O. ZIMMERMANN.

FORMATION OF STACKS OF TUBES.

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935,723.

Patented Oct. 5, 1909.

Fig. 1.

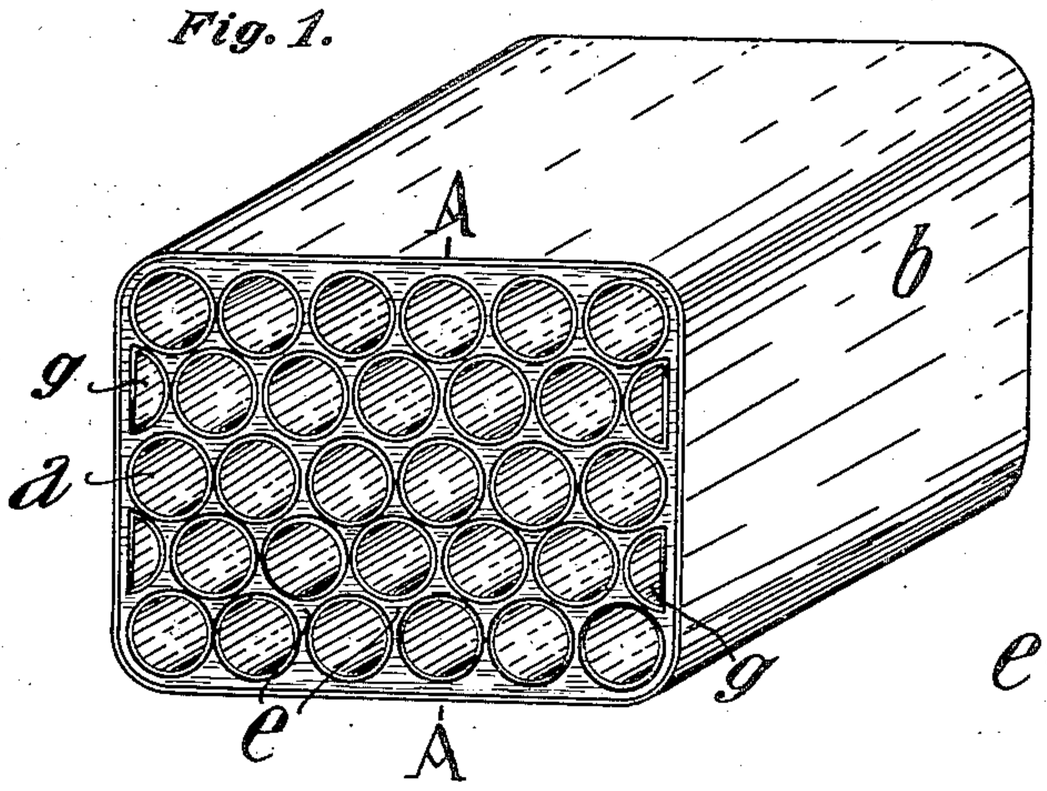


Fig. 3.

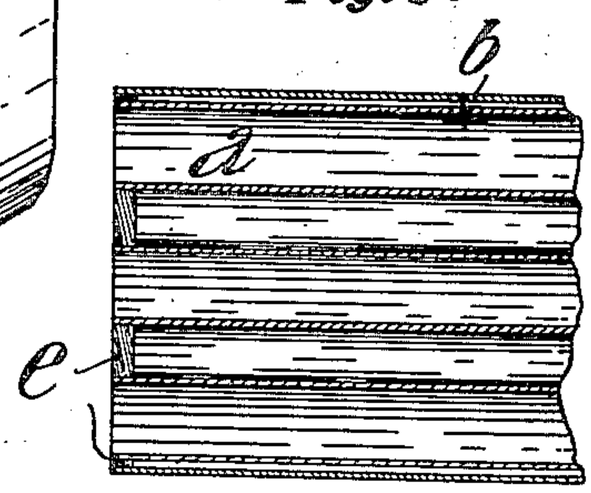


Fig. 2.

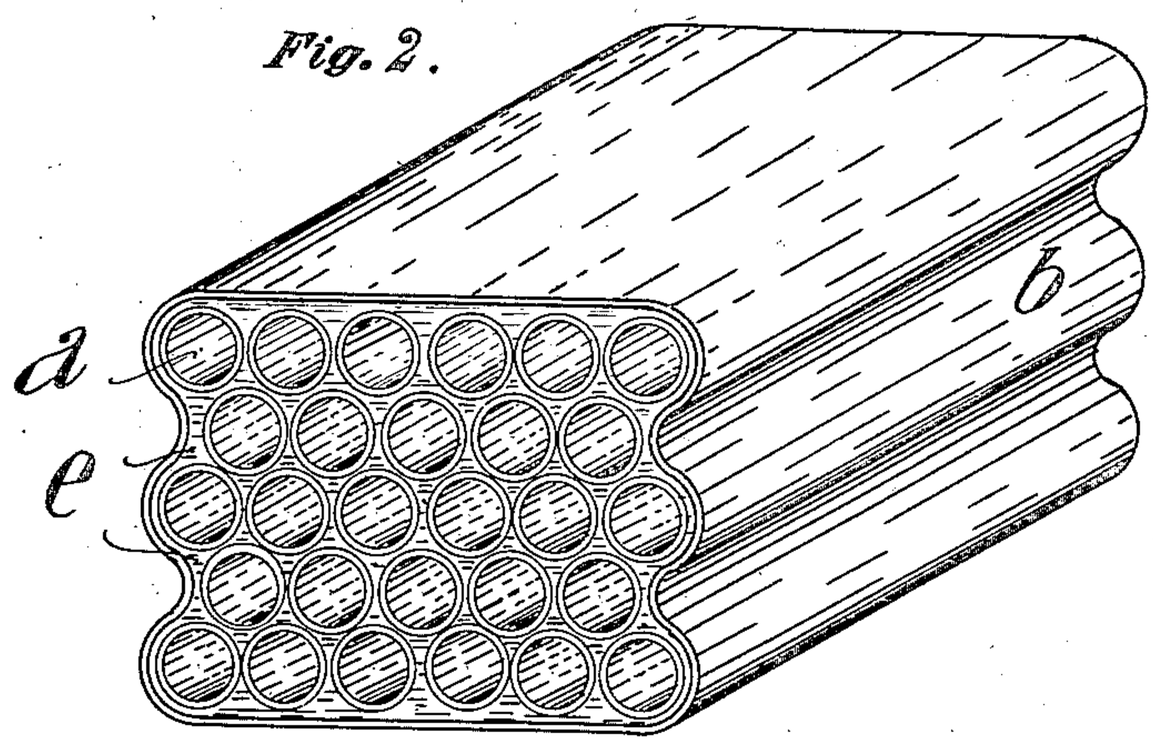


Fig. 6.

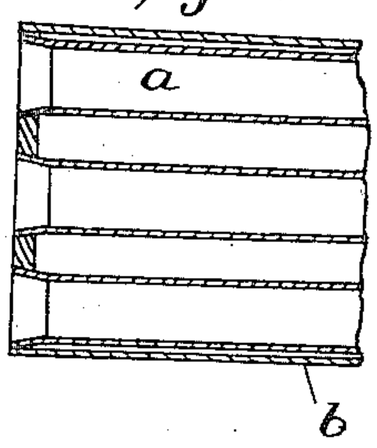


Fig. 4.

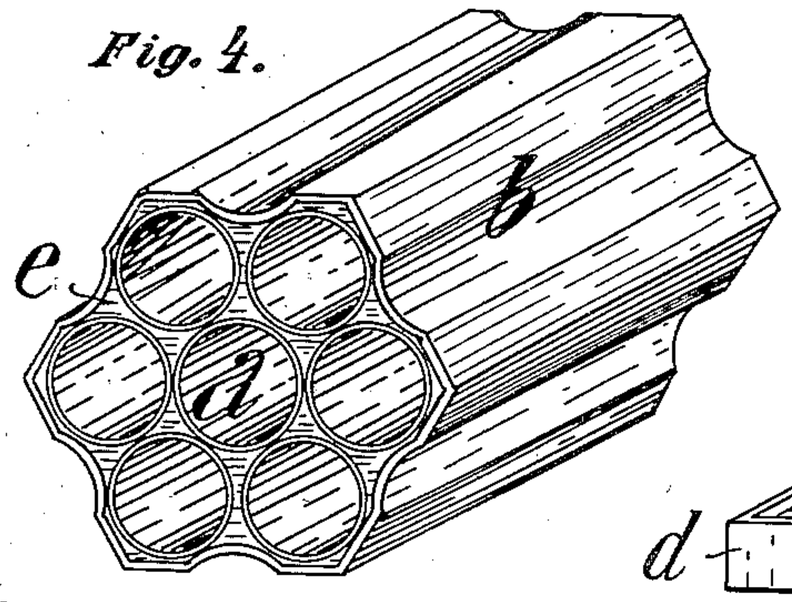
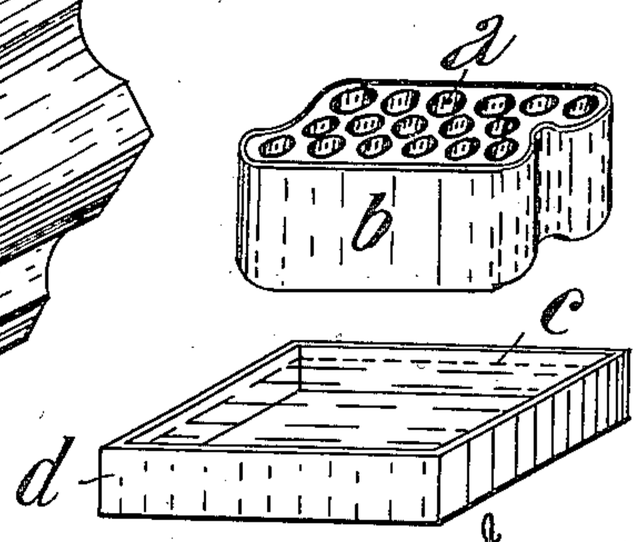


Fig. 5.



Witnesses

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FORMATION OF STACKS OF TUBES.

935,723. Specification of Letters Patent. Patented Oct. 5, 1909.

Application filed August 13, 1906. Serial No. 330,456.

To all whom it may concern:

Be it known that I, OTTO ZIMMERMANN, a subject of the German Emperor, and resident of No. 1 An der Leimfabrik, Ludwigshafen-on-the-Rhine, Germany, have invented certain new and useful Improvements in the Formation of Stacks of Tubes, of which the following is a specification.

This invention relates to a method whereby a plurality of tubes arranged side by side are connected together at their ends by a wall thus forming a tube plate.

The tubes, preferably in the form of stacks or groups, are specially adapted for use in radiator coolers used on motor vehicles but are equally adapted for heating purposes as will be easily understood. A method hitherto proposed for connecting the ends of a plurality of tubes consists in placing a stack of tubes surrounded or not by an outer casing into a suitable casting mold with the ends of the tubes previously stoppered to prevent them being blocked by molten material which is then poured into the mold.

The object of the present invention is to greatly simplify the connecting together of the ends of a plurality of tubes arranged side by side, for it has been found by the attempts made to do this, that the use of a casting mold and stoppers for the ends of the tubes is unnecessary.

The invention will now be described with reference to the accompanying drawings, in which—

Figure 1 shows a stack of tubes arranged in the form of a square, such a shape being obtained by the employment of semicircular tubes where shown, the bundle being surrounded and held by a band preparatory to dipping in the molten soldering material. Fig. 2 shows an example in which the semicircular tubes being dispensed with, the surrounding band is shaped to correspond with the profile of the stack. Fig. 3 shows a section on the line A—A of Fig. 1, showing the depth the tubes are dipped into the molten material and which corresponds with the thickness of the tube plate. Fig. 4 shows a round stack of tubes, the surrounding band being suitably shaped for this purpose. Fig. 5 shows a stack of tubes being dipped into the molten material contained in a flat bottomed vessel. Fig. 6 is a modification showing the preferred form of the invention.

In carrying the invention into effect, a plurality of tubes, *a*, of equal length are grouped side by side to the preferred shape and then gripped or, firmly held together by a suitable surrounding metal band, *b*. The stack of tubes thus formed is dipped endwise into the molten soldering material, *c*, contained in a suitable flat-bottomed vessel, *d*, in such a way that the soldering material enters in the space at the sides, *e*, and between the tubes to a suitable depth, *f*, somewhat as shown in Fig. 3. The bundle of tubes is then cautiously and gently withdrawn from the molten material when it will be found that those portions of the latter filling the interstices between the tubes will remain there, while the metal within the end of each tube will flow out, owing to the fact that the cohesion between the metal in the melting vessel and that inside the tubes is greater than the cohesion existing between the wall of the tube and the metal therein, provided that the bore of the tube is not so small that capillary action can occur. Thus, the employment of stoppers is needless and it is unnecessary to provide the ends of the tubes with graphite, lime or the like stoppers. Where tubes of larger bore are required to be soldered in this manner and thereby the spaces at the sides and also between the tubes and the band become greater, the ends of the tubes may be enlarged like bell mouths as shown in Fig. 6, for retaining the molten material at the sides after dipping. In the event of square stacks, semicircular tubes, *g*, are employed at certain places shown in order that the band, *b*, surrounds and binds the tubes firmly together.

Having now described my invention what I claim as new and desire to secure by Letters Patent is:—

1. A method of forming end plates for securing the ends of radiator tubes in position consisting in placing a series of tubes of the same length side by side and in direct contact for a part of their length, placing a metal band around said tubes so as to hold them together, dipping each end of the group of tubes into molten metal and then withdrawing said group of tubes, said tubes being of such a diameter that the spaces between them are of such a size as to retain the metal therein while said metal within the tubes will flow out as the tubes are withdrawn.

2. A method of forming end plates for

securing the ends of radiator tubes in position, said tubes having expanded ends, consisting in arranging a series of tubes of the same length side by side in direct contact at their ends, placing a metal band around said tubes, said band being of the same width as the length of the tubes, dipping each end of said tubes and band into molten metal and then withdrawing the tubes and band, said expanded ends of the tubes being of such a diameter that the spaces between them are of such a size as to retain the metal therein while said metal within the tubes will flow out as tubes are withdrawn.

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Witnesses:

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