Oct. 11, 1932. R. H. HYDE 1,881,610

TUBING

Filed July 11, 1930

Fig. 1.

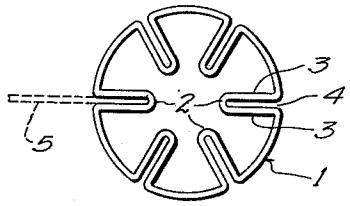


Fig. 2.

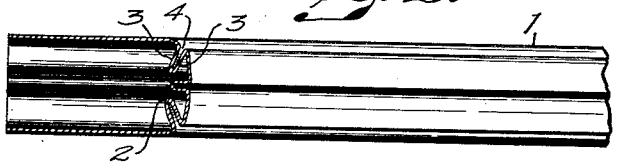


Fig. 3.

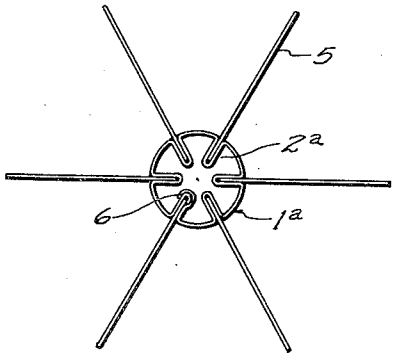


Fig. 4.

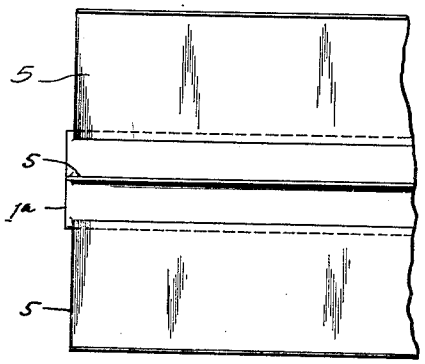


Fig. 5.

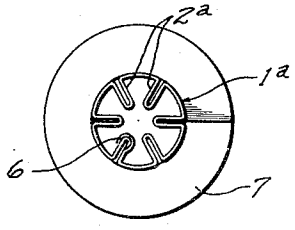
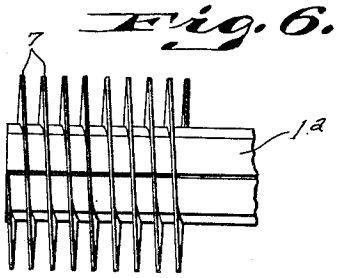


Fig. 6.



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Patented Oct. 11, 1932

1,881,610

UNITED STATES PATENT OFFICE

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TUBING

Application filed July 11, 1930. Serial No. 467,323.

This invention relates to tubing and more particularly to tubing adapted for use in transferring heat in heating, cooling, refrigerating and ventilating devices and installations.

One object of my invention is to provide a tubing, whether seamless or otherwise, with heat conducting fins extending longitudinally or axially of the tubing and connected with or carried by the exterior wall thereof to conduct heat either to or from said wall, depending on whether the fins are internal fins projecting into the tubing or external fins extending outside of the tubing.

Another object of my invention is to have the internal fins formed by extending inward portions of the metal constituting the outer wall of the tube so that the fins will be integrally connected with said wall to more efficiently conduct heat to or from the same.

A further object of my invention is to have the fins extend into the tube in such manner as to not only divide or separate the body of the fluid within the tube into smaller sections for contact with the fins, but also to considerably increase the inner surface of the tube wall in contact with the fluid to facilitate a more rapid transfer of heat to and from the same than possible with a tube with a plain bore or passage.

A further object of my invention is to provide in a lock-seam tube the internal fins by folding the metal of the tube wall to provide the fins in the making of the tube.

The invention consists further in the matters hereinafter described and claimed.

In the accompanying drawing:

Fig. 1 is an end view of a seamless tube with internal fins constructed in accordance with my invention;

Fig. 2 is a side view of the tube with a portion broken away to show that the fins extend longitudinally of the tube;

Fig. 3 is an end view of the tube of my invention showing external fins inserted in the pockets formed by the internal fins;

Fig. 4 is a side view of the structure shown in Fig. 3 to show that the external fins also extend longitudinally of the tube;

Fig. 5 is an end view of a tube of my invention with internal fins and provided with external fins in the form of a strip wound spirally about the tube; and

Fig. 6 is a side view of the structure shown in Fig. 5.

In accordance with my invention, I so form a tube that it is provided with an internal fin or fins integral with and extended into the tube from the outer wall thereof. The fins may be extended into the interior of the tube to the extent desired and the tube may be of any pre-determined cross section, round, oval, flat, etc. The tube may be provided with any number of internal fins which are preferably disposed to extend lengthwise of the tube. The tube may be of the seamless type, in which case the internal fins are formed by drawing the tube through a suitable die. On the other hand, the tube may be of the lock-seam type, in which case the tube is formed from a strip of the desired sheet metal with the fins folded from the metal sheet and extending into the interior of the tube. In this type, the lock seam for the tube is provided along the inner edge of one of the internal fins where the edges of the sheet metal strip meet or come together.

In Figs. 1 and 2 of the drawing, I have shown my invention applied to a seamless tube, in which 1 indicates the outer wall of the tube and 2 the internal fins. The fins are formed by extending inward portions of the outer wall 1 to the extent desired. In Figs. 1 and 2, the fins 2 extend into the tube to substantially the same extent, and when the tube is round or cylindric, the fins may be radially disposed with respect to the center or axis of the tube. It is to be understood, however, that any other arrangement for the fins may be adopted without departing from the spirit and scope of my invention. In forming the fins 2 by projecting inward integral portions of the wall 1, each fin comprises a pair of substantially parallel inwardly extending wall portions 3, 3, integrally connected by the fold in the metal at the inner end of the fin and similarly connected with the outer wall 1 at the bend or turn in the metal as shown in Fig. 1. The fins 2 so formed ex-

tend longitudinally or axially of the tube throughout the entire length thereof, and after the tube has been formed, it is cut into sections to the lengths desired.

Forming the fins 2 in the manner described provides spaces or pockets 4 between each pair of fin sections 3, 3, and which pockets extend longitudinally of the tube and open outwardly through the outer surface thereof, as shown in Fig. 2. These pockets 4 could be closed as by pressing the wall sections 3, 3 together in the making of the tube or left open for the entrance of the media in which the tube is located to aid in the transfer of heat to or from the liquid or gas contained in or flowing through the tube. The pockets also provide means whereby external fins may be readily attached to the tube. These fins are preferably made in the form of flat strips of the desired sheet metal or other material, and are of a width to fit sufficiently tight in the pockets to secure the fins to the tube. In Fig. 1 I have indicated one of these external fins in dotted lines by 5. In Fig. 3, I have shown the external fins in full lines, and it will be noted from Fig. 4 that these fins extend lengthwise of the tube. They may be either in continuous strips or in sections as may be desired, according to the nature of the installation in which the tubing is employed. To prevent any possibility of the external fins 5 dropping out of the pockets, they may be soldered in same.

In Figs. 3 to 6 I show my invention applied to a tube 1^a of the lock-seam type. When of this type, the tube is made from a strip of the desired sheet metal and the internal fins 2^a are formed by folding the metal strip on itself to provide the fins. When the tube is round, as shown in the drawing, the internal fins 2^a may be radially disposed the same as before. The seam of the tube where the edges of the sheet metal strip come together are overlapped and interlocked as at 6 along the inner edge of one of the internal fins, as shown in Figs. 3 and 5.

Instead of external fins in the form of strips 5, 5 as heretofore described, I may provide the tube with external fins either in spiral form or in individual disk form. The tube after being produced with its internal fins is then run through a machine designed for the purpose of applying either the spiral fin or the individual disk fins which extend around the tube and are arranged generally transverse to the longitudinal axis thereof. In Figs. 5 and 6, I have shown a spiral fin 7 provided on the exterior of the tube, and surrounding the tube from end to end thereof, or throughout such portion or portions which are to be provided with such fins.

The internal fins greatly increase the surface on the inside of the tube, and by forming the fins of the same piece of which the outer wall of the tube is formed, greater heat transfer is obtained as there is no heat loss, as would occur if the fins were made of separate pieces. With the internal fins longitudinal of the tube, the fins extend in an upward direction when the tube is vertical, and thus follow the direction of the conduction of heat to air. The internal fins present more surface to the gas or liquid to be cooled than provided by a tube with a plain bore, and thus provide for a greater transfer of heat. In leaving the internal fins open at their outer ends, I not only provide pockets for the longitudinal external fins, but bring such fins into direct contact with a greater amount of direct surface on both sides of the external fin, which further tends to increase the heat flow. When the tube is used without external fins or used with external fins which extend around or outside of the tube as when in individual disk or spiral form, the pockets at the internal fins allow for the heat absorbed thereby to flow out into the open air or other media in which the tube may be employed. The internal fins not only provide an increased surface on the inside of the tube for contact with the gas or liquid flowing through or contained in the tube, but also divide the gas or liquid into a multiplicity of relatively narrow sections lengthwise of the tube, and thus bring a greater portion of the medium within the tube into contact with the internal fins for the transfer of heat to or through the same as the case may be, depending on whether the tube is used for dissipating heat from the content of the tube or applying heat thereto.

The tube of my invention is particularly applicable in the heating and ventilating field, the refrigerating field, and, in fact, any field where heat transfer is dealt with. The tubes may be connected to suitable headers or manifolds in the same manner as now employed with plain tubes.

The details of structure shown and described may be variously changed and modified without departing from the spirit and scope of my invention.

I claim as my invention:

1. A tube of the character described having an outer wall, said outer wall having portions at a number of places about the axis of the tube extended inward to provide internal fins for the tube, and external fins applied to the outer wall and extending around about the same.

2. A tube of the character described, having an outer wall made from a strip of sheet material, said strip being folded longitudinally on itself to provide internal fins within the tube when the strip is bent into tube form, the meeting edges of the strip being at and forming the inner edge of one of the internal fins and there being interlocked to provide the seam for the tube.

3. A tube of the character described hav

ing an outer wall, said wall having portions at a number of places about the axis of the tube extended inwardly to provide internal fins for the tube, said fins extending longitudinally of the tube and each having the opposite side portions thereof in spaced relation to provide pockets opening through the outer surface of the tube along the length of the same, and flat strips inserted in said pockets and extending outwardly from the tube along the same to provide external fins therefor, said strips being substantially as wide as the pockets.

4. A tube of the character described having an outer wall, said wall having portions at a number of places about the axis of the tube extended inwardly to provide internal fins for the tube, and extending longitudinally thereof, and a substantially flat strip wound spirally about the tube in edgewise relation thereto and extending outward from the tube to provide external fins for the tube.

In testimony whereof I affix my signature.

ROLLIN M. HYDE.