

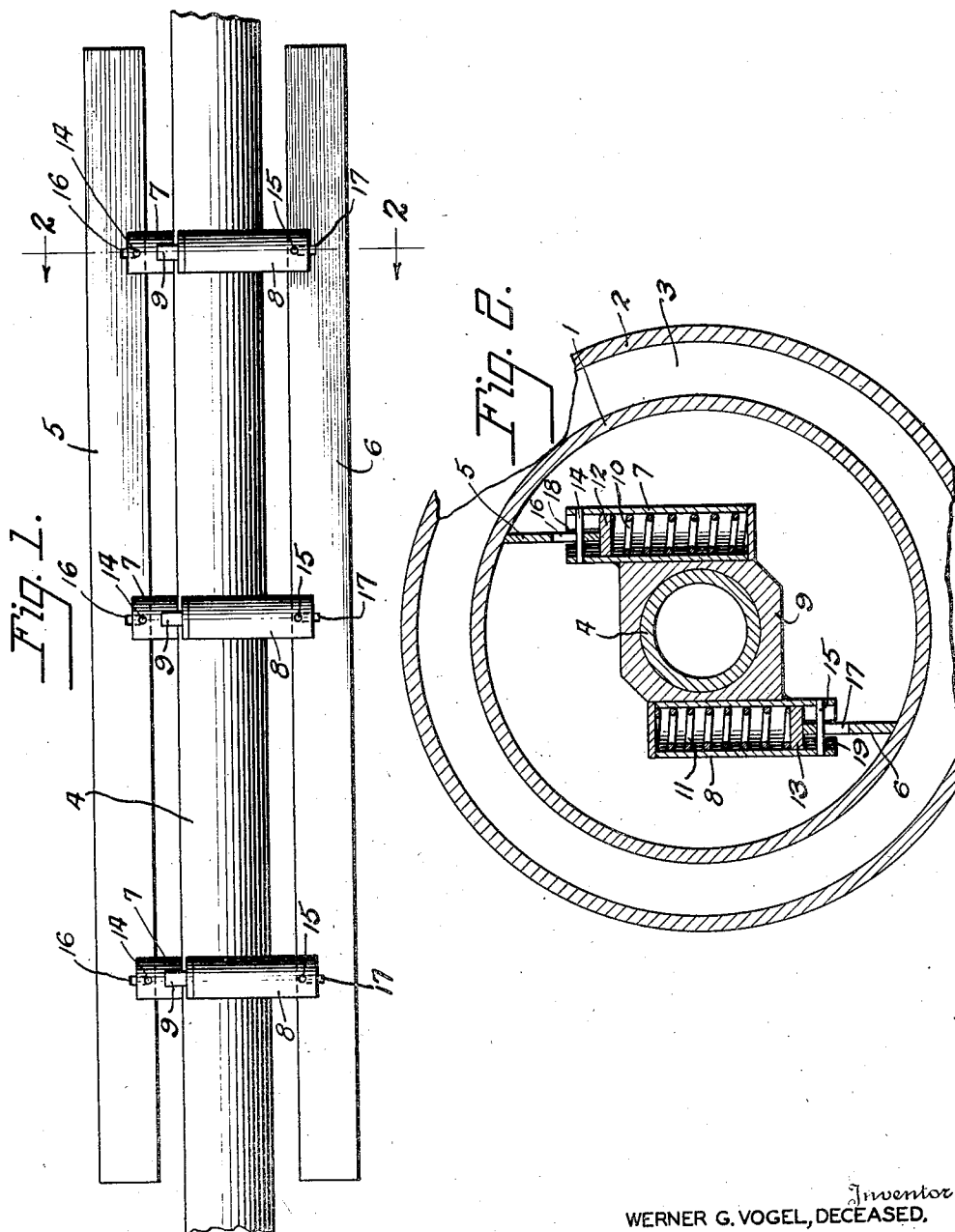
May 5, 1942.

W. G. VOGEL

2,282,298

SPRING SUPPORTED SCRAPER BLADE FOR CONDUITS OF HEAT EXCHANGERS

Original Filed Oct. 26, 1938



WERNER G. VOGEL, DECEASED.  
BY EMMA BARTMAN VOGEL, EXECUTRIX.

By *Mason Lemick Lawrence*  
Attorneys

## UNITED STATES PATENT OFFICE

2,282,298

SPRING SUPPORTED SCRAPER BLADE FOR  
THE CONDUITS OF HEAT EXCHANGERSWerner G. Vogel, deceased, late of Louisville, Ky.,  
by Emma Bartman Vogel, executrix, Louisville,  
Ky.Original application October 26, 1938, Serial No.  
237,135. Divided and this application Novem-  
ber 9, 1939, Serial No. 303,709

## 3 Claims. (Cl. 259-109)

This invention relates to rotary scrapers for tubular heat exchangers, and particularly those of the double pipe chiller type. Such generally comprise a sinuous conduit consisting of a plurality of straight, substantially horizontal jacketed pipe sections serially connected at the ends by return bends. The liquid to be chilled is pumped through the conduits while a refrigerant circulates through the jackets surrounding the straight pipe sections.

This invention is a division of application Serial No. 237,135, filed October 26, 1938, upon which Patent No. 2,182,712 was granted on December 5, 1939.

It is well known that in the case of many liquids, such for example as hydrocarbon oils, chilling of the same precipitates out certain matters, the natural tendency of which is to collect upon the walls of the conduit in the form of an adherent sediment or scale, and if the conduits are left during off periods of operation filled with liquid, these matters frequently become persistently adherent and difficult to remove.

Now, in the interest of efficient heat exchange, it is essential not only to keep the inner walls of the conduits free from deposits of this nature, but also to maintain them in smooth and polished condition.

With this end in view, it is customary to mount driven scrapers in the straight pipe sections of the chiller with ribbon blades arranged in the general longitudinal direction, sometimes straight and sometimes spirally, which revolve against the inner surfaces of the conduits, dislodging the adherent matter and keeping the surface of the conduit polished. Where spiral type blades are used, the conveying function is quite subordinate to the scraping function, inasmuch as the liquid being treated is pumped through the chiller. The spiral disposition of the blades is rather for the purpose of meeting the adherent matter at an angle, and thus performing an inclined shearing cut.

Scraper blades are generally of the narrow or ribbon type, and may be either rigidly or resiliently supported from a driven shaft arranged coaxially within the chiller pipe.

Spring supported blades have the advantage over rigidly supported blades, for not only can they accommodate themselves to variations in the diameter of the pipe so as to maintain unbroken contact with the pipe throughout their length, and automatically adjusting themselves to compensate for wear, but they can be so constructed and arranged as to yield upon making contact

with persistently adherent matter, dislodging it with gradually built up pressure rather than by a rigid impact blow which is apt to be detrimental to the scraper blades as well as to mar the inner surface of the chiller pipe.

Scraper blades that are supported by springs, in previously known manner, are subject to vibrations which cause "chatter," by which is meant a succession of vibratory impulses against the inner surface of the chiller pipe immediately following the release of the spring upon the dislodgement of a difficultly removable particle, which succession of vibratory blows tends to flatten or score or groove the inner wall of the chiller pipe, a condition which promotes rapid wear of the scraper blades and the chiller pipe, and by roughening the latter encourages the adhesion of the sedimentary matter, and in general, lowers the heat exchanging efficiency of the apparatus. This untoward action ordinarily affects spring blade supports of the leaf spring type which vibrate laterally, as well as spring supports of the coil type which vibrate only axially.

In the aforementioned parent application of which this is a division, a spring support for scraper blades is claimed, in which the springs are of the leaf type, yielding laterally to the resistance of adherent matter, in which the undesired vibrations are quenched by causing the springs to bend about a shifting fulcrum as they are laterally stressed, changing their amplitude of vibration and thus quickly bringing them to rest.

In said parent application, a hypothetical construction is described and the defect of such construction pointed out, in which the scraper blades would be supported by coil springs at diametrically opposite points, thrusting against the inner wall of the chiller pipe with the entire force of the springs so that upon meeting an adherent obstruction they would either forcibly dislodge the obstruction, or if the obstruction has a sloping side, which is more frequently the case, the blade would rise upon said obstruction, pushing inwardly against the spring, and upon passing the obstruction would immediately fly out, delivering a hammer blow against the surface of the pipe. This blow, if analyzed by an oscillograph, would show as a single major impulse followed by a plurality of lesser impulses, and it can readily be appreciated that such a blow frequently repeated, would destroy the smooth and polished interior surface of the chiller pipe.

The present invention has for its object the provision of a spring type scraper blade support, making use of coil springs, but so positioned with

respect to the axis of rotation of the scraper blade unit as to substantially eliminate the harmful impact blow which the above hypothetical example describes and explains, and which will therefore prevent chattering or scoring of the interior wall of the chiller pipe.

Other objects of the invention will appear as the following description of a preferred and practical embodiment thereof proceeds.

In the drawing throughout the several figures of which the same characters of reference have been employed to designate identical parts:

Figure 1 is a longitudinal view in elevation, showing a portion of the shaft of a scraper blade unit, embodying a spring blade support embracing the principles of the present invention; and

Figure 2 is a cross-section through one of the spring supports, showing also the outer tube, defining the refrigerant jacket.

Referring now in detail to the several figures, the reference character 1 represents the inner conduit or chiller pipe, 2 being an outer casing defining with the chiller pipe 1 a jacket 3 in which a refrigerant is designed to flow.

The liquid to be chilled, which is frequently a hydrocarbon oil, is pumped through the chiller pipe 1. Extending axially through said chiller pipe is the shaft 4. The shaft 4 carries the scraper blades 5 and 6. It will be observed from Figure 2 that the scraper blades 5 and 6 are each slidably fitted within slots 18 and 19 formed in the opposite walls of the respective sockets 7 and 8. Said sockets are fixedly attached to a hub 9, which in turn is suitably fixed to the shaft 4. The scraper blades 5 and 6 are continually urged outwardly by means of coil springs 10 and 11 housed within said sockets, the springs thrusting against followers 12 and 13 against which the inner edges of the blades 5 and 6 abut. As a means for preventing the springs from flying out and displacing the blades entirely from the sockets when the scraper unit is withdrawn from the chiller tube, retaining pins 14 and 15 are provided, which have their ends fixed in the opposite walls of the sockets and their intermediate portions passing through slots 16 and 17 formed in the blades.

It will be observed in Figure 1 that the blades 5 and 6 are spring supported at several points. The blades, together with the spring supports, may be considered a blade unit. Inasmuch as the chiller pipes 1 may be quite long, it is customary to provide the shaft 4 with several blade units arranged end to end, and sometimes in staggered relation. The separateness of the units permits them to accommodate themselves to slight deviations of the shaft 4 from axial alignment, which is apt to occur in chiller pipes of great length.

The salient feature of this invention is the fact that the spring blade supports are not in opposite diametrical arrangement, but that they are offset from the axis of rotation of the unit. It has been already explained that if these coil spring supported blades were at diametrically opposite points the blades would touch the inner surface of the chiller pipe at a point or points substantially normal to the direction of thrust of the springs. Under such circumstances, if the blades in their rotation strike an obstruction over which they cannot ride, there is no other outcome but that the obstruction must give way. However, if as is most frequently the case, the obstruction is a high spot going off to a feather edge, the blade will ride upon the high spot, and

instead of dislodging it, may ride off of it so abruptly as to strike a hammer blow against the wall of the chiller pipe, followed by a succession of lesser vibrations. By placing the spring supported blades in an offset position, as shown with respect to the axis of rotation of the unit, an entirely different order of operations occur. In the first place, the scraper blade now becomes a chisel having an acute angled edge on the approach side of the obstruction. This means that the blade will dig into the base of the obstruction and, in most instances, remove it. However, should the obstruction be so obstinate and so thin at its base as to permit the blade to ride up on it, the blade upon leaving the obstruction, will always be descending the sloping wall of the chiller pipe, and therefore, the force of the blow which it will strike against the inner wall of the chiller pipe will be materially reduced almost to the point of elimination. Another way of stating this is that the thrust of the spring will be resolved into two components, one which is directed normally to the interior surface of the chiller pipe, and the other of which is directed circumferentially thereof. It is this circumferential component which is entirely lacking in the hypothetical case where the two spring support blades are positioned at diametrically opposite points.

It will be understood to those skilled in the art that one of the advantages of the type of spring blade support disclosed in the present application over that forming the subject matter of the claims in the hereinbefore parent application, is that in the former, if one of the points of spring support is retarded by an obstinate adherent particle, while the others are free, this causes a twisting of the blades which reduces the diameter of the scraper in the zone of the point of retardation, drawing it away temporarily from contact with the surface of the chiller pipe. This cannot occur in the present construction, for there is no lateral deflection of the blades possible, and therefore, no such retardation of the movement of the blades as could occur with the leaf type spring support.

While there has been described in the above disclosure what is believed to be a preferred and practical embodiment of the invention, it will be understood to those skilled in the art that the details of construction and the arrangement of parts may be modified to suit the exigencies of use without departing from the spirit and scope of the invention which is defined in the appended claims.

What is claimed is:

1. Rotary scraper for the liquid carrying conduits of heat exchangers comprising a shaft, a ribbon blade extending longitudinally of said shaft and spaced therefrom having a chisel edge adapted to scrape the inner cylindrical surface of the conduit in which said shaft is axially inserted, blade supports fixed to said shaft at spaced longitudinal intervals, each support comprising a hub, means forming a spring housing carried by said hub having a spring receiving socket offset from the axis of said shaft with the axis of said socket tangential to an imaginary circle concentric with the axis of said shaft, said housing having a slot at one end slidably receiving said blade permitting movement thereof longitudinally of said socket but inhibiting lateral deflection of said blade, and a spring in said socket thrusting against said blade biasing it against the surface of said conduit.

2. Rotary scraper for the liquid carrying conduits of heat exchangers comprising a shaft, a ribbon blade extending longitudinally of said shaft and spaced therefrom having a chisel edge adapted to scrape the inner cylindrical surface of the conduit in which said shaft is axially inserted, blade supports fixed to said shaft at spaced longitudinal intervals, each support comprising a hub, a spring housing carried by said hub having a socket offset from the axis of said shaft with the axis of said socket tangential to an imaginary circle concentric with the axis of said shaft, said housing having a slot at one end intersecting said socket and slidably receiving said blade permitting movement thereof longitudinally of said socket but inhibiting lateral deflection of said blade, a coil spring in said socket thrusting against said blade biasing it against the surface of said conduit and a pin intersecting said socket fixed in the walls thereof passing through a slot in said blade for retaining said blade and said spring in

said socket when the scraper is removed from said conduit.

3. Rotary scraper for the liquid carrying conduits of heat exchangers comprising a shaft, hubs fixed to said shaft at longitudinally spaced intervals, a pair of spring housings carried by each hub offset from the axis of said shaft and having spring receiving sockets tangential to an imaginary circle concentric with the axis of said shaft, a slot at one end of each socket, a pair of blades slidably fitting said slots, freely movable longitudinally therein but restrained thereby from lateral deflection, coil springs in said sockets thrusting against said blades biasing them against the surface of said conduit, said sockets, springs and blades being arranged symmetrical with respect to said shaft on opposite sides thereof and in reverse phase.

EMMA BARTMAN VOGEL,  
Executrix of the Estate of Werner G. Vogel,  
Deceased.