Oct. 12, 1948. L. B. DONOVAN 2,451,158

PAINTING OF GAS HOLDERS

Filed March 30, 1945 4 Sheets-Sheet 1

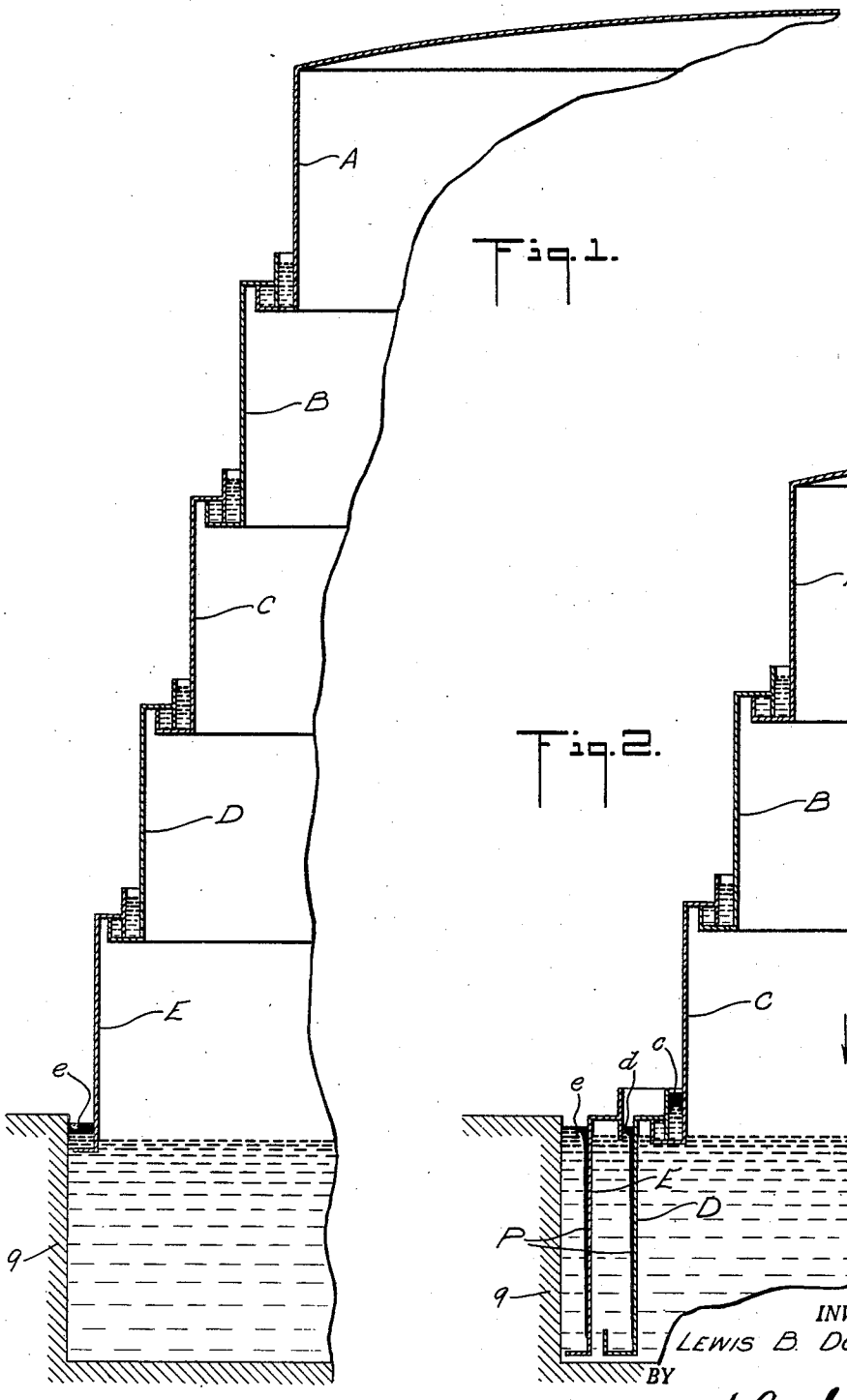



Fig. 1.




Fig. 2.

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PAINTING OF GAS HOLDERS

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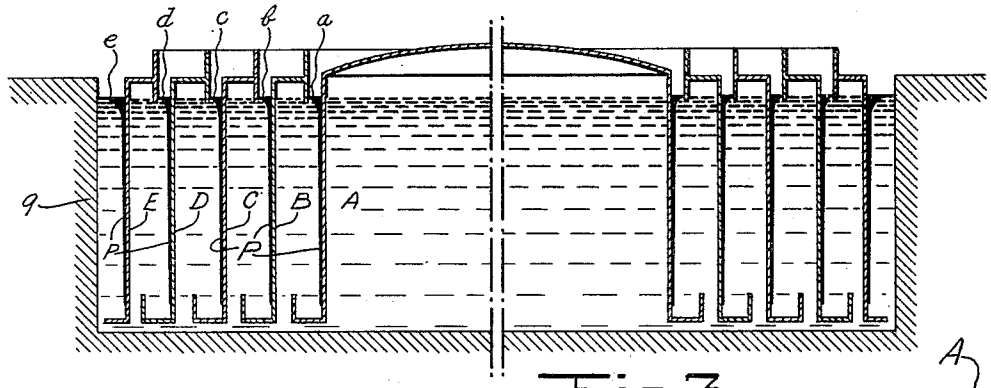



Fig. 3.

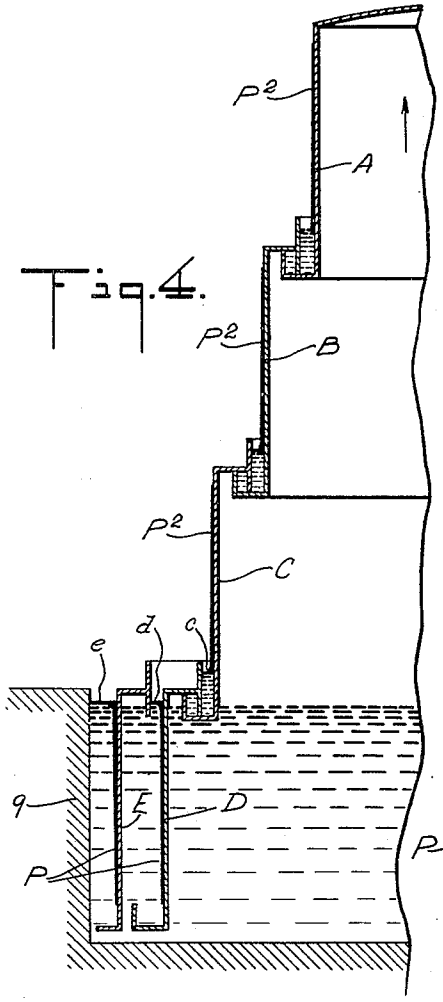



Fig. 4.

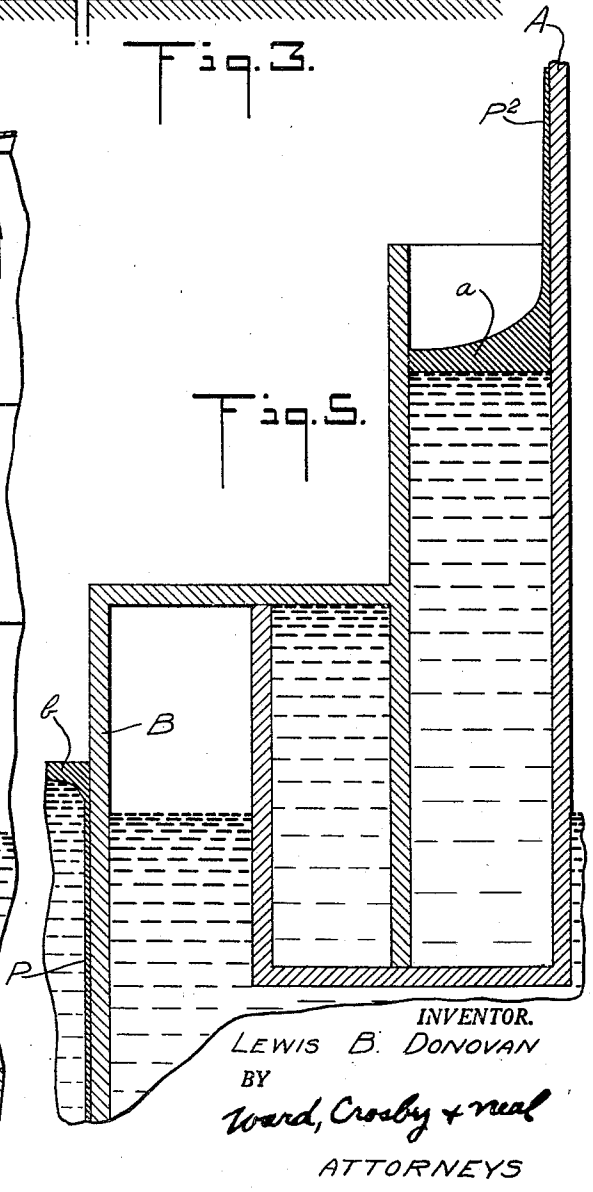



Fig. 5.

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PAINTING OF GAS HOLDERS

Filed March 30, 1945 4 Sheets-Sheet 3

Fig. 6.

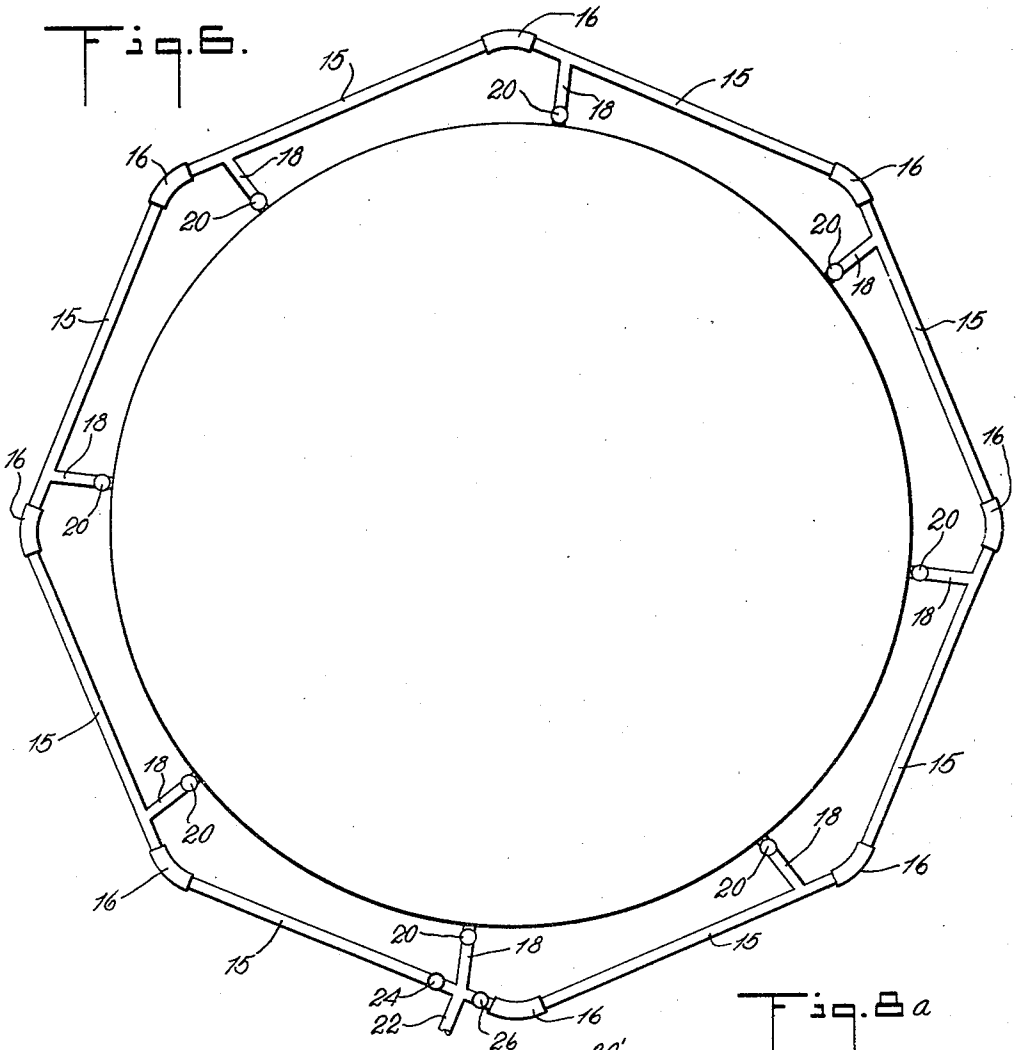



Fig. 8.

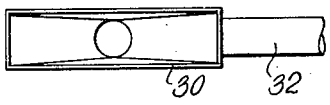



Fig. 8a

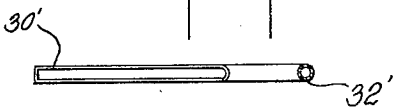



Fig. 7.

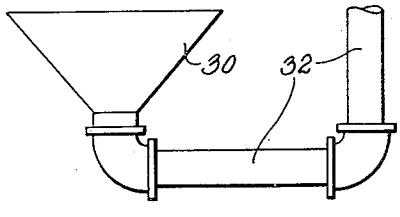
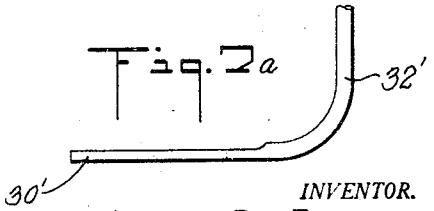



Fig. 7a




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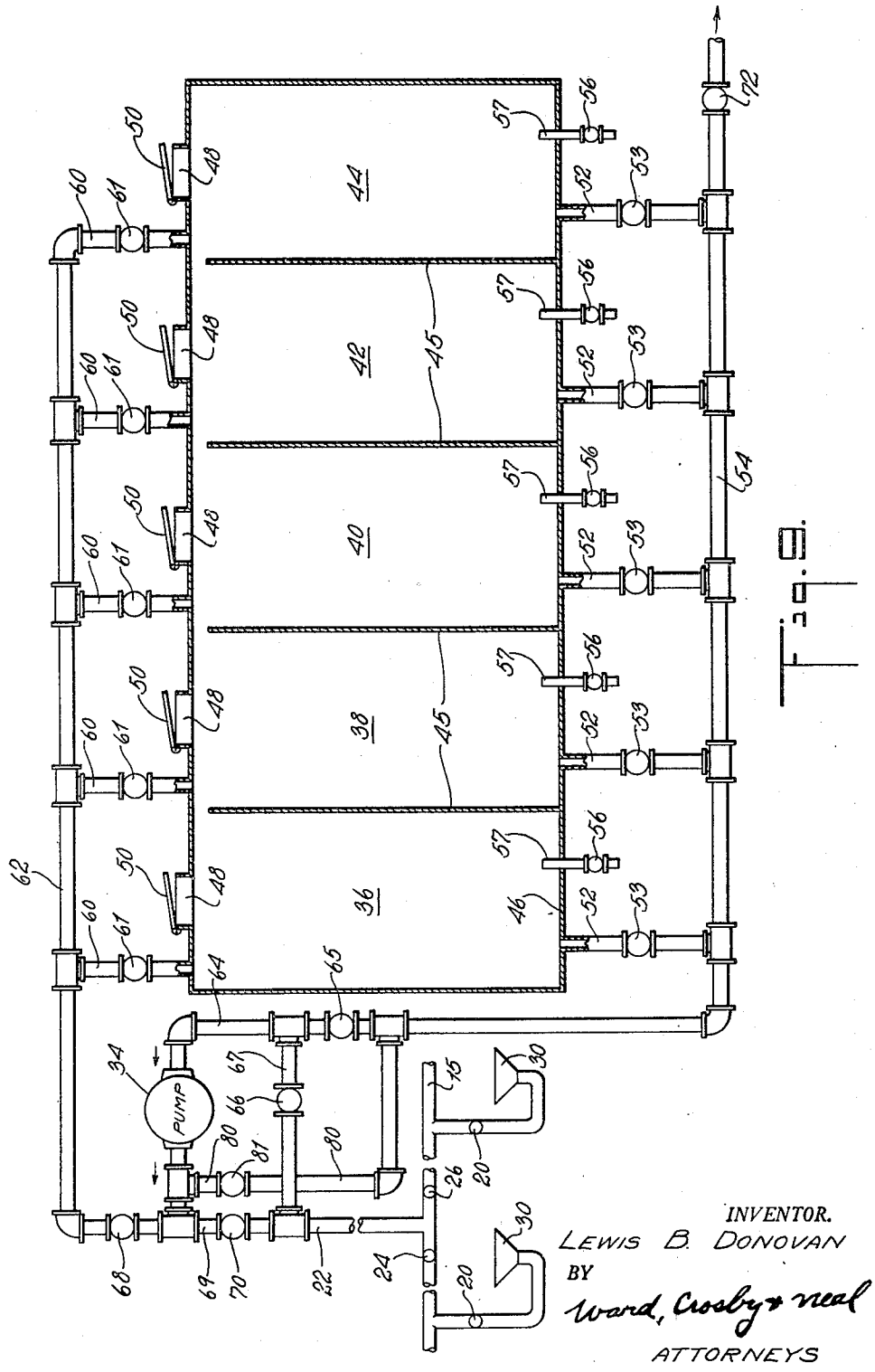



Fig. 8.

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# UNITED STATES PATENT OFFICE

2,451,158

## PAINTING OF GAS HOLDERS

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Application March 30, 1945, Serial No. 585,609

4 Claims. (Cl. 117—94)

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This invention relates to the painting of gas-holders and particularly to the painting of the major portions of the outer or exposed surfaces of the movable sections of a telescoping water-sealed gas-holder.

In the maintenance of telescoping gas-holders, the painting of their outer exposed surfaces presents serious problems owing to the large areas of these surfaces, the large amount of labor required for doing the painting by the usual methods, and the hazards to the workmen doing the painting owing to the elevations at and the conditions under which they must work. In some climates, deterioration of the surface coatings of gas-holders is so rapid that frequent renewal of the surface coatings is required, a fact which makes highly important all of the factors just mentioned.

The general object of the present invention is to provide for economical painting of the major portions of the outside surfaces of gas-holders having one or more "lifts" or movable sections provided at their bottoms with water-seals.

The method of the present invention is broadly characterized by the delivery of a layer of floating paint on the water-seal of each lift or telescoping section of the gas-holder, followed by progressive lowering and raising of said telescoping sections, whereby paint is drawn first downwardly and then upwardly from said floating paint layers on to the outside surfaces of the various telescoping sections, after which the surplus paint left floating on the surfaces of the various water-seals is removed for subsequent use.

An apparatus suitable for practicing the method of the present invention is described and claimed in my application Serial No. 661,670, filed May 12, 1946, for Painting apparatus which is a continuation-in-part of the present application. It is to be understood, however, that the method of the present invention may be practiced with other apparatus.

By the term "paint", as used in this specification and the appended claims, is meant any suitable surface coating such as paint, drying oil, etc. The paint to be used must be suitable not only for coating the surfaces to be covered but also for use in accordance with the present invention. The specific gravity of the paint preferably should be less than the specific gravity of water, in order that it may float on the surface of the water-seals which are provided at the bottom of each section of the gas-holder. For best results a paint should be chosen having a viscosity as well as a specific gravity within certain limits as hereinafter explained. Also, the paint used should not easily emulsify with water or, if a paint is used which does emulsify with water, it should be easily recoverable from the emulsion. In the practice of the present invention, a larger quantity of paint is required than would be used for covering the equivalent surface in ordinary ways such as by brushing or spraying; but surplus paint employed according to the present invention may be recovered for use again, as will be obvious from the following description of the method and an apparatus which may be employed in practicing the invention.

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The invention will be understood from the following description taken in connection with the accompanying drawings schematically illustrating both the method and a form of apparatus for carrying it out. In the drawings, Fig. 1 is a fragmentary sectional-elevation of a gas-holder of conventional type, in the position which it assumes when completely filled with gas so that its sections are in their uppermost position, the paint being shown as having been applied in a floating layer to the water-seal of the bottom section; Fig. 2 is a fragmentary sectional-elevation similar to Fig. 1 showing the two lower sections of the gas-holder in lowered position and the next section about to be lowered, during the painting operation; Fig. 3 is a sectional-elevation showing all of the sections of the gas-holder in their lowered positions during the painting operation; Fig. 4 is a sectional-elevation showing the upper three sections of the gas-holder, after they have been elevated during the painting operation; Fig. 5 is a fragmentary sectional-elevation, on a scale larger than Figs. 1 to 4, showing the manner in which the surplus paint drains back from the surface of a gas-holder section on to the water-seal from which it had been drawn; Fig. 6 is a plan view, which is somewhat diagrammatic, showing the distribution piping extending around the gas-holder and communicating with those places to and from which paint is to be delivered and removed during the painting operation; Figs. 7 and 7*a* are elevations showing respectively two forms of skimming devices useful for removing the surplus paint from the water-seals; Figs. 8 and 8*a* are plan views of the devices shown in Figs. 7 and 7*a* respectively; and Fig. 9 is a sectional and partly conventional elevation showing apparatus (which is preferably mounted on a truck to make it portable) useful in the painting of the outside surfaces of the movable lift or lifts of a water-sealed gas-holder in accordance with the present invention.

In all of the figures, the gas-holder, portions of which are shown in section, is of conventional telescoping water-sealed type, although it will be understood that the invention is also applicable to gas-holders having but a single lift or section. Essentially, such gas-holders comprise a cylindrical foundation 9, usually cylindrical in form, into which the several sections of the gas-holder telescope as the amount of gas in the holder decreases. The foundation 9 is filled with water to a predetermined level, as indicated in Figs. 1 to 5. For convenience of reference, the various sections of the gas-holder are indicated in the drawings by reference characters A, B, C, D and E. Each of these sections is provided at its bottom with a water-seal of a well known type of construction such as diagrammatically illustrated in the drawings. These water-seals act in a manner well understood to prevent the escape of gas from the inside of the gas-holder, regardless of the positions to which the sections of the gas-holder may be elevated or lowered under the influence of varying quantities of gas within the holder. These water-seals are utilized in carrying out the painting operation according to the present invention in the manner which will now be described.

When all sections A to E of the gas-holder are to be painted, sufficient gas is pumped into the gas-holder to fully extend its telescoping sections to the positions indicated in Fig. 1. Then a layer of floating paint is delivered as shown at *e* to the water-seal at the bottom of section E; after which enough gas is withdrawn from the gas-holder to permit section E to sink into the water-filled foundation 9 nearly to its lowermost position. During the sinking of section E, paint from the floating paint layer *e* adheres to the dry outside surface of section E, and is drawn downwardly from the floating paint layer *e*, as indicated at P in Figs. 2 and 3. Section D (and also sections C, B and A) of the gas-holder have then sunk until the water-seal of section D is approximately at the level of the top of the foundation 9; whereupon a layer *d* of floating paint is supplied to the water-seal of section D. Then more gas is withdrawn from the gas-holder, until section E sinks to its lowermost position in the foundation 9, and section D sinks nearly to its lowermost position. During these sinkings of sections E and D, paint is drawn downwardly from the paint layers *e* and *d* of the water-seals at the bottoms of sections E and D on to the previously dry outer-surface of those sections as indicated at P in Fig. 2. Then the operations just described are repeated for sections C, B and A, until all of the sections of the gas-holder are in the position shown in Fig. 3, which shows the major portions of the outside surfaces of the movable sections A to E of the gas-holder coated at P with paint that has been drawn downwardly from the paint layers *a*, *b*, *c*, *d* and *e* floating on the surfaces of the various water-seals of the sections A to E. During the lowering of the gas-holder sections, satisfactory adhesion of the paint-coatings P to the previously dry surfaces of the section takes place, if the paint is selected as one having a suitable viscosity and specific gravity, and this adhesion is not disturbed by submersion of those paint-coated portions in the water within the foundation 9.

After the gas-holder sections A, B, C, D and E have sunk to the positions shown in Fig. 3, sufficient gas is pumped into the gas-holder to raise section A until the cooperating parts forming the water-seal between sections A and B are in the position illustrated in Fig. 5. During the rising of section A, paint from the floating paint layer *a* on the water-seal is drawn upwardly on to the already paint-coated surface of section A, thereby adding another paint-coating, the two paint-coatings being indicated at $P^2$ in Fig. 5 (and also in Fig. 4 where paint has been twice applied to sections A, B and C). Fig. 5 shows how the surplus paint which has been drawn upwardly from the floating paint layer *a* drains back into that floating paint layer. Owing to the slow upward movement of section A, this drainage of surplus paint back into the floating paint layer *a* is largely completed by the time section A has finished its first stage of upward movement. Then or soon thereafter, all of the paint left in the floating paint layer *a* is removed by the use of the apparatus hereinafter described or by any other suitable means.



Thereafter, sufficient additional gas is pumped into the gas-holder to raise section A and with it section B until the cooperating parts forming the water-seal between sections B and C are at a level slightly above the top of the foundation 9. During this upward movement of section B, the surplus paint which has been drawn upwardly from the floating paint layer *b* on to the previously paint-covered surface of section B, drains back into the floating paint layer *b*. Then or soon thereafter, all of the paint left in the floating paint layer *b* is removed in the manner hereinbefore mentioned. The operations just described are successively repeated by the successive pumping of gas into the gas-holder thereby causing the successive raising of the sections C, D and E; and after each of these raisings the surplus paint in the floating paint layers *c*, *d* and *e* is removed in the manner described. Fig. 4 shows the conditions when the painting operations have been partially completed, that is, the sections A and B have been twice coated with paint at $P^2$, and the surplus paint has been removed from the surfaces of the water-seals for those sections; section C has been twice coated with paint at $P^2$ but the surplus paint has not yet been removed from the water-seal; and sections D and E have been once coated with paint at P during their downward movement into the water contained in the foundation 9. It will be noted that the introduction of the various paint layers on to the surfaces of the various water-seals, and the removal of the surplus paint from those water-seals, takes place at a level only slightly above the top of the foundation 9. Therefore, the paint distribution piping and parts associated therewith, for the introduction of the floating paint layers and the removal of the surplus paint, may be arranged at the same low level around the outside of the gas-holder. This is one of the important advantages of the invention, since the workmen handling the introduction of paint into and the removal of paint from the various water-seals can work around the gas-holder at one low level. Since it is desirable to remove the surplus paint from the water-seals as soon as possible, the removal operation may be commenced without awaiting the completion of all of the drainage of surplus paint from the surfaces of the gas-holder sections. By so proceeding, the time required for the complete painting operation can be kept to a minimum.

If desired, it will be understood that the gas-holder may be painted one lift or section at a time, or, for example, two lifts at a time. In such cases it is preferable to start with the upper lift or the

upper two lifts so that these may, in their uppermost positions, have ample time for the paint to dry, while the lower sections are raised or lowered for painting or in normal use.

In order to secure the most desirable results, care should be taken in selecting a paint which not only has a specific gravity low enough to float on the water, but it also appears desirable to take into consideration the relationship of the specific gravity to the viscosity of the paint used. In general it appears desirable to avoid use of paints which are relatively thin and have a high specific gravity, even though the specific gravity is less than that of water. It would appear that paints having a specific gravity within the range of about 0.80 to 0.99 with a preferred gravity of about 0.91 are most satisfactory for the purposes of the invention if so chosen that the viscosity thereof will be within a range of about 25 to 60 seconds (as measured in Consolidated Edison Company #4 Ford type cup at 70° F.)

While a variety of different kinds of paint may be used for the purpose, care should also be taken to select one in which the pigments and other ingredients do not tend to stratify in the paint layer within the period of time required for conducting the painting operations on a gas holder. Paints embodying carbon black and having gravities and viscosities within the above stated limits have been found satisfactory, also aluminum paints of such viscosity or other characteristics as will cause the aluminum particles to be maintained in suspension for the requisite period. Paints of various colors are also available for the purpose.

Since for good results the viscosity of the paint as applied is important, and since the viscosity may be substantially higher at winter temperatures, than during the summer, it will be apparent that in selecting a paint of proper viscosity, one should take into consideration the outdoor temperature at which the paint is to be used for the purpose. As above indicated the paint should also be one which does not readily emulsify when being pumped along with water through the particular pump being used.

The apparatus illustrated in Figs. 6 to 9 for supplying paint to the water-seals, for removing surplus paint therefrom, and for de-watering the removed paint, will now be described. It is desirable that the paint be distributed to the various water-seals at a plurality of points around the gas holder, so that a floating paint layer which is substantially uniform in depth will be produced. Also, in removing the surplus paint from the water-seals it is desirable that the removal be effected at a plurality of places in the water-seals around the gas-holder, to facilitate complete removal of the surplus paint as quickly as possible. To these ends, distribution piping may be arranged around the gas-holder slightly above the level at which the treatments of the water-seals are to take place, that is slightly above the top of the foundation **9**, as hereinbefore described.

An example of such distribution piping is illustrated in Fig. 6. Such piping and its arrangement may of course be varied depending upon the form and dimensions of the gas-holder. In this figure, the distribution piping is shown as comprising pipes **15** connected to one another at their ends by flexible connections **16** and branch pipes **18** extending with flexible connections to the places in the water-seals to which paint is to be delivered and from which paint is to be removed. Each of these branch pipes **18** is preferably provided with a valve **20** for controlling the flow of paint to and from the water-seal via that pipe; and these branch pipes **18** are adapted to be attached to skimming nozzles of any suitable kind such as the one shown in Figs. 7 and 8 and hereinafter described. One of the pipes **15** is provided with a feed pipe **22** leading to the apparatus (a form of which is shown in Fig. 9 and hereinafter described) by which the paint is supplied to and withdrawn from the water-seals through the distribution piping. Valves **24** and **26** may be inserted in the pipe **15** at each side of the place to which the pipe **22** is connected, to facilitate the feeding and withdrawal of paint.

Figs. 7 and 8 show a skimming nozzle **30** attached to a pipe **32** which may be connected to a pipe **18** by hose connections (not shown) or in any other suitable manner. A simpler form of skimming nozzle is shown in Figs. 7*a* and 8*a*, comprising a pipe **32'** with its lower end portion bent in to a horizontal position and formed with a slot as at **30'** adapted to be placed in a position to extend along just below the surface of the paint to be removed. The distribution piping and the skimming nozzles may be supported from the stationary frames around the gas-holder, in any suitable manner. If desired, the skimming nozzles may be employed not only for removing the surplus paint from the water-seals but also for supplying the paint in a floating layer on the surface of the water-seals.

Fig. 9 shows a form of apparatus useful for supplying paint through the pipe **22** to the distribution piping, the nozzles and the various water-seals, and for removing the surplus paint and for de-watering it. This apparatus is preferably mounted on a truck so as to be readily portable. As shown in Fig. 9, the apparatus includes a pump diagrammatically indicated at **34** which may be driven from any convenient source of power; and a paint holding tank divided into sections **36, 38, 40, 42** and **44** by partitions **45** upwardly extending from the tank bottom **46** nearly to the top of the tank, as shown in the drawing. In the top of the tank above each tank section is an opening **48** having a cover **50**, through which paint may be introduced into the various tank sections. As shown in Fig. 9, the bottom of each tank section **36, 38, 40, 42** and **44** is connected by a pipe **52** containing a valve **53** to a common pipe or bottom header **54**. The bottom of each tank section is also provided with a test valve **56** in a pipe **57** which communicates with the tank section, for purposes hereinafter described. The top of each tank section **36, 38, 40, 42** and **44** is connected by a pipe **60** containing a valve **61** to a common pipe or top header **62**. The direction of flow through the pump **34** is indicated by the arrows on the intake and outlet sides of the pump. As will be obvious from Fig. 9, the intake side of the pump is connected with the bottom header **54** through a pipe **64** and a valve **65**, and with the distribution piping **22** through a valve **66** and a pipe **67**. It will also be noted that the outlet side of the pump **34** is connected with the top header **62** through a valve **68**; and that the outlet side of the pump **34** is also connected to the distribution piping **22** through a pipe **69** and a valve **70**.

The manner in which the several valves may be manipulated so as to selectively control the pumping of paint from the bottom of any tank section **36, 38, 40, 42** and **44** to the distribution piping **22**, or from the distribution piping **22** to the top of any tank section, or from the bottom of any tank section to the top of any tank section, will now be described.

Let it be assumed that paint has been introduced into all of the tank sections 36, 38, 40, 42 and 44 preparatory to the painting of the various sections of a gas-holder in the manner hereinbefore described. Let it also be assumed that the distribution piping has been suitably arranged around the gas-holder and is ready to deliver paint to a water-seal. The outlet side of the pump 34 is connected to the pipe 22 by the opening of the valve 70; the valve 68 is closed in order to shut off connection of the pump 34 with the top header 62; the intake side of the pump 34 is connected to the bottom header 54 by opening the valve 65; the valve 66 is closed in order to cut off the intake side of the pump 34 from connection with the pipe 22; and the valve 72 near the end of the bottom header 54 is closed, as is also a valve 81 which may be provided in a pipe 80 for a purpose later explained. Opening of any one or more of the valves 53 will permit paint to flow from any one or more of the tank sections 36, 38, 40, 42 and 44 into the bottom header 54. Therefore, with the valves set in the manner just described, the pump 34 will draw paint from any one or more of the tank sections through one or more of the pipes 52 into the bottom header 54, the valve 65 and the pipe 64; and the pump will force paint from its outlet through the pipe 69 and valve 70 and to the pipe 22 leading to the distribution piping arranged around the gas-holder. Obviously, the supply of paint to the distribution piping may be controlled by manipulation of the valves 24 and 26 in the distribution piping, and by the valve 70 which is part of the apparatus shown in Fig. 9.

Let it be assumed that the painting of a gas-holder section has been completed, and that it is desired to withdraw the surplus paint from the water-seal. Let it also be assumed that the distribution piping and the skimming devices have been suitably arranged around the gas-holder preparatory to the paint-removing operation. The valves 65, 70 and 81 are closed and the valve 66 is open, thereby connecting the intake side of the pump 34 (through the pipe 64, valve 66 and pipe 67) with the pipe 22 leading to the distribution piping; and the valve 68 and any one or more of the valves 61 are open thereby connecting the outlet side of the pump (through the valve 68, top header 62, pipe or pipes 60 and valve or valves 61) to the top of one or more of the tank sections 36, 38, 40, 42 and 44. Under these conditions the pump 34 when operated draws paint from the surface of the water-seal through one or more of the skimming devices, through the distribution piping, pipe 22, pipe 67, open valve 66 and pipe 64, and delivers this paint through the open valve 68 and top header 62 to one or more of the tank sections through the pipe or pipes 60 in which the valve or valves 61 are open. The operation of removing surplus paint from the water-seal may obviously be controlled by manipulation of the valves 20, 24 and 26 in the distribution piping, and by manipulation of the valve 66 which is part of the apparatus shown in Fig. 9.

In the withdrawing of surplus paint from the water-seals, some water is likely also to be withdrawn and left mingled with the paint in one or more of the tank sections. The manner in which the apparatus shown in Fig. 9 may be used for the storage and de-watering of such paint will now be described. Let is be assumed that enough paint and water have been withdrawn from a water-seal into the tank sections 36 and 38 to



fill them about three-quarters full and let it also be assumed that the tank sections 40, 42 and 44 are empty. The paint and water in the tank sections 36 and 38 will stratify into a top paint layer and a bottom water layer, since the paint is of less specific gravity than the water and does not emulsify with the water. The existence of the bottom water layers can be proved by opening the test valves 56 in the pipes 57 extending into the bottoms of the tank sections. If it is permissible to discharge water from the tank sections at the place where the truck carrying the apparatus shown in Fig. 9 is located, the water in the bottom layers in tank sections 36 and 38 may be drained out through the pipes 52, valves 53, bottom header pipe 54 and the valve 72; valves 65 and 81, and the valves 53 beneath tank sections 40, 42 and 44 being closed during this operation. If, however, it is not permissible to discharge the water in the bottom layers in tank sections 36 and 38, that water may be pumped from those sections into empty tank section 44 where it may be temporarily stored. During this water-pumping operation, the valves 53 beneath the tank sections 36 and 38 are open, and the valves 53 beneath the tank sections 40, 42 and 44 and valve 72 are closed, valve 65 is open, valves 66, 70 and 81 are closed, valve 68 is open and all of the valves 61 above the various tank sections are closed except valve 61 above tank section 44 which is open.

Instead of the procedures just described, all of the water and paint in section 36 may be pumped out of that section into tank section 38 thereby not only filling that section but causing floating paint to flow from that section 38 into section 40 over the top of the partition between those sections, thereby separating paint from the water. The proper settings for the various valves during this operation will be obvious.

In some cases it may be preferred to pump the paint from pipe 22 into the bottom of one or more of the tank sections instead of into the tops of the tank sections as above described. For this purpose pipe 80 containing valve 81 is provided for inter-connecting the outlet of the pump 34 to the header pipe 54. When it is thus desired to use the pipe 80, valves 65, 68 and 70 are closed and valves 66 and 81 opened. Then with the pump operating, paint will be drawn from pipe 22 through valve 66 in pipe 67, through the pump, and forced through valve 81 in pipe 80 into header pipe 54, thence through any of the valves 53 as desired, into the bottom portion of one or more of the tank sections.

In these and other ways, the paint and water may be separated and stored in the various tank sections. When, however, it is possible to discharge the water at the place where the apparatus shown in Fig. 9 is located, that procedure is preferable to the pumping of water from one tank section to another. It will be obvious also that the apparatus shown in Fig. 9 permits the pumping of paint from any tank section to any other tank section. And of course the method of painting gas-holder sections which is herein described and claimed may be carried out with many forms of apparatus other than that shown in Fig. 9.

While the invention has been described in detail with respect to certain preferred examples, it will be understood by those skilled in the art after understanding the invention, that various changes and further modifications may be made without departing from the spirit and scope of

the invention, and it is intended therefore in the appended claims to cover all such changes and modifications.

What is claimed as new and desired to be secured by Letters Patent is:

1. Method for painting the exterior wall surfaces of a gas holder of a type having a plurality of telescoping sections, each provided with a water seal adjacent its lower edge and adapted to be raised and lowered by gas compressing and exhausting equipment cooperating with the holder, which method comprises the following steps starting with the sections in elevated position and with their external surfaces substantially dry: first delivering a layer of floating paint onto the water seal for a lower section, exhausting sufficient gas to lower the sections whereby paint is drawn from such water seal onto the outside dry wall surfaces of said lower section, delivering a layer of such paint onto the water seal for a higher section, exhausting sufficient gas whereby such higher section is lowered and paint is drawn from the last named water seal onto the outside dry wall surfaces of such higher section, thereafter introducing sufficient compressed gas to elevate such higher section whereby paint is again drawn onto the outside surface thereof, then removing the excess paint from the last named water seal, thereafter further introducing sufficient compressed gas to elevate said lower section whereby another layer of paint from the first named water seal is drawn onto the outside surface of such lower section, and finally removing excess paint from the first named water seal.

2. Method for painting the exterior wall surfaces of a gas holder of a type having a plurality of telescoping sections, each provided with a water seal adjacent its lower edge and adapted to be raised and lowered by gas compressing and exhausting equipment cooperating with the holder, which method comprises the following steps starting with the uppermost section only in elevated position and dry on its outer surface: first delivering a layer of floating paint onto the water seal for said uppermost section, exhausting sufficient gas to lower such section, whereby paint is drawn from such water seal onto the outside wall surface of said uppermost section, introducing sufficient compressed gas to then elevate said uppermost section and also removing the excess paint from the water seal and elevating another section, delivering a layer of such paint onto the water seal for such other section, and causing paint to be drawn onto such other section in the same manner as for the uppermost section.

3. Method for painting the exterior wall surfaces of a movable section of a gas holder provided with a water seal adjacent its lower edge and adapted to be raised and lowered by gas



compressing and exhausting equipment cooperating with the holder, which method comprises delivering floating paint onto the water seal simultaneously at a plurality of spaced points around the holder to rapidly form a layer of paint of substantially uniform thickness on the water, operating said equipment to vertically move the section whereby paint is drawn from the water seal onto said wall surfaces of the section, and then skimming off the excess paint promptly and before same becomes dried from the water seal simultaneously at a plurality of spaced points around the section.

4. Method for painting the exterior wall surfaces of a gas holder of a type having a plurality of telescoping sections, each provided with a water seal adjacent its lower edge and adapted to be raised and lowered by gas compressing and exhausting equipment cooperating with the holder, which method comprises the following steps starting with the sections in elevated position and with their external surfaces substantially dry; first delivering a layer of floating paint onto the water seal for a lower section, exhausting sufficient gas to lower the sections whereby paint is drawn from such water seal onto the outside dry wall surfaces of said lower section and the water seal for a higher section is brought down to a position adjacent a water seal for said lower section, delivering a layer of such paint onto the water seal for said higher section, then exhausting sufficient gas whereby such higher section is lowered and paint is drawn from the water seal therefor onto the outside dry wall surfaces of such higher section, and removing excess paint from said water seals before such paint becomes dried.

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