Oct. 25, 1949. A. MOHR, JR., ET AL 2,486,312

PRESSURE SEALING MEANS FOR REVOLVING DISTRIBUTORS OF BLAST FURNACES

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4 Sheets-Sheet 1

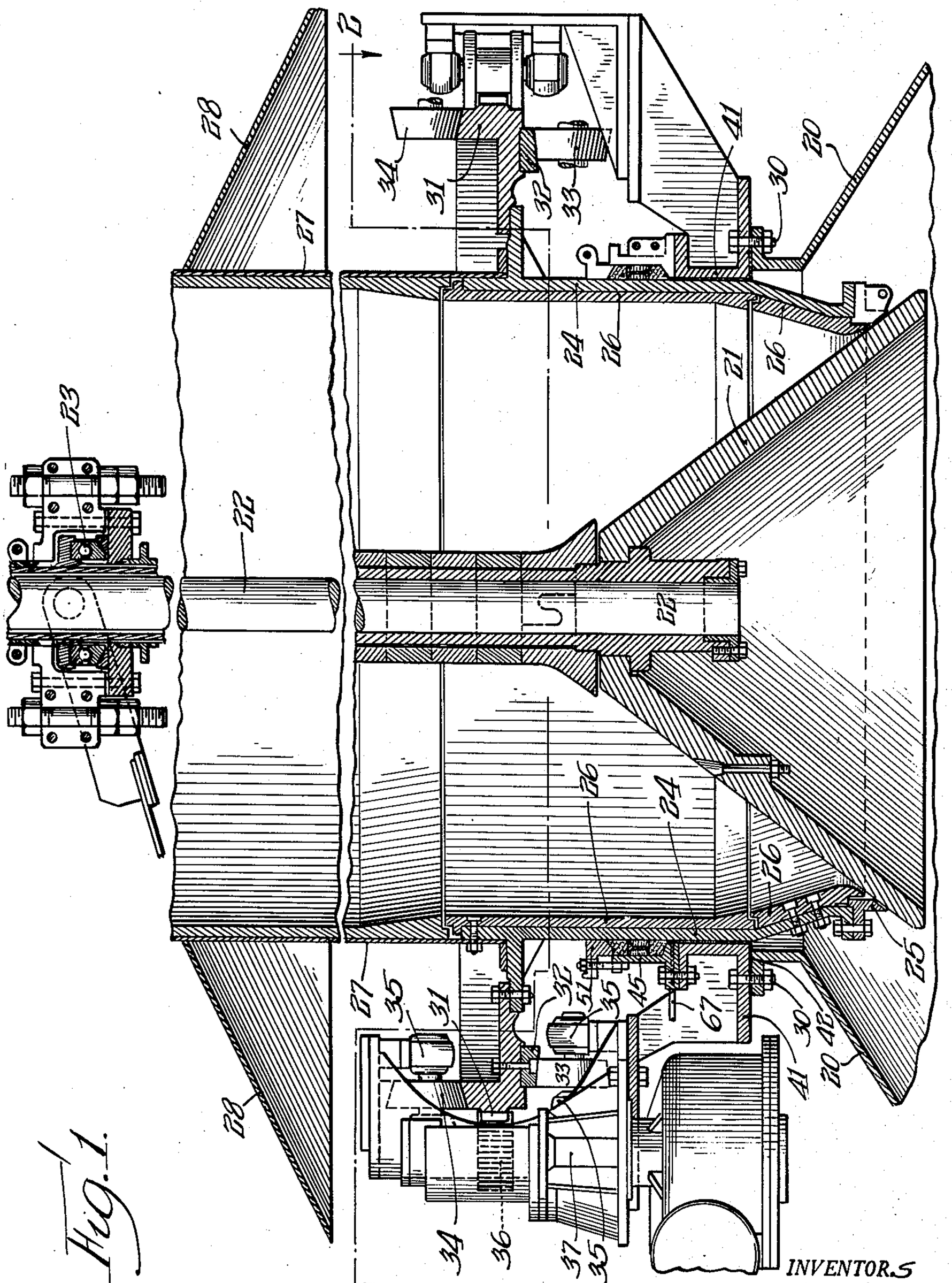

Fig. 1.

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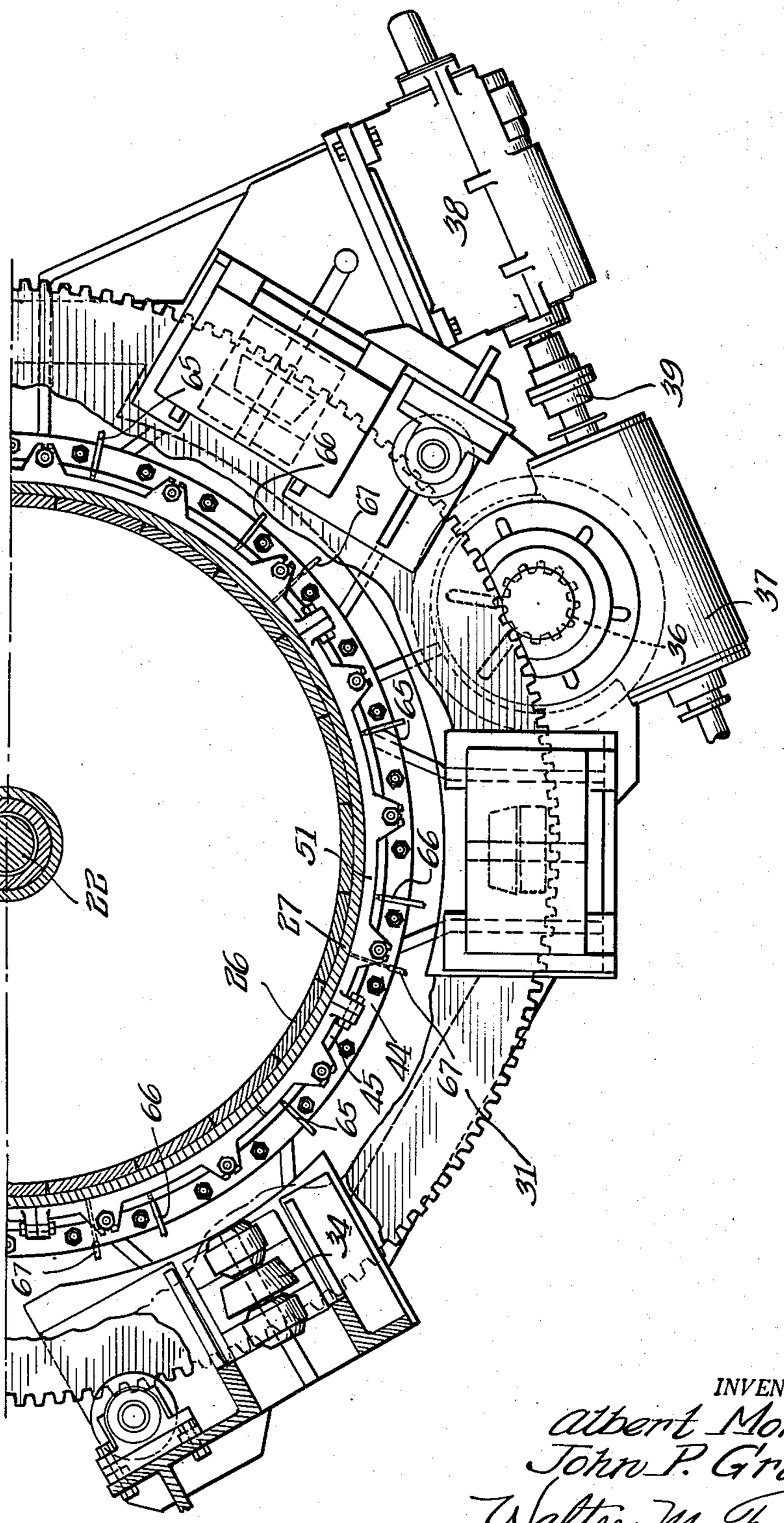

Fig. 2.

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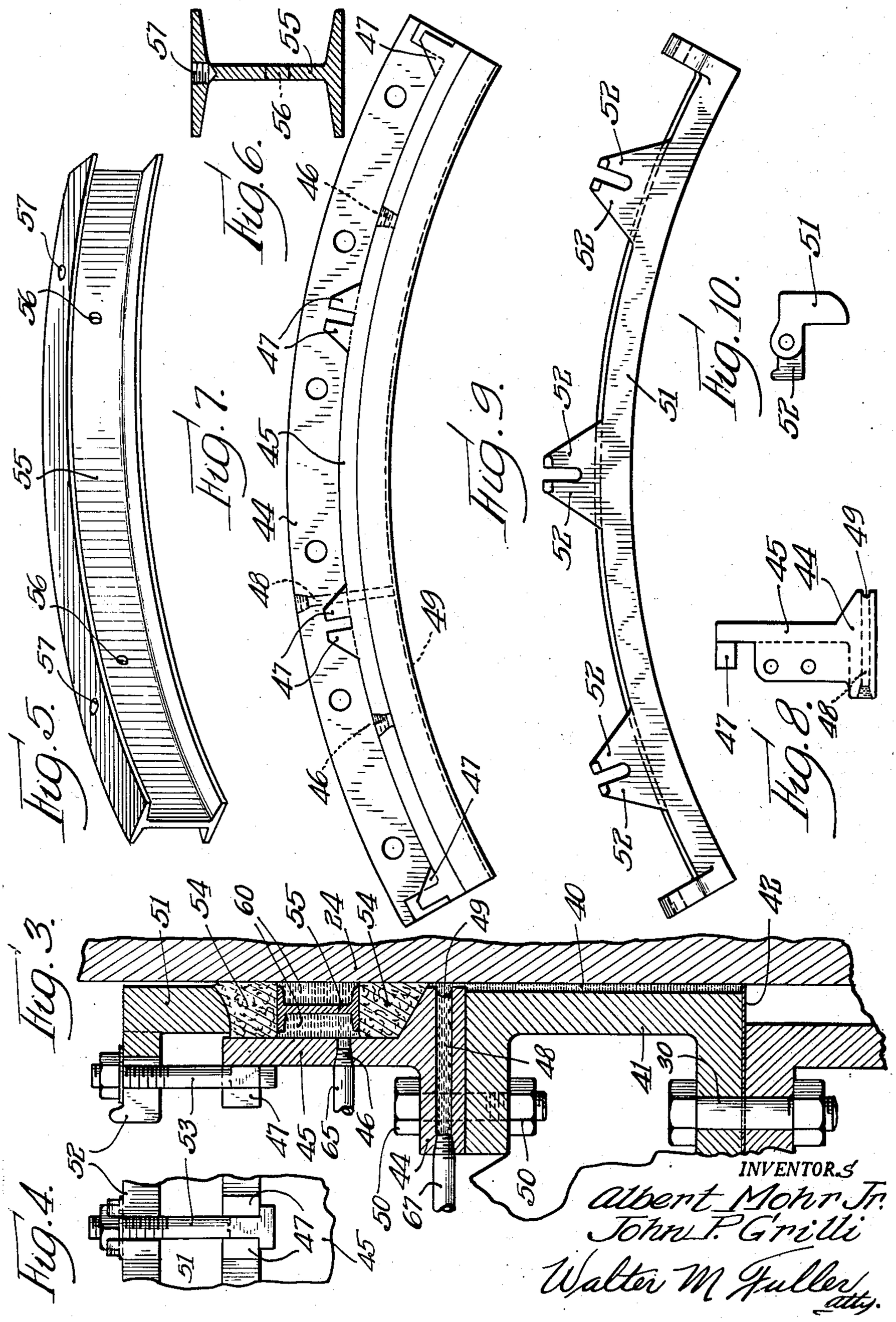

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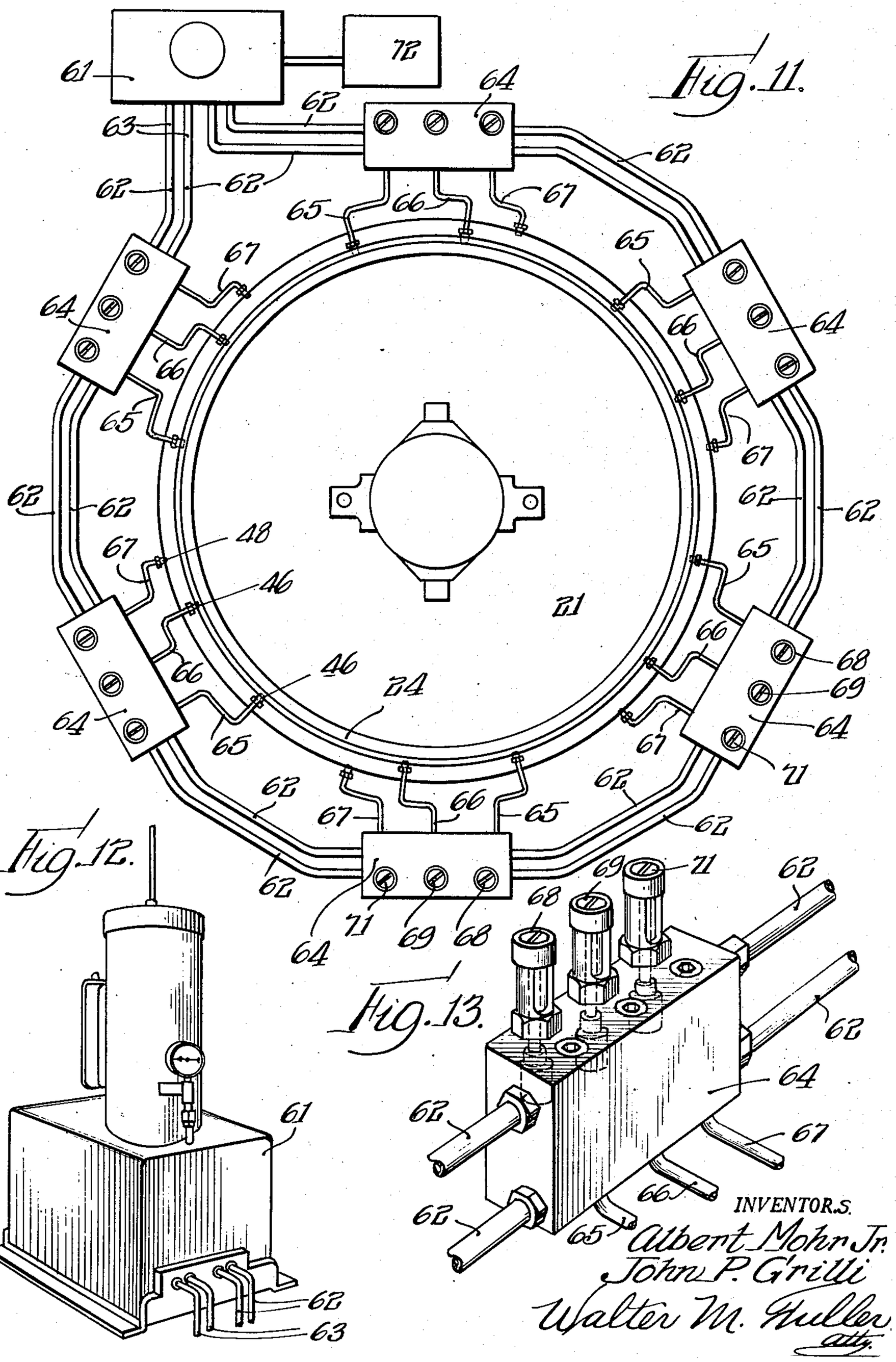

Fig. 11.

Fig. 12.

Fig. 13.

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PRESSURE SEALING MEANS FOR REVOLVING DISTRIBUTORS OF BLAST FURNACES

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Application June 12, 1947, Serial No. 754,192

14 Claims. (Cl. 285—97.1)

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The present invention relates to certain structural advantages and functional betterments in connection with the oscillatory or rotary distributor of an iron blast-furnace or similar appliance wherein a pressurized gland or pressure-sealing means is employed encircling the hopper of the furnace in which sealing media grease, not employed for lubricating purpose, is always maintained at a pressure sufficiently greater than that of the gas existing within the furnace gas-seal between its small and large bells to preclude leakage of such gas, or if it should occur, to purge the abradant dust accompanying it.

In accordance with the novel principles of the new invention, the pressure sealing appliances with which the furnace hopper is thus externally equipped are fitted with a multiplicity of circumferentially separated grease supplying points, such plurality of greasing locations being each fitted with an automatic valve through which the grease is fed and which valve is capable of adjustment to vary the amount of grease injected each time into its sealing means.

In turn, these valves are connected to a high pressure grease header operatively joined to a high pressure grease-pump driven by an electric-motor controlled by an automatic timing device to feed grease by the pump into the system in regulated amounts intermittently at adjustable time intervals.

In order that those acquainted with or skilled in this art may fully understand this innovatory invention and the advantages accruing from its employment, a present preferred embodiment thereof has been fully illustrated in the accompanying drawings forming a part of this specification and to which reference should be had in connection with the following detailed description thereof, like parts or elements of the structure being supplied with the same reference numerals throughout the several views thereof.

In these drawings:

Figure 1 constitutes a fragmentary, central, vertical section, with some parts omitted, through the small bell, hopper, flange and gland portion of the blast-furnace equipped with the new invention;

Figure 2 comprises a horizontal section through the furnace on approximately line 2—2 of Figure 1 showing only one-half of the furnace;

Figure 3 represents the flange and bland portion of Figure 1 materially enlarged;

Figure 4 is a side-view of the bolt portion of Figure 3;

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Figure 5 exhibits a perspective view of one of the arcuate bars employed between the upper and lower packings of the gland;

Figure 6 sets forth a cross-section through the I-beam of Figure 5 on a large scale;

Figure 7 represents a plan view of one curved segment of one of the two, metal, segmental members forming the gland chamber;

Figure 8 depicts in elevation one end of such member of Figure 7;

Figure 9 portrays a plan of one of the segments of the other of the companion members forming the gland chamber;

Figure 10 pictures the left-hand end elevation of the member presented in Figure 9;

Figure 11 discloses somewhat diagrammatically a plan view of the novel pressure greasing system;

Figure 12 shows the grease-pump in perspective; and

Figure 13 illustrates one of the adjustable, multiple grease-valves in perspective.

Referring first to Figure 1 of the drawings, it will be noted that the conventional rotary or oscillatory and reciprocatory small bell **21** which receives or has dumped upon it from above while closed the several, successive, individual charges or skip-loads of ore, stone and coke and when opened downwardly delivers its single loads at different angular locations on the lower larger bell, not shown, such small bell and its associated hopper having been partially rotated in one direction or the other before the bell opens, is carried or supported in the customary manner on the lower end of the usual upright, split, small bell-rod **22** mounted above in an appropriate ball-bearing support assembly **23** for the accomplishment of its stated functions.

As is commonplace in blast-furnaces, such upper small bell acting as a valve cooperates with the bottom mouth of a round, cast steel, revolvable discharge-hopper **24**, such bell controlled opening being supplied with a suitable circular seat **25** on which it is adapted to bear when closed, the inner surface of such hopper **24** being overlaid, covered and protected by removable, manganese steel, wearing liner plates **26**, **26**.

Above such hopper **24** the structure includes the usual, boiler-plate, receiving hopper **27** which turns with the oscillatory distributing hopper **24** and which is equipped externally with an appropriate, umbrella type protective-shield **28**.

Conformably mounted on the outer side of round hopper **24** is a ring type, horizontal, segmental gear **31**, equipped with the revolving cir-

cular track **32**, adapted to rotate the hopper around the axis of the furnace in either direction on bottom carrying-rollers **33** and beneath hold-down rollers **34** engaging the top of gear **31**, both sets of such rollers being appropriately mounted in suitable pillow-blocks **35, 35**.

This large, round segmental gear **31**, the hopper **24**, its small bell **21** and its load and rod are all revolved by the pinion **36** of the vertical, worm-gear reducer **37** in mesh with gear **31**, such pinion being operated by the driving electric-motor **38** functioning through a flexible coupling **39** (Figure 2).

Turning now to the novel pressurized gland structure and its mounting, more particularly embodying the features of the current invention, it will be noted that it is conveniently located slightly lower than and beneath gear **31** and it encircles the hopper and contacts its exterior cylindrical surface, not for lubricating purposes but rather to perform a highly important pressure-sealing function.

Referring to Figures 1 and 3, it will be observed that a ring-shaped, stationary, segmental flange **41** is suitably mounted by bolts **30** in gas-tight relation on the top of the furnace-shell **20** just outside of hopper **24** with a very shallow, upright, annular space **40** between the hopper and the flange, the bottom surface of such flange having appropriately secured thereagainst a thin, circular, stainless steel, resilient sealing strip **42** in edge contact with the adjacent, outer, round face of the rotary hopper (Fig. 3), such round flange **41** having fixedly secured by bolts **50** on its top annular face the base **44** of a horizontal, upright, round, segmental, metal, female gland member **45** which at annularly spaced points, twelve in number in the present instance, around its circular length and at about one-half its height has a series of screw-threaded holes **46, 46** therethrough to receive grease pipe couplings, the top portion of the outer surface of such member **45** at spaced locations along its circular length having pairs of outstanding spaced lugs **47, 47** (see Figs. 7 and 8).

Along the whole circular length of the inner edge of such base **44** facing and adjacent to the rotary hopper **24** is a continuous, shallow, grease groove **49** replenished or fed with grease through a plurality of radial, separated passages **48, 48** through the base **44** and extended to the outer edge thereof where each is internally screw-threaded to receive a grease feeding pipe coupling.

The complementary or companion metal male gland member **51** in circular form and composed of arcuate sections detachably secured endwise together in any approved manner is shown in Figures 1, 2, 3, 4, 9 and 10, and has pairs of spaced-apart lugs or projections **52, 52** at points around its circumference.

The two upper and lower cooperating round gland elements **45** and **51** are held in their proper assembled relation depicted in Figure 3 by bolting them together so as to permit up and down adjustment with relation to one another, each such bolt **53** being located between two of the lugs **47, 47** of the one member and the two lugs **52, 52** of the other element which are in vertical register with one another, the head of the bolt being located below the two lugs **47, 47** with the nut and washer of the bolt positioned at the top of the pair of lugs **52, 52**.

It should be observed that the under-surface of member **51** and the top-surface of base **44** directly beneath it converge outwardly, and coacting with

such oppositely sloping surfaces are two continuous, circular packing-rings **54, 54**, conveniently but not necessarily an asbestos braided packing impregnated with a graphite castor-oil base, each packing having one of its side faces in direct contact with the round surface of the hopper **24**, these two packings being maintained vertically separated with a duplex grease-chamber **60** provided between them by a circular segmental I-beam **55** which extends entirely around the furnace between the packings, the top and bottom flanges of such beam being of substantially the same width as the double chamber **60, 60** which it occupies.

As shown in Figures 5 and 6, these segments **55** are each about 30° long and they are not directly connected together, there being slight spaces, say one-sixteenth or one-thiry-second of an inch between their ends, such segments being left disconnected so that they may be readily removed when it is necessary to replace the packings, and for aid in handling such members their tops may be conveniently fitted with threaded holes **57, 57** for the temporary insertion of manipulating rods.

The web of each such I-beam **55** has a suitable number of holes **56** therethrough, say two more or less, to connect the two chambers **60** on the opposite sides of the web. In an actual erected structure, each such I-beam section is about 24 inches long, 3 inches high and approximately $13/16$ inch wide, the holes through the web being about one foot apart.

Obviously, when the structure is originally installed the plurality of bolts **53** around the furnace are adequately tightened to hold all of the parts of the gland firmly in place and the bevelled surfaces compress the packings and force them outwardly of the gland into proper contact with the external surface of the hopper to secure the proper degree of engagement therewith.

As the packings wear, adjustment of the bolts **53** all the way around the furnace will compensate for such wear and keep the gland in proper condition for effective functioning.

Turning now to the system for supplying sealing grease to the gland and cooperating associated flange as presented in Figure 3, it includes, as shown in Figure 11, a central, stationary, suitably supported, electric-motor-operated time-clock-controlled grease-pumping unit **61** (see also Figure 12) known to the trade and readily purchasable on the market, which provides self-acting delivery of the required grease at all needed points around the periphery of the furnace at regular intervals and as frequently as needed.

This system constitutes a positive, mechanical method of delivering and injecting the grease under the required pressure to all of the specified admission points around the circumference of the furnace from one central pumping unit in exact measured quantities and at the needed time intervals, such appliance in the present case being desirably supported on the ground rather than on the furnace itself.

This pump **61** is so constructed that the time intervals between its grease-pumping actions may be manually controlled as desired as well as the amount of grease delivered by the pump at each such operation.

Two pump discharge-conduits or pipes **62, 62** as portrayed, extend completely around the furnace and reconnect with the pump at **63, 63** and at each of the six circularly arranged stations where grease is fed to the companion gland and flange around the furnace the two conduits **62, 62** are connected as shown to a special multiple-

valve **64** (Figures 11 and 13), purchasable in the open market, which delivers an individually adjustable measured quantity of grease to each of its discharge pipes or conduits **65**, **66** and **67**, the amount of grease delivered through each thereof being manually governed or regulated at **68**, **69**, **71** respectively as to the amount fed through the valve each time, such pipes or conduits **65** and **66** being connected to the two ports or passages **46**, **46** of one of the 60° segments of the gland-member **45**, the remaining pipe **67** feeding its grease through the greasing passage **48** into the circular groove **49** and space **40** and in sufficient quantity to cause some discharge of grease out through the lower end of passage **40** by temporarily forcing down its closure or valve **42**.

From what precedes it should be understood that the furnace after having its pressure-sealing system initially completely filled with grease under adequate pressure automatically maintains it at all times under that condition to accomplish its specified novel functions.

The closure or valve **42** covers the bottom of the annular space **40** normally preventing any of its grease from descending and escaping, but every time that a change of grease is injected into the plurality of inlet-passages **48**, groove **49** and the space **40** it forces the lowest retained portion thereof from the lower part of space **40** out downwardly deflecting guard **42** temporarily to accomplish this result and thus purges that portion of the grease at such valve which most likely contains any retained abrasive material.

The hopper **24** revolves in opposite directions and when rotating in one direction the parts of the mechanism are under certain strains and stresses and when turning in the opposite direction are under slightly different forces and powers and to assure that the grease pressure-sealing function shall properly prevail at all times and conditions to best advantage it has been discovered to be advisable to produce a grease-injecting operation by the pump each time that the direction of hopper rotation is reversed.

As is customary with blast-furnaces the various operations of the furnace are performed automatically by electrically-actuated devices, such as the reversal of the hopper rotation, and these are automatically regulated and produced by a known control system characterized as **72** (Figure 11) and the relay means of such system used to cause the hopper rotation reversal is in this instance also employed to cause the grease-pump **61** to feed a charge of grease into its conduit system each time that the hopper or distributor changes direction, such relay connection not being shown since any electrician will have no difficulty in making the necessary connection to cause such pump to act when the reversal occurs.

The pump **61** is so constructed and arranged to feed its grease alternately into the two conduits **62**, **62**, the reason for this being that the adjustable multiple valves **64** operate on the accurate piston displacement principle of measurement, each such valve being individually adjustable to provide exact control over the amount of grease delivered each time.

Upon initial installation of the appliance the grease under about 2000 lbs. pressure is caused to fill the conduit system described and the gland duplex chamber in part occupied by the I-beam **55**, and the grease is also caused to completely fill the shallow space between the flange and the hopper, the groove **49**, and all of the feeding channels **48**, the gland acting as a closure for the top

of the space **40** between the flange and the distributor. Thereafter, at suitable intervals determined by the condition of the appliance, and for periods of time to attain the desired result, grease is injected under pressure automatically into the above-mentioned spaces so as to be sure that they are always properly filled to perform their pressure-sealing function as the requirements of the appliance may vary from wear, the intervals between these periods of grease feeding and the amounts of grease fed being readily modified or adjusted as seems desirable.

The maintenance of the high grease pressure in the gland chamber assures that the two packings will always have suitable and adequate pressure applied thereto to properly perform their pressure-sealing work.

The grease in groove **49** and in the space below it between the flange and hopper acts to protect the gland in that it prevents the escape of abradant gas from the gas-charged portion of the furnace below the small bell and which has access to the underside of the shell or guard **42**, but inasmuch as the grease is always at a higher pressure than that in the furnace the latter is adequately protected from undue wear or deterioration.

In this connection it should be noted that the gland and its packings constitute closures for the top of the grease-filled space **40** whereby the two grease-occupied spaces coact and cooperate with one another to provide an efficient and effective appliance to produce the required sealing function.

Those skilled in this art will readily understand that this invention is not necessarily limited and restricted to the precise and exact details hereinabove set forth and that reasonable modifications and changes may be resorted to without departure from the heart and essence of the invention as defined by the appended claims.

We claim:

1. In a gas-sealing construction for a blast-furnace having a shell surrounding the furnace, and at its top a rotary round distributor, the novel combination of a stationary member in gas-tight relation with the shell and encircling the distributor thereby defining a shallow annular space between said member and the distributor, a pair of male and female gland elements on said member encircling the distributor forming a gland-chamber open toward the distributor above said space, solid packing means in said gland-chamber engaging the external surface of the distributor, and means injecting sealing grease automatically intermittently into said space and into said gland-chamber at a plurality of separated points around the furnace and continuously maintaining the grease in said space and chamber at a pressure greater than the gas pressure in the furnace when the latter is in operation, said grease injecting means including a high pressure grease header joined to conduit means connecting with said space and gland-chamber at said separated points, high pressure grease-pump means and operating means therefor including automatic timing device means to feed grease by the pump means into said header intermittently.

2. The novel combination set forth in claim 1, in which the amount of grease fed by said pump means intermittently is equipped with manually regulatable means.

3. The novel combination set forth in claim 1, in which each grease injection point has its own

individual control valve manually adjustable to regulate the amount of grease introduced at such point during each injection.

4. The novel combination set forth in claim 1, including in addition an automatically closing valve normally sealing the lower portion of said space, which valve temporarily opens upon each injection of grease and discharges from said space a part of the previously introduced grease thus purging it.

5. The combination set forth in claim 1, including in addition an automatically sealing, thin, resilient metal valve mounted on said stationary member and closing the lower portion of said space, and having a circular edge in contact with the external surface of the distributor, such valve normally closing the lower portion of said space and temporarily opening upon each injection of grease and discharging from said space a part of the previously introduced grease thus purging it.

6. The novel combination set forth in claim 1, in which the pump means producing the intermittent injections of the grease is adjustable as to the time intervals between the injecting actions.

7. The novel combination set forth in claim 1, in which said distributor is oscillatory and in which said grease injection action includes one such action each time the distributor changes its direction of rotation.

8. The novel combination set forth in claim 1, in which said gland-chamber accommodates a pair of upper and lower spaced packings each engaging the surface of the distributor, a segmental circular spacer in said chamber between and separating said packings and affording means to permit the introduced grease to pass from one side of the spacer to the other side thereof, and means to adjust the gland elements relative to one another and to said spacer to compensate for wear of said packings, said introduced grease maintaining sealing contact with the exterior surface of the distributor under a pressure greater than the gas pressure existing in the furnace when in operation.

9. The novel combination set forth in claim 8, in which said gland elements bearing on the opposite surfaces of the two packings converge outwardly.

10. The novel combination set forth in claim 8, in which said spacer is composed of independent curved segments arranged end-to-end.

11. The combination set forth in claim 8, in which said spacer is composed of independent curved segments arranged end-to-end with spaces between their adjacent ends.

12. The novel combination set forth in claim 8, in which said spacer is U-shape in cross-section and has longitudinally spaced apertures through its web.

13. The novel combination set forth in claim 8, in which said spacer is U-shape in cross-section is composed of independent curved segments arranged end-to-end with spaces between their adjacent ends and has longitudinally spaced apertures through its web.

14. The combination set forth in claim 1, in which both ends of said grease header is connected to said pump means.

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