Feb. 2, 1943. E. I. HUFF 2,309,699

ANNEALING FURNACE

Filed Nov. 25, 1941 2 Sheets--Sheet 1

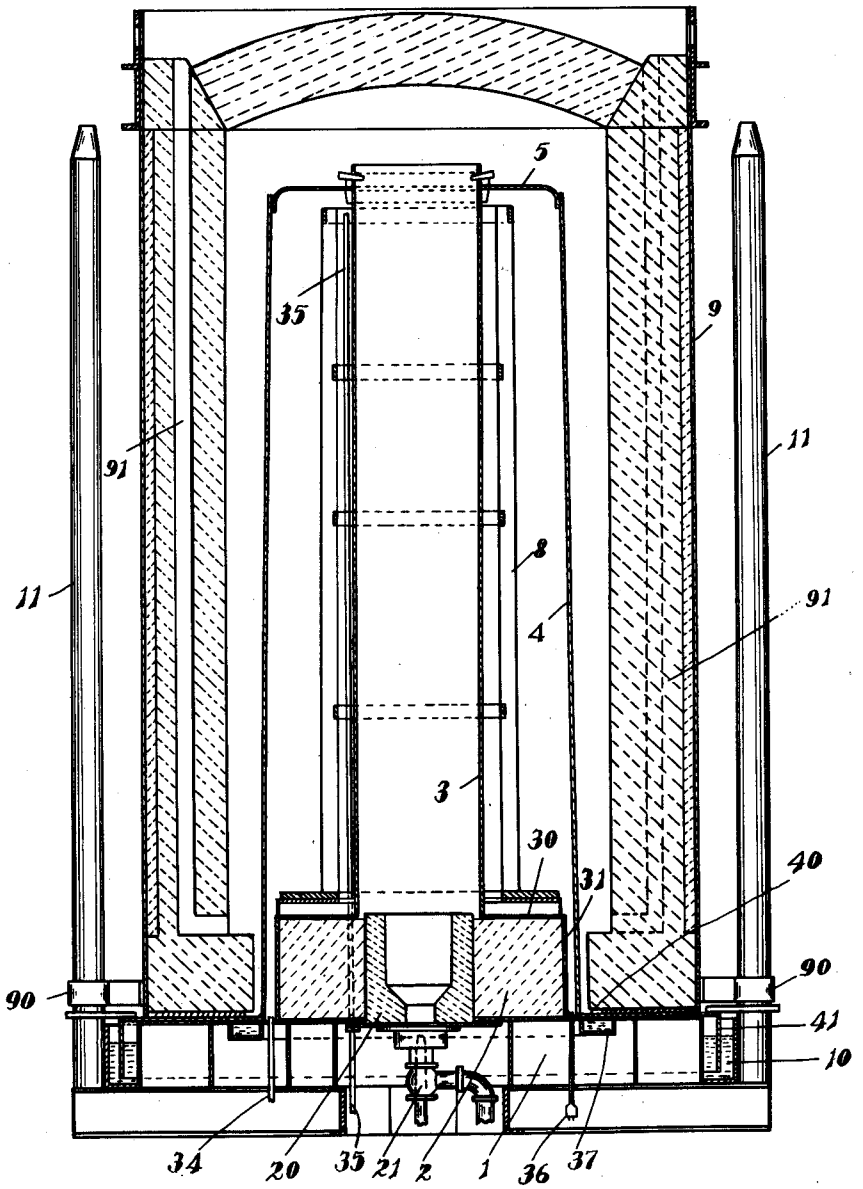


Fig. I.

INVENTOR
Edward I. Huff
BY
Christy, Parmelee and Strickland
ATTORNEYS

Feb. 2, 1943. E. I. HUFF 2,309,699

ANNEALING FURNACE

Filed Nov. 25, 1941 2 Sheets-Sheet 2

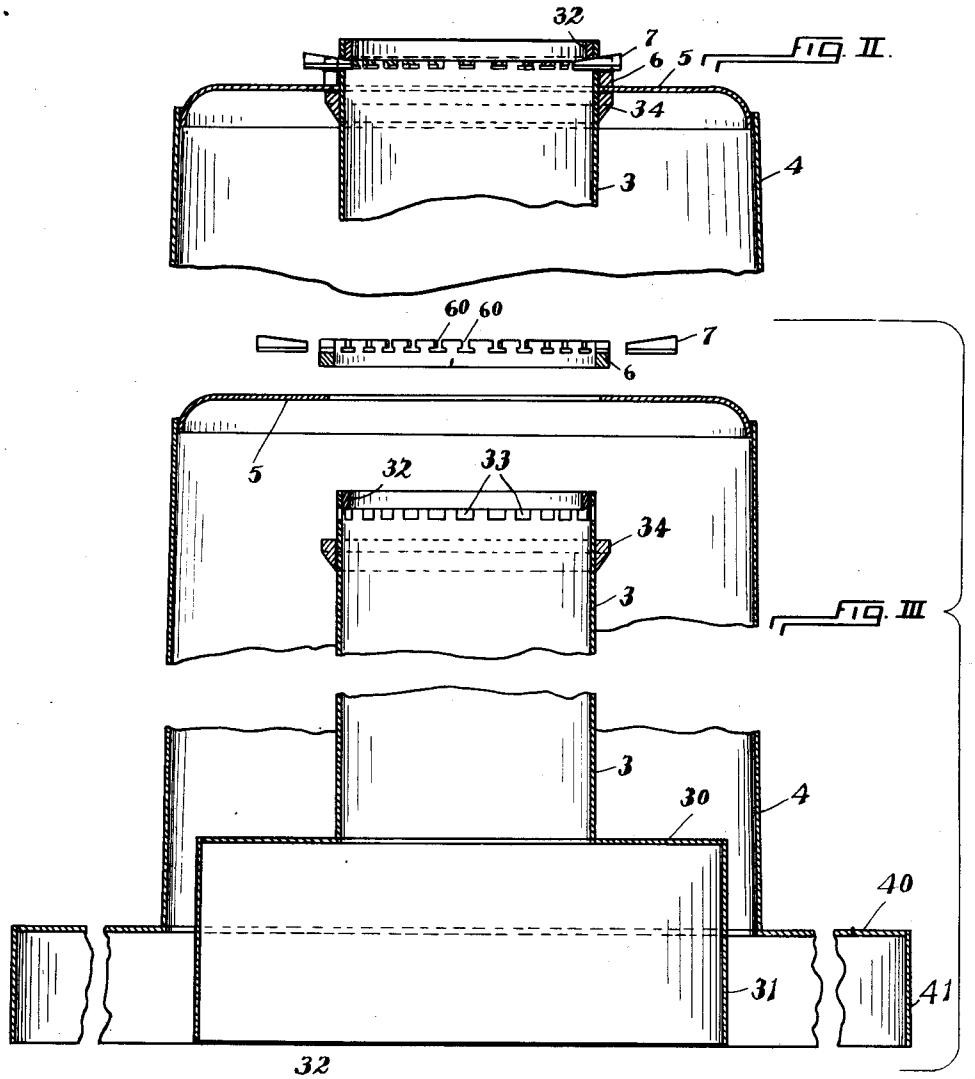


FIG. II.

FIG. III.

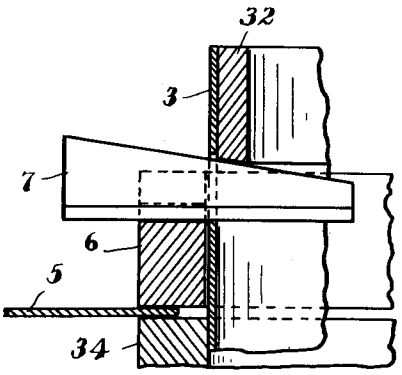


FIG. IV.

INVENTOR
Edward I. Huff
BY
Christy, Parmelee and Strickland
ATTORNEYS

Patented Feb. 2, 1943 2,309,699

UNITED STATES PATENT OFFICE

2,309,699

ANNEALING FURNACE

Edward I. Huff, Nutley, N. J., assignor to Huff Equipment Company, a corporation of Pennsylvania

Application November 25, 1941, Serial No. 420,393

1 Claim. (Cl. 263—49)

The invention relates to annealing furnaces; and, more particularly, to annealing furnaces of muffle type, adapted to the annealing of articles of annular shape, such as coils of wire or strip. Such furnaces have found practical application in the annealing of steel strip and wire; but manifestly are applicable in the annealing of articles of annular shape, regardless of whether the material be brought to annular shape by coiling or otherwise, and regardless of whether the articles be formed of steel or of other material that requires to be annealed. Furnaces of the type here defined are shown and described in prior patents granted on my application, Nos. 2,146,432, granted February 7, 1939, and 2,250,868, granted July 29, 1941. The invention is found in structural improvements that make for facility in operation and perfection of the product.

In the accompanying drawings Fig. I is a view in vertical and axial section of an annealing furnace in which are embodied the structural features of the invention; Fig. II is a fragmentary view to larger scale showing on the same plane of section with Fig. I the upper portion of the muffle and illustrating details of construction; Fig. III is a view similar to Fig. II, including, however, the basal portion of the muffle, and showing in "exploded" positions the parts that in Fig. II are shown in assembly. Fig. IV is a view to yet larger scale, and on the same plane of section, showing more clearly the manner in which certain separable parts are secured in the assembly.

The furnace includes a base, a muffle, and a hood. The base 1, ordinarily formed of structural steel, affords a table-like support for the muffle and the hood. Upon the table-like surface of the base rests a block 2 of refractory material which in the assembly affords insulation beneath the floor of the muffle chamber. The muffle is essentially a shell of heat conducting material (ordinarily steel, or steel alloy), which, resting upon the base, covers the work to be annealed. The hood is a larger shell of insulating material which, resting at its edges upon the base, encloses the whole. The heat for annealing is afforded by flame that finds passageway between the muffle and the hood, sweeping the outer surface of the muffle as it flows. The invention is found in the structure of the muffle of a furnace of the general character here indicated.

The muffle of the invention is intended primarily for the annealing of work of annular shape or arrangement, exemplified in coils of rolled steel strip; and, accordingly, it is annular in form (conveniently cylindrical, or substantially so) and includes inner and outer side walls and a top wall that closes from above the space between the side walls. The central space defined by the cylindrical inner wall is open above and in the assembly forms part of the passageway for flame. To such extent, the muffle is such as is shown in my prior patent, No. 2,250,868.

The muffle is formed as a two-part structure, separable upon a transverse line, and the invention is found in improvements in construction, to the end that: (1) the outer wall may be readily applied to and removed from assembly while the inner wall and the work are in place upon the base; (2) the hermetically secure union of the separable parts may be readily effected. Advantageously, and as here shown, the top wall is carried integrally by the outer wall of the muffle, and the line of separation is at the inner margin of the top wall and between the top wall and the inner side wall.

Referring to Figs. I and III of the drawings, the cylindrical inner wall 3 of the muffle is at its lower end provided with a horizontally and outwardly extending flange 30 and the flange is continued in a vertically and downwardly extending margin 31. In the assembly this flange encircles the block 2; and the inner wall of the muffle is supported on the base and makes practically hermetically sealed union with the block 2. The placement of the inner wall upon the base is a relatively permanent one; it will not ordinarily be disturbed in the prolonged and repeated use of the furnace. The outer wall 4 of the muffle is at its lower end similarly provided with a horizontally and outwardly extending flange 40 and the flange is continued in a vertically and downwardly extending margin 41. By its flange 40 the outer part of the muffle rests on the table-like surface of the base 1; and the margin 41 extends when the structure is assembled within a trough 10 of circular extent formed in the base; and, a suitable liquid being provided, the removable outer wall is, when applied, hermetically sealed at its lower edge.

The top wall 5 is essentially a plate of annular shape. At its outer margin this plate is united integrally with the outer wall 4. The cylindrical inner wall 3 in the assembly extends through the central orifice of the annular plate and extends vertically beyond it.

The two parts of the muffle are assembled in the union that is particularly illustrated in Figs. II–IV. It is a union that may readily be made and broken, and a union that, being made, is hermetically tight. The inner wall 3, reenforced

at its upper edge, as by an internally arranged annulus **32**, is, immediately beneath such re-enforcement, provided with a circumferential line of orifices **33**. At a suitable and relatively small interval below the orifices **33** the wall **3** is shouldered exteriorly, as by an applied and integrally secured annulus **34**. Upon this shoulder the otherwise free edge of the annular plate that forms the top wall **5** is clamped. The assembly is best shown in Fig. IV. A clamping ring **6** is provided which, when the two parts of the muffle have been brought together with the top wall **5** resting upon the annulus **34**, is slipped over the upwardly protruding end of the cyclindrical wall **3**, and caused to rest upon the upper face of the top wall **5**. The clamping ring **6** is provided around its upper edge with a circumferential succession of slots **60**. The slots **60** correspond in number and spacing to the orifices **33** in the wall **3**, and when the ring **6** is applied its slots are brought to alignment with the orifices **33**. Wedges **7** then are introduced into and are driven home in the aligned openings. The lower surface of the annulus **32** is so shaped and the dimensions and configuration of ring **6** are such that the in-driven wedges find opposed bearings upon the surfaces of these members, with the effect of forcing the ring **6** downward and clamping the edge of the wall **5** securely and in hermetically tight engagement upon the shoulder of the annulus **34**. The number of wedges is shown to be great (twenty-four in a complete circumference) and such multiplicity insures accuracy of fit and security of union. The slots **60** are shown to be refined in shape, widened at the bottom in doubly rabbetted recesses, and the wedges are correspondingly shaped: this to the end that the stress of wedging shall be more widely and evenly spread and distributed.

Removable from but resting upon the basal flange **30** of the inner wall **3**, and in the assembly suitably disposed within the muffle, is a coil-holder **8**. It consists of a base plate and vertical bars suitably spaced and secured to the base plate and to one another and it serves to guide the work to be annealed in the loading and unloading of the furnace, and to maintain the work suitably spaced within the walls of the muffle.

The hood **9** is of conventional and well-established form and structure. It is removable and replaceable upon the table-like base, and it will be noted that the outward extending basal flange **40** of the outer wall of the muffle is by the weight of the hood clamped to the table-like base of the furnace. Guiding-posts **11** that rise from the base, being engaged by guide-rings **90** borne by the hood, serve to bring the hood, when applied, accurately to position. Within the walls of the hood flues **91** are formed that lead from within the hood below to the open air above.

The block or stool **2** is centrally ported, and the porting of this block and the opening of flues through the walls of the hood afford a line of flow for flaming gases within the hood and exteriorly of the muffle. As here shown, a centrally perforate burner block **20** is set in the central port in block **2** and through the burner block upwardly from below is injected a stream of combustible fluid. The combustible fluid may be liquid or gaseous (or it may even be finely divided, solid fuel borne on a stream of air). In the drawings an oil burner **21** is shown, arranged to project its jet of combustible mixture axially upward within the burner block **20**. The fuel ignites in the burner block, and the flames stream upward through the columnar space defined by the inner wall **3** of the muffle, spread beneath the dome of the hood and over the upper end wall of the muffle, stream thence downward over the outer surfaces of the muffle wall **4**, and find egress through the flues **91**.

An inert or a reducing atmosphere may be maintained within the muffle and during the annealing operation through the pipe connections **34**, **35**. A thermo-couple is indicated at **36**, by means of which operating temperatures may be known, and in response the fuel supply may be properly adjusted. Conduits **37** may be provided for water-cooling for the protection of metal parts exposed to the heat of the flame.

In service, the base with its block **2** and the inner wall **3** of the muffle are to be regarded as permanent in placement. When material is to be annealed, it is first mounted upon the coil-holder **8**, and the coil-holder with its burden is then applied over the upper end of the stationary wall **3** and brought to the position relatively to the wall **3** that is shown in Fig. I. The outer part of the muffle is then applied; the clamping ring **6** is brought to place; and the wedges **7** are set in the aligned openings **60**, **33** and are driven home. Finally, the hood **9** is applied, and the assembly is completed. The burner then is lighted and annealing proceeds in normal manner. The even flow of the flame through the perfectly symmetrical structure has effect in an annealed product of highly perfected uniformity. When the heating cycle is nearing completion, in place of fuel for ignition, a cooling stream of air may be injected through the burner and thence over the heat-exchanging walls of the muffle within the hood.

When the furnace is to be unloaded, the operations are performed in reverse order. The flow of fuel being cut off, the hood is first removed. The wedges then are loosened and withdrawn; the outer part of the muffle is raised and carried out of the way; and then the coil-holder **8** with its burden of work is removed; and, finally, the annealed material is removed from the coil-holder.

I claim as my invention:

A muffle for an annealing furnace including inner and outer walls of cylindrical form and a top wall with central orifice closing from above the space between the walls, the top wall being integrated at its outer margin with the outer wall, and the inner wall constituting a separable part and in the assembly extending through and beyond the central orifice in the top wall, the inner wall being shouldered externally, a clamping ring applicable to the upper end of the inner wall, and wedges adapted to engage the inner wall and the clamping ring and to clamp the inner margin of the top wall upon the shoulder of the inner wall.

EDWARD I. HUFF.