March 9, 1965 V. F. KOONTZ 3,172,936

SLIDING SEALS FOR SINTERING MACHINES

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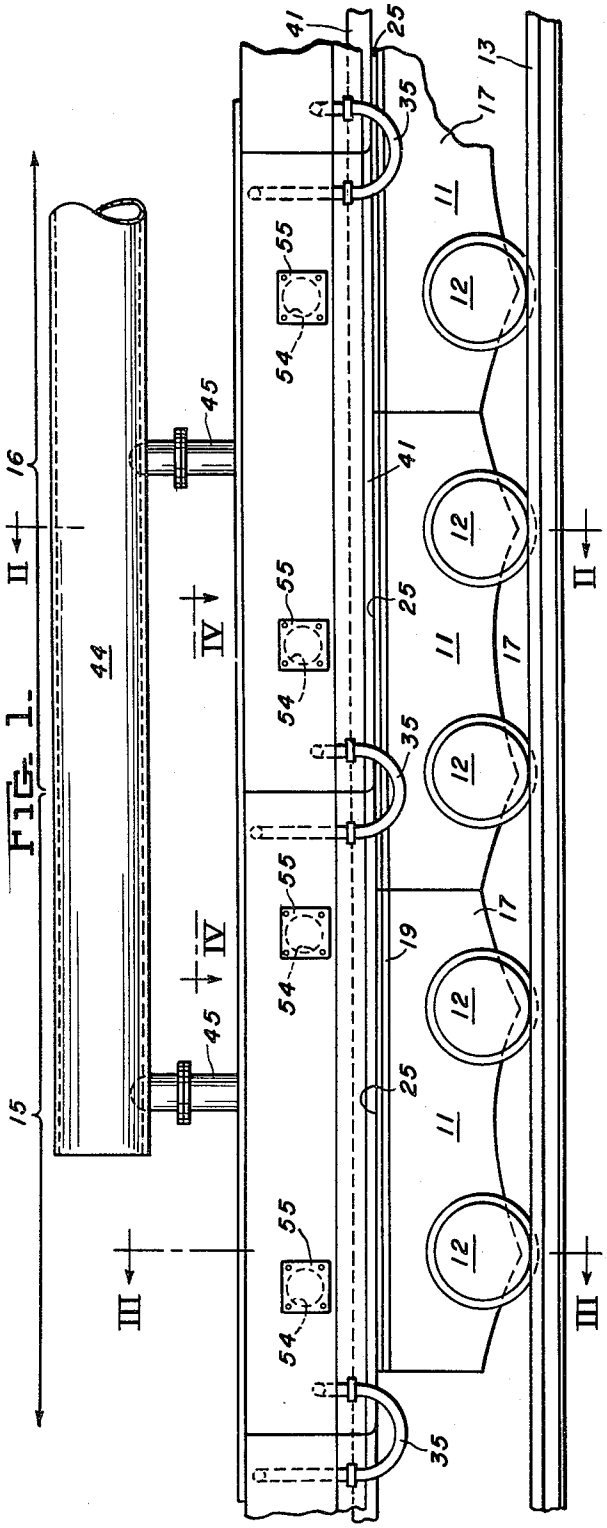


FIG. 1.

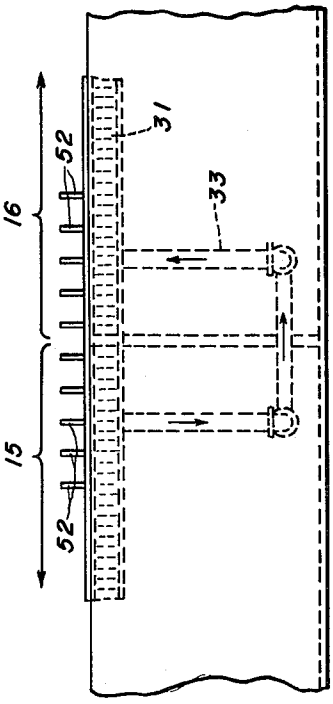


FIG. 4.

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FIG. 3.

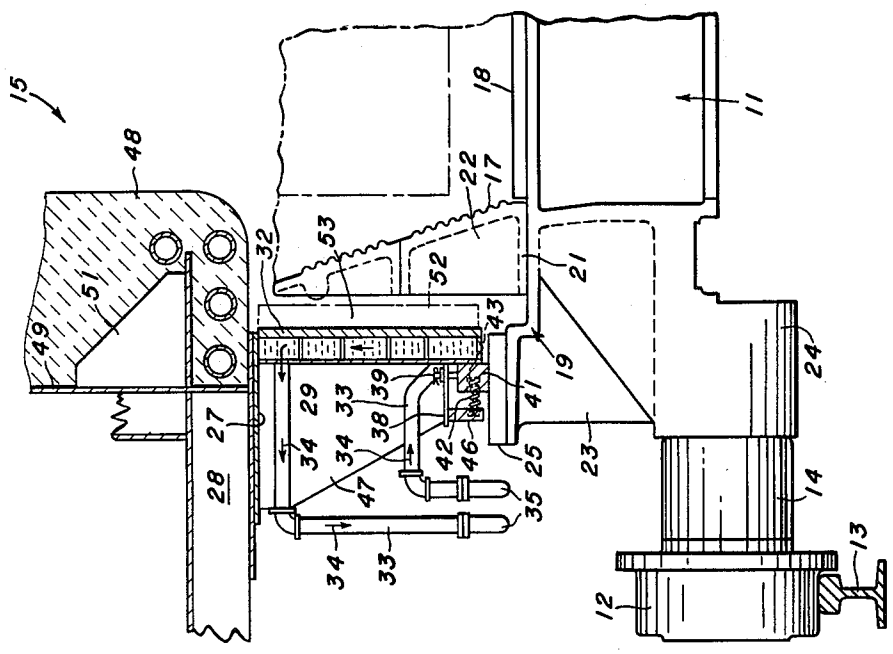
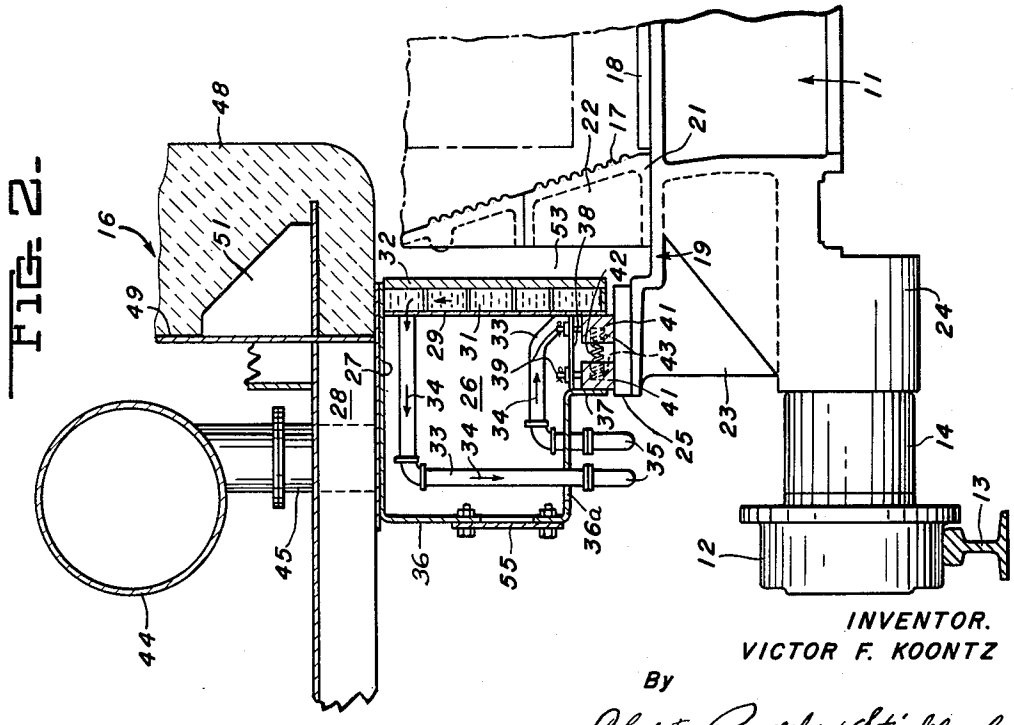


FIG. 2.



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SLIDING SEALS FOR SINTERING MACHINES

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This invention is for traveling grate machines of the type used in heat hardening pellets, sintering of ore and like operations in which there is a hood extending over the traveling grate for confining the atmosphere over the grate, and particularly to an improved seal between the hood and the pallets and to a method of operating same.

This invention is particularly applicable to a traveling grate machine such as disclosed in Anthes and Phelps application Serial Number 172,554, filed February 12, 1962, wherein the conditions of operation require a positive pressure or super-atmospheric pressure over certain areas of the grate and atmospheric or below-atmospheric pressure in other areas. For example, in the aforementioned application air is forced upwardly through the previously fired and still intensely hot pellets into a hood above the grate at a rate sufficient to maintain a positive pressure in the hood such as to cause the air which has been heated by passing through the pellets to flow from the hood into preceding hood areas, including a preheating, firing and after-firing zone.

Unless an effective seal can be maintained in such a machine between the sides of the traveling grate, which is comprised of a succession of pallets in abutting relation and the sides of the hood, an excessive amount of the heated air would be forced outwardly into the atmosphere around the machine, reducing the efficiency of the heat recuperation sought to be accomplished by this system, over-heating the sidewalls of the pallets, and creating a hazardous environment in the vicinity of the machine.

The present invention provides a seal arrangement between the hood and the pallets and a method wherein air under pressure is confined in the seal at a pressure higher than the pressure under the hood, so that even where super-atmospheric pressure is maintained under the hood, leakage about the seal will still be from the exterior of the hood into the hood instead of heated air blowing out from under the hood.

The invention has for its object to provide an improved seal between the hood and the pallets of a traveling grate machine.

A further object is to provide a seal between the hood and the pallets having parallel sealing strips with means for supplying air under pressure to the space between the strips at a pressure higher than the pressure under the hood.

A further object of the invention is to provide a seal in machines of this type that affords protection against overheating of the sides of the pallets.

A further object of the invention is to provide a method of operating the seal to prevent blow-out of gases from under the hood and to cool the sides of the pallets.

Another object is the provision of a coolant circulation system for lowering the temperature of pallet sidewalls which are heated by the heat treatment of ores upon the bed or grate of the pallet.

A complete understanding of the invention may be had from the following detailed description of a specific embodiment thereof when read in conjunction with the appended drawings, wherein:

FIG. 1 is a side elevational view of a portion of a sintering apparatus with pallets in end-to-end abutting relationship;

FIG. 2 is an enlarged view of the invention taken along line II—II of FIG. 1;

FIG. 3 is an enlarged cross-section of the apparatus taken along line III—III of FIG. 1, and

FIG. 4 is a fragmentary section taken along line IV—IV of FIG. 1.

Referring now to the drawings, wherein like reference characters designate like or corresponding parts throughout the several views, there is shown in FIG. 1 a series of pallets **11** mounted on wheels **12** which roll along a track of parallel rails, one of which is designated **13**. The pallets are here shown in intimate end-to-end abutting relationship as the result of their serial advancement along the rails **13** by power means well known by those skilled in the art, such as driven sprocket wheels, not shown, which engage rollers **14**, FIGS. 2 and 3, of the pallets **11** as they travel in a looped or endless path which carries them over the sprocket wheels from an upper strand to a lower strand, and vice versa, of the loop, for example. The present invention does not include the conventional structure of known sintering machines, per se; accordingly it will suffice for a clear understanding of the invention to describe in detail in this specification the particular elements claimed, and, by reference, their arrangement in the organization of the well known sintering machine structures.

Immediately superposed over the pallets are hoods **15** and **16**, the former designating a firing zone hood and the latter a cooling zone hood. As is the conventional practice, the pallets **11** travel from left to right as viewed in FIG. 1, and within and beneath the firing zone hood **15** of the machine the charge of ore layered on the bed or grate of the pallets is subjected to high temperature heat treatment or sintering. Following the firing of the ore charge carried in the pallets **11**, the treated charge is cooled by updrafts or downdrafts of air induced by fans, and the heated air is then ducted selectively to preheating, drying, and the firing zones as secondary air for conditioning the charge for firing or as primary combustion oxygen for firing the ore charge. It is, as stated hereinabove, a primary object of this invention to provide a seal between the pallets and the hoods for achieving optimum operation of the apparatus by maintaining the ducted air and other gases within their correct paths, thereby improving the forced preselected circulation of the air and gases and conserving the heat energy of the gases and air to maintain an over-all heat balance within the machine.

As depicted in FIGS. 1, 2 and 3 of the drawings, each pallet **11** is formed with a pair of sidewalls **17**, only one of which need be shown for purposes of the description of the invention because the pallets are bilaterally symmetrical about their longitudinal center line. Grate bars **18**, FIGS. 2 and 3, make up the bottom of each pallet on which is laid a charge of ore for treatment in the machine. Extending laterally from the sidewalls **17** is a ledge **19**, the upper planar surface of which being arranged parallel to the plane which includes the upper surfaces of the grate bars **18**.

As shown best in FIGS. 2 and 3, the ledge **19** supports for a portion of its lateral dimension, a bottom structural plate **21** to which is integrally joined the pallet side wall **17**. The side walls **17** are divergent upwardly and outwardly from the bottom or grate bars **18** of the pallet, and support ribs **22** are fixed, as by welding or casting, to the side wall **17** and to the plate **21** to unite these elements rigidly together. To add further to the strength of each pallet **11** there is provided a suitable number of reinforcing brackets **23** which structurally tie the ledge **19** to a hub **24** within which is housed the terminal of a stub shaft, not shown, on which the roller **14** and the wheel **12** are rotatively mounted.

The ledges 19 which extend laterally from the side walls 17 of each pallet 11 support seal plates 25, and, as depicted in FIG. 1, the seal plates abut one another in end-to-end relationship on each side of the pallet series, thereby forming a continuous seal plate on each side of the train of pallets 11.

The structure shown in FIG. 2 is particularly applicable for employment in the cooling hood and a terminal portion of the machine firing zone. In the cooling zone of the conventional sintering apparatus, ambient atmospheric air is forced through the previously heat-treated ores in the pallets. It is in this zone that the draft of air through the ore bed is heated, and the heated air confined by the cooling zone hood 16 is circulated to other portions of the machine for purposes hereinbefore explained. The air is forced under pressure, induced by fans, through the ore beds within the pallets as they pass through the cooling zone, and the air confined above the beds within the hood is at a pressure greater than atmospheric in order to be forced through subsequent ductwork and to be circulated onwardly to other machine portions. It is necessary, therefore, that the heated air which is constantly forced upwardly through the pallets into this section of the hood be prevented from escaping between the lower edges of the hood and the pallets which are traveling beneath the hood.

In that part of the apparatus shown in FIG. 2 there is an air chamber 26 along the bottom of the hood above the level of the wheels 12 and positioned above the lateral extension 19. It is formed by a top plate 27 attached to the hood-supporting superstructure. This plate has a downturned inner wall 29 and a downturned outer wall 36. The lower edge of the outer wall is inwardly offset at 36' and terminates in a depending flange 37. The vertical wall 29 is parallel with and spaced from another vertical wall 32, there being a closed water circulating chamber 31 between the two walls 29 and 32. Preferably this chamber has vertical internal baffles for directing cooling water introduced through lower pipe 34 in a devious flow through the chamber to the upper pipe 34 which is the outlet. As best seen in FIGS. 1 and 2 this water jacket or chamber is desirably made in sections divided vertically to allow for longitudinal expansion and contraction, in which case the water inlet pipe connection 35 connects pipes 34 of abutting sections. The water-jacketed wall so provided is spaced from but confronts the side walls 17 of the moving pallets to cool the same by radiation as well as to protect this part of the hood from the intense heat.

The lower edges of the water-cooled wall and the flange 37 terminate with slight clearance above the sealing strips 25 of the pallets.

Across the top of the opening or gap between the flange 37 and the wall 29 are fixed transverse bars or discontinuous or perforated plates 38 through which are slidably mounted studs 79. These studs support sealing strips 41, the studs permitting limited vertical movement of the strips. The seal strips 41 are spaced, and are biased apart by resilient means, such as by springs 42, each of which has its ends received within suitable apertures 43 formed in the confronting walls of the strips 41. The outer walls of the strips thus are urged with sealing pressure against the inner wall of flange 37 and the chamber wall 29, respectively. The spaced strips 41 bear on the seal plates 25 of the individual pallets 11 by which a sliding seal arrangement is effected between the hoods 15 and 16 and the pallet side walls 17. It will be seen, therefore, that the bottom of the air chamber 26 is closed by the pallet sealing plates 25 and the spaced sealing strips 41.

As previously mentioned, the air and gases under the cooling zone hood 16 is at a pressure above atmospheric. To avoid leakage of this air and gases between the strips 41 and the seal plates 25 which together form the sliding seal, the air-tight chamber 26 has air under pressure introduced into it from an air header 44 in communication with the chamber through ducts 45 which open into the top of the chamber. The pressure of air within the chamber 26 is maintained above that of the gases under the cooling zone hood 16. Accordingly, leakage that inevitably exists between the inner seal strips 41 and the pallet seal plates 25 will be into the hoods rather than out, thus preventing the escape of hot gases from under the hood with a minimum dilution of the hot gases under the hood from such inflowing air. Air which leaks past the outer sealing strips to the atmosphere is harmless and represents no hazard to workmen in the vicinity of the machine.

Where the pressure of gases under the hoods of the sintering machine is less than atmospheric, for example, throughout the main portion of the firing zone, the air chamber 26 and the outer sealing strip 41 are not necessary because ambient pressure outside the hood is greater than the pressure under the hood. The sliding seal arrangement of the pallets to the hoods in such areas or machine zones is illustrated in FIG. 3 wherein the structure is the same as that shown in FIG. 2 with the exception of the omission of the air-tight chamber 26 and associated air header 44 and pipes 45, and the change in the arrangement of the sealing bar 41. That is, only one seal strip 41 is required to effect the seal, and this single strip 41 is urged against the wall 29 of the jacket 31 by any differential pressure between atmospheric pressure and the pressure under the hood and a spring 42 having one end received within the aperture 43 of the strip 41, and the other end within an aperture provided in a depending support 46 fixed to the bar 38. Thus, the seal strip 41 has its lower surface in intimate sliding contact with the seal plates 25 of the pallets 11, and also is sealed slidably to the wall 29 for vertical movement. The upper wall 27 is again connected sealingly to the machine superstructure 28. For purposes of structural rigidity, angle brackets or gusset plates 47 join the bars 38 with the walls 27 and 29.

In both FIGS. 2 and 3, the hoods are lined with a refractory 48 anchored to the outer housing walls 49 of the furnace or sintering machine by lintels 51 or the like attached to the machine superstructure 28.

Where partitions exist between the zones delineated by the zone hood and the firing zone hood, for example, a series of baffle plates 52 can be fixed in parallel spaced relation along a position of the wall 32 on each side of the partition to assist in the isolation of one zone from the other. The baffle plates 52 then extend from the walls 32 of the water jackets 31 into the space 53 between the walls 32 and the side walls 17 of the pallets 11 as best shown in FIG. 3. Other isolation means such as a curtain of air obtained from the box 26 through holes in the inner bar or seal strip 41 may also be used.

In the event maintenance or repair of the pipes 33, water jackets 31, or connection of the bars 41 to the bars 38 is necessary, access into the chambers 26 shown in FIGS. 1 and 2 is gained through suitably disposed hand openings 54 which are provided with covers 55 bolted to form an air-tight seal onto the chamber outer walls.

By the concept of the instant invention an effective sliding seal is made possible between pallets, which are passed in series or in end-abutting relation through zones of a sintering machine, and the hoods which are arranged over the train of pallets for the confinement of air and gases which are directed through the charge of ore and the grate bars of the pallets. The heat recuperated by the air circulated through the system is held at a maximum by means of the sliding seal arrangement. Also, the pallet side walls and the chambers carrying the seal strips, which are elements of the sliding seal, are separated by a water jacket to eliminate heat destruction of the chamber and to lower the temperatures of the pallet side walls as well.

It is manifest that the above-described embodiments of

the invention are merely illustrative, and that many other modifications may be made within the spirit and scope of the invention.

What is claimed is:

1. A sintering machine having a plurality of pallets, a track along which the pallets move in continuous end-to-end contact, each side of the pallets having a side wall, a supporting wheel positioned thereon movable on the trackway below the side wall and outside the plane of the side wall and a laterally-projecting ledge above the level of the wheel with a horizontal sealing plate extending along the ledge, the machine having a hood with a depending side wall at each side that projects downwardly into confronting relation with the side walls of the pallets on the track and terminating above and in proximity to the sealing plates of the pallets, a sealing strip supported for vertical sliding movement against the outer face of each such wall and bearing against the sealing plates of the pallet beneath it, and means for urging each of the sealing strips into sealing contact with the side wall on which it is supported.

2. A sintering machine as defined in claim 1 in which the depending wall of the hood comprises a water-circulating duct.

3. A sintering machine as defined in claim 1 wherein there is an enclosure extending along the outer face of each depending wall forming an air chamber, the enclosure having a lower vertical edge portion parallel with but spaced from the lower edge of said depending side wall and also terminating above and in proximity to the sealing plates of the pallets, said lower edge portion of the enclosure having an inner face confronting the depending wall of the hood, a second sealing strip parallel with the first and spaced therefrom supported for sliding movement against the inner face of said lower edge of the enclosure for vertical sliding movement thereagainst and bearing downwardly on the sealing plates of the pallets over which it is positioned, the sealing plates of the pallets and the two sealing strips forming part of the confining walls of the air chamber, and means for introducing air under pressure to said chamber, which pressure is effective to urge the sealing strips downwardly against the sealing plates of the pallets and exerting pressure laterally against said strips to urge them apart and against the edge portion of the respective wall faces against which they are positioned.

4. A sintering machine as defined in claim 1 wherein there is an enclosure extending along the outer face of each depending wall forming an air chamber, the enclosure having a lower vertical edge portion parallel with but spaced from the lower edge of said depending side wall and also terminating above and in proximity to the sealing plates of the pallets, said lower edge portion of the enclosure having an inner face confronting the depending wall of the hood, a second sealing strip parallel with the first and spaced therefrom supported for sliding movement against the inner face of said lower edge of the enclosure for vertical sliding movement thereagainst and bearing downwardly on the sealing plates of the pallets over which it is positioned, the sealing plates of the pallets and the two sealing strips forming part of the confining walls of the air chamber, and means for introducing air under pressure to said chamber, which pressure is effective to urge the sealing strips downwardly against the sealing plates of the pallets and exerting pressure laterally against said strips to urge them apart and against the edge portion of the respective wall faces against which they are positioned, said means for urging the first sealing strips into contact with the side wall on which it is supported also acting against the second sealing strip to urge said second strip against the lower vertical edge portion of the enclosure on which it is carried.

5. In a traveling grate sintering machine having a plurality of pallets movable in abutting relation along a trackway and having a hood over a portion of the trackway, the invention comprising a lower side wall section for the hood forming a longitudinally-extending air chamber having a closed top and having spaced confronting wall faces defining an open bottom along the air chamber, a sealing strip mounted in the chamber against each of said confronting wall faces and confined thereagainst, the sealing strips projecting below the bottom edges of said side wall portions, the pallets having sealing surfaces projecting laterally from the sides thereof against which the sealing strips bear and which provide with the sealing strips a closure for the open bottom of said chamber.

6. The invention in a sintering machine as defined in claim 5 wherein the invention is further characterized by the pallets having wheels therein which support the pallets on the trackway, the wheels and trackway being below the said sealing surfaces on the pallets.

7. The invention in a traveling grate sintering machine as defined in claim 5 wherein the pallets have a side wall and the inner side wall portion of said lower hood section is in confronting relation to the side walls of the pallets movable along the trackway, said inner side wall portion having a passage therealong for the circulation of coolant along said inner side wall portion.

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