May 31, 1949. A. G. GRANATH 2,471,487

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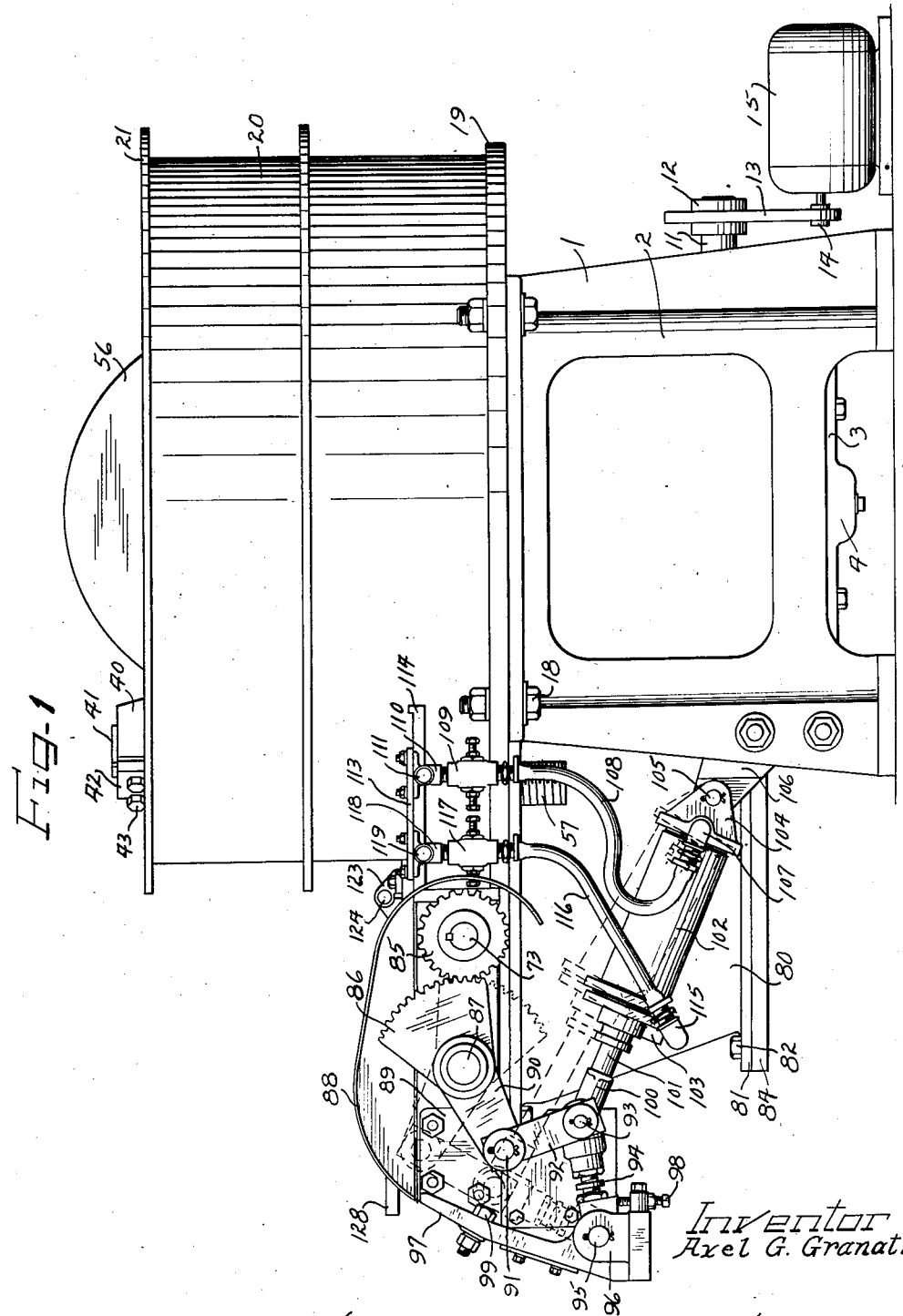


Fig-1

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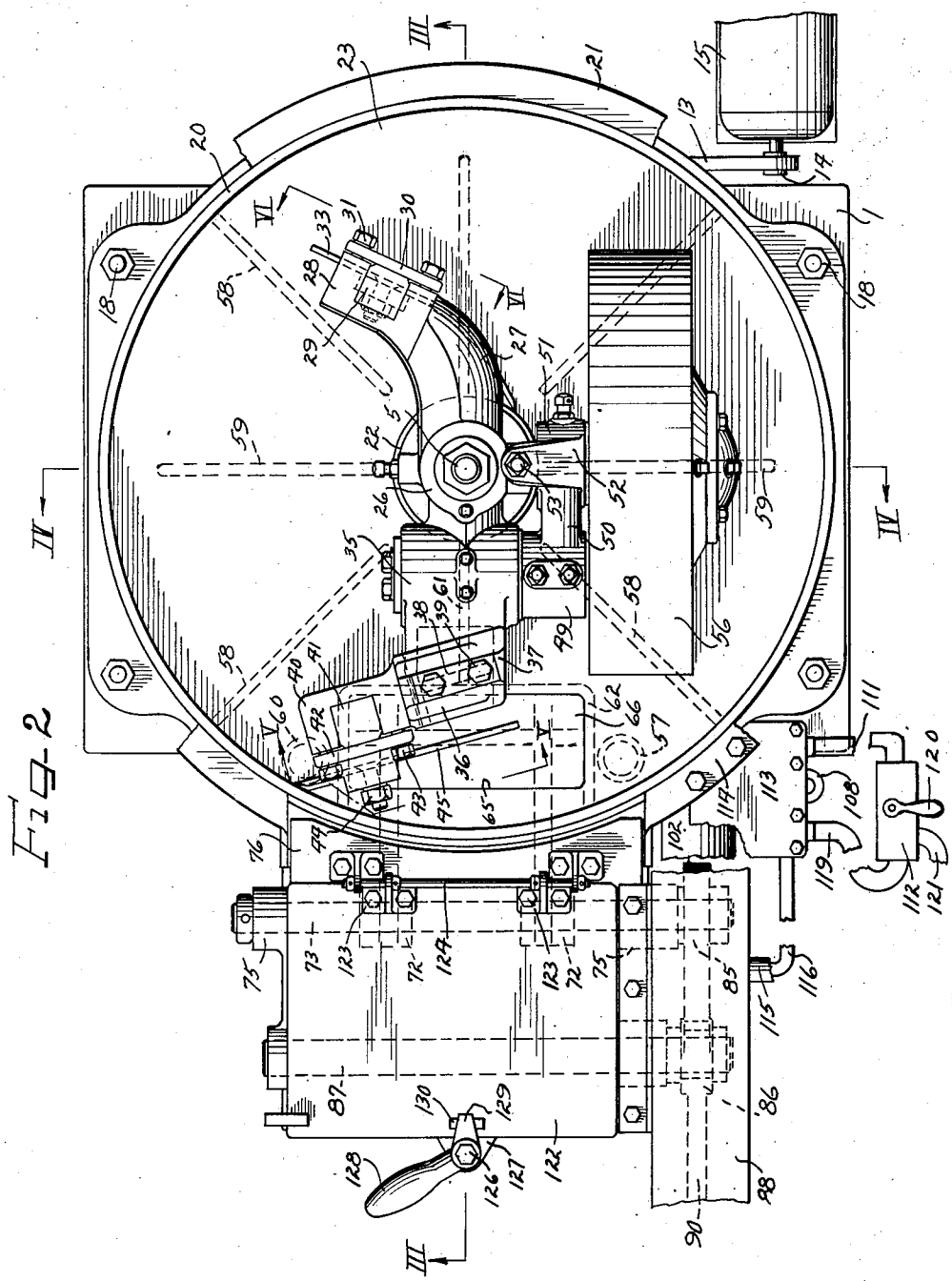


Fig. 2

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Filed Aug. 20, 1945 4 Sheets-Sheet 3

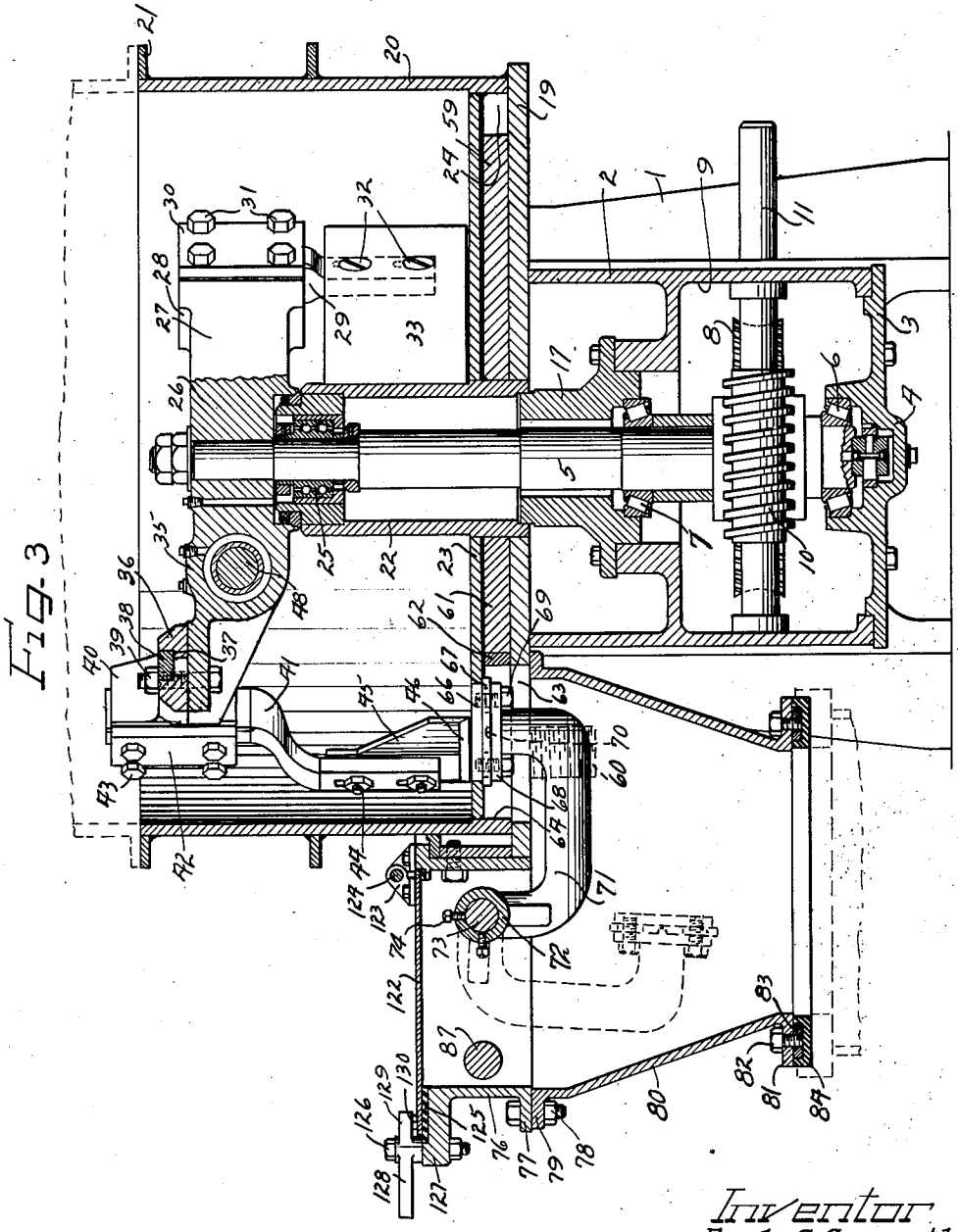


Fig. 3

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May 31, 1949. A. G. GRANATH 2,471,487

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Filed Aug. 20, 1945 4 Sheets-Sheet 4

Fig. 4

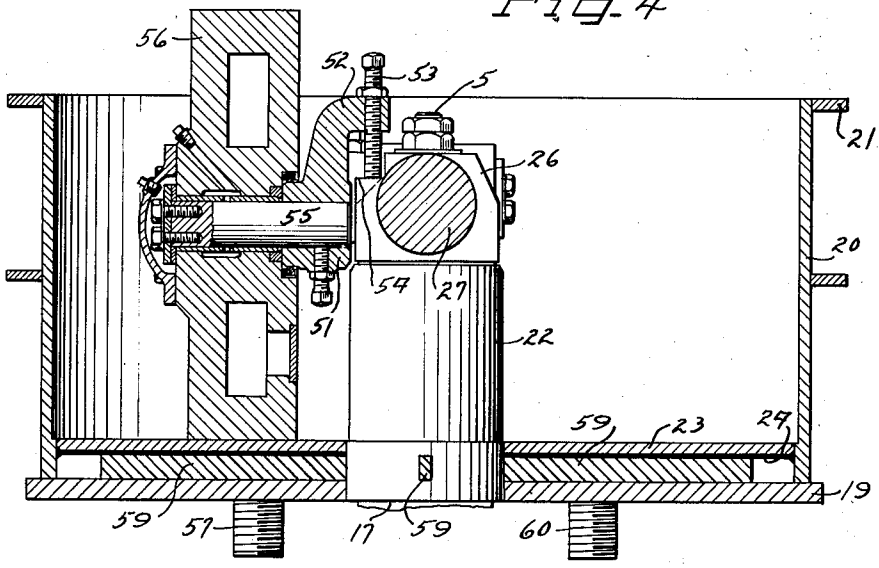


Fig. 5

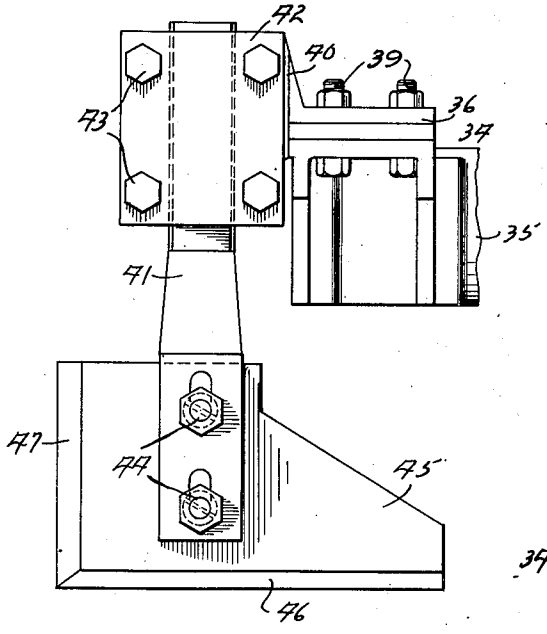
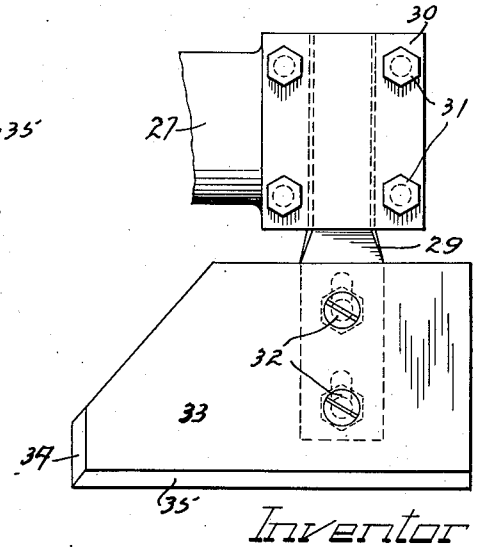


Fig. 6



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Patented May 31, 1949 2,471,487

UNITED STATES PATENT OFFICE

2,471,487

MIXER

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Application August 20, 1945, Serial No. 611,494

2 Claims. (Cl. 259—44)

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The present invention pertains to material mixers adaptable for use in the chemical field as well as for the treatment of materials during the treatment of which it is desirable to control the temperature of the mix.

With the advent of the present war and the tremendous increase in the requirement for products requiring the mixture of different materials in controlled atmospheres, it has become necessary to provide an improved mixer adapted for the mixture and treatment of chemical materials for the production of high explosives and the like. A mixer has also been needed that might also be adaptable for the reclaiming and reprocessing of either new or spent materials such as foundry molding sand, which usually is delivered while still in a hot condition, thereby making it desirable for the subsequent treatment of such molding material, as well as the premixture of chemical materials, to take place in an area in which the temperature of the mix may be either reduced or increased depending upon the nature of the mixture being subjected to treatment.

It is an object of this invention to provide a material mixing and treating machine of an improved and simplified type which is designed and constructed with improvements for increasing the adaptability and efficiency thereof.

It is also an object of this invention to provide an improved material mixer wherein the material being treated may be subjected to either cooling or heating treatments, depending upon the nature of the products undergoing treatment.

Still another object of the invention is the provision of an improved and simplified form of material mixer adaptable for use in the chemical field to permit the mixing and the treatment of materials requiring the cooling of the mixture during treatment.

A further object of the invention is the provision of an improved type of material mixing and mulling machine in which the mixing crib is provided with a cooling jacket for cooling the mix during treatment in the crib, thereby making the machine adaptable for use in the production of high explosives and chemical products in which it is desirable to control the temperature of the mixtures during treatment.

It is furthermore an object of this invention to provide an improved type of material mixing and mulling machine having an improved discharge door the operation of which is positively controlled and is adapted to be held in a locked position not only when the operating medium is available, but also in the event that the control medium

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is turned off or is accidentally shut off or exhausted.

Still another object of the invention is the provision of a material mixing and mulling machine wherein the scrapers and plow mechanism are mounted to permit the same to be accurately adjusted to a minute degree.

A feature of the invention is to provide a material mixing and mulling machine wherein the mixing crib, the turret and the wear plate are either integral or rigidly secured together to form a substantially one-piece structure and in which the wear plate forms the top of an integral cooling jacket provided in the lower portion of the crib, and through which either a cooling or a heating medium may be circulated for controlling the temperature of mixes while being treated in the crib.

An additional and further feature of the invention relates to the circulation of a temperature controlling liquid through a jacket forming part of a material mixing and mulling container of a machine for the treatment of chemical materials in the production of high explosives or other products during the production of which it is desirable to control the temperature of the mixture while being treated.

Other objects and features of this invention will more clearly appear from the following detailed description taken in connection with the accompanying drawings, which illustrate the embodiment of the invention.

In the drawings:

Figure 1 is a front elevational view of a mixer embodying the principles of this invention;

Figure 2 is a top plan view of the mixer with parts broken away;

Figure 3 is a longitudinal vertical sectional view taken on line III—III of Figure 2 with parts shown in elevation;

Figure 4 is a transverse vertical sectional view taken on line IV—IV of Figure 2 with parts shown in elevation and with parts omitted;

Figure 5 is an enlarged detailed elevational view of the outer scraping and plowing mechanism; and

Figure 6 is an enlarged vertical elevational view of the inner mixing and plowing mechanism.

As shown in the drawings:

The present invention is particularly concerned with the method of and the apparatus for treating materials in the chemical field for the production of products such as explosives and the like. The machine is also adapted for the conditioning of foundry sand and the reclaiming of

other materials, in a manner including a temperature control of the materials being mixed and treated.

It is accordingly believed that the novel process of treating or conditioning the ingredients of a mixed product in a controlled atmosphere to either cool the mix or heat the same, depending upon the nature of the product being produced, will best be understood from a description of a mixing machine embodying the features of this invention and by means of which the process may be practiced.

The mixing machine comprises a combination supporting and driving unit, a mixing unit supported thereon and a combination discharge hopper and door unit coacting with the mixing unit and supported on the supporting unit or adjacent thereto.

The mixing machine comprises a supporting framework 1 including a drive housing 2 for enclosing a driving unit for the machine. The drive housing 2 is provided with a bottom 3 formed with a bearing box 4 in which the lower end of the main vertical driven shaft 5 is supported by means of a roller bearing unit 6. The shaft 5 is also supported by means of a roller bearing unit 7 supported in the housing 2 as illustrated in Figure 3. Keyed or otherwise supported on the lower portion of the vertical driven shaft 5 is a worm wheel 8 disposed within a chamber or compartment 9. Meshing with the worm wheel 8 is a driving worm 10 which is rigidly secured or forms a part of a drive shaft 11 which projects out of the drive housing 2 and has secured on the outer projecting end thereof a pulley 12 around which a driving belt 13 is engaged. The belt 13 is also engaged around a small pulley 14 supported on the shaft of a driving motor 15, from which a drive is transferred to the main vertical shaft 5. The shaft 5 which is engaged in the roller bearing unit 7 has the upper end thereof projecting upwardly out of the drive or gear housing 2 through a supporting casting 17 which is rigidly mounted within the gear housing 2 as clearly illustrated in Figure 3.

The upper portion of the main vertical driven shaft 5 projects upwardly into the mixing, mulling and treating unit which is supported upon the framework 1, on the gear or drive housing 2 and on the casting 17. The mixing and treating unit is secured in place by means of bolts 18. The mixing unit includes a container comprising a bottom or base plate 19 having integrally formed thereon or welded thereto the lower end of a cylindrical shell or crib 20 terminating at its upper end in an integral outwardly projecting flat rim or flange 21, on which a material delivering hood or hopper, partly illustrated in dotted lines, may, in some cases be tightly seated for the delivery of materials into the crib. Integrally formed centrally on the crib base plate 19 is an upwardly projecting turret 22 through which the main vertical driven shaft 5 projects. Integrally formed around the turret 22 or rigidly secured thereto, by welding or other means, is a combination wear plate 23 which is spaced above the crib base plate 19 and forms the top wall of a temperature control jacket including the chamber 24 as clearly illustrated in Figure 3. The outer peripheral edge of the wear plate 23 is integral with the inner wall of the crib 20 or is rigidly secured thereto by welding or the like. It will thus be noted that a mixing or treating container is provided for the mixer, said container consisting of the crib having a temperature control jacket in the lower portion thereof around the turret, all of said parts being integrally formed with one another or so securely welded together that they form a unitary construction.

The portion of the main driven shaft 5 which projects outwardly through the crib turret 22 is journaled in a ball bearing unit 25 through which the upper end of the shaft 5 projects. Keyed or otherwise secured on the upper projecting end of the main driven shaft 5 above the bearing unit 25 is a propulsion head 26. Integrally projecting from one side of the propulsion head 26 is a plow supporting arm 27 which projects radially outwardly from the propulsion head and is curved. The outer end of the plow supporting arm 27 is provided with a guide head 28. The guide head 28 is formed with a vertical guide slot or groove in which the upper end of a plow supporting post or bar 29 is slidably engaged, and when adjusted, is adapted to be rigidly held in a set position of adjustment by means of a clamping plate 30 held in place by means of screw bolts 31. Rigidly secured by means of screws 32 to the lower slotted end of the supporting bar 29 is a plow blade 33, illustrated in detail in Figure 6 and provided with a scraping edge 34 at the inner end thereof adapted to move over the exterior of the turret 22 while the lower plowing edge 35 of the plow blade 33, is positioned along the lower edge of the plow to travel over the top of the wear plate 23 when the propulsion head 26 is rotated by the shaft 5.

Integrally formed on the propulsion head 26 opposite the arm 27 is a second or outer plow supporting arm or beam 34 which is formed with a bearing sleeve 35 positioned at right angles to the vertical shaft 5. The outer end of the plow beam 34 adjustably supports a guide arm 36 having a guide slot or groove 37 formed therein through which clamping bolts 39 engage. The bolts 39 are carried by the plow beam 34 and engage through openings in a clamping plate or bar 38 which seats in a recess provided in the top of the arm 36 to permit the same to be clamped in an adjusted position with respect to the plow beam 34.

Integrally formed on the outer end of the guide arm 36 is a plow head 40 formed with a vertical guide groove. The upper end of a plow supporting bar or post 41 is adjustably engaged in the plow head 40 and is held in an adjusted position therein, by means of a clamping plate 42 held in place by screw bolts 43. The lower end of the plow supporting bar 41 is provided with slots through which clamping bolts 44 are engaged. The clamping bolts 44 are engaged through apertures in an outer plow blade 45 having a lower edge 46 which is adapted to travel over the top surface of the wear plate 23. The outer plow blade 45 is also provided with a vertical scraping edge 47, which as clearly illustrated in Figure 2, is adapted to travel over the inner face of the lower portion of the cylindrical crib 20 when the mixing mechanisms are in operation.

The mulling mechanism of the mixer is also associated with the propulsion head 26 and includes a stub shaft or axle 48 which is rotatably journaled in the bearing sleeve 35. Keyed or otherwise secured on a projecting end of the axle 48 is collar 49 of a crank arm 50 the free end of which is formed with an integral collar 51. Integrally formed on the collar 51 of the crank arm is an elbow bracket 52, having adjustably threaded through a threaded passage therein, an adjusting screw 53 the lower projecting end of which is

adapted to seat against a stop shoulder 54 (Figure 4) to provide an arrangement for limiting the downward swing of the crank arm 50. An arrangement is thereby provided for adjusting the positioning of the mulling mechanism with respect to the wear plate 23. Secured by means of a screw bolt or other suitable means within the crank arm collar 51 is one end of a muller subshaft or axle 55 on the outer end of which is rotatably journalled a pressure roll or muller 56, which may be of any selected type and weight desired to permit the periphery of the muller to travel over materials on the wear plate 23 of the mixing crib.

It will thus be noted that the mixing and mulling mechanism within the mixing container or crib are adapted to be operated by the rotation of the propulsion head 26, which in turn is rotated by the vertical driven shaft 5 through the worm drive mechanism connected to receive a drive from the motor 15.

Attention is called to the mountings for the inner and outer plows 33 and 45 which are adjustably mounted so that they can be adjusted to within a very small and exact degree.

One of the important features of the present mixer is the provision of a unitary mixing container which is formed with an integral temperature control jacket in the lower portion there of with the top of said jacket also serving as the wear plate for the mixing crib. The chamber 24 of the temperature control jacket is adapted to serve as a cooling medium by causing a cooling liquid, such as water or the like, to be admitted into the jacket chamber 24 through an intake or supply nipple 57 to the outer end of which a supply hose may be connected for supplying the cooling medium to the temperature control jacket.

For the purpose of causing the cooling medium to circulate circuitously through the water jacket chamber 24 beneath the wear plate 23 of the crib, the chamber 24 is provided with a plurality of radially directed baffle plates or vanes 58 and 59. The baffle vanes 58 have the outer ends thereof integrally secured to the peripheral wall of the jacket and extend inwardly to within a short distance of the turrent 22 where it projects through the water jacket. The baffle plates or vanes 59 extend from the turret outwardly and radially to within a short distance of the peripheral wall of the jacket, as illustrated in dotted lines in Figure 2. The baffle vanes 58 and 59 extend from the crib bottom plate 19 to the wear plate 23 and thus bridge the distance between the wear plate and the bottom 19 so as to support the wear plate between its peripheral margins as shown in Figures 3 and 4. The vanes 58 and 59 are staggered or alternately project radially in opposite directions within the compartment 24 of the temperature control jacket so that the water or cooling medium entering through the supply pipe 57 will flow inwardly and around the inner end of the baffle vane 58 into the second division of the chamber and will then flow outwardly around the outer end of the next vane 59 and so on throughout the entire area of the jacket chamber until the last division is reached permitting the cooling medium to flow out through a discharge nipple 60.

For the purpose of separating the opposite sides of the temperature control chamber so that the water will circulate in a circuitous path, a solid partition wall 61 is provided in the chamber 24 and extends from the turret 22 radially outwardly

to a U-shaped closure wall 62 which extends around three sides of a crib door opening 63 provided in the base plate 19 (Figure 3). The opening 63 together with the adjoining passage 64 formed by the U-shaped wall 62 and a portion of the lower part of the crib wall 20, forms a passage for the crib discharge closure mechanism which includes a closure member supported at a point or position remote or outside of the crib unit.

To permit discharge of the material which has been mixed and mulled or treated within the mixing compartment of the crib 20, the wear plate 23 is provided with a discharge opening 65. The discharge opening 65 in the wear plate 23 is adapted to be closed by a door mechanism comprising a metal door plate 66 which is constructed to have a precision fit with the discharge opening 65 in the wear plate 23. Positioned against the outer or lower side of the door plate 66 is an apertured door seal pad or plate 67 which is constructed of a resilient compressible seal material. The door pad 67 seats upon an apertured door supporting plate 68. Bolts 69 engage freely through the supporting plate 68 and through the pad 67 and thread into the door plate 66 to hold the door plate and the pad securely fastened in position on the supporting plate 68.

Rigidly secured on the top surface of the door supporting plate 68 are a plurality of stop studs 70 which are embedded in the compressible seal pad 67 and are shorter than the thickness of said seal pad so that when the door is moved into closed position, as shown in Figure 3, the seal pad may be compressed a predetermined amount before the upper ends of the stop studs contact against the door plate 66 to limit the compression of the seal pad. The seal pad is larger than the supporting plate 68 and larger than the door plate 66 so that the peripheral margin of the seal pad is adapted to engage against the bottom surface of the wear plate 23, within the passage 64, through which the door is adapted to move.

The door supporting plate 68 is integrally formed on the ends of a pair of U-shaped door hinge arms 71. The mounting ends of the door hinge arms 71 are formed with sleeves 72 which are engaged on a door hinge shaft 73 and are secured to said shaft by means of set screws 74. The hinge shaft 73 is journalled in suitable bearings 75 which are formed on the outer sides of an upper hopper 76 which is in the form of a rectangular frame open at the bottom and at the top. The lower end of the upper hopper 76 is provided with an apertured flange 77 to permit the upper hopper to be rigidly and tightly bolted, by means of the bolts 78, to the top flange 79 of a lower discharge hopper 80 which is larger than the upper hopper 76 and projects underneath the base plate 19 of the crib unit as clearly illustrated in Figure 3 to position an opening in the top portion of the lower hopper 80 to register with the opening 63 in the crib base plate 19.

The lower hopper 80 is rigidly supported on the framework 1 and has the lower tapered end thereof provided with an outwardly projecting flange 81 having secured on the lower side thereof, by means of screws 82, a seal ring 83 around which is formed a compressible seal washer 84. The seal washer 84 is provided to form a tight seal between the discharge hopper 80 and the rim of a receiving container (partly shown in dotted lines) which is adapted to be forced or tightly held against the seal washer 84 to prevent any of the treated material from the mixing crib from

escaping when the material is discharged through the discharge hopper 80 when the crib door is opened after a mixing cycle has been completed in the crib 20.

For the purpose of opening the crib door 66 the door control shaft 73 has keyed or otherwise secured on a projecting end thereof a pinion or gear 85 having a gear segment 86 in mesh therewith. The gear segment 86 is rotatably supported on a gear segment supporting shaft 87 which projects through the upper hopper 76 and through supporting sleeves formed on the upper hopper side walls. One end of the shaft 87 projects beyond one side of the upper hopper 76 to permit the gear segment 86 to be supported thereon in the plane of the gear 85. A gear guard 88 engages over and partially around the gear 85 and gear segment 86 to protect the same. The gear guard 88 is supported on a bracket 89 which is rigidly bolted on one side of the upper hopper 76.

The gear segment 86 which controls the opening and closing of the crib door is operated by a toggle mechanism which in turn is operable by an air control mechanism. Integrally formed on the gear segment 86 and in diametrical alignment with the center line of the gear segment is an integral gear arm 90. Projecting through the outer end of the gear arm 90 is a link pin 91 having pivotally mounted on the opposite ends thereof, on opposite sides of the gear arm 90, the upper ends of a pair of toggle links 92. The opposite ends of the pair of spaced parallel toggle links 92 are pivotally engaged on a link pin 93 which serves as a three-way connector. Also pivotally connected on the link pin 93 is one end of an adjustable toggle 94 the other end of which is pivotally supported on a link pin 95 which is supported in a pair of spaced ears or plates 96 which form an integral part of a toggle supporting arm 97, which is part of the bracket 89 as illustrated in Figure 1. Adjustably supported on the lower portion of the toggle supporting arm 97 is a stop screw 98 against which a portion of the adjustable toggle 94 is adapted to engage to limit the lowermost swing of said toggle. Also engaged on the arm 97 is an upper stop screw 99 against which the upper portion of the toggle 94 is adapted to engage to limit the outward swing of said toggle.

For the purpose of operating the toggle mechanism to actuate the gear segment 86 and the pinion 85 to cause opening and closing of the crib discharge door, an air control mechanism is connected with the link pin 93 by means of a clevis 100 the forked end of which is engaged on the pin 93 while the opposite end is provided with a threaded recess in which the outer projecting end of an air operated piston rod 101 is engaged. The piston rod 101 slidably projects into one end of an air cylinder 102 which is mounted in an inclined position, as illustrated in Figure 1, and is provided with a collar portion which is adapted to contact a cylinder stop block 103 mounted on the exterior of the lower hopper 30 to limit the downward swing of the air cylinder 102.

The lower end of the air cylinder 102 is provided with a bottom or base 104 including an extension through which a pivot pin 105 projects. The pivot pin 105 is supported on a bracket 106 which is securely bolted to a portion of the framework 1 of the mixer. Connected to communicate with the interior of the lower end of the cylinder 102 is one end of an elbow fitting 107 to the other end of which one end of an air hose 108 is connected. The air hose 108 is also connected to the bottom end of a speed control valve 109 the upper end of which is connected to an elbow fitting 110. Also connected to the elbow fitting 110 is one end of an air hose 111. The second end of the air hose 111 is connected to an air control valve 112. The elbow fitting 110 is supported on the underside of an air pipe supporting bracket 113 which is rigidly bolted to a bracket arm 114 mounted on the exterior of the upper hopper 76.

The flow of air into and out of the upper end of the air cylinder 102 is through an elbow fitting 115 to the outer end of which one end of an air hose 116 is connected. The second end of the air hose 116 is connected to the bottom of a speed control valve 117 to the top of which one end of an elbow fitting 118 is connected. Connected to the second end of the elbow fitting 118 is one end of an air hose 119. The air hose 119 is also connected to the air control valve 112. The air control valve 112 is provided with a control handle or lever 120 which is adapted to be manually operated to actuate a four-way double passage valve plug, of a standard construction, within the control valve housing 112 to permit air under pressure from an air pressure supply pipe 121 to be admitted into either the air hose 111 or the air hose 119 and at the same time permit air pressure to be released from the other of said hose connections so that air may be admitted into the air cylinder 102 against one side of the piston while the air on the opposite side of the piston is permitted to be exhausted.

It will thus be noted that by operating the air control valve handle 120 that air may be admitted into the air cylinder 102 on either side of the piston to cause operation of the piston rod and actuation of the toggle mechanism which governs the operation of the gear segment 86 which in turn rotates the pinion 85 to either open or close the crib door 66.

When the door control gear members and the toggle mechanism are in the positions illustrated in full lines in Figure 1 the crib door 66 is swung into the dotted line position illustrated in Figure 3 so that the door proper is moved completely out of the path of discharge of the material from the crib to the lower hopper 30. If the air control handle 120 is now operated to admit air beneath the piston in the air cylinder 102, the piston rod will be projected outwardly to actuate the toggle mechanisms causing the toggle 94 and the toggle links 92 to be moved beyond dead center thereby causing operation of the gear segment 56 and the pinion 85 to move the door into a tightly sealed and locked position illustrated in full lines in Figure 3. When the toggle members 94 and 92 are moved beyond dead center the toggle member 94 is adapted to engage against the upper stop 99. With the toggle members 94 and 92 moved beyond dead center as described, the door 66 is positively locked in closed position and cannot be opened by any force applied to the door from the interior of the crib 20. The door can only be opened by operating the air control handle 120 to again admit air above the piston in the cylinder 102 to pull the toggle mechanism back into the full line position illustrated in Figure 1, thereby causing opening of the discharge door of the crib.

During the operation of the mixer it is essential, in some cases, to maintain the top of the upper hopper 76 tightly closed, particularly in the mixing and treatment of certain materials for the production of chemical products such, for example, as high explosive compounds requiring

treatment in a tightly enclosed area obtainable in the present mixer by the use of a material delivery hood and cover which is adapted to be fitted to the upper end of the crib 20. The bottom of the discharge hopper is adapted to be closed by means of a material receiving container adapted to be sealingly held in contact with the seal washer on the lower end of the discharge hopper 80.

In order to complete the confinement of the material being discharged from the mixer, the upper hopper 76 is provided with an inspection door 122 which is supported on the top of the upper hopper 76 by means of hinges 123 and a hinge shaft 124. To insure a tight fit between the top of the upper hopper 76 and the bottom surface of the inspection door 122, a door seal 125 is provided in the top face of the upper hopper 76 against which the inspection door 122 is adapted to tightly seal. For the purpose of locking the inspection door 122 in sealing contact with the top of the upper hopper 76, a locking mechanism is provided which consists of a pivot bolt 126 which is supported in a projecting lip 127 integrally formed to project outwardly from the upper outer portion of the upper hopper 76. Pivotally supported on the pivot bolt 126 above the lip 127 is a bell crank locking member consisting of a locking handle 128 and a shorter clamping arm or finger 129 positioned at an angle thereto and adapted to be moved into frictional locking contact with a friction block 130 which is integrally formed or rigidly secured upon the top face of the marginal portion of the inspection door 122. The inspection door 122 not only provides an adequate closure and seal for the top of the upper hopper 76 but it also provides a means affording access to the interior of the hoppers 76 and 80 and to the crib door and hinge mechanisms to permit the same to be inspected and thoroughly cleaned after the treatment and discharge of products from the mixer.

With the parts assembled as described it will be seen that the machine may be set in operation by starting the motor 15 after the air control handle 120 has been operated to cause the crib door 66 to be moved into the closed position illustrated in Figure 3. In one use of the mixer a material delivery hood may be moved into position to tightly seat upon the top flange 21 of the crib 20 to permit the different ingredients to be mixed, to be deposited into the crib 20. When the motor is started the mixing and mulling mechanisms within the crib are operated by the rotation of the propulsion head 26. The inner and outer plow blades act to turn and move the ingredients alternately outwardly and inwardly into the path of the muller, so that the ingredients are thoroughly mixed and mulled to produce the desired products. During the treatment of the materials within the crib 20 a cooling liquid is admitted into the jacket chamber 24 through the inlet nipple 57 and caused to circulate through the chamber 24 by means of the positioning of the radial baffles. The circulating liquid thus cools the wear plate 23 and is then discharged through the outlet nipple 60. The circulating liquid within the jacket chamber 24 thus acts to uniformly cool off the wear plate 23 and the materials which are being mixed and mulled thereon within the crib 20.

After the ingredients have been thoroughly mixed and mulled to produce the desired product, such as an explosive mixture requiring cooling during the mixing and treatment thereof, the resultant product is ready to be discharged from the crib. Before the discharge of a treated batch of material, it is essential that the inspection door 122 be tightly locked in place and that a receiving container be sealingly pressed against the seal ring or washer 84 at the lower end of the lower discharge hopper 80. The crib door 66 is now opened, and this is accomplished by simply operating the air control handle 120 to admit air under pressure into the upper end of the air cylinder 102 to force the piston downwardly in said cylinder thereby pulling the toggle mechanisms from the dotted line positions of Figure 1 to the full line positions to operate the door control gears and the door hinge shaft 73 to swing the door mechanism downwardly from the full line position of Figure 3 to the dotted line position so that the door 66 is moved entirely out of the path of discharge of the material permitting the material to drop downwardly through the lower hopper 80 and into the receiving container positioned against the bottom thereof. The receiving container may then be released from its engagement with the bottom of the lower hopper 80 and moved to any desired location.

In the mixing and treatment of materials for the production of high explosives it is desirable and important that the mixing and treating mechanisms as well as the door mechanisms be thoroughly cleaned after each cycle of operations. The plowing and mulling mechanism within the crib may be conveniently cleaned with the removal of the material delivering hood from the top of the crib, and the door mechanisms may be cleaned by simply removing the hopper inspection door 122 after the locking handle 128 is pivoted to move the clamping finger 129 off of the door block 130.

In the mixing and mulling of chemical mixtures for the production of products such as high explosives, it is essential that the crib door 66 is not only thoroughly sealed when closed but that it is also securely locked against opening, so that in case of an accidental explosion within the covered crib the explosive force will not open the door. This is made possible by the locked position of the toggle and gear control mechanisms of said door which can only be released by the positive operation of the air control mechanisms.

Attention is called to the fact that the crib, the cooling jacket, the wear plate and the turret are all integrally formed or connected to produce a unitary structure which is adaptable for the mixing and treatment of materials in a temperature controlled area. While the crib jacket has been described as a medium whereby a cooling liquid may be circuitously circulated within the jacket beneath the wear plate to cool the plate and the materials being treated thereon, it is to be understood that a hot liquid may be circulated through the jacket to cause heating of the wear plate and the material being mixed thereon in case a product is being produced which requires an increase in temperature. The temperature control jacket may also be adapted for the use of the circulation of steam as a heating medium. It will also be understood that if cooling off of the materials being mixed in the crib is desired, that any other cooling medium may be circulated in the temperature control jacket in place of the circulation of cold water.

While the improved mixer is highly adaptable for the production of chemical mixtures, high explosives and other products requiring careful and expert handling in temperature controlled

area, it is to be understood that the mixer may also be conveniently adaptable for the reclaiming and reconditioning of foundry sand and the like.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention, and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. In a muller including a crib having a muller element movable over the crib bottom, means for controlling the discharge of the crib contents comprising an opening in said bottom, a discharge hopper depending from the crib bottom and around said opening, a closure for said opening and movable in said hopper into tight engagement with the edge of the opening, and lever means in the hopper for supporting and moving said closure and being pivotally supported remote from said opening and to one side of said crib bottom so as to be clear of the discharge path of the crib contents when the same is being discharged from the crib, said lever means upon actuation to open said opening swinging said closure bodily to one side of the crib bottom and clear out of said discharge path so as to be remotely supported by the lever means independent of the crib bottom.

2. In a mulling apparatus a container defining a chamber for receiving material to be mulled and having a side wall and a bottom wear plate, a turret carrying a rotatable mulling roll in said container frictionally engaging and pressing against said plate to comminute material between the plate and roll, a bottom wall for the container spaced from said wear plate and defining between it and said plate an area for receiving a heat exchange fluid, said turrent extending down through openings in said plate and bottom wall and being integrally attached thereto, said side wall having its lower end resting on said bottom wall and being secured thereto and said wear plate having its outer edge secured to said side wall.

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