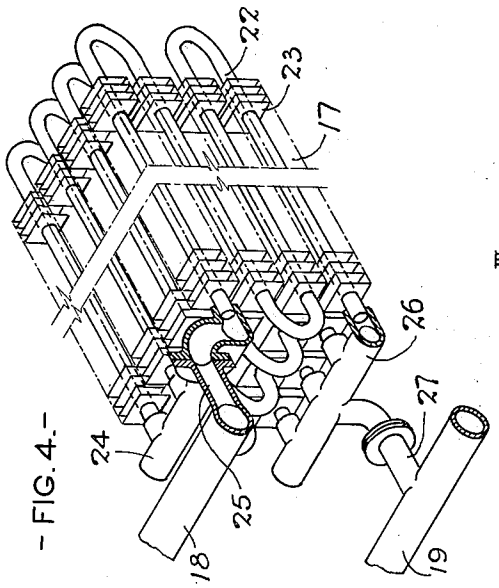
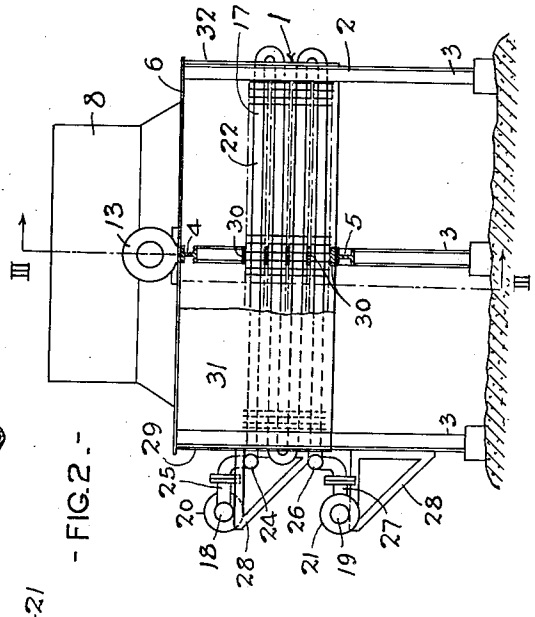
June 11, 1946. F. T. ELDER ET AL 2,401,918

AIR COOLED HEAT EXCHANGER

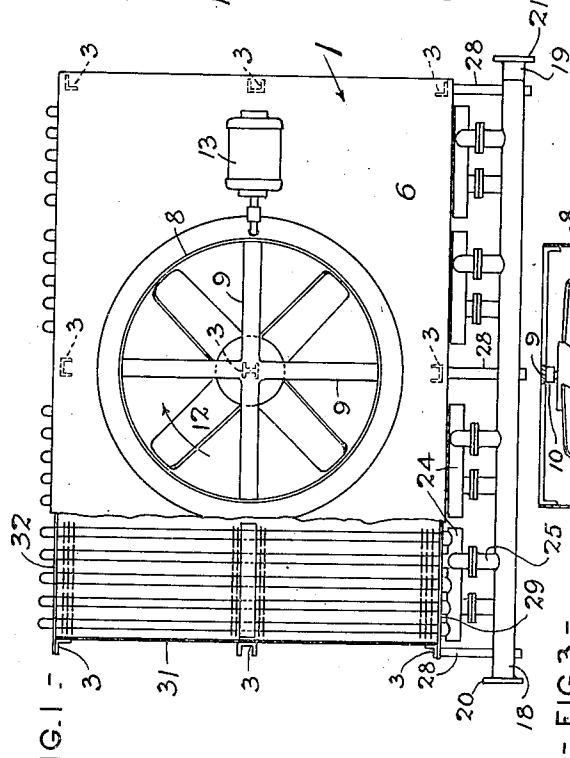
Filed July 25, 1944 2 Sheets-Sheet 1



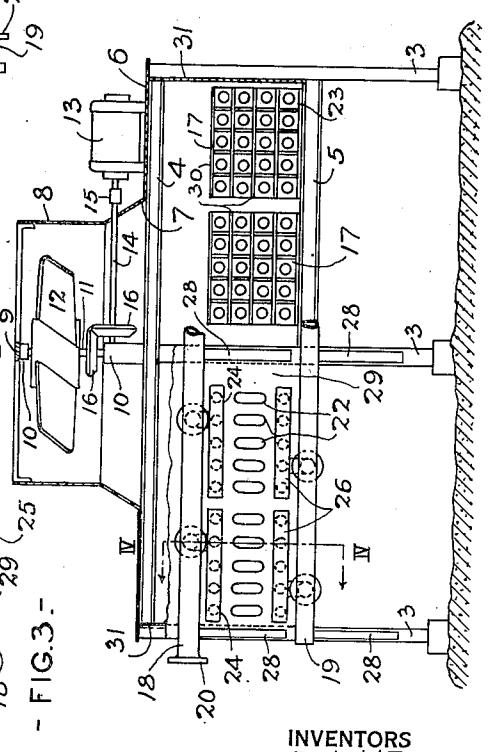
- FIG. 4. -



- FIG. 2. -



- FIG. 1. -



- FIG. 3. -

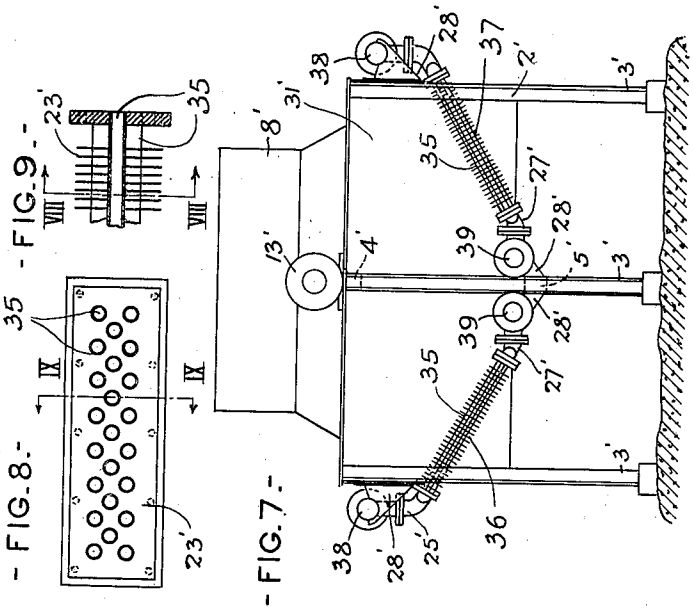
INVENTORS
Frederick T. Elder
George B. Farkas
Addison Y. Gunter

BY S. C. Yeaton
ATTORNEY

June 11, 1946. F. T. ELDER ET AL 2,401,918

AIR COOLED HEAT EXCHANGER

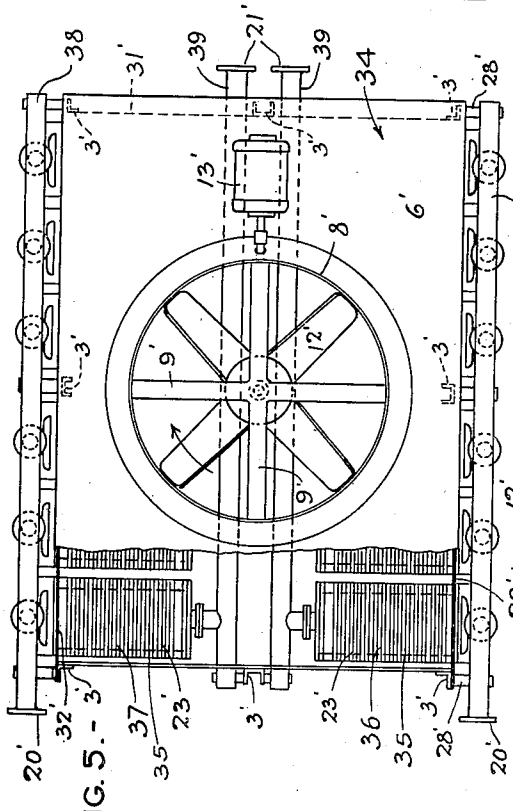
Filed July 23, 1944 2 Sheets-Sheet 2



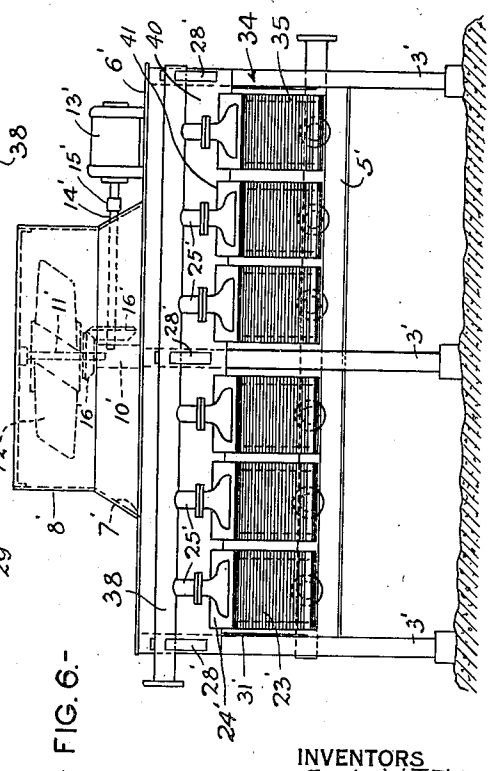
- FIG. 9. -

- FIG. 8. -

- FIG. 7. -



- FIG. 5. -



- FIG. 6. -

INVENTORS
Frederick T. Elder
George B. Farkas
Addison Y. Gunter

BY
S. C. Yeaton
ATTORNEY

Patented June 11, 1946

2,401,918

UNITED STATES PATENT OFFICE

2,401,918

AIR-COOLED HEAT EXCHANGER

Frederick T. Elder, Mountain Lakes, N. J., and George B. Farkas, Jackson Heights, and Addison Y. Gunter, Larchmont, N. Y., assignors to American Locomotive Company, New York, N. Y., a corporation of New York

Application July 25, 1944, Serial No. 546,476

1 Claim. (Cl. 257—137)

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This invention relates to air cooled heat exchangers in which heat is dissipated to atmospheric air from a fluid flowing within a coil or the tubes of a radiator core.

An object of the present invention is to provide an air cooled heat exchanger in which heat is dissipated to atmospheric air by indirect heat exchange with a fluid flowing through a conduit, the apparatus being open at all of its sides for the free influx of cooling air.

A further object is to provide a cooling apparatus as aforesaid having a fan for inducing an upward draft of air around the cooling tubes of the cooling apparatus.

A further object is to provide a cooling apparatus as aforesaid having the tubes thereof arranged in horizontal cores.

A further object is to provide a cooling apparatus open at all of its sides and provided with an induced draft fan as aforesaid, and having tubes arranged in inclined rows.

Other and further objects of this invention will appear from the following description, the accompanying drawings and the appended claim.

Referring to the drawings forming a part of this application, Figure 1 is a plan view of a cooling apparatus embodying the present invention, parts being broken away; Fig. 2 is a right end view of the apparatus, parts being broken away and parts being shown in section; Fig. 3 is a section on the line III—III of Fig. 2, part of the apparatus at the left side thereof being shown in front elevation; Fig. 4 is an enlarged perspective view of a portion of the core unit of the apparatus, partly in section on the line IV—IV of Fig. 3; Fig. 5 is a view similar to Fig. 1 showing another embodiment of the present invention, partly broken away; Fig. 6 is a front view of the apparatus of Fig. 5; Fig. 7 is a right end view of the apparatus of Fig. 5 with the end wall removed; Fig. 8 is an enlarged section of a tube core of the apparatus of Fig. 5 taken on the line VIII—VIII of Fig. 9; and Fig. 9 is a section on the line IX—IX of Fig. 8.

The present invention is applicable to heat exchangers generally, but more particularly to atmospheric cooling apparatus, especially gas cooling apparatus and jacket water cooling apparatus and to atmospheric condensing apparatus. An apparatus for cooling or condensing gas, such as the hydrocarbon gases, is shown in Figs. 1 to 4 and indicated generally by the reference numeral 1. It includes a frame 2 standing on nine legs 3 which rest on the ground, one of the legs being at the center of the frame. A longitudinal horizontal I-beam 4 is secured to the legs in the longitudinal center plane of the apparatus at their tops and a similar I-beam 5 is secured to these legs intermediate their ends, I-beam 5 being made in two parts secured by bolts (not shown) to the adjacent legs 3 so that they may be removed when desired. Below the I-beam 5 the frame is entirely open on all four sides to the atmosphere, and above the I-beam 5 it is closed, as will presently appear.

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The top of the frame is covered by a wall 6 having a central orifice 7 from which a collar 8 stands, the top edges of the collar being supported by cross braces 9. Bearing blocks 10 are secured one at the juncture of the braces 9 and one to the top of the center leg 3 and a vertical shaft 11 is journalled in these blocks. A fan 12 is secured to the shaft 11. An electric motor 13 is supported on the wall 6 outside of the collar 8 and a shaft 14 is connected at one end to the motor shaft by a coupling 15. Shaft 14 extends through an orifice in the collar and is journalled at its other end in the lower bearing block 10. Intermeshing bevel gears 16 are secured one on shaft 11 and the other on shaft 14 for driving the fan by the motor 13 in the direction of the arrow, Fig. 1. Fan 12 will draw air in through the four open sides of the frame below the I-beam 5 and force it out through the top of the collar 8.

A plurality of tube cores 17 form a core unit disposed within the frame between the I-beams 4 and 5, the cores being supported at their middle on the I-beam 5. The core unit includes a top inlet header 18 and a bottom outlet header 19, header 18 having a bolting flange 20 at the left end thereof (Fig. 1) for connection to a pipe leading from a source of gas supply under pressure (not shown), and header 19 having a bolting flange 21 at the right end thereof for connection to a pipe leading to a reservoir or other place of disposal (not shown) for the cooled gas.

The core unit includes four tube cores 17 as is clearly shown in Fig. 3. Each core includes five tubes 22 bent back and forth to form four vertically disposed series passes, square fins 23 being provided on the tubes. A header 24 is connected to the top inlet ends of the tubes 22 of each core, each header 24 being connected to header 18 by a nozzle 25. A header 26 is connected to the outlet ends of the tubes 22 of each core, each header 26 being connected to the header 19 by a nozzle 27.

Headers 18 and 19 are supported on brackets 28 secured to the front face of a wall 29 covering the front of legs 3 above the I-beam 5, that

is to say, over the front of the cores. The bottom leg of each tube 22 of each core is supported on a strip 30 disposed on top of the I-beam 5 and a similar strip 30 is indicated on top of the fins of each leg of each core, in line with the I-beam 5, for supporting the finned legs at their middles as is clearly shown in Fig. 2, the top strip 30 serving as a retainer for the tube legs of the tubes of each core. Strips 30 of each core are secured together by bolts (not shown).

The sides of the frame above the I-beam 5 are covered by walls 31 and the rear of the frame above the I-beam 5 is covered by a wall 32. The inlet and outlet ends of tubes 22 extend through orifices in the wall 29 and the U-bends of tubes 22 extend through slots in the walls 29 and 32. Thus the cores are supported by the brackets 28, the walls 29 and 32 and the I-beam 5. Walls 29, 31 and 32 are secured to the outside legs.

Another apparatus, indicated generally by the reference numeral 34, is shown in Figs. 5 to 9. It is similar in many respects to the apparatus 1 but distinguishes therefrom in having straight fin-tubes 35 arranged in inclined cores, the tubes 35 of each core being connected in parallel by a header member 24', one core unit 36 being in the front half of the apparatus and the other core unit 37 being in the rear half of the apparatus. Each unit has an inlet header 38 at the top and an outlet header 39 at the bottom, the units being separate. Apparatus 34 may be, for example, an atmospheric condenser or a jacket water cooler. If desired, when employed as a jacket water cooler, the tubes may be elongated in cross section with their wide dimension vertically disposed. Apparatus 34 will hereafter be referred to as a jacket water cooling apparatus.

The jacket water flows from the headers 38 downwardly through the tubes to the headers 39. The sides of the apparatus 34 are walled above the tubes similar to the apparatus 1 and open on all four sides below the tubes, the front and rear of the frame being covered above the tubes by plates 40 secured to the adjacent legs 3'. Each plate 40 has recesses 41 cut in the bottom thereof for the header members 24'. Other parts of the apparatus 34 corresponding to similar parts of the apparatus 1 are indicated by like reference numerals with an accent added.

The operation of the two apparatuses is similar. The fluid of each is delivered to the top header and taken off at the bottom header after flowing through the fin-tubes. While the fluid is flowing through the fin-tubes, an induced current of cold air is being pulled in by the fan through the four open sides of the apparatus below the tubes and blown out through the top of the collar around the fan. Thus the direction of natural wind is immaterial to the apparatus, as the induced draft fan makes this direction of no consequence, the fan drawing in air from all sides and always supplying the tubes with enough cooling air regardless of natural wind conditions. The air is in countercurrent flow with the fluid in the tubes in the apparatus of Fig. 1.

While there have been hereinbefore described approved embodiments of this invention, it will be understood that many and various changes and modifications in form, arrangement of parts and details of construction thereof may be made without departing from the spirit of the invention and that all such changes and modifications as fall within the scope of the appended claim are contemplated as a part of this invention.

The invention claimed and desired to be secured by Letters Patent is:

A cooling apparatus adapted to be disposed in the open for cooling by atmospheric air comprising a rectangular skeleton-like frame; a top wall secured to said frame and having a cylindrical chimney; an induced draft fan in said chimney for drawing atmospheric air upwardly therethrough; two inlet headers disposed exteriorly of said frame, one along the top portion of each of two oppositely disposed sides of said frame; outlet header means extending through the interior of said frame parallel to said inlet headers and between the top and bottom of said frame; a row of cross fin-tube cores connected in parallel to each of said inlet headers and the adjacent side of said outlet header means, the cores of one of said inlet headers forming a core unit and the cores of the other of said inlet headers forming another core unit, said units converging downwardly and inwardly from said inlet headers to said outlet header means, the cross fins of said cores each being a one-piece thin plate secured to and surrounding every tube of its correlated core, the fins on opposite sides of said outlet header means converging upwardly and inwardly toward said chimney; walls covering said sides above said tubes only, exposing the under faces of said tubes to the atmosphere; and walls covering the other two sides of said frame from said outlet header means to said top of said frame whereby the four sides of the bottom portion of said frame are open for the drawing therethrough of atmospheric air by said fan, said air being drawn across said tubes and parallel with said fins and being forced upwardly through said chimney.

FREDERICK T. ELDER.
GEORGE B. FARKAS.
ADDISON Y. GUNTER.