May 22, 1962 J. T. ROBSON 3,035,323

HEAT TREATING KILN CAR END SEAL

Filed March 11, 1960 2 Sheets-Sheet 1

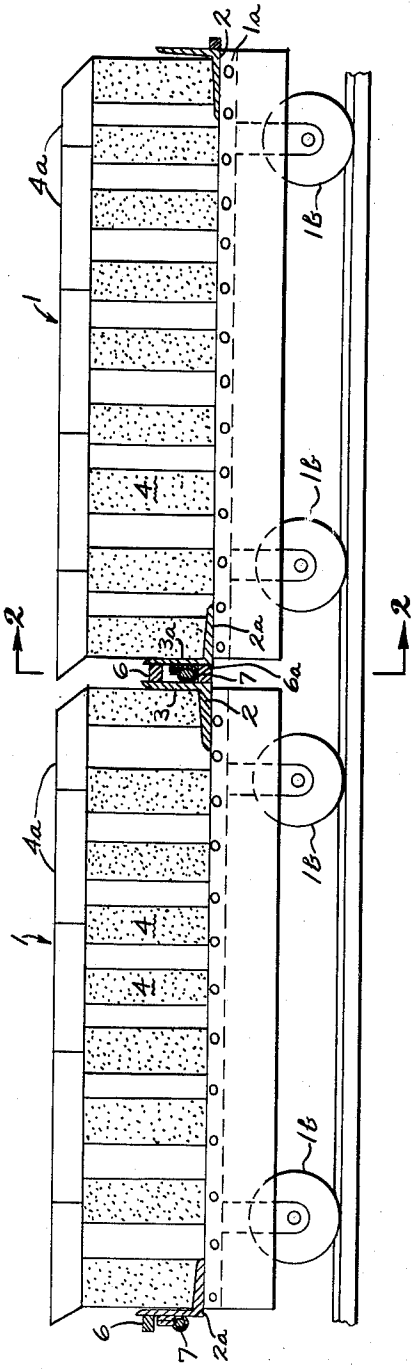


Fig. 1

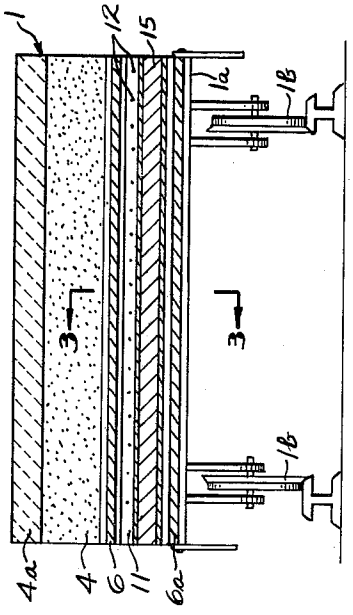


Fig. 2

INVENTOR.
JAMES T. ROBSON

BY

Meyer, Baldwin, Doran & Young
ATTORNEYS

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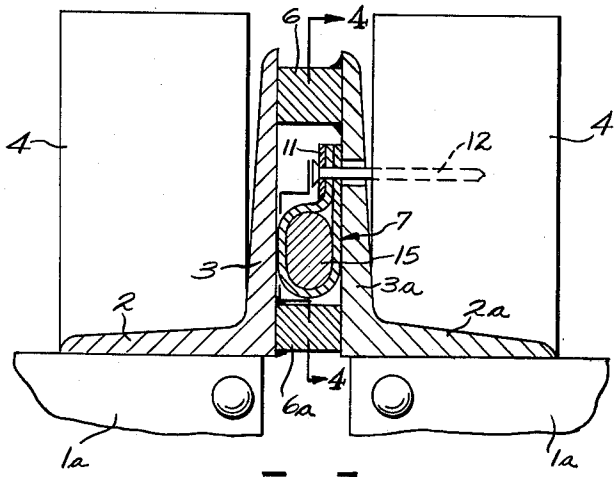


Fig. 3

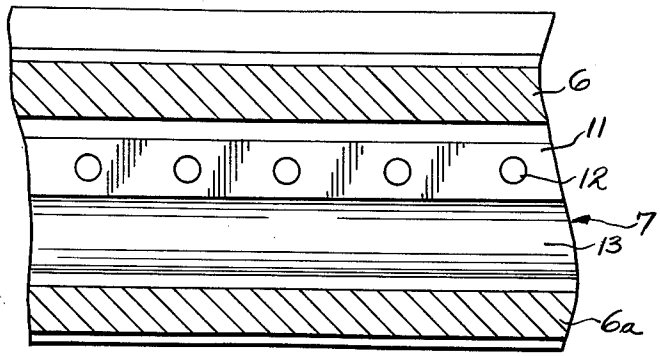


Fig. 4

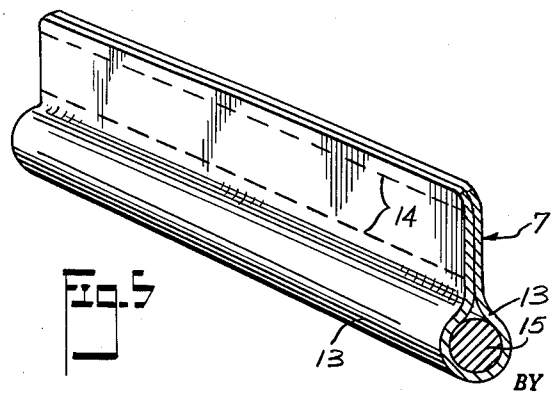


Fig. 5

INVENTOR.
JAMES T. ROBSON

BY

Meyer, Baldwin, Doran & Young

ATTORNEYS

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HEAT TREATING KILN CAR END SEAL

James T. Robson, Cleveland Heights, Ohio, assignor to Ferro Corporation, Cleveland, Ohio, a corporation of Ohio

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This invention deals generally with apparatus for supporting and conveying articles to be heat treated and more particularly, with a railway vehicle for conveying ceramic ware through a heat treating kiln or dryer.

Considering that the atmosphere in a ceramic and/or metallurgical kiln or heat treating furnace is generally well in excess of 1000° F. in the hot zone, there is always the problem of effectively sealing the supporting and conveying means for the heat-resisting, refractory surface which bears the ware to be treated, from the intense heat and products of combustion of said hot-zone atmosphere.

There are several reasons for striving to confine heat solely to that area occupied by the ware to be treated. First, the running gear which comprises the supporting and conveying means for the aforementioned refractory bearing surfaces in general includes parts made of ferrous materials. Such being the case, excessive heat tends to cause accelerated oxidation, warpage, and in general, is detrimental to the operating efficiency of said running gear. Second, the proper lubrication of moving parts in said running gear becomes increasingly difficult at elevated temperatures.

Third, in those areas in a kiln wherein air currents are such that the colder air in the vicinity of the running gear is induced to move upwardly into the heated area, the need for effective heat sealing means becomes even more important since, in a ceramic kiln, underfired and possibly cracked ware will occur near the point of cold air entry. Fourth, the leakage of cold air into a hot zone lowers fuel economy and interferes with temperature control.

Generally, kiln cars are pushed through a ceramic kiln from the rear, the leading ends of the rearward cars pushing against the trailing end of the foremost cars. As is well known in the art, kiln cars for ceramic firing and drying, as well as for metallurgical purposes, have evolved which are partially sealed end-to-end by shaping the refractory car top in such a manner that there is an overlap. That is, as the rearmost cars are forced against those foremost, the effect is to urge them into tight, end-to-end contact due to inertial resistance of the foremost cars, thus bringing the angular refractory car top ends into closely spaced, overlapping relationship.

To prevent the escape of heat or passage of cold air past the kiln car ware bearing surface adjacent to the side of the kiln, or heat treating furnace, refractory car tops have been designed to slightly overlap a coinciding refractory shelf built into the kiln side wall so that a partial baffle, at least as to radiant heat, is achieved.

As is further well known in the art, escape of convective heat or passage of cold air past the sides of kiln cars adjacent to the kiln side wall has been further minimized by employing the well-known sand seal wherein an apron, the length of the individual car, rides in a trough of sand disposed the length of the kiln, or heat treating furnace and in close proximity to the wheels which support the kiln cars.

However, there has never been devised, until applicant's novel concept, a suitable means for supplementing the end-to-end overlap of the kiln cars, which overlap serves to baffle a certain amount of radiant heat, but which still permits considerable transfer of heat by convection to the area occupied by the kiln car supporting and conveying means, and which also permits the passage of cold air into the heated area, depending upon prevailing thermodynamic conditions.

Various attempts by me have been made to provide a more effective car end seal by fixing, to one or both ends of kiln cars, a slightly compressible, heat resistant strip of gasketing such as asbestos rope, which, when the cars are placed in end-to-end relationship and pushed through the kiln, or heat treating furnace, is compressed and flattened between the cars thus providing a relatively effective seal supplementing the overlap of the refractory ware-bearing surfaces of said cars at their ends.

However, this previous system of mine had several disadvantages.

In the first place, the unrelieved pressure exerted on such partially compressible seals, combined with the high temperatures to which they were exposed during their journey through the kiln, or heat treating furnace, caused the gasket fibers to quickly break down, lose their elasticity, and disintegrate, thus rendering them quickly ineffective as car end heat seals.

Therefore, while my previous gasketing methods of car end sealing were effective for a few trips through the kiln, or heat treating furnace, they constantly required expensive and time consuming replacement. Another drawback to this method was to be found in the inconvenience caused by the seals being torn completely from the car end, and falling to the rails below. This inconvenience was the result of the fixing means utilized to fix the car end seal to the car end, being subjected to the same, severe compressive and shearing stress as the gasket seal itself.

My invention overcomes all these difficulties through a novel spacing means which permits only enough compression of a compressible car end seal to effectively block the flow of heat or cold air between the cars, and at the same time eliminates most stress, other than the weight of the gasket itself, from the means for holding the gasket to the car end. Said spacing means also act to shield the compressible car end seal from radiant heat from the hot zone.

It is therefore an object of this invention to provide a means for minimizing heat damage to the running gear of the supporting means for surfaces designed to carry ware to be heat treated through a ceramic kiln, dryer or metallurgical heat treating furnace, from the heat and products of combustion of the hot-zone.

Another object of this invention is to be found in the improved economy through reduction of heat loss past the end juncture of kiln cars when in end-to-end relationship in a ceramic kiln, or a metallurgical heat treating furnace.

It is also an object of the present invention to provide an effective heat seal between the ends of railway vehicles used to carry ceramic ware through kilns.

Yet another object of this invention is to provide an improved heat seal for the ends of cars used to carry ceramic articles through kilns in which a slightly resilient material is used for the seal and its compression controlled so as to eliminate undue strain on said car end seals caused by compressive and shear stresses.

Yet another object of this invention is to relieve the means for fixing slightly resilient car end seals to car ends from undue stresses other than those resulting from the weight of the car-end seal itself.

Still another object of this invention is to provide heat sealing means which reduce leakage of cold air into the heated area of a kiln or furnace past the ends of junctures of conveying surfaces.

Following then, by way of illustration, but in no way to be construed as a limitation on the innumerable modifications and variations contemplated by this invention

as part and parcel thereof, is a detailed description, including a preferred embodiment, in which FIG. 1 is a front elevational view of two kiln cars in end-to-end relationship as they would be during their passage through a ceramic kiln, or heat treating furnace, FIG. 2 is an end elevational view of one of the kiln cars taken through the section 2—2 indicated in FIG. 1, FIG. 3 is an enlarged view of the car end seal through the section 3—3 indicated in FIG. 2, FIG. 4 is section of the car end seal from an end view taken through section 4—4 indicated in FIG. 3, and FIG. 5 is an enlarged perspective view of the gasket used as part of the car end seal.

For purposes of illustrating this invention, by way of describing a preferred embodiment, kiln cars of the type shown were constructed as follows.

The conventional car, as a unit, is designated by the reference numeral **1**. Two conventional cars are shown in FIG. 1, each car having a bottom, **1***a*, suitably mounted on wheels **1***b*. Referring to FIGS. 1 and 3, steel angle supports **2** and **2***a* are welded to the car bottom **1***a* at each end thereof. As shown in the drawings, each of the angle supports **2** and **2***a* are of similar construction, angle **2** having a vertical web **3** and angle **2***a* having a vertical web **3***a*. Disposed between the vertical webs **3** and **3***a* of said angles **2** and **2***a* along the longitudinal axis of the car **1**, and resting on the car bottom **1***a* are piers **4** of refractory insulating material, for carrying the refractory ware-bearing surfaces or platforms, **4***a*.

A hole **5**, on approximately 4" centers, is provided in the vertical web **3***a*. Each opening **5** is tapped on a horizontal line through the vertical web of the angles **2** and **2***a* on the gasket-carrying end of the kiln car. In the embodiment illustrated in the drawings, these holes are just slightly larger in diameter by 1/16" than a standard 16d nail. A ½" square steel bar **6**, is provided horizontally, as shown, along the entire width of the car **1**. In the preferred embodiment illustrated in the drawings, the bar is disposed approximately 3" above a line connecting the centers of the holes **5**, and welded to the web **3***a*.

According to the present invention and as a preferred part of the kiln car sealing means, a gasket **7** of asbestos or other resilient compressible heat resistant material is provided between the vertical webs of the angles **2** and **2***a* and is preferably rigidly connected to the web **3***a*. The angle **2** on the trailing end of the kiln car, designed to come in contact with and seat the slightly resilient gasket **7** on the leading end of the preceding car, has a ½" square steel bar **6***a* welded as shown across the entire width of the kiln car and disposed along a horizontal line approximately ½" from the bottom of the vertical web of the angle **2**. The ½" bars **6** and **6***a* are made of mild steel, although any ferrous alloy would suffice. Thus, bars **6** and **6***a* provide spacing means and heat sealing means for the gasket **7** as described in more detail later.

In making the gasket **7**, a piece of gasketing, in this case a slightly resilient asbestos base material produced by both the Garlock Packing Company of Palmyra, New York, and Johns-Manville of New York, New York, approximately 1¾" wide and ⅝" thick through its thickest point, was cut to a length coinciding with the total width of the kiln car **1**. Referring to FIG. 5 showing a perspective view of gasket **7**, the gasket has an outer covering **13** composed of relatively coarse, heavy woven, asbestos fabric, sewn with thin, heat-resistant metallic wire **14** as illustrated, to hold in place in the fold of the gasket thus formed, a length of relatively soft, asbestos rope, **15**.

In the preferred embodiment shown in the drawings, said gasket **7**, is fixed to the vertical web of angle **2***a* as shown, with a strip of box banding **11**, ¾" wide x 0.020" thick, by driving 16d common nails **12** through the box banding **11**, through the gasketing **7**, through the holes **5** in the vertical web of **2***a*, and firmly into the porous refractory supporting material **4**.

When the car is pushed through a heat treating kiln or metallurgical furnace in end-to-end relationship, and the pushing force being applied to the trailing end of the rear-most car, the tendency is to completely compress the gasket **7**. By virtue of the horizontal bars **6** and **6***a*, having a horizontal thickness slightly less than the maximum thickness of the compressible heat-resistant gasket **7**, there is limited compression of said gasket **7**, being just enough to effectively seal the flow of hot gases, but insufficient to severely fracture the gasketing fibers, or damage the fixing means, in this case, a series of 16d common nails, **12**. Thus the horizontal cross-sectional dimension of the bars **6** and **6***a*, or other suitable spacing means between the webs **3** and **3***a*, is generally slightly less than the maximum, horizontal cross-sectional dimension of the uncompressed sealing means, gasket **7**, and preferably is about ¾ to 9/10 of the maximum horizontal cross-sectional dimension of the gasket **7**, which, in the embodiment shown, is at the portion containing the asbestos rope **15**.

Thus, the relatively unyielding horizontal bars **6** and **6***a* serve the dual purposes of limiting the compression of the gasket **7**, and at the same time form a partial seal for aiding in preventing the flow of hot gases between the cars, supplementing the gasket, and partially protecting said gasket from radiant and convected heat. In effect, the vertical webs **3** and **3***a* assume the function of relatively parallel gasket seating surfaces for the gasket **7**.

It is impossible to maintain the car ends in precise alignment, so small undulations and warpage in the vertical webs of the steel angles **2** and **2***a* would not permit the bars **6** and **6***a* to be used exclusive of the gasket **7** and still achieve the same, tight seal. Being of higher thermal conductivity than the gasket, said bars **6** and **6***a* would also tend to permit greater passage of heat if not used in conjunction with the compressible relatively low thermal conductivity heat-resistant gasket **7**.

Obviously, means other than the 16d common nails **12** may be used to effectively fix the gasket in a horizontal position to the kiln car ends, and the horizontal bars **6** and **6***a* may of course vary in dimension, the important consideration being that they have a maximum horizontal cross-sectional dimension slightly less than the greatest, maximum, cross-sectional horizontal dimension of the slightly resilient, heat resisting gasket **7**, to permit partial, controlled compression thereof without permitting undue structural damage to the fibers of said gasket, or to the means for fixing said gasket to said car ends.

Although I have described the illustrated embodiment of my invention in considerable detail, it will be understood that variations and modifications may be made in the form and arrangement of parts employed. I do not, therefore, wish to be limited to the exact apparatus herein shown and described, but claim as my invention all forms thereof coming within the scope of the following appended claims.

I claim:

1. In a vehicle for transporting material through a heat treating atmosphere, the combination therewith of means for reducing heat and air passage past junctures between two such vehicles when urged together in end-to-end relationship, comprising a resilient, heat resistant gasket disposed the entire width along the end of said vehicle, said gasket comprising a metal wire core and an outer covering therefor of asbestos fabric, a spacer piece of relatively unyielding material above and out of contact with said gasket, a spacer piece of relatively unyielding material below and out of contact with said gasket, both spacer pieces being of an equal horizontal cross-sectional dimension, and less in horizontal cross-sectional dimension than the maximum horizontal cross-sectional dimension of said gasket thus limiting compression of said gasket to the horizontal cross-sectional dimension of said spacer pieces when said cars are urged into tight, end-to-end relationship in a heat treating atmosphere.

2. In a vehicle for carrying articles in a heat-treating furnace in which the vehicle has two ends, the combination therewith of heat sealing means located between one

end of the vehicle and one end of a vehicle of like construction, said sealing means including supporting means mounted on each end of each of the vehicles, gasket means comprising a compressible heat resistant gasket of asbestos rope material located between said supporting means and rigidly connected to one thereof, and spacer means comprising spacer bars disposed between said supporting means for preventing the flattening of said gasket material beyond its elastic limit and for preventing deterioration of said gasket by heat whereby the adjacent ends of said vehicles are provided with effective heat and air seals, the spacer bars being located on opposite sides of the gasket and located between said gasket and the source of heat, said spacer bars being spaced from said gasket to prevent contact between said spacer bars and said gasket when said vehicles are in end-to-end abutting relationship.

3. In a pair of refractory topped, railway conveyed kiln cars, in end-to-end, abutting relationship, each of said kiln cars having at its abutting end a substantially vertical gasket compressing surface extending generally the width of each of said cars and positioned below the surface of said refractory top, each said surface, respectively, generally parallel to the other, and each said surface disposed to tend to contact the other when said kiln cars are in said end-to-end, abutting relationship, the combination therewith of a resilient, compressible, heat resistant, gasket disposed between said surfaces and fixed to one of said surfaces, extending generally the width of said surface, said gasket having a vertical dimension less than the vertical dimension of said gasket contacting surface, said gasket adapted to be compressed when said cars are urged into end-to-end, abutting relationship, and spacer means comprising at least two metal bars interposed between said surfaces and each bar rigidly attached to one and only one of said surfaces, each bar having a maximum dimension, normal to said surfaces that is less than the maximum dimension, normal to said surfaces, of said gasket in its uncompressed state, said bars separating said surface when said cars are urged into end-to-end relationship, and limiting compression of said gasket to said maximum horizontal dimension of said spacer means, to minimize transfer of heat or cold air between the abutting ends of said kiln cars.

4. The apparatus of claim 3 wherein each of said bars has a generally regular cross section and the gasket comprises asbestos rope.

5. The apparatus of claim 3 wherein said gasket comprises woven asbestos, and one end of at least one of the spacer bars is welded, respectively, to one and only one of the gasket-compressing surfaces, each of said bars having a maximum dimension, normal to said gasket compressing surface, of from about ¾ to 9/10 of the maximum uncompressed dimension of said gasket, measured normal to said gasket compressing surface.

References Cited in the file of this patent

UNITED STATES PATENTS

1,321,388	Owens	Nov. 11, 1919
2,041,176	Hartford	May 19, 1936
2,107,762	Olds	Feb. 8, 1938
2,662,053	Brown	Dec. 8, 1953
2,839,283	Buckholdt	June 17, 1958
2,899,189	Matis et al.	Aug. 11, 1959

FOREIGN PATENTS

812,822	Great Britain	May 6, 1959