June 5, 1934. M. M. DURKEE 1,961,744

HEAT TRANSFER WITH VISCOUS LIQUIDS

Filed Aug. 22, 1931

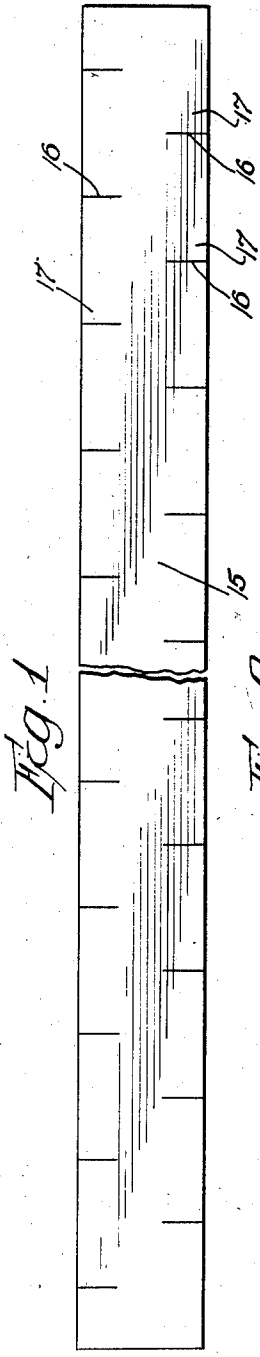


Fig. 1

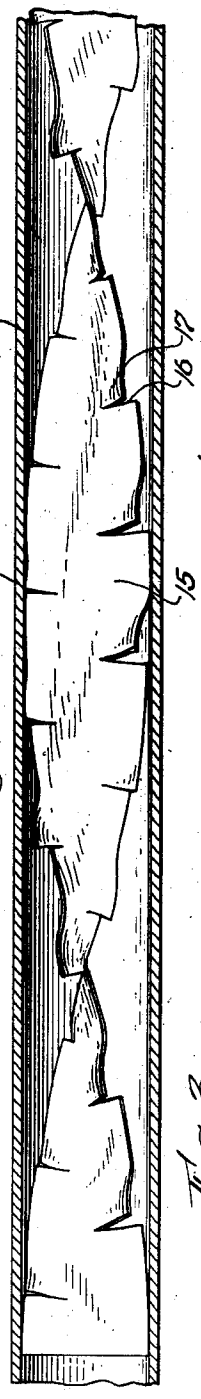


Fig. 2

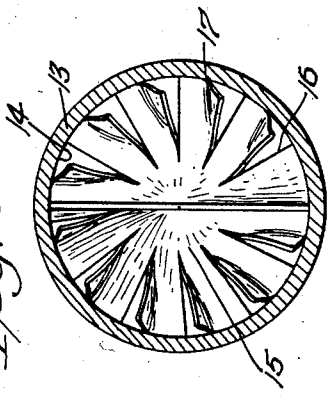


Fig. 4

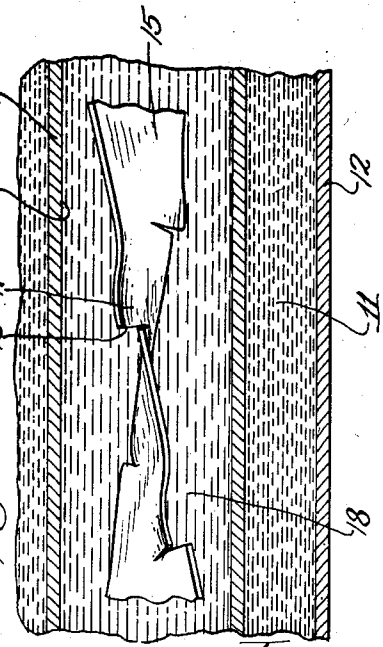


Fig. 3

Inventor:
Maurice M. Durkee
John C. Carpenter
Atty.

Patented June 5, 1934 1,961,744

UNITED STATES PATENT OFFICE

1,961,744

HEAT TRANSFER WITH VISCOUS LIQUIDS

Maurice M. Durkee, Decatur, Ill., assignor to A. E. Staley Manufacturing Company, Decatur, Ill., a corporation of Delaware

Application August 22, 1931, Serial No. 558,763

1 Claim. (Cl. 257—262)

This invention relates to the cooling of liquids and more particularly to the heating and cooling of liquids having relatively low heat conductivity and relatively slow or sluggish molecular action. Mineral, animal and vegetable oils are typical examples of liquids to the treatment of which this invention is of special value.

It has been discovered that oils passing through a pipe in a heating or cooling medium flow through the apparatus in a stream with relatively little lateral or convectional action. The result is that the outer portions or layers of the oil stream heat or cool more rapidly than the center and that due to the relatively low heat conductivity of the flowing stream considerable time is needed to transfer the heat to or from the center and inner portions of the stream.

A principal object of the present invention is the expediting of the heating or cooling of the oil stream by producing convectional action therein so that various portions, preferably all portions, of the oil are constantly and repeatedly brought directly into or substantially directly into contact with the inner surface of the pipe or conductor through which the material is being passed.

The invention contemplates the accomplishment of this result without material obstruction to the flow of the oil and without materially reducing the capacity of the pipe or conductor through which it is conveyed.

Numerous other objects of the invention will be apparent as it is better understood from the following description, which, when taken in connection with the accompanying drawing, discloses a preferred embodiment thereof.

Referring to the drawing:

Figure 1 is a plan view of a stream breaking strip provided in accordance with the invention, and in the process of formation;

Fig. 2 is a transverse sectional view through an oil cooling pipe showing the strip of Fig. 1 completed and in operative position;

Fig. 3 is a fragmentary section through a cooling bath illustrating the movement of the oil in passing; and

Fig. 4 is a transverse section through the pipe and strip assembly shown in Fig. 2.

This invention contemplates the provision of a simple expedient for imparting to oil or other viscous, relatively sluggish liquids, a convectional action which will prevent stratification and which will insure that substantially all portions of the flowing stream rapidly come into contact with the presented pipe or conductor surface. In the instant embodiment of the invention this is accomplished by twisting the oil stream through the pipe and at intervals also directing oil into whirling eddies that engage the heat receiving surfaces of the pipe and which move along with the oil stream as it flows through the pipe.

The invention will be described as embodied in an apparatus for cooling oil and referring first to Fig. 3, a section of a cooling bath 11 is illustrated as contained within a tank 12 of usual or preferred construction. One or more cooling pipes 13 extend through this bath for conveying the oil or other liquid to be cooled. Reference character 14 indicates the interior surface of the pipe against which, in accordance with the present invention it is desired that the oil be constantly directed from the center to effect the cooling operation. As has been stated, the oil is directed through this pipe in a twisted stream and the entire stream receives a convectional movement which breaks up the stratification and brings the molecules into contact with the inner heating surface of the pipe.

In the present instance a single strip of sheet metal or other suitable material is arranged within the pipe both to twist the oil stream and to break up the stratification from the center outwardly, as already suggested. A strip, generally indicated at 16, is slitted at intervals, as indicated at 16, inwardly from each side preferably to about two-fifths of the width. Thereafter the corners rearward in the direction of movement and indicated generally at 17 are bent from the plane of the strip, the corners on one side being bent upwardly and the corners on the opposite side downwardly. Thereafter the strip is twisted into the spiral form shown on the drawing and is arranged within the pipe, preferably extending from end to end of the cooling length.

The oil, indicated in Fig. 3 by reference character 18, in flowing through the pipe is constantly deflected outwardly in contact with the surface and it is believed that the bent corners 17 of the strip set up minute swirls at the inner pipe surface which scour the inner surface of the pipe in intimate contact therewith and as the oil stream as a whole moves forward.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

An apparatus for heating and cooling oil and other liquids normally stratifying in flow through a pipe, comprising a pipe, and a twisted sheet metal strip slitted inwardly from its edges at spaced intervals, the material adjacent the side of each said slit being bent to impart convectional action to the oil stream.

MAURICE M. DURKEE.