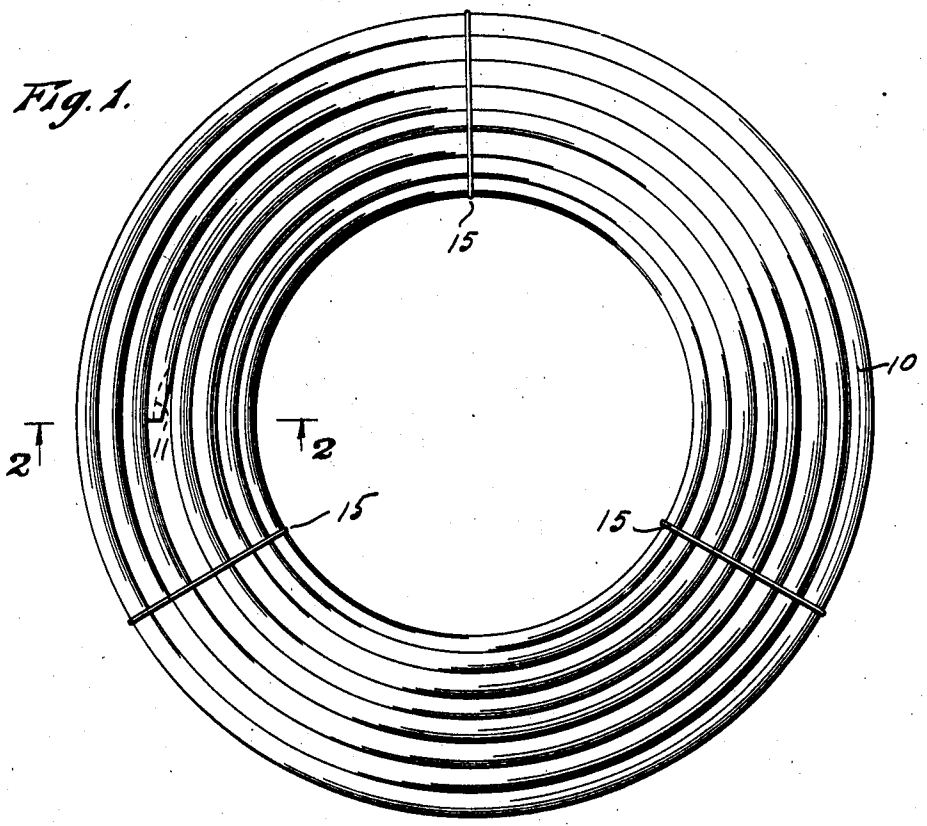
July 4, 1933. F. W. FRENCH ET AL 1,916,474

COPPER AND COPPER ALLOY TUBE AND METHOD OF MAKING

Filed Dec. 10, 1930

Fig. 1.



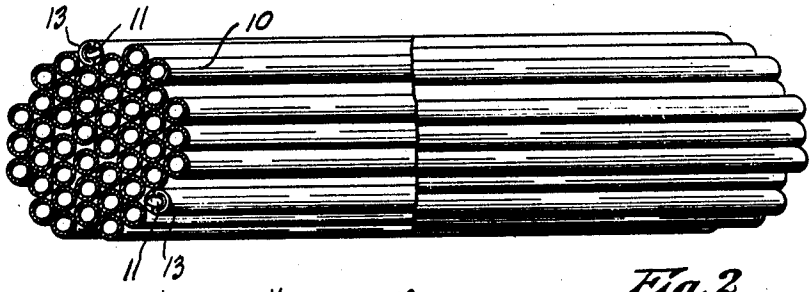


Fig. 2.

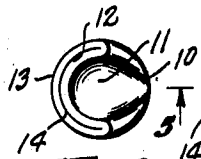


Fig. 3.

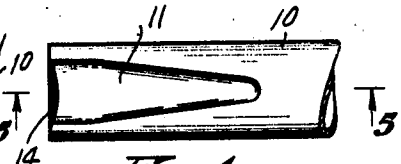


Fig. 4.



Fig. 5.

Inventors
Fred W. French
Leon H. French and
Harry B. Rathbun
By Wooster & Davis
Attorneys.

Patented July 4, 1933 1,916,474

UNITED STATES PATENT OFFICE

FRED W. FRENCH, LEON H. FRENCH, AND HARRY B. RATHBUN, OF WATERBURY, CONNECTICUT, ASSIGNORS TO THE AMERICAN BRASS COMPANY, OF WATERBURY, CONNECTICUT, A CORPORATION OF CONNECTICUT

COPPER AND COPPER ALLOY TUBE AND METHOD OF MAKING

Application filed December 10, 1930. Serial No. 501,226.

This invention relates to the manufacture of metal tubes, particularly copper and copper alloy tubes, although it is not by any means limited thereto.

It is a particular object of the invention to provide a method of treating metal tubes, particularly drawn metal tubes such as copper or copper alloy tubes so that the interior surface of the tubes is maintained clean and bright during subsequent manufacturing operations such as annealing, drawing, pickling and the like, and this surface is so maintained until the tube is placed in service by the user.

Another object of the invention is to provide improved means for sealing the ends of the tube to maintain within the tube a condition to prevent oxidizing or marring of the interior surface and which will prevent injury to other tubes during transportation.

Still another object of the invention is to produce a drawn metal tube in which the interior surface is maintained in such a condition as to eliminate corrosion and deterioration of the refrigerating fluids used in refrigerating apparatus such as household refrigerators.

With the foregoing and other objects in view, we have produced an improved tube and method of making the same which will be more fully disclosed in connection with the accompanying drawing.

In this drawing:

Fig. 1 is a top plan view of a coil of tubing such as may be produced by our invention.

Fig. 2 is a partial side elevation and a partial section substantially on line 2—2 of Fig. 1.

Fig. 3 is an end view of a closed end of the tube on an enlarged scale.

Fig. 4 is a side elevation thereof looking from the right of Fig. 3; and

Fig. 5 is a longitudinal section substantially on line 5—5 of Fig. 4.

In certain uses of metal tubes, such for example as drawn copper or copper alloy tubes as used in household refrigerating apparatus, it is very important that the inner surfaces be kept clean and dry until the refrigerant has been placed in the system.

Particularly is it important that moisture be excluded as the refrigerants, such for instance as sulphur dioxide, are non-corrosive or have minimum effect on the tube in the absence of moisture, but in the presence of moisture corrosion takes place very rapidly and the tube soon fails on account of the resulting disintegration. It will thus be evident that for this and similar uses, it is very essential to produce a drawn tube dry on the inside and maintain it in this condition.

While we have mentioned refrigerating apparatus as an example of a use for which these tubes are adapted they are not confined to such use but are equally adapted for other uses where a tube having a clean, non-oxidized and dry inner surface is desirable.

We have found that by filling a dry drawn metal tube with a non-oxidizing gas or a gas which will have no effect on the tube, and then sealing the ends of the tube to retain the gas therein, the inner surfaces of the tube can be maintained clean, bright and dry during subsequent manufacturing operations and until the tube is actually placed in service by the user. In other words, this result is secured by creating and maintaining in the tube a non-oxidizing condition or a condition in which there is no detrimental effect on the interior surface, and as indicated above this can be produced by filling the tube with a non-oxidizing gas or a gas that will have no detrimental effect on the metal, such for example as nitrogen, and then sealing the ends of the tube to retain the gas therein.

Thus, for example, in carrying out our method a metal tube indicated at 10 of any suitable metal and particularly copper and copper alloys such for example as are used for refrigerator tubing or other uses where it is desired to have a clean, bright, dry non-oxidized inner surface is coiled immediately after being drawn, the rough end cut off and the entire tube immediately filled with the non-oxidizing gas such as nitrogen, before the surfaces become moistened or dulled by

oxidation, and then the ends are sealed to retain the gas therein.

Various ways may be used for sealing the tube, but a very effective way particularly adapted for this particular method is shown in the drawing. That is, the end of the tube is placed in suitable shaped dies movable relatively to each other to press inwardly one side of the tube indicated at 11 to concave this side of the tube and press it against the inner wall 12 of the opposite side of the tube. Thus, it will be seen that this closes the end of the tube without flattening the tube or making it wider in any part than it was previously. In other words, the outer surface 13 of the closed end is of the same curvature as it was originally and remains the same curvature as the body portion of the tube. The closed end is then sealed to make it gas tight either by dipping it in a suitable molten solder, such for example as a phosphor-copper solder, or by welding, either electric or gas welding, the sealing means such as the solder or weld being indicated at 14. The seal should be able to withstand the subsequent operations which are to be performed on the tube. Thus, if the tube is to be annealed and solder is used this solder should be of a material which will not melt at the annealing temperature.

The tube can then be passed through an annealing furnace and heated to the proper annealing temperature. The gas inside the tube keeps the inside surface bright and prevents oxidation. If other manufacturing operations are to be performed such as drawing the tube in dies, pickling and so forth, this sealed gas also maintains the interior surface bright and clean during these operations, and the seal prevents foreign matter getting into the tube. Thus, the tube can be pickled without in any way injuring the interior surface, or the outer surface of the tube can be drawn, and the cycle such as drawing, annealing and pickling can be repeated any number of times while the interior surface is always maintained clean and bright and without marring this surface in any way. This sealed tube can be drawn to any size desired and then sent to the trade while still sealed. While so sealed it can be held in stock indefinitely and the tube will remain bright on its interior surface and free from moisture, oxidation and other foreign material. Thus, the interior surface is kept clean, bright and dry until actually placed in service which is a very important feature, particularly when the tube is to be employed for uses requiring a clean, non-oxidized and dry inner surface such for example as in refrigerating apparatus as the refrigerant can be placed in the tubes without danger of moisture being present and thus the refrigerants will have a minimum corrosion effect on the tubes.

Tubes treated by the above method have been found in actual practice to remain bright, clear and clean on their inner surfaces much longer when exposed to atmospheric or other adverse conditions, or service conditions, than tubes not so treated.

The particular type of seal illustrated prevents damage to other tubes in transit. In shipping, these tubes as illustrated, wound in coils may be tied together by any suitable means 15 and piled one upon the other in suitable containers. Or they need not be tied, and may be shipped loose or tied in freight cars or trucks without being placed in containers. In any case, the particular shape of the end after sealing shown in the drawing prevents the formation of sharp or enlarged surfaces to mar or injure adjacent tubes such as the coil either above or below this coil.

Having thus set forth the nature of our invention, what we claim is:

1. The method of annealing a metal tube which consists in producing a non-oxidizing atmosphere within the tube, sealing the tube to maintain this atmosphere, and then heating the tube to the annealing temperature.

2. The method of annealing a metal tube which consists in filling the tube with a non-oxidizing gas, sealing the tube to retain the gas therein, and heating the tube to the annealing temperature while so sealed.

3. The method of annealing a metal tube which comprises filling the tube with nitrogen, sealing the tube to retain the nitrogen therein, and then heating the tube to the annealing temperature while it is so sealed.

4. The method of annealing a drawn copper or copper alloy tube which comprises filling the tube with a non-oxidizing gas and one which will not react with the metal of the tube detrimentally, sealing the tube to retain the gas therein, and then heating the tube to the annealing temperature while it is so sealed.

5. The method of annealing a drawn copper or copper alloy tube which comprises filling the tube with a non-oxidizing gas, sealing the ends of the tube with a solder having a melting temperature above the annealing temperature, and then heating the tube to the annealing temperature while so sealed.

6. The method of annealing a drawn copper or copper alloy tube which consists in filling the tube with nitrogen, sealing the tube to retain the nitrogen therein, and then heating the tube to the annealing temperature while it is so sealed.

7. The method of annealing a drawn copper or copper alloy tube which consists in producing a non-oxidizing atmosphere within the tube, sealing both ends of the tube to maintain this atmosphere, and then heat-

ing the tube to the annealing temperature while it is so sealed.

8. A new article of manufacture comprising a coil of a drawn metal tube filled with a non-oxidizing gas, each end of the tube being closed by one side wall being concaved to substantially fit the inner wall of the other side and the space between the two walls being closed by a solder.

9. A drawn metal tube the ends of which are closed by one side being concaved inwardly to substantially fit the inner wall of the opposite side, and the walls being connected together to seal the space between them.

10. A new article of manufacture comprising a coil of a drawn metal tube filled with a non-oxidizing gas, each end of the tube being closed by one side wall being concaved to substantially fit the inner wall of the other side, and means sealing the space between the two walls.

11. A drawn metal tube filled with nitrogen the ends of which are closed by one side being concaved inwardly to substantially fit the inner wall of the opposite side, and means sealing the space between these walls.

In testimony whereof we affix our signatures.

FRED W. FRENCH.
LEON H. FRENCH.
HARRY B. RATHBUN.