

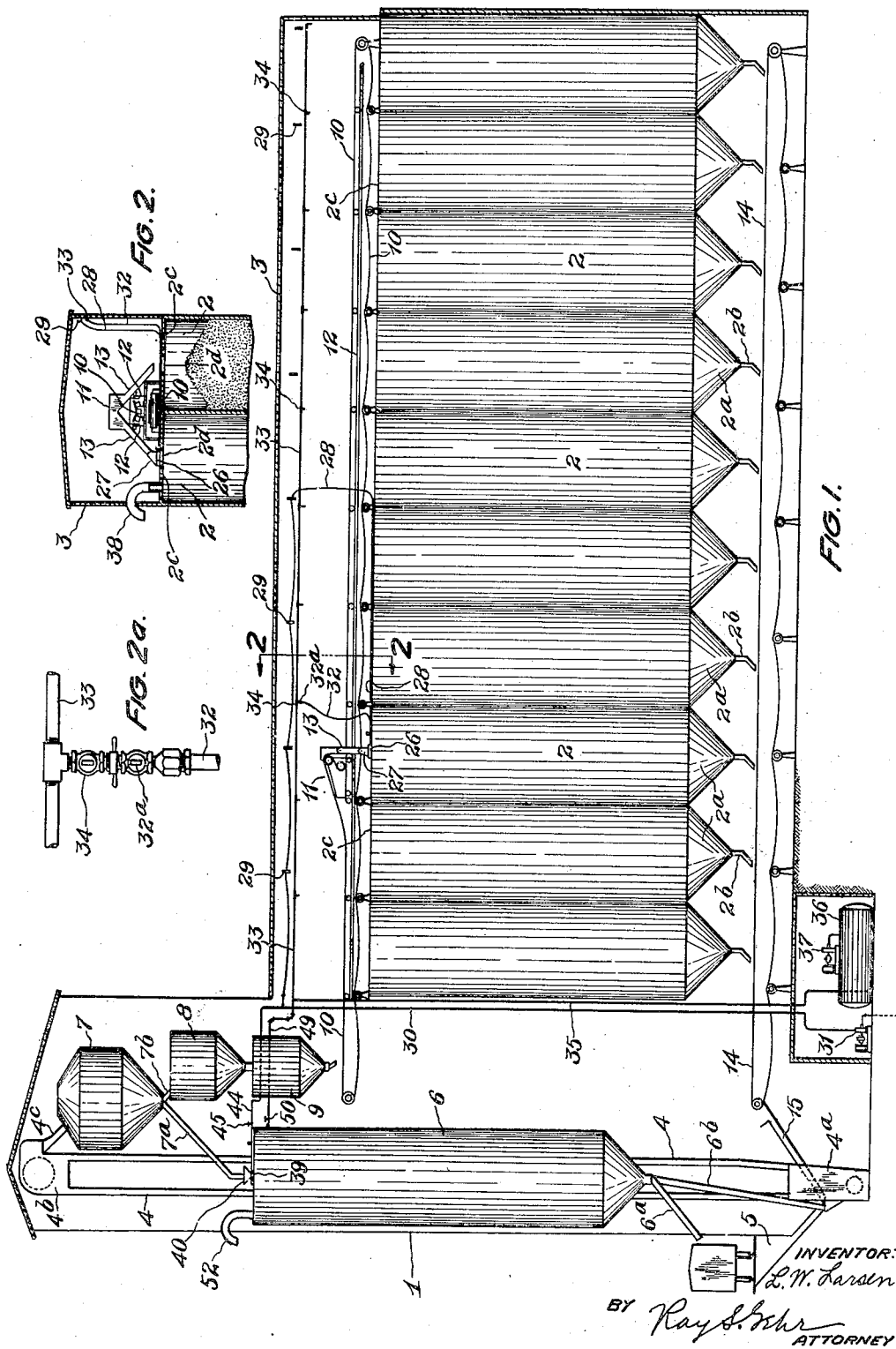
June 13, 1933.

L. W. LARSEN

1,914,342

APPARATUS FOR TREATING GRAINS

Original Filed June 18, 1930 3 Sheets-Sheet 1



June 13, 1933.

L. W. LARSEN

1,914,342

APPARATUS FOR TREATING GRAINS

Original Filed June 18, 1930

3 Sheets-Sheet 2

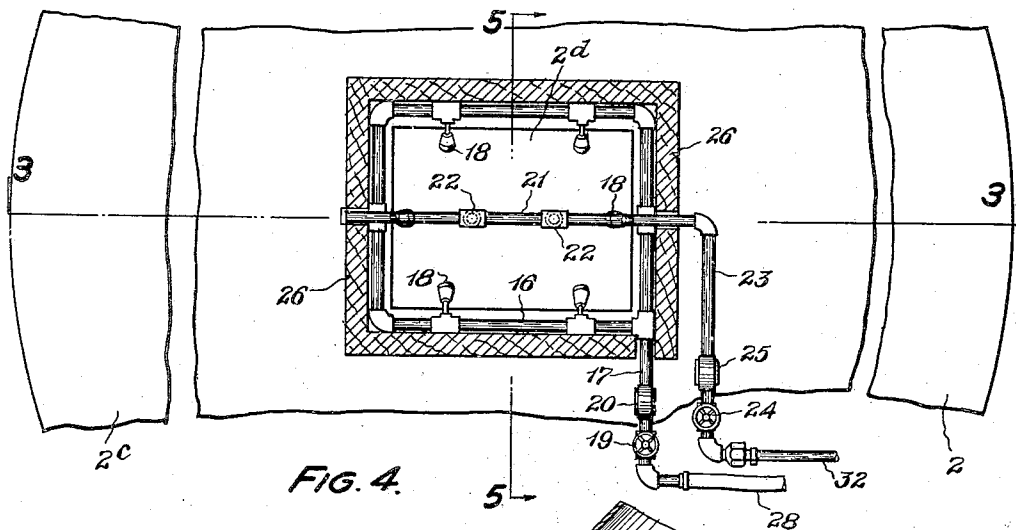


FIG. 4.

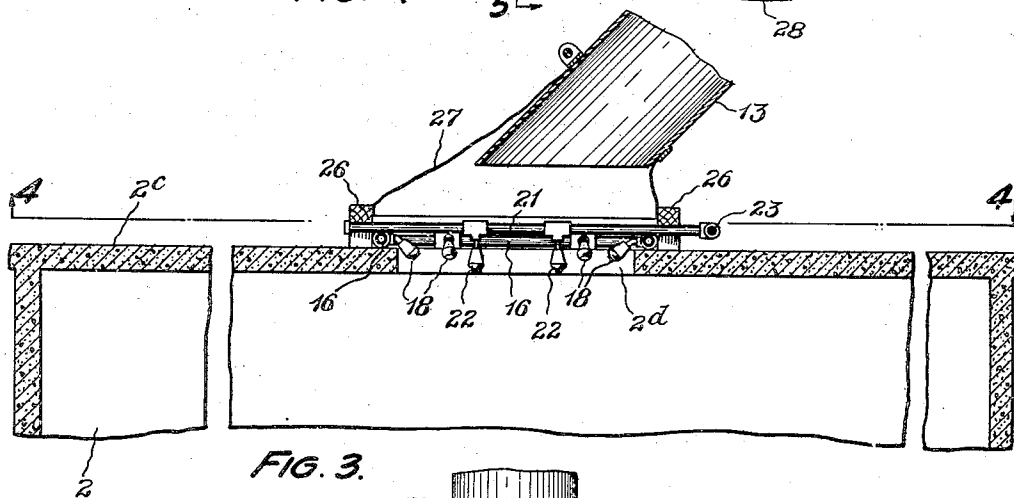


FIG. 3.

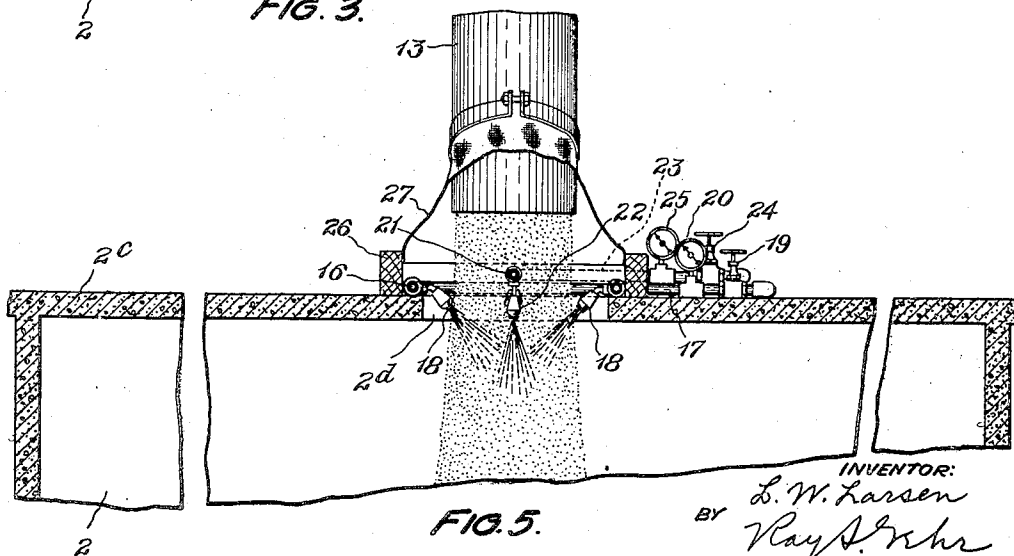


FIG. 5.

INVENTOR:
L. W. Larsen
BY
Ray S. Kehr
ATTORNEY

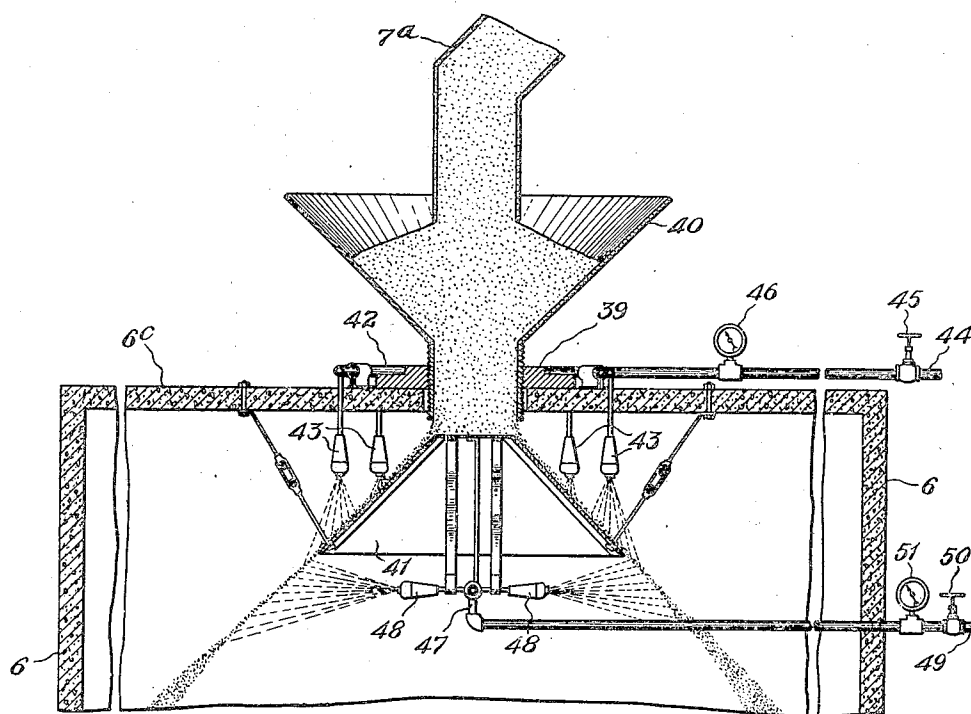
June 13, 1933.

L. W. LARSEN

1,914,342

APPARATUS FOR TREATING GRAINS

Original Filed June 18, 1930 3 Sheets-Sheet 3



INVENTOR:

L. W. Larsen

BY

Ray S. Sahr

ATTORNEY

UNITED STATES PATENT OFFICE

LAWRENCE W. LARSEN, OF MARINETTE, WISCONSIN, ASSIGNOR TO ANSUL CHEMICAL COMPANY, OF MARINETTE, WISCONSIN, A CORPORATION OF WISCONSIN

APPARATUS FOR TREATING GRAINS

Original application filed June 18, 1930, Serial No. 462,058. Divided and this application filed September 18, 1930. Serial No. 482,777.

The invention relates to an improved apparatus which is especially adapted for sulphurizing grains for the purpose of removing stain, must and mold from such grains as oats, barley and the like.

The present application relates to the apparatus disclosed in my copending application Serial No. 462,058 filed June 18, 1930, in which the corresponding process is claimed, and constitutes, in effect, a division of that application.

The bleaching of grain, and particularly oats and barley, by treatment with the fumes of burning sulphur is an old and established practice. In its essentials, this prior practice consists in treating a stream of grain descending through a tower with a mixture of steam, or steam and water and the fumes of the burning sulphur. The forms of apparatus that have been employed are varied but in all of them known to me the treatment comprises the essential steps here mentioned. In these prior treatments the bleaching action is, of course, due to the formation on the grains of sulphurous acid resulting from the absorption by the condensed moisture of the sulphurous oxide fumes.

The prior methods of treatment referred to have several serious disadvantages. First, the grain is warmed to such an extent by the use of the steam that the bleaching treatment must ordinarily be followed by some cooling treatment such as passing it through an aspirator or through an elevator one or more times, to prevent undue heating of the grain subsequently. Second, it has not been possible to control the amount of moisture introduced into the grain closely enough to prevent excess moisture and the resultant necessity of partially drying the grain after treatment to prevent overheating during subsequent storage. Third, the volume of gases which must be handled in the prior treatments is extremely large because the sulphur fumes are largely diluted with air or nitrogen so

that it is necessary to use a treating tower of large size in proportion to the quantity of grain treated. Fourth, the cost of installing apparatus such as the prior sulphurizing treatments require is relatively high, a typical apparatus comprising a large concrete and steel tower, an oven type sulphur burner and a steam boiler plant. Fifth, the cost of upkeep on the prior type of apparatus, such as is referred to, is very high by reason of the rapid corrosion of the metal parts by the sulphurous acid fumes.

The objects of the present invention comprise (1) the provision of apparatus adapted to carry out a grain sulphurizing treatment in a highly effective and efficient manner; (2) the provision of apparatus by means of which the application to the grain of the bleaching or treating agent can be controlled with nicety; (3) the provision of apparatus by which an effective sulphurizing of the grain can be carried out without overheating or overmoistening of the grain with the resultant avoidance of the labor and expense of rehandling the grain to cool and dry it; (4) the provision of apparatus by which the grain to be treated can be effectively sulphurized at a rapid rate without the handling of a large volume of air or other gases; (5) the provision of apparatus which is adapted to effectively and efficiently sulphurize the grain to be treated and which at the same time is exceedingly simple in construction, of low first cost and capable of being maintained at very moderate cost; (6) the provision of apparatus by which the grain can be effectively sulphurized and which can readily be assembled and operated under widely varying conditions as to the handling and housing or storing of the grain; (7) the provision of grain sulphurizing apparatus adapted to be conveniently and effectively employed in grain elevator and storage buildings without incurring any added fire hazard; and other objects, more or less incidental or ancillary

to the foregoing, which will be apparent from the following description.

My improved apparatus for the sulphurizing of grain comprises means for diffusing
 5 the grain to be treated, as by showering or streaming it into a bin or chamber, means for spraying it while in the diffused state and with water in predetermined amount to suitably moisten it, and means, acting either
 10 simultaneously with or immediately after the spraying with water, to spray the grain with liquid sulphur dioxide in predetermined amounts. When the grain is sprayed simultaneously with water and SO_2 the two liquids
 15 combine, forming a cloud-like body of sulphurous acid through which the grain passes so that the individual kernels are effectively coated with the acid. When the SO_2 spray follows the water spray the sulphur dioxide
 20 dissolves in the film of moisture on the individual grains or kernels, forming thereon a coating of sulphurous acid. In either case, by proper control of the moisture and the liquid SO_2 , which is readily accomplished
 25 by means of my apparatus, the amount and concentration of the sulphurous acid can be nicely controlled to effect the desired treatment.

In order that my improved apparatus, the
 30 manner of treating grain with it and the numerous advantages attaching to it may be clearly understood and appreciated, I shall now describe a preferred form thereof in connection with typical grain elevator structures and appliances.

35 In the accompanying drawings, Fig. 1 is a more or less schematic vertical section of a grain elevator fitted with my improved apparatus.

40 Fig. 2 is a fragmentary section on the line 2—2 through the conveyor gallery of the elevator.

Fig. 2^a is a fragmentary view showing a construction detail.

45 Fig. 3 is an enlarged vertical sectional view of one form of my improved treating apparatus arranged at the grain inlet opening at the top of one of the storage bins.

Fig. 4 is a horizontal section on the line
 50 4—4, Fig. 3.

Fig. 5 is a vertical section on the line 5—5, Fig. 4, i. e. at right angles to the section of Fig. 3.

Fig. 6 is a view similar or corresponding to
 55 Fig. 3 showing a modified form of the treating apparatus.

Referring in detail to the apparatus illustrated and first to Figs. 1 to 5, inclusive, Fig. 1 illustrates a typical form of grain elevator
 60 comprising a main or working house 1, a series of cylindrical storage bins 2 which are arranged in two rows (Fig. 2), and which are topped by a conveyor gallery 3.

The working house 1 is provided with one
 65 or more elevator legs 4. The elevator 4 has

its boot 4^a arranged below the normal ground level at the bottom of the working house and its discharge head 4^b at the top of the house. At the ground level the working house is provided with a grain receiving pit 5 over which
 70 freight cars may run and discharge their contents, as indicated in Fig. 1. The pit 5 has its discharge spout arranged to deliver into the boot 4^a of the elevator leg. The working house also contains one or more shipping and
 75 treating bins 6. Each such bin is fitted at its lower end with a discharge spout 6^a arranged to deliver grain into freight cars, as indicated, and with a discharge spout 6^b which is arranged to deliver into the boot 4^a of the elevator leg. The head of the elevator leg has its
 80 discharge spout 4^c arranged to deliver into a distributing hopper 7 at the top of the house and this hopper has bottom discharge spouts one of which 7^a is adapted to discharge into the bin 6 and another of which 7^b is arranged
 85 to discharge into a garner hopper 8 which in turn is arranged to discharge into a scale hopper 9.

The scale hopper 9 is arranged to discharge
 90 in turn upon the main distributing belt conveyor 10 which extends from the working house through the gallery 3 which tops the storage bins 2. The conveyor 10 is provided with a tripper or a throwoff carriage which
 95 is designated as an entirety by 11 and which runs upon track rails 12 extending longitudinally of the gallery. As shown in Fig. 2 the tripper is provided with two discharge spouts 13, 13 which extend from opposite sides of
 100 the tripper to deliver grain discharged from the conveyor into the top or receiving openings of either row of bins.

The storage bins 2 have hopper bottoms 2^a and discharge spouts 2^b which are arranged
 105 to discharge grain upon a conveyor 14 which extends beneath the storage bins and has its delivery end arranged within the working house 1 to discharge into a chute 15 which is arranged to deliver grain into the elevator
 110 boot 4^a.

All of the foregoing structural features and apparatus are typical of present day grain elevator practice and will be readily understood by those familiar with such structures without further description and explanation.

Referring now more particularly to my improved apparatus and equipment by which the elevator plant illustrated is adapted for
 120 the carrying out of the sulphurizing treatment, Figs. 3, 4 and 5 illustrate a preferred form of apparatus for spraying grain, as it is discharged from the conveyor tripper into the storage bins, with the water and with the
 125 liquid sulphur dioxide. The top wall 2^c of each storage bin, (these top walls of the bins also constituting the floor of the conveyor gallery 3), is formed with a grain receiving opening 2^d of rectangular outline. For the
 130

purpose of treating the grain as it leaves the tripper spout 13 and is showered through the receiving opening 2^a into the bin, I provide a water spraying equipment comprising a rectangular spraying head 16, formed of suitable pipe sections and fittings, which is connected at one corner with a supply pipe 17 and is fitted with a series of spray nozzles 18 which extend downward and inward at an inclination of 45°, there being six of these water spraying nozzles in the construction illustrated. The supply pipe 17 is fitted with a manual control valve 19 by which the pressure in the rectangular spray head 16 can be varied at will and the supply pipe 17 is also fitted on the discharge side of the control valve 19 with a pressure gauge 20 by which the operator can be guided in adjusting the valve 19 to secure the desired pressure on the spray nozzles.

Similarly the spraying apparatus is provided with a straight spray head 21 for liquid sulphur dioxide, said spray head consisting of pipe sections and fittings, and this spray head is fitted with a pair of spray nozzles 22, 22 which extend directly downward. To the spray head 21 is connected a supply pipe 23 which is fitted with a manual control valve 24 and a pressure gauge 25.

The spray nozzles 22 should be made of material that will not be corroded by sulphurous acid fumes. Spray nozzles of the type used in the manufacture of chamber acid are suitable for this purpose and I have found Monarch chamber sprays having a 7 m.m. orifice very satisfactory. I have also found it convenient to use the same nozzles for the water sprays 18. This particular spray nozzle is made with a lead body and porcelain tips and is not attacked by the sulphurous acid fumes.

As indicated in Figs. 3, 4 and 5, the rectangular spray head 16 is made of a size to rest upon the floor 2^c with its nozzles projecting into the floor opening, while the spray head 21 rests upon the spray head 16 and is disposed on the longitudinal axis of the latter. To hold the two spray heads in this assembled relation to each other, I provide a rectangular wood frame 26 which fits around the spray head 16 and is formed with notches on its under side to accommodate the supply pipe 17 and the spray head 21. To prevent the escape of sulphurous fumes from the bin into the conveyor gallery and elevator house, the tripper spout 13 is fitted with a skirt 27 of heavy, closely woven canvas and the lower edge of this skirt is secured to the rectangular frame 26.

Water is supplied to the spray apparatus by means of a hose pipe 28 which may be conveniently supported on the side wall of the gallery 3 by hooks 29 and which is connected to a water supply pipe 30 which extends upward from the source of water supply at the

base of the working house, through said house to the gallery level. To insure the delivery of the water at suitable pressure to the spray nozzles, I provide at the base of the working house a motor driven pump 31 which may suitably be a small gear pump provided with a pressure by-pass valve which automatically insures delivery of the water at the desired pressure. In installing a water supply line it is to be borne in mind that grain elevators are usually below freezing temperature in cold weather. The upright water supply line 30 can readily be drained when the grain treating apparatus is not in use, but as there is more difficulty in draining a horizontal line running through the conveyor gallery I prefer to use the hose line 28 to carry the water from the upright water pipe 30 to the spray nozzles.

Liquid SO₂ is delivered to the supply pipe 23 of the spray head 21 by means of a section of flexible copper tubing 32 which is coupled at one end to the supply pipe 23 of the spray head 21 and at its other end has a cut-off valve fitting 32^a which is adapted to be removably coupled to a liquid SO₂ supply pipe or tube 33 at any one of the series of valved fittings 34 with which the tube 33 is provided at intervals corresponding to the spacing of the series of storage bins 2, 2. By closing the cut-off valves in the fittings 32^a and 34, the tube 32 can be uncoupled from the supply line 33 and moved to any other one of the fittings 34. The tube 33 extends along the wall of the gallery 3 and in turn connects with an upright supply pipe 5 that extends downward through the working house to a supply tank 36. This supply tank is fitted with a motor driven air pump 37 which forces the liquid SO₂ from the tank through the tubes 35, 33 and 32 to the spray head.

To provide for the free escape of excess sulphurous fumes from the bins, each bin which is to be used in the treating of the grain is fitted with a vent pipe 38 (Fig. 2) which extends through the side wall of the gallery house and has its downwardly projecting outer end open to the atmosphere. It will be understood that during the treating of the grain the bin gradually fills with grain thereby displacing air which must be vented. This air becomes mixed with the sulphurous fumes and it is this mixture of air and fumes which is carried to the outer atmosphere through the vent 38.

In order that the operation of the apparatus in carrying out the sulphurizing treatment may be clearly understood, I will now describe the bleaching of grain, oats for example, using the apparatus which has been described. The grain to be bleached, which may be drawn either from the receiving pit 5 of the elevator or from some one of the storage bins 2 or even from one of the shipping bins 6 in the main working house, is in

any case delivered into the boot 4^a of the elevator 4 by which it is lifted to the top of the house and delivered into the hopper 7, and in case the treated grain is to be delivered into one of the storage bins 2, the said grain is discharged from the hopper 7 through the garner 8 and into the scale hopper 9 from which it may be discharged at a suitable predetermined rate upon the belt conveyor 10. The rate of discharge of grain upon the belt conveyor can readily be controlled by adjusting the discharge slide of the scale hopper until the discharge of grain is at the desired rate as shown by the scales.

15 The tripper 11 having been positioned to discharge into the particular bin 2 in which the bleached grain is to be stored, the spray apparatus is connected up with the tripper discharge spout 13 with the spray heads properly positioned in relation to the inlet opening of the bin and the water and sulphur dioxide lines are connected in the manner previously indicated. When the flow of grain starts, the water and liquid SO₂ valves are quickly adjusted to positions which give the desired pressure upon the spray nozzles as indicated by the respective pressure gauges 20 and 25. The pressures at which the water and liquid SO₂ supply valves are set will depend upon the rate of flow of the grain and upon the concentration of the liquid treating agent which it is desired to apply to the grain. Apparatus such as I have illustrated and described is capable for treating from 5,000 to 7,500 bushels of grain per hour. For the treatment of 7,500 bushels of oats per hour, with spray nozzles of the character previously specified, the water should be sprayed at a pressure of approximately 17 pounds per square inch and the liquid SO₂ should be sprayed at a pressure of approximately 21 pounds per square inch. This will apply to the grain approximately 1% by weight of water and 0.12 of a pound of sulphur dioxide per bushel. These amounts of water and sulphur dioxide per bushel of grain are suitable for an ordinary or typical case of grain requiring bleaching. It will, of course, be understood that the amount of water used will vary with the degree of dryness of the grain to be treated and that the amount of sulphur dioxide will vary with the condition of the grain in other respects so as to give a sulphurous acid of suitable concentration to do the work. According to my experience in the use of the process, the amount of water which should be sprayed upon the grain will fall within the range of 1% to 3% of the weight of the grain and the amount of liquid sulphur dioxide employed will fall within the range of 0.05 pounds to 0.50 pounds per bushel of grain, although in the great majority of cases the sulphur dioxide required will probably be within the range of 0.1 to 0.3 pounds per bushel of grain.

Obviously by making a series of tests the spray nozzles employed can easily be calibrated so that the weight of water and liquid SO₂, respectively, delivered at different pressures may be known and any desired amount of water and liquid SO₂ applied per bushel of grain. As the sulphur dioxide, as well as the water, is metered in the liquid state the control of the treating agent as well as of the water is very accurate and dependable and any desired concentration of sulphurous acid may be applied to the grain.

As the grain delivered from the tripper spout is struck by the sprays of water and liquid SO₂ the individual grains or kernels are given a resulting coating of sulphurous acid and, thus coated, the grain falls into the bin. As the grain lies in quiescent state in the bin the bleaching action proceeds and is ordinarily complete within twenty-four hours. The close control of the moisture which is supplied to the grain makes it possible to avoid adding moisture in excess of what may properly be added without the danger of causing overheating of the grain; and also the use of water at ordinary temperatures of the room or surrounding atmosphere, rather than steam or hot vapors of water which characterizes former processes, avoids heating of the grain. Consequently it is not necessary to subject the grain after treatment to any further handling to effect drying or cooling. Thus grain can be very rapidly treated as it is delivered into the storage bins with practically no more labor and handling than would be required in effecting the storage without the treatment.

Obviously the apparatus employed to apply the treating reagent to the grain may take a great variety of forms. While for most purposes I prefer the form of spraying apparatus illustrated in Figs. 3, 4 and 5, because of its low cost, simplicity, portability, ease of handling and general effectiveness, the specific form of the apparatus can be widely varied in carrying out my invention, and as illustrative of such variation I have shown a modified construction in connection with the shipping bin 6 in the working house of the elevator shown in Fig. 1. In this construction the top wall 6^c of the bin 6 has its grain inlet opening supplied with a floor plate 39 in the threaded opening of which is adjustably mounted the grain hopper 40 which is arranged to receive the grain from the spout 7^a of the hopper 7 (Fig. 1). Within the bin and directly below the discharge of the hopper 40 is arranged a corrugated dispersing cone 41 from which the grain flows in a diffused state as it is discharged into the bin. A water spray head 42 is supplied with a series of depending spray nozzles 43 which are arranged to spray water upon the diffused grain as it flows over and is discharged from the cone 41. The spray head 42 is supplied

by a water line 44 which extends to and is connected with the main water supply pipe 30, the pipe 44 being fitted with a control valve 45 and a pressure gauge 46. Below the dispersing cone 41 is arranged a spray head 47 which carries a series of SO₂ spray nozzles 48, 48 which are arranged horizontally to project a spray of liquid SO₂ upon the grain as it is discharged from the cone 41. The spray head 47 is supplied with liquid SO₂ by a tube 49 which connects with the main supply tube 35. The tube 49 is fitted with a control valve 50 and a pressure gauge 51. The discharge slide of the hopper 7 can be calibrated to regulate the rate of flow of grain through the spout 7^a and in addition the flow of grain over the dispersing cone 41 can be controlled by turning the hopper 40 to adjust it upward and downward in relation to the cone 41.

The bin 6 is preferably provided with a vent 52 for discharge of excess air and fumes from the bin in the manner described in connection with the bins 2.

It will be seen that grain can be treated in connection with the bin 6 and either immediately discharged into freight cars after the treatment is completed or the bin can, after the treatment is complete, be discharged through the spout 6^b into the boot of the elevator 4 and thence lifted and delivered by the conveyor 10 into any one of the storage bins 2.

From a comparison of the two forms of spraying apparatus that have been described, it will be apparent that such apparatus can take a great variety of forms, the essential things being to provide suitable spray nozzles properly mounted to spray the grain while in a diffused state with water and with the liquid bleaching or treating agent, and to provide means by which the rates of flow of the two liquids can be readily and nicely controlled.

However, a comparison of the spraying apparatus of Fig. 6 with that illustrated in Figs. 3, 4 and 5 makes readily apparent the marked simplicity and the ready adaptability of the latter form. It will be observed that while the water and liquid SO₂ spray heads are effectively held in working relation by the simple wooden frame 26, it is possible to quickly separate the two spray heads by simply lifting off the frame 26, whereupon the several parts of the spray apparatus can very easily be picked up and moved from bin to bin by simply disconnecting the SO₂ tube from the supply line 33.

On the other hand some elevators or grain storage houses do not have covered bins fed by conveyor belt and tripper. In such instances it may be advisable to devote a single bin to the sulphurizing treatment and a fixed installation of the spraying apparatus, such

as is shown in Fig. 6, is entirely suitable in these latter cases.

My improved apparatus for treating grain has numerous advantages which will be readily appreciated by those familiar with the prior forms of apparatus and methods of treatment. By avoiding the use of steam and the consequent heating of the grain I avoid the necessity of a subsequent handling of the grain to cool it and prevent its overheating in storage. In addition, by not heating the grain I am enabled to apply to it a more concentrated sulphurous acid since the solubility of sulphur dioxide and water varies with the temperature, being much higher at moderate temperatures than at the high temperatures caused by the use of steam in prior apparatus and methods of sulphurizing. The more concentrated sulphurous acid attained by my treatment makes possible a more rapid and effective treatment of the grain. Indeed, grain treated in the manner herein described with my improved apparatus is completely bleached at the end of twenty-four hours after the spraying treatment.

The advantage incident to the avoidance of introducing an excess of moisture into the grain is quite obvious as that obviates the labor and expense of handling the grain to effect drying following the sulphurizing treatment. Furthermore, the close control of the moisture is advantageous because of the laws and regulations relating to permissible amounts of moisture in grain that is marketed.

By applying the treating agent directly to the grain in liquid form and avoiding the introduction of air or other diluent gases into the treating bin or chamber, I, at the same time, secure marked efficiency and effectiveness of bleaching and avoid the serious problem of handling large volumes of air or gases which has characterized prior sulphurizing treatments. I am thus enabled, by the use of very simple and inexpensive apparatus, to treat grain effectively at a relatively rapid rate. Thus the simple treating apparatus which I have illustrated in Figs. 1 to 5 is capable of treating 7,500 bushels of grain per hour, whereas by prior methods known to me a treating apparatus which would cost several times as much as my apparatus has a treating capacity very much lower than 7,500 bushels per hour.

The manner in which my apparatus applies the reagent in liquid form insures effective application of the reagent to the grain with a minimum loss of the reagent. This result is due in part to the fact that the reagent is applied to the grain while the latter is in a diffuse state and in part to the fact that the cloud or mist of sulphurous acid formed by bringing the liquid SO₂ and water together settles upon the grain in the bin as it accumu-

lates therein and only a relatively small part of the mist is carried out through the ventilating flue and lost.

- Furthermore, by applying the pure liquid SO_2 directly to the grain I delay the formation of the sulphurous acid until the actual point of application to the grain and thus greatly lessen corrosive effects upon metal parts of the apparatus and correspondingly reduce upkeep charges.

The absence from my apparatus of furnace or other heating equipment makes it feasible to install the apparatus in any building without any added fire hazard.

- The marked simplicity and low cost of the apparatus illustrated, particularly the form in Figs. 1 to 5, and the ease with which such apparatus can be installed for operation under widely varying conditions, is believed to be obvious.

While I have described specific forms of apparatus, it will be understood that the invention is not limited to any specific form except as indicated in the appended claims.

- What I claim is:

1. In apparatus for treating grain, the combination of means for diffusing the grain to be treated; means for spraying the diffused grain with a predetermined amount of water per bushel of grain treated; and means for also spraying the grain with a predetermined relative amount of a liquid reagent adapted to combine with the water to form on the grain a coating of liquid bleaching agent.

2. In appearance for treating grain, the combination of a bin to receive the grain to be treated; means for showering the grain to be treated into the bin in a diffused state and at a predetermined rate; means for spraying the diffused grain as it enters the bin with a predetermined amount of water per bushel of grain treated; and means for also spraying the diffused grain with a predetermined relative amount of a liquid reagent adapted to combine with the water to form on the grain a coating of liquid bleaching agent.

3. In apparatus for treating grain, the combination of a bin adapted to receive the grain to be treated; means for showering the grain to be treated into the bin in a diffused state and at a predetermined rate; a nozzle arranged to direct a spray of water on the diffused grain as it enters the bin; means for supplying water to said nozzle under a predetermined pressure; a nozzle arranged to direct a spray of liquid reagent on the diffused grain; and means for supplying the liquid reagent to the last mentioned nozzle under a predetermined pressure.

4. In apparatus for treating grain, the combination of a bin having an inlet opening at the top thereof to receive grain; means for showering grain to be treated through said inlet opening at a predetermined rate; a water spray head having a plurality of noz-

zles arranged to spray the grain delivered through the inlet opening; means for supplying water to said spray head at a predetermined pressure; a second liquid spray head having a plurality of nozzles arranged to spray the grain delivered through said inlet opening; means for supplying to the second spray head at a predetermined pressure a liquid reagent adapted to combine with the water from the first spray head to form a liquid bleaching agent; and means for detachably securing the two spray heads in operative relation to each other and to the said inlet opening.

5. In a grain handling and treating plant, the combination of a plurality of adjacent bins having top inlet openings to receive grain; a conveyor gallery extending over the tops of said bins; an endless belt conveyor in said gallery having a movable tripper adapted to discharge grain from the conveyor into the inlet openings of the bins alternatively; apparatus for spraying the grain as it is discharged into the bins from the conveyor comprising a water spray head and a spray head for a liquid reagent adapted to combine with water from the first spray head to form a liquid bleaching agent; pipes for supplying water and liquid reagent, respectively, arranged in the conveyor gallery; and movable connections between the respective supply pipes and the corresponding spray heads, whereby the spraying apparatus can be moved readily from one bin inlet opening to another.

6. In a grain handling and treating plant, the combination of a work house; a grain elevator therein; an elevated grain hopper arranged to receive grain from the top of the elevator; a plurality of grain bins adjacent to the work house; a conveyor gallery extending from the work house over the tops of the grain bins; an endless belt conveyor extending through the said gallery and comprising a tripper adapted to discharge grain through the top inlet openings of the grain bins alternatively; means for spraying the grain with a liquid bleaching agent adapted to be mounted in the inlet opening of any one of the said bins; pipes for supplying the liquid bleaching agent arranged in the conveyor gallery; and movable connections between said pipes and said spraying means, whereby the spraying means can be moved from one bin to another to permit treatment of the grain with the bleaching agent as the grain is delivered from the conveyor into any one of the plurality of bins.

7. In apparatus for treating grain, the combination of means for diffusing the grain to be treated; means for spraying the diffused grain with a predetermined amount of water per bushel of grain treated; and means for simultaneously spraying the diffused grain with a predetermined relative amount of liq-

uid reagent adapted to combine with the water to form on the grain a coating of liquid bleaching agent.

8. In apparatus for treating grain, the
5 combination of means for diffusing the grain to be treated; means for spraying the diffused grain with a predetermined amount of water per bushel of grain treated; and means arranged to thereafter spray the grain while
10 in the diffused state with a predetermined relative amount of a liquid reagent adapted to combine with the water on the grain to form thereon a coating of liquid bleaching agent.

In testimony whereof, I hereunto affix my
15 signature.

LAWRENCE W. LARSEN.

20

25

30

35

40

45

50

55

60

65