

Sept. 7, 1948.

T. E. SCHLEY
PIPE EXCHANGER SCRAPER

2,449,012

Filed July 19, 1945

2 Sheets-Sheet 1

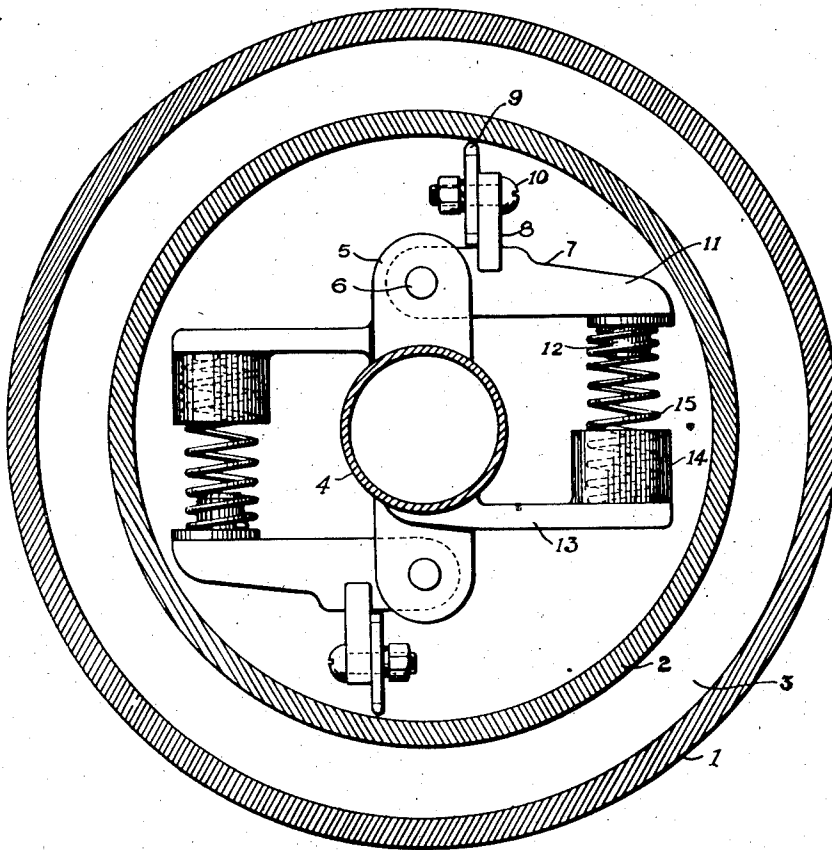


Fig. 1

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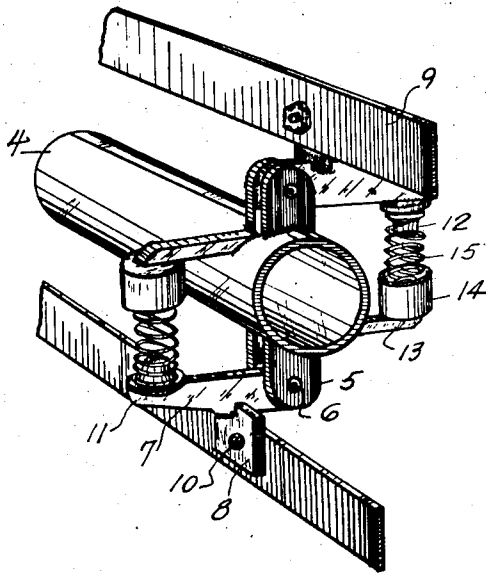
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Fig. 2



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2,449,012

PIPE EXCHANGER SCRAPER

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Application July 19, 1945, Serial No. 605,975

3 Claims. (Cl. 257-102)

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This invention has to do with devices for clearing deposits from the heat transfer surfaces of double pipe heat exchangers and the like. For example, in the separation of wax from petroleum fractions containing the same, it is customary to chill the petroleum fraction by pumping it through the interior pipe of a double pipe heat exchanger. That is to say, the pipe through which the oil is pumped is surrounded by another pipe or jacket and a cooling material such as chilled brine is pumped through annular spaces between the two pipes. The oil in the interior pipe being chilled tends to form deposits upon the inside of the wall of the pipe through which it flows. These deposits not only slow down the rate of heat exchange through the pipe wall, but also the material which is deposited is the wax which it is desired to separate from the oil and it must not be allowed to remain within the cooler. So it is customary to provide scraping devices of various kinds to remove this material from the wall of the pipe. The most usual and simplest form of scraper for this purpose is a blade of helical form carried on and rotated by a central shaft, which blade not only serves to scrape the deposit from the walls but also to some extent serves to force the material on through the cooling tube much in the same manner as the screw in a meat grinder forces the meat toward the cutting blades. However, in most instances, the necessity for advancing the material through the exchanger by virtue of the action of the helix or scroll is not of importance and in many cases a blade carried on the ends of the arms of a spider is sufficient.

One major difficulty arises in connection with all rigidly mounted blades particularly when the material being chilled is cooled down at some portion of the apparatus to a temperature below the freezing point of water. Hydrocarbon oils are capable of dissolving various amounts of water. In operation in an oil refinery, they are frequently in contact with steam or with water and it is not uncommon for the hydrocarbon fraction being chilled to carry with it not only dissolved water but some water actually carried along in the form of droplets. Of course, when an oil carrying dissolved water is cooled, the dissolved water drops out. From these two sources it will be seen that water is very frequently present in exchangers utilized for this purpose and when temperatures are low enough, this water collects upon the interior walls of the heat exchanger in the form of ice. With rigidly mounted scraper assemblies, this ice soon give rise to physical diff-

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culties in the operation of the exchanger, increasing the power that must be supplied in order to turn the scrapers and in the extreme case gives rise to breakage of scraper blades, of blade supporting arms and the like and frequently results in shutdowns of the apparatus.

The principal object of this invention is the development of a scraper assembly suitable for this purpose and capable of continuing an operation and maintaining efficiency despite such things as the collection of ice upon the pipe wall, irregularities in the pipe wall, springing of the scraper shaft and similar things.

The invention may be understood most readily by reference to the drawing attached to this specification, Figure 1 of which shows a cross-section of a double pipe heat exchanger within which there is mounted a scraper designed according to the present invention. Figure 2 shows the assembled scraper mechanism in perspective. In these two figures, in which like parts where shown are similarly numbered, 1 is the outer pipe of the double pipe heat exchanger and 2 is the inner pipe thereof, 3 being the space in which chilling medium flows. Mounted centrally within pipe 2 and extending axially thereof is scraper shaft 4 which may, if desired, be a solid shaft but is more usually a tube with appropriately inserted solid pieces at the end to carry drive mechanism, such as gears and the like, with which this invention is not concerned. Mounted upon pipe 4 at spaced intervals along the length thereof are carrier devices for supporting the scraper blades. Each carrier device consists of a clevis 5 formed of two upstanding lugs, which lugs are drilled for the insertion of a pivot pin 6.

Pivotaly mounted upon the pivot pin 6 between the two lugs forming each clevis 5, there is a roughly T-shaped rocker arm 7. Upon the outward side of rocker arm 7, there is formed a plate supporting lug 8 to which scraper blade 9 is attached by bolt 10, the arrangement being such that when the scraper blade 9 is in contact with the interior of pipe 2, it lies in a plane roughly parallel to a line through the center of shaft 4 and the center of pivot pin 6. Rocker arm 7 is extended beyond the plate supporting lug 8 to form a lever arm extension 11, which in its normal position lies at an angle of approximately 90° with the line joining the shaft and pivot centers. Upon the lower side of the outer end of this lever arm there is formed a boss 12 for a purpose later explained. Rigidly fixed to the opposite side of shaft 4 and extending therefrom in the same direction as does rocker arm 7, there is mounted

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a spring support arm 13. This spring support arm is mounted opposite and in alignment with rocker arm 7 and is provided at its outer arm with a spring holding cup 14, the whole being so arranged that the spring holding cup 14 is in alignment with the boss 12 upon the lower side of lever arm extension 11 of rocker arm 7. A compression spring 15 is mounted between support arm 13 and rocker arm 7 being retained in position by spring holding cup 14 and boss 12. With this assembly, the force of spring 15 reacting against the fixed spring holding arm 13 serves to move rocker arm 7 pivotally about its mounting upon pin 6 in clevis 5 and so urges blade 9 into contact with the interior of the pipe in which the assembly is placed. This assembly is sufficiently yieldable so that the deposits of the nature of ice and the like or irregularities in the pipe or minor springing of the shaft will not adversely affect proper contact of the blade with the pipe surface with a force sufficient to remove the yieldable deposits normally formed thereon.

In the drawing only two blades are shown. It is to be understood that any appropriate number of blades may be used, say four blades, or three blades or six blades, the only change necessary being a proper staggering of the location of the supports for the various blades in order that they may all be carried properly by the central shaft. It is also within the spirit of this invention that the blades 9 may either be straight blades, that is, blades which are aligned axially with the shaft for the whole of their length or the blades 9 may be helical blades arranged spirally about central shaft 4. In general, particularly in long double pipe exchangers, it is advisable that the scraper assembly be broken up into short lengths, each complete in itself, and composed of a central shaft with its surrounding blades, the whole to be joined together by proper keying and mounted upon proper head and tail shafts which are to be supported in bushings provided at either end of the usual double pipe heat exchanger, both the head and tail shafts as is usual extending through said bushings and bearings to support the usual external drive mechanism whereby they are rotated.

Scrapers of this construction have been installed and utilized under rather difficult conditions of operation and have been found to be singularly free from build up in power requirements and breakage resulting from icing and similar causes.

I claim:

1. In a double pipe heat exchanger, an interior wall scraper comprising a shaft located centrally and extending axially of the interior pipe of said heat exchanger and a plurality of axially extending scraper blades carried thereby, mounting means for said scraper blades, each mounting means comprising a rocker arm pivotally engaged to a clevis lug mounted upon said shaft and extending to form a lever at an angle with a line drawn through the shaft center and the lug pivot center with blade-fastening means located upon said rocker arm between said pivot and the end thereof, said mounting means also comprising a rigidly fixed spring-carrying arm extending from said shaft in alignment with said lever arm, spring retaining means upon the outer end of the rocker arm, spring retaining means upon the outer end of said spring-carrying arm, and a compression spring mounted therebetween and

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biasing the scraper blade into contact with the pipe wall by rotation of the rocker arm about its pivot.

2. A wall scraper assembly for removing deposits from the interior wall of the interior pipe of double pipe heat exchangers and the like, comprising a centrally located, axially extending scraper shaft and a plurality of axially extending scraper blades carried thereby, each blade being supported by a plurality of mounting means, each mounting means comprising a clevis lug affixed to said shaft; a generally T-shaped rocker arm having one arm of the T pivotally mounted in said clevis lug with the other arm extending as a lever in a direction generally at right angles to a line drawn through the shaft center and clevis pivot center, the shank of the T extending toward the pipe wall along a line generally parallel to said center line, means for affixing the blade to the shank of the T-shaped rocker arm, and spring retaining means upon the lever extremity of said T-shaped rocker arm; a spring supporting arm rigidly affixed to said central shaft opposite said clevis lug and extending therefrom in alignment with the cross arm of said T-shaped rocker arm, spring retaining means upon the extremity of said spring supporting arm; and a compression spring mounted between the two said spring retaining arms acting to rotate the rocker arm about its pivot and to force the scraper blade carried thereby into engagement with the interior pipe wall.

3. A wall scraper assembly for removing deposits from the interior wall of the interior pipe of a double pipe heat exchanger and the like, comprising a centrally located, axially extending scraper shaft and a plurality of axially extending scraper blades carried thereby, each blade being supported by a plurality of mounting means, each mounting comprising a pivot support affixed to said shaft; a generally T-shaped rocker arm having one T arm end pivotally mounted in said pivot support with the other T arm end extending as a lever in a direction generally at right angles to a line drawn through the shaft center and pivot center, the shank of the T extending toward the pipe wall along a line generally parallel to said center line, means for affixing the blade to the shank of the T-shaped rocker arm, and spring retaining means upon the lever extremity of said T-shaped rocker arm; a spring support affixed to said shaft and extending therefrom in alignment with the lever extremity of said T-shaped rocker arm, spring retaining means upon the extremity of said spring support; and a compression spring mounted between the two said spring retainers and acting to rotate the rocker arm about its pivot and to force the scraper blade into engagement with the interior pipe wall.

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