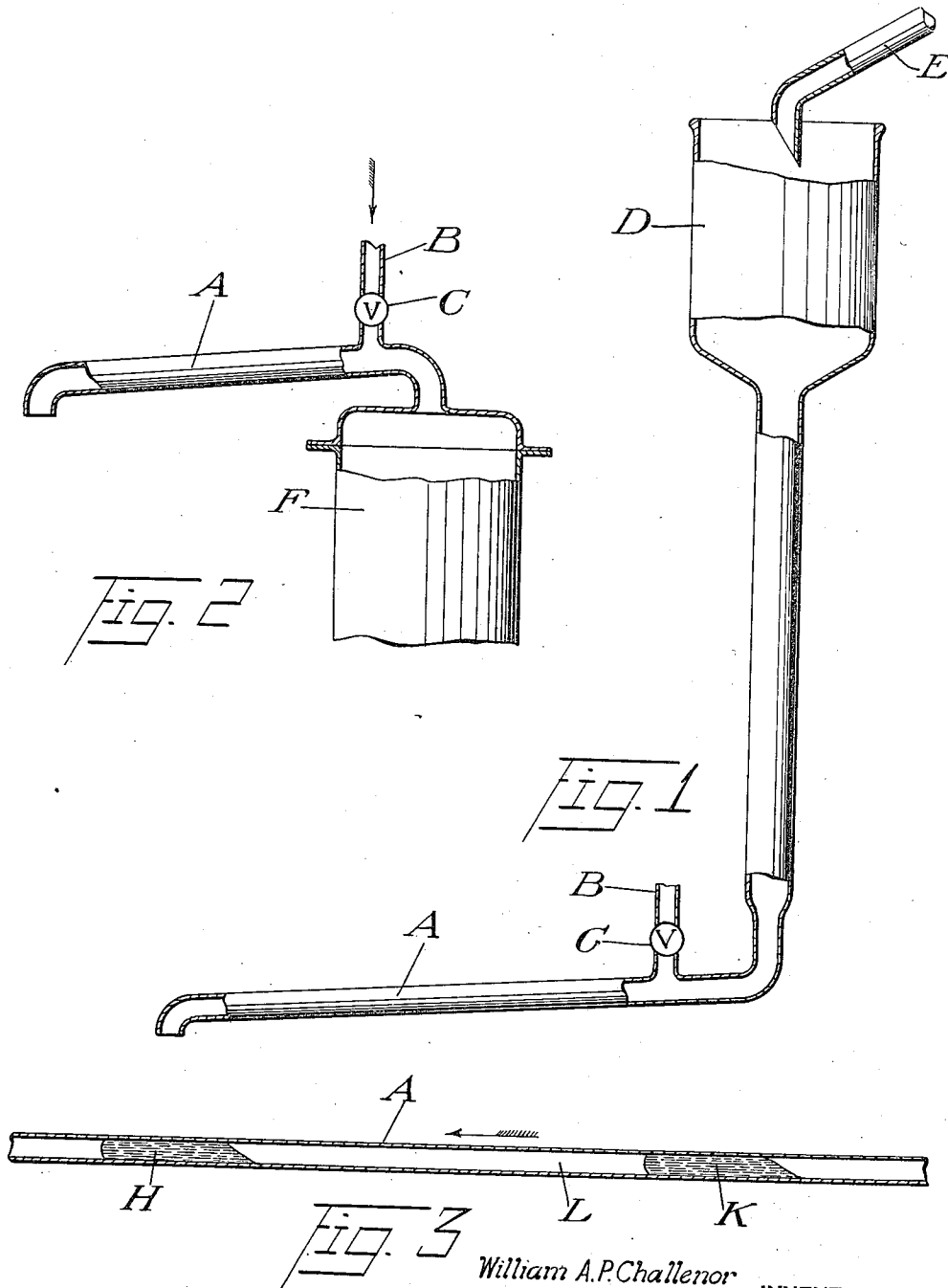
Dec. 20, 1938.

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2,140,897

MANUFACTURE OF EXPLOSIVES

Filed Oct. 14, 1936



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UNITED STATES PATENT OFFICE

2,140,897

MANUFACTURE OF EXPLOSIVES

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Application October 14, 1936, Serial No. 105,608
In Great Britain October 21, 1935

4 Claims. (Cl. 52—20)

The present invention relates to an improved method and apparatus for transferring liquid explosives and particularly liquid nitric esters such as nitroglycerin in the form of an emulsion from one place to another.

In the manufacture of nitroglycerin and similar liquid nitric esters it is customary to separate the liquid nitric ester from the refuse nitrating acid and then to wash the separated liquid nitric ester by agitation with water and usually further with a dilute alkaline solution before the liquid nitric ester is removed from the separating house to the final washing house in which it is further washed. The partly washed nitric ester is sometimes run to the final wash house along a gutter.

Should a detonation occur in the gutter in which the liquid nitric ester is flowing, or in one house connected thereto, it may be propagated along the liquid nitric ester flowing in the gutter, which may thus communicate a detonation from one house to another.

In order to avoid the propagation of a detonation through the liquid nitric ester during its transport, it has been proposed to transport the liquid nitric ester in the form of an aqueous emulsion in which it is dispersed in a continuous aqueous phase. Aqueous emulsions of liquid nitric esters, however, separate easily, and trouble may be experienced in this respect, if the emulsion is transferred over any considerable distance.

The present invention provides an improved method of transferring liquid explosives, and particularly liquid nitric esters, in the form of an aqueous emulsion whereby the emulsion may be transferred over considerable distances without separating and with a reduced danger of propagation in the event of local detonation.

The chief object of the present invention is a new and improved method of transferring liquid explosive material, and particularly liquid nitric esters. A further object is a method for transferring liquid explosive material in the form of an aqueous emulsion. Another object is an apparatus for transferring the foregoing materials. An additional object is an improved method of transferring liquid explosive material over considerable distances with reduced danger of propagation in the event of local detonation.

Thus, for example, into a current of an emulsion of the liquid explosive in an aqueous medium there is introduced a stream of air at a volumetric speed exceeding that of the emulsion so as to cause turbulence therein; the air being

retained in association with the emulsion during its travel through a long horizontal or somewhat inclined transfer tube, the diameter of which is sufficiently narrow to cause the formation of a series of short surges in the emulsion which move along the tube and are of sufficient size to occupy its cross section, and a plurality of spaces occupied mainly by air, whereby the emulsion is prevented from separating out. The aqueous liquid used in making the emulsion may be for instance a dilute alkali carbonate solution. In one form of putting the invention into effect the air stream may be introduced directly into the transfer tube preferably near to the emulsion feed; and according to another form of the invention it may be introduced into an emulsion feed vessel, from which the air and the emulsion pass into the transfer tube. According to still another form of the invention, part of the air may be introduced into the feed vessel and part into the tube near the feed end. The transfer tube may leave the feed vessel horizontally or at a slight inclination, but if desired a portion at the feed end of the transfer tube may be bent over into a substantially vertical direction and arranged so as to form a short air lift portion.

The emulsion is introduced under a pressure sufficient to drive the emulsion and air through the transfer tube. The air may conveniently be supplied from a reducing valve on a high pressure air line, and after starting up the supply of air the emulsion may be admitted, and the air supply adjusted to cause the development of alternate surges and spaces. When it is no longer desired to transfer emulsion, a quantity of water may be introduced into the system and the air supply may be continued for some time.

By way of illustration it may be said that with a supply of 0.3 cub. ft. emulsion per minute under a head of about 3 ft. to a 1 inch diameter nearly horizontal pipe of about 80 ft. in length dropping 3 ft., the air may be supplied at about 2.5 cub. ft. per minute from the compressed air supply.

The tube may conveniently be made of rubber, with glass portions if desired. Joints in the tube may be made with lead insertions.

It is found that as the turbulent flow of emulsion and air proceeds along the horizontal or somewhat inclined tube, a surge develops which, when it has grown sufficiently to occupy the cross section of the tube, will be followed at intervals by other similar surges, with intervening spaces which constitute in effect long air bubbles. These surges persist for a long time in the advancing

emulsion, and maintain it as an emulsion over long distances. The formation of this kind of flow does not depend on a supply of emulsion of such velocity that its flow is turbulent in the absence of the air introduced therewith.

The invention is further illustrated by the diagrams attached hereto, of which Figure 1 represents a vertical section of one form of an apparatus for putting the invention into effect, Figure 2 represents a vertical section of another form of apparatus for putting the invention into effect, and Figure 3 represents a vertical longitudinal section of a portion of transfer tube showing the alternation of surges of emulsion and air spaces that is caused to occur according to the invention.

In Figure 1, A represents the long transfer tube, which may be made of rubber or lead. For convenience of representation it is shown broken in the drawing. B represents a compressed air pipe leading from a source of compressed air (not shown) into the tube, and C represents a control valve for the compressed air. D represents an open feed vessel for the emulsion through which the latter is supplied at the required rate from the source (not shown) through the pipe E. The lower part of the tube is of sufficient length to provide the necessary driving pressure, and the upper portion is expanded into a deep funnel.

In Figure 2 the letters A, B and C have the same significance as in Figure 1, and F represents a portion of the feed vessel which in this is a washing apparatus in which the liquid nitric ester is maintained in emulsion with the aqueous liquid by means of air stirring. The portion of the apparatus containing the inlets for air and the liquids is not shown. In this case the air entering the feed vessel constitutes a portion of the air entering the transfer tube, the remainder being supplied through the air inlet B.

In Figure 3, A represents a portion of the transfer tube through which the contents are passing in the direction shown by the arrow; H, K represents two surges of emulsion occupying the whole cross section of the tube; and L represents an intervening air space. It will be observed that the advancing surge leaves a considerable tail behind it, and that the drainings from each surge are taken up by the next one advancing.

In the foregoing detailed description of our invention it is apparent that many variations in detail may be made without departing from the spirit and scope thereof. We, therefore, intend to be limited only in accordance with the following patent claims:

We claim:

1. The method of transferring liquid explosive nitric esters, which comprises forming an aqueous emulsion with said explosive and forcing said emulsion through a conduit, along with an amount of air sufficient to cause turbulence.
2. The method of claim 1, wherein the liquid explosive nitric ester comprises nitroglycerin.
3. The method of claim 1, wherein the liquid explosive nitric ester comprises ethylene glycol dinitrate.
4. The method of transferring liquid explosive nitric esters, which comprises forming an aqueous emulsion with said explosive and forcing said emulsion through a conduit along with an amount of air sufficient to cause turbulence to prevent the separation of said emulsion into the constituents thereof, part of said air being introduced into said emulsion prior to the introduction of said emulsion into the conduit, and part being introduced into the conduit during the passage of the emulsion therethrough.

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