

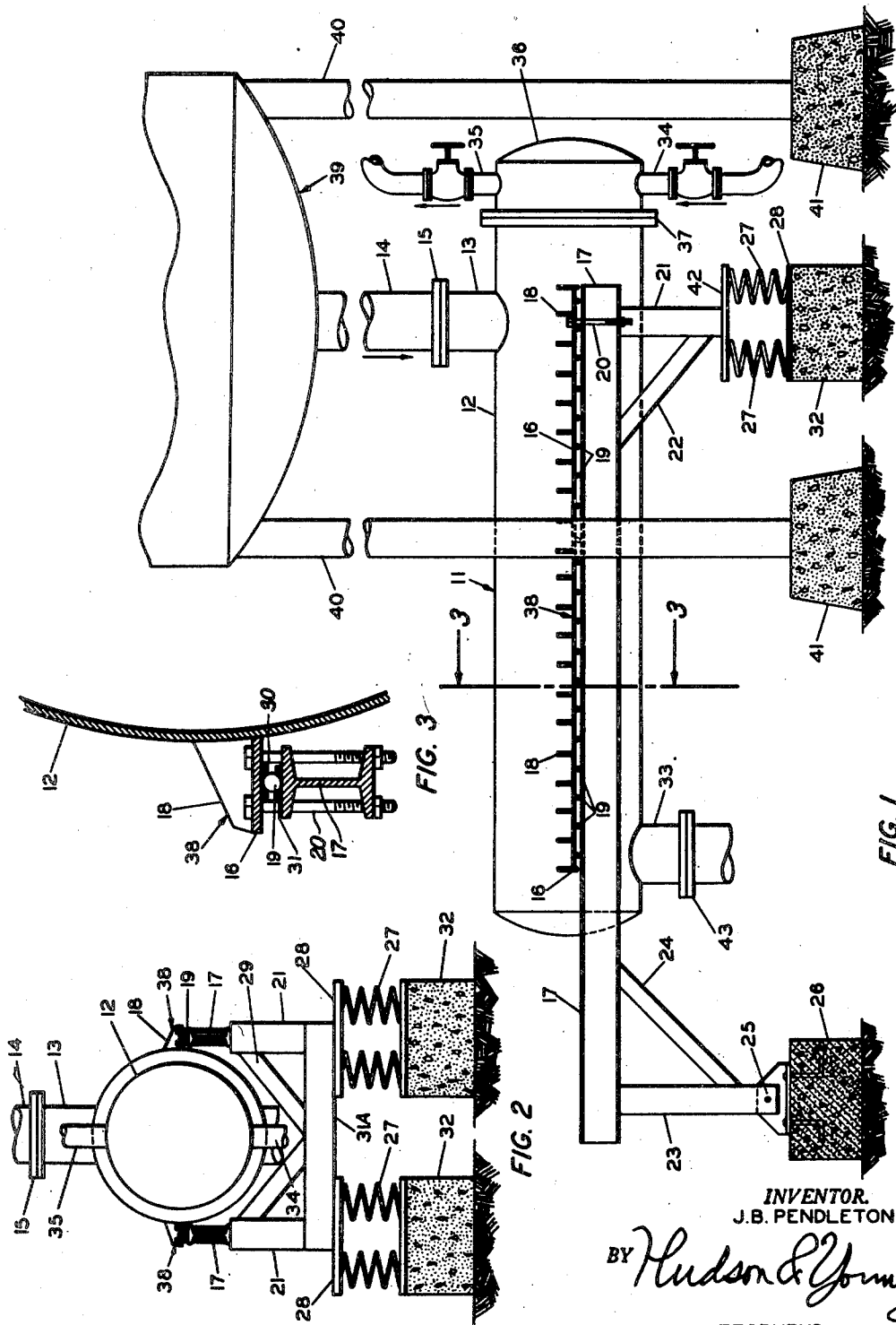
July 5, 1949.

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2,475,109

FLOATING HEAT EXCHANGER SUPPORT

Filed Aug. 6, 1945



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UNITED STATES PATENT OFFICE

2,475,109

FLOATING HEAT EXCHANGER SUPPORT

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Application August 6, 1945, Serial No. 609,218

2 Claims. (Cl. 248—358)

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This invention relates to heat exchangers. In one of its more specific aspects it relates to apparatus and a method for the support of heat exchangers adapted to high temperature exchange wherein linear expansion of parts due to high temperatures is appreciable.

In heat exchange equipment for operation at temperatures of 400 to 500° F. linear expansion need not be excessive. This condition may hold when pipe sections are relatively short or when sufficient bends are present to absorb the linear expansion. However, for rather large temperature changes elongation due to thermal expansion may become quite appreciable. In case of long pipe sections there may be a sufficient number of bends or one or more U-type bends may be intentionally installed. Considerable art is available on expansion joints, U-bends or circular or other arcs or other types of expansion absorbers for use in transportation pipe lines, in steam lines, and hot oil lines when such lines are of sufficient length that such relatively large designs can be used.

Thermal expansions in relatively short pipes present an entirely different problem. This problem is especially acute when a short section of pipe connects two vessels which are large or are made of heavy materials necessitated by a high working pressure. A temperature difference from atmospheric to say a catalyst chamber regeneration temperature is a relatively great temperature difference to be absorbed by a pipe section between two rigidly fixed vessels. Regeneration temperatures are seldom maintained as low as 1000° F.; more commonly they are of the order of 1300 to 1400° F. and can be higher than 1400° F. if the catalyst can withstand the high temperature without permanent injury. Pipes to carry gaseous effluents of such temperature are of course installed at atmospheric temperature, then when heated to say 1400° F. considerable expansion occurs. For example, when a steel pipe about 10 feet in length is heated from 100° to say 1400°, the linear expansion is of the order of 1¼ inches. This expansion is quite large when it must be absorbed over a length of only 10 feet. Thus, my invention has for an object the provision of means for absorbing expansion due to severe thermal changes in relatively short sections of pipe connecting two vessels.

Another object of my invention is the provision of means for absorbing linear expansion of a short section of pipe connecting two thick walled, rigid vessels.

Still another object of my invention is the pro-

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vision of means for absorbing linear expansion of a short section of pipe connecting two vessels wherein one vessel is mounted on a floating support especially adapted to assist in compensating for such expansion.

Yet another object of my invention is the provision of a non-rigid support for a vessel, which support is adapted to absorb movement due to thermal expansion and at the same time to provide easy means for installing and removing the vessel.

These and other objects and advantages will be apparent to those skilled in such art by reference to the following detailed description and annexed drawing which respectively describes and illustrates a preferred embodiment of my invention, and wherein

Figure 1 shows a side elevational view of the vessel support and supported vessel in place.

Figure 2 shows an end elevational view of the vessel support and supported vessel in place.

Figure 3 shows a detailed cross section, in part, along the line 3—3 of Figure 1, showing the movable side supporting means.

Referring now to Figure 1, a waste heat exchanger 11 is composed of an outer shell 12, a gas inlet pipe 13, a gas outlet pipe 33, a head member 36 having an inlet pipe 34 and an outlet pipe 35. Pipes 34 and 35 may be provided with long portions at right angles to their vertical movement, or large turns, or coils, or any other means old in the art to allow for expansion, as their contents is merely a cooling fluid which presents no problems of quick transfer through pipe 14 necessary for reactant chemicals in line 14. The exchanger contains a conventional tube system, not shown, for effecting the actual heat exchange between the heating and heated fluids. This exchanger is constructed and adapted to relatively high temperature service, as for example, for use with hot combustion gases from regenerating catalyst chambers.

Such an application is illustrated in Figure 1 of the drawing in which a catalyst chamber 39 supported by supporting members 40, which in turn rest on bases 41, is disposed directly over and above the exchanger 11. This catalyst chamber may contain catalyst of substantially any type useful for cracking, reforming, polymerizing or other reactions wherein carbonaceous material is deposited upon the catalyst. The deposition of such material on catalysts, as is well known, tempers the original activity, and after a period of operation the catalyst becomes so sluggish as to be of no further use and consequently is with-

drawn from operation. In modern practice such spent catalysts are usually regenerated or revived in some manner. The common method of such regeneration is to burn the carbonaceous matter by a controlled combustion. During this burning or controlled combustion, large volumes of high temperature gases are available as a source of heat. It is for a better and more efficient utilization of this heat that my invention is directed.

In such installations vessels containing catalyst are ordinarily situated some distance off the ground level to furnish easy access to all portions of the vessels. For best utilization of regeneration heat I have found that the catalyst chamber should be mounted sufficiently high as to permit a heat exchanger, as exchanger 11 of Figure 1, to be installed directly underneath and to provide pipe 14 to convey the hot gases from the bottom of the catalyst chamber 39 to the inlet pipe 13 of the exchanger.

The effluent combustion gases from a regenerating mass of catalyst will vary in temperature, this usually being dependent upon the catalyst. In many cases this temperature may be as high as 1200 to even 1500° F.; 1400° F. is a common maximum regeneration temperature.

The steel pipe 14 connecting the catalyst chamber and the heat exchanger will expand considerably when heated from a normal installation temperature of say a maximum of 100° F. to an operating temperature of 1400° F. Such an expansion for a pipe length of 10 feet will be from 1 to 1½ inches. A 10 foot length of pipe rigidly fastened to two vessels such as catalyst chamber 39 and heat exchanger 11 cannot absorb a pipe expansion of this magnitude. Pipe expansion joints function well under certain conditions but not so well at high temperatures. The solution of this expansion problem is the subject of my invention.

I have found that when a catalyst chamber and heat exchanger are rigidly joined by a section of pipe not adapted to absorb thermal expansion, the expansion can be absorbed by a supporting spring-fulcrum arrangement for the exchanger. This support is a mobile support adapted, as mentioned, to absorb the thermal expansion and yet be sufficiently rigid as to support the weight of the exchanger mechanism.

The exchanger 11 is equipped with elongated side fins 38, one rigidly attached to either side of the exchanger walls as shown in the drawing. These fins may be riveted to the exchanger walls, but preferably should be welded and extend nearly the full length of the exchanger body, not including the head member 36. These fins composed of horizontal plates 16 reinforced by webs 18. On the lower side of the plates 16 are two bars 30 welded into place at a spaced distance apart so that steel balls or ball bearings 19 may be inserted therebetween. These bars are intended to serve as retaining guides for the ball bearings.

I-beams 17 with similar guide bars 31 serve to support the exchanger with the balls 19 serving as bearings. These I-beams in turn are supported by the front column members 21 and rear columns 23. These columns or post members are made rigid by such brace members as the front braces 22 and 29, and corresponding rear braces 24 and 29. The rear cross braces 29 are directly back of the front cross braces 29 shown in Figure 2.

Horizontal movement of the exchanger 11

along the I-beam is prevented by bolts 20 which pass through the fin plate 16 and I-beam flanges.

To absorb vertically downward movement of the head 36 end of the exchanger, the front column members 21 are fixed to shoes 42 which in turn rest upon helical springs 27. These springs then rest upon bed plates 28 and these in turn upon concrete bases 32. Cross members 31A at front and back prevent spreading of the respective columns and serve as a means to which the front and back cross members 29 may be attached. Resulting from this construction, then, with the position of the catalyst chamber 39 fixed and upon heating of the pipe 14 with its resultant expansion and lengthening, the springs 27 will be compressed to compensate for this increase in length.

The vertical movement of the head end of the exchanger will be around point 25 as a center. Thus point 25 is a pivot joint carrying a portion of the weight of the exchanger and its share of the weight of the I-beams and structural framework supporting the exchanger.

A further point of utility in my apparatus is the bolts 20. With these bolts on either side of the exchanger fastened in place, both ends of the exchanger are free to expand upon heating up and to contract upon cooling of the exchanger. Also, when it is desired to gain access to the lower portion of the catalyst chamber through pipe 14 or into the exchanger through inlet pipe 13, it is only necessary to remove the bolts from the flanges 15 and 43, disconnect pipes 24 and 35, removes bolts 20 and roll the exchanger from right to left or toward the fulcrum 25 end of the I-beam supports. And conversely, to reconnect the exchanger it is merely necessary to roll it into place, insert bolts 20 and make the several pipe connections.

Materials of construction for the catalyst chamber, heat exchanger, interconnecting pipe 14, exchanger fins, I-beams and other members of the apparatus need not be special material but may be selected from that commercially available.

The hereinabove described catalyst chamber and heat exchanger are merely exemplary of the utility of my invention and are in no way intended to be limiting factors. My exchanger support may find other uses wherein thermal expansion of short pipe sections is abnormally great and at least one connecting vessel because of its size and/or weight is definitely fixed in position.

Having disclosed my invention, I claim:

1. A heat exchanger unit comprising in combination an elongated relatively horizontally disposed heat exchanger chamber having a hot heat exchange material inlet in the upper part of a first end portion and a hot heat exchange material outlet in a second end portion; an elongated fin member relatively horizontally disposed and rigidly affixed to each lateral side of said heat exchanger chamber, said fins being disposed in substantially the same horizontal plane and extending longitudinally along the sides of said heat exchanger chamber; at least two guide ribs spaced apart and extending longitudinally along the lower surface of each said fin; a pair of parallel rider members, each said rider member having at least two guide ribs spaced apart and extending longitudinally along its upper surface; a plurality of roller members longitudinally spaced apart between said guide ribs along the length of said rider members; retainer means affixing said heat exchanger chamber to each

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said rider member at a single point along said fin member, said retainer means being substantially equally spaced from one end of said fin members and said roller members being retained between said rib members on said fin members and said rider members; support members rigidly affixed to the ends of said rider members adjacent said second end portion of said heat exchanger chamber, said support members being pivotally supported by a pivot support member; and support members rigidly affixed to the ends of said rider members adjacent said first end portion of said heat exchanger chamber, said support members being compressibly supported by spring members, whereby as said hot heat exchange material inlet pipe expands longitudinally upon heating, said expansion is absorbed by said spring support members.

2. A heat exchanger unit comprising in combination an elongated relatively horizontally disposed heat exchanger chamber having a hot heat exchange material inlet in the upper part of a first end portion and a hot heat exchange material outlet in the lower part of a second end portion; an elongated fin member relatively horizontally disposed and rigidly affixed to each lateral side of said heat exchanger chamber, said fins being disposed in substantially the same horizontal plane and extending longitudinally along the sides of said heat exchanger chamber; at least two guide ribs spaced apart and extending longitudinally along the lower surface of each said fin; a pair of parallel rider members, each said rider member having at least two guide ribs spaced apart and extending longitudinally along its upper surface; a plurality of roller members longitudinally spaced apart between said guide

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ribs along the length of said rider members; bolt members affixing said heat exchanger chamber to each said rider member at a single point in substantially the same vertical plane as said hot heat exchange material inlet, thereby retaining said roller members between said rib members on said fin members and said rider members; support members, extending downwardly and perpendicularly from said rider members, rigidly affixed to the end of said rider members adjacent said second end portion of said heat exchanger chamber, said support members being pivotally supported by a pivot support member; and second support members, extending downwardly and perpendicularly from said rider members, rigidly affixed to the end of said rider members adjacent said first end portion of said heat exchanger chamber, said second support members being joined at their lower ends by a shoe member; at least one compression spring member extending between a support base and said shoe member, whereby as said hot heat exchange material inlet pipe expands longitudinally upon heating said expansion is absorbed by said spring support members.

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