D McR. LIVINGSTON.

COOLER.

APPLICATION FILED JUNE 26, 1907.

985,687.

Patented Feb. 28, 1911.

Fig. 1.

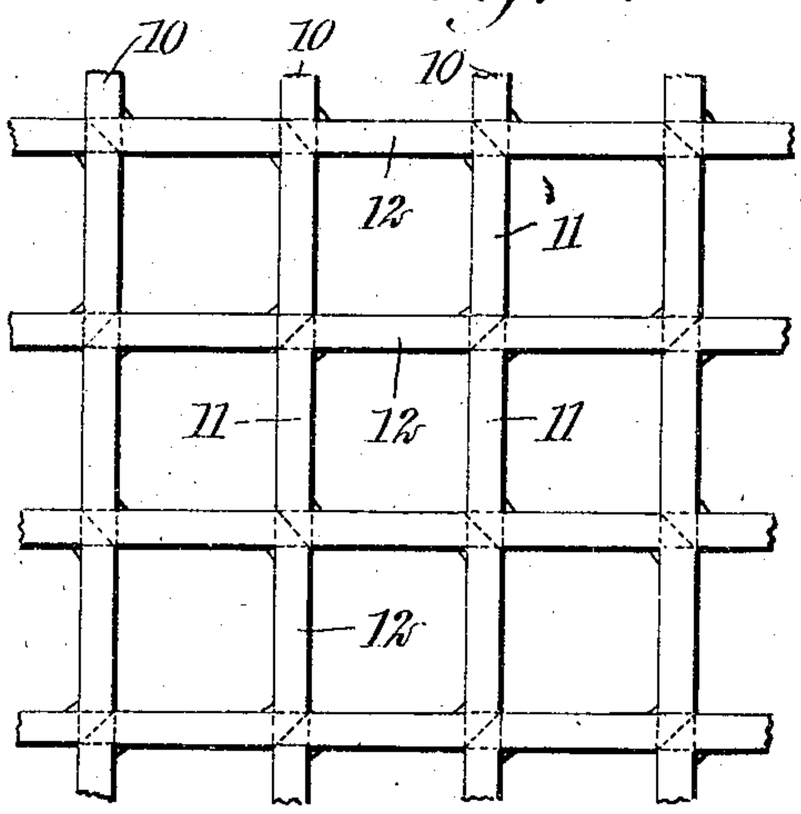


Fig. 2.

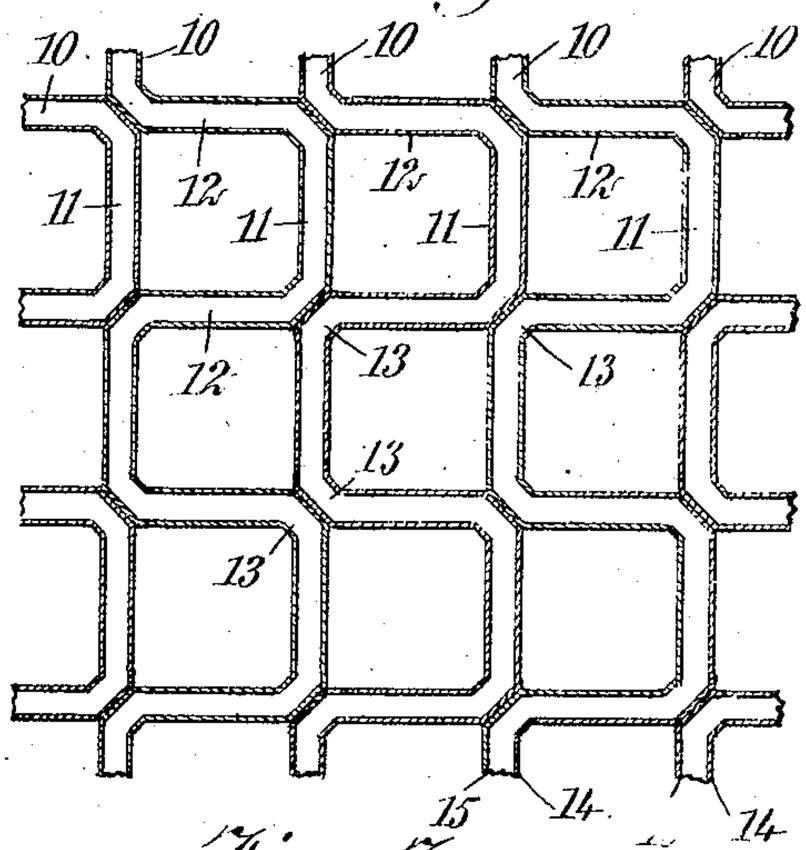


Fig. 3.

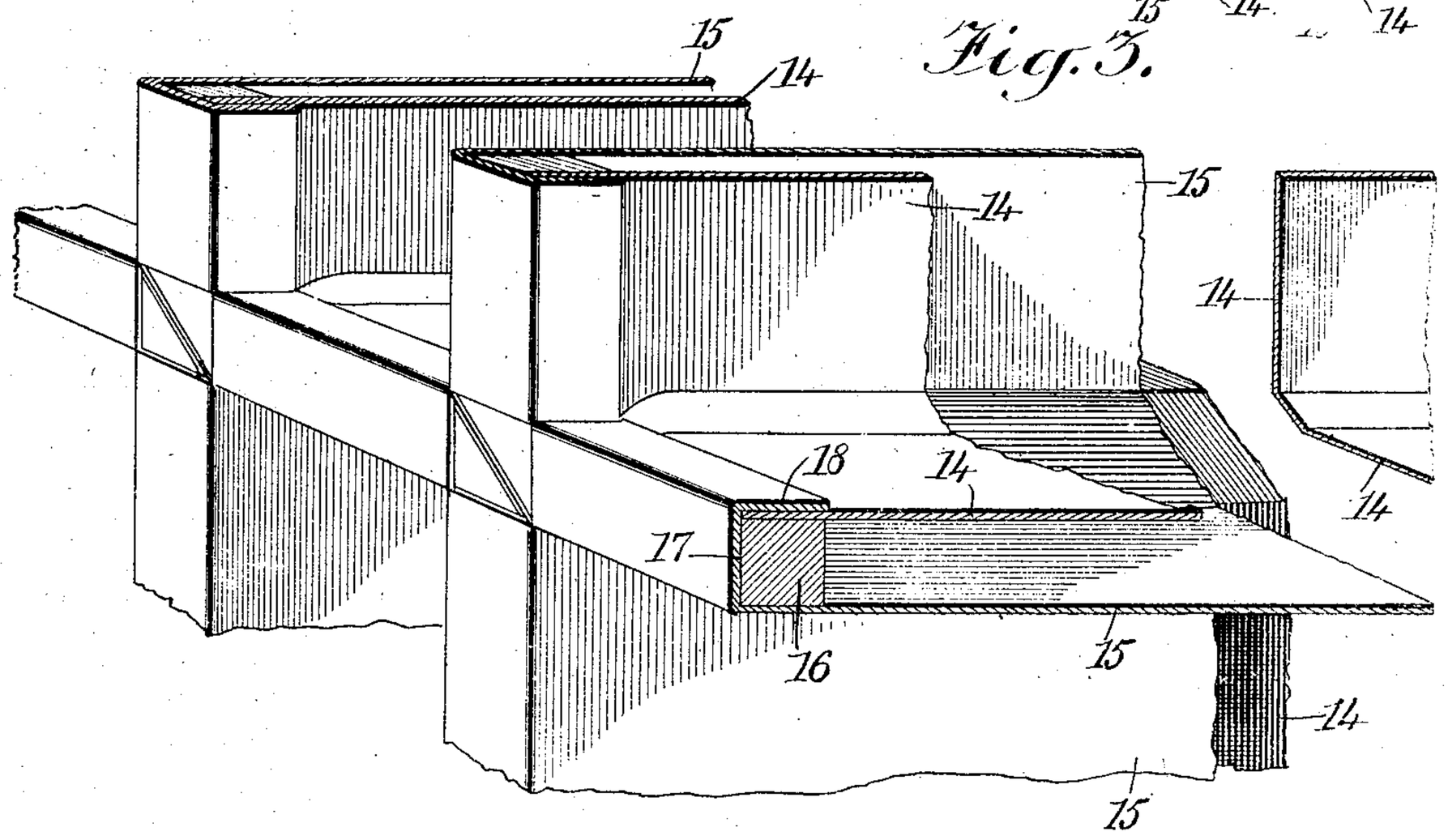
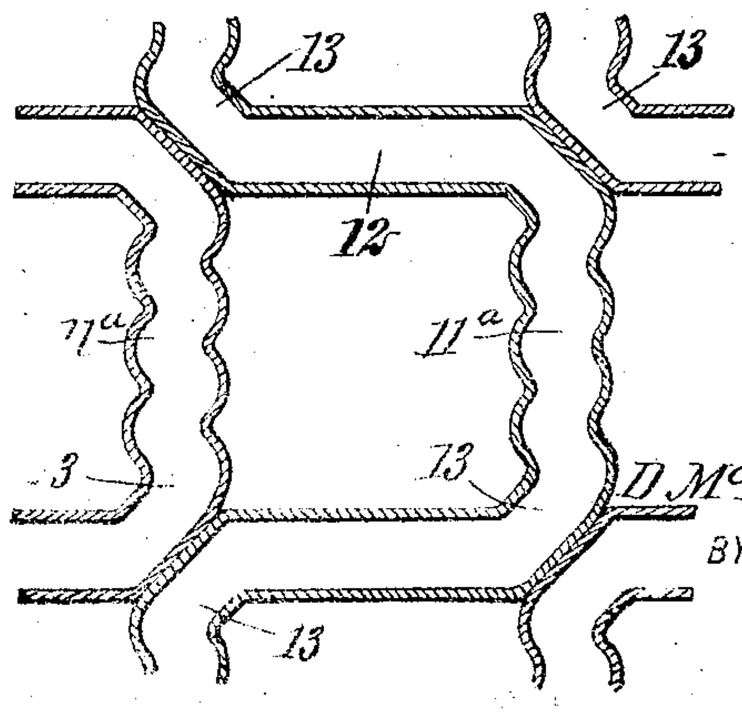


Fig. 4.



WITNESSES

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COOLER.

985,687. Specification of Letters Patent. Patented Feb. 28, 1911.

Application filed June 26, 1907. Serial No. 380,962.

To all whom it may concern:

Be it known that I, D McRa Livingston, a citizen of the United States, and a resident of the city of New York, borough of Manhattan, in the county and State of New York, have invented a new and Improved Cooler, of which the following is a full, clear, and exact description.

This invention relates to certain improvements in coolers, and more particularly to that type of cooler described and claimed in my United States Patent No. 767,905, granted August 16, 1904. Coolers of this character are especially adaptable for use upon motor vehicles for cooling the water circulating about the jacket of the explosive engine, or for condensing the steam in case a steam engine is employed for propelling the vehicle.

It is, of course, understood that the cooler may be employed for any purpose in which it is desired to vary the temperature of one fluid by a second fluid of a different temperature.

In coolers constructed as described in my previous patent above referred to, each corrugation or bend is bridged by a portion of the corresponding corrugation or bend of the next adjacent conduit, but the bridging portions of one conduit do not lie in alinement with the adjacent longitudinally-extending portions of the corrugations of the bridged conduit. In order to give the structure the greatest possible strength, it is desirable that the bridging portion of each corrugation be vertically supported by the adjacent conduit, and that the longitudinally-extending portions shall be in alinement, so as to more effectively sustain the weight of the upper portions and add rigidity to the structure. It is also desirable that all right-angle turns be avoided, and all portions of the conduit be of substantially uniform width, whereby the flow of the fluid is facilitated and all restricted portions at the bends or angles eliminated.

The invention consists in certain features of construction and combinations of parts, all of which will be fully set forth hereinafter and particularly pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures, and in which—

Figure 1 is an end elevation of a portion of a cooler constructed in accordance with my invention; Fig. 2 is a section parallel to the end elevation shown in Fig. 1, and showing the conduits in section; Fig. 3 is a perspective view of a portion of a cooler on an enlarged scale, and Fig. 4 is a section similar to Fig. 2, but showing the corrugations with curved longitudinally-extending portions.

In coolers of the type above illustrated, there are provided a plurality of corrugated conduits, each formed of oppositely-disposed walls, each corrugation forming substantially the three sides of a square, and a portion of each corrugation bridging the corrugation of the next adjacent conduit and completing the fourth side of the square. In Fig. 2 there is illustrated a vertical section through the cooler, in which there are employed a plurality of conduits 10, each provided with a plurality of corrugations or bends, each bend or corrugation being made up of longitudinally-extending members or runs 11 parallel with the general direction of the conduit, and transverse members or runs 12 extending at substantially right angles to said general direction. In the construction previously employed, the longitudinally-extending portions of one conduit were not in alinement with the longitudinally-extending portions of the next adjacent conduit, but were secured adjacent and parallel thereto. In order to increase the strength and rigidity of the construction, it is desirable that the entire strain or weight be sustained in vertical lines, and in order to secure this object I have so constructed the cooler that the longitudinally-extending portions of one corrugation are set into the corrugation of the next adjacent conduit, so as to bring said longitudinally-extending portions into perfect alinement. The longitudinally-extending portions and the transversely-extending portions of each corrugation do not meet in a right-angle but communicate with each other by connecting portions 13 extending at an angle of substantially 135 degrees to both the longitudinal and transverse portions. Each conduit is formed of oppositely-disposed parallel walls 14 and 15, and at the diagonal connecting portions 13 of the con-

duits these walls extend parallel and at an angle to the adjacent wall portions, and are spaced apart a distance equal to the width of the conduit at the longitudinally and at the transversely-extending portions thereof. The length of the diagonal connecting portions 13 is such that the walls of the longitudinally-extending portion 11 of each conduit at the point at which it bridges the corrugation of the adjacent conduit is in perfect alinement with the walls of each alternate extending portion of said last-mentioned conduit, thus greatly strengthening the construction as a whole, eliminating the right-angle turns in the conduits, and facilitating the flow of fluid therethrough.

For spacing the wall plates the proper distance apart, I preferably provide a wire 16 bent to the desired form and of any suitable shape, as, for instance, square in cross section. One of the plates, as plate 15, is of somewhat greater length than the opposite plate 14, and this longer plate is bent to extend across to the outer surface 17 of the wire 16 and to form an inwardly-directed flange 18 in engagement with the plate 14, as is clearly illustrated in Fig. 3. The wire at the intersection of the longitudinally-extending portion and the transversely-extending portion is of reduced cross section, so that the longitudinally-extending portions present straight vertical columns, the diagonal meeting line being largely concealed by the solder which is applied to secure the parts together. At a point closely adjacent the wire 16 the wall forming the inner surface of the corrugation is bent to form the diagonal inner wall of the connecting portion 13 of the conduit, so that the flow of the fluid through the conduit is unrestricted, but this diagonal wall is practically invisible from the outer surface of the cooler and does not detract from the straight column effect produced by the successive longitudinally-extending portions.

Preferably the walls forming the conduit are parallel at all points, but it is not essential that they extend perfectly straight. In Fig. 4, the longitudinally-extending portion 11^a is formed of parallel walls, but these parallel walls are each curved not only to increase the radiating surface, but also to increase the strength of the apparatus and to prevent the adjacent walls from collapsing under excessive strain. Identically the same spacing wires are employed in connection with the form illustrated in Fig. 4 as those illustrated in the other figures. In each case, the spacing strips or wires have straight longitudinally-extending portions and straight transversely-extending portions at the intersection of which there is a right angle on the inner side and a beveled or flattened surface on the outer side. Where the longitudinally-extending portions of each corrugation are also corrugated, these corrugations extend only to the spacing strips and are practically invisible from the front side of the cooler. In each case the straight column effect is produced and the union of the several conduits and their lines of intersection are concealed by the solder.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. An apparatus of the class described, comprising corrugated conduits juxtaposed to form intervening spaces or passages, the bends or corrugations in one conduit being in alinement with and bridged by corresponding corrugations of an adjacent conduit, and the bridging portion of each bend or corrugation being itself corrugated and communicating with each adjacent side portion by an unrestricted diagonally-disposed connecting portion having oppositely-disposed parallel walls.

2. An apparatus of the class described, comprising a plurality of corrugated conduits juxtaposed to form intervening spaces or passages, a portion of each corrugation of each conduit being itself corrugated, each conduit being formed of oppositely-disposed walls spaced apart to a uniform distance throughout their lengths.

3. An apparatus of the class described, comprising a plurality of corrugated conduits, each conduit including oppositely-disposed walls spaced apart at their edges by separate strips of metal of greater thickness than said walls and bent to present corrugations corresponding to the corrugations of the conduits, one of said walls being of a greater width than the other wall and being bent about said strip of metal and in engagement with the opposite wall.

4. An apparatus of the class described, comprising a plurality of corrugated conduits, each conduit including oppositely-disposed parallel walls spaced apart at their edges by separate strips of metal bent to present corrugations corresponding to the corrugations of the conduits, a portion of the walls forming said corrugations and intermediate said strips being itself corrugated.

5. An apparatus of the class described, comprising corrugated conduits juxtaposed to form intervening spaces or passages, the bends or corrugations in one conduit being in alinement with and bridged by corresponding corrugations of an adjacent conduit, and the bridging portion of each bend or corrugation communicating with each adjacent side portion by an unrestricted diagonally-disposed connecting portion, and each of said bridging portions being itself corrugated, the walls forming said conduits being spaced apart at their edge by strips of metal bent to present corrugations having

straight longitudinally-extending portions and straight transversely-extending portions meeting in a right angle at the inner side of each corrugation and being beveled or flattened at the outer side of each corrugation opposite to the right angle, whereby the ends of the apparatus present straight columns and straight transverse rows, and the body of each conduit is unrestricted and of uniform width.

6. An apparatus of the class described, comprising corrugated conduits juxtaposed and forming transverse passages or spaces between the adjacent conduits, each conduit being formed of a plurality of parallel runs or members and a plurality of intermediate runs or members, the parallel runs and the intermediate runs of each conduit being in alinement with corresponding parallel runs and intermediate runs of the adjacent conduits, the walls forming said conduits being spaced apart at their edges by spacing strips bent to present corrugations corresponding with the corrugations of the conduit, the adjacent runs of said strips meeting in an angle at the inner side of each corrugation and being beveled or flattened at the outer side of each corrugation, opposite to the right angle, whereby the ends of the apparatus present straight columns and straight transverse rows.

7. An apparatus of the class described, comprising corrugated conduits juxtaposed and forming transverse passages or spaces between the adjacent conduits, each conduit being formed of a plurality of parallel runs or members and a plurality of intermediate runs or members, the parallel runs and the intermediate runs of each conduit being in alinement with the corresponding parallel runs and intermediate runs of the adjacent conduits, and the walls forming each of the intermediate runs being connected to the walls of the adjacent parallel runs of the same conduit by wall portions paralleling each other and at an angle to both series of runs, and said walls being spaced apart at their edges by spacing strips of greater thickness than said walls and bent to present corrugations corresponding with the corrugations of the conduit, the adjacent runs of said strips meeting in an angle at the inner side and being beveled or flattened at the outer side opposite said angle, whereby the ends of the apparatus present straight columns and straight transverse runs.

8. An apparatus of the class described, comprising corrugated conduits juxtaposed and forming transverse passages or spaces between the adjacent conduits, each conduit being formed of a plurality of parallel runs or members and a plurality of intermediate runs or members, the parallel runs and the intermediate runs of each conduit being in alinement with the corresponding parallel runs and the intermediate runs of the adjacent conduits, the walls forming said conduits being spaced apart at their edges by strips of metal of greater thickness than said walls and bent to present corrugations having straight longitudinally-extending portions and straight transversely-extending portions meeting in a right angle at the inner side of each corrugation, and being beveled or flattened at the outer side of each corrugation opposite to the right angle, and the parallel walls forming one side of each corrugation being themselves corrugated, said corrugations terminating short of said spacing strips, whereby the ends of the apparatus present straight columns and straight transverse runs.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

D McRA LIVINGSTON.

Witnesses:
CLAIR W. FAIRBANK,
JOHN P. DAVIS.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents Washington, D. C."