Feb. 21, 1933. L. L. LEWIS 1,898,674

ANNEALING ART

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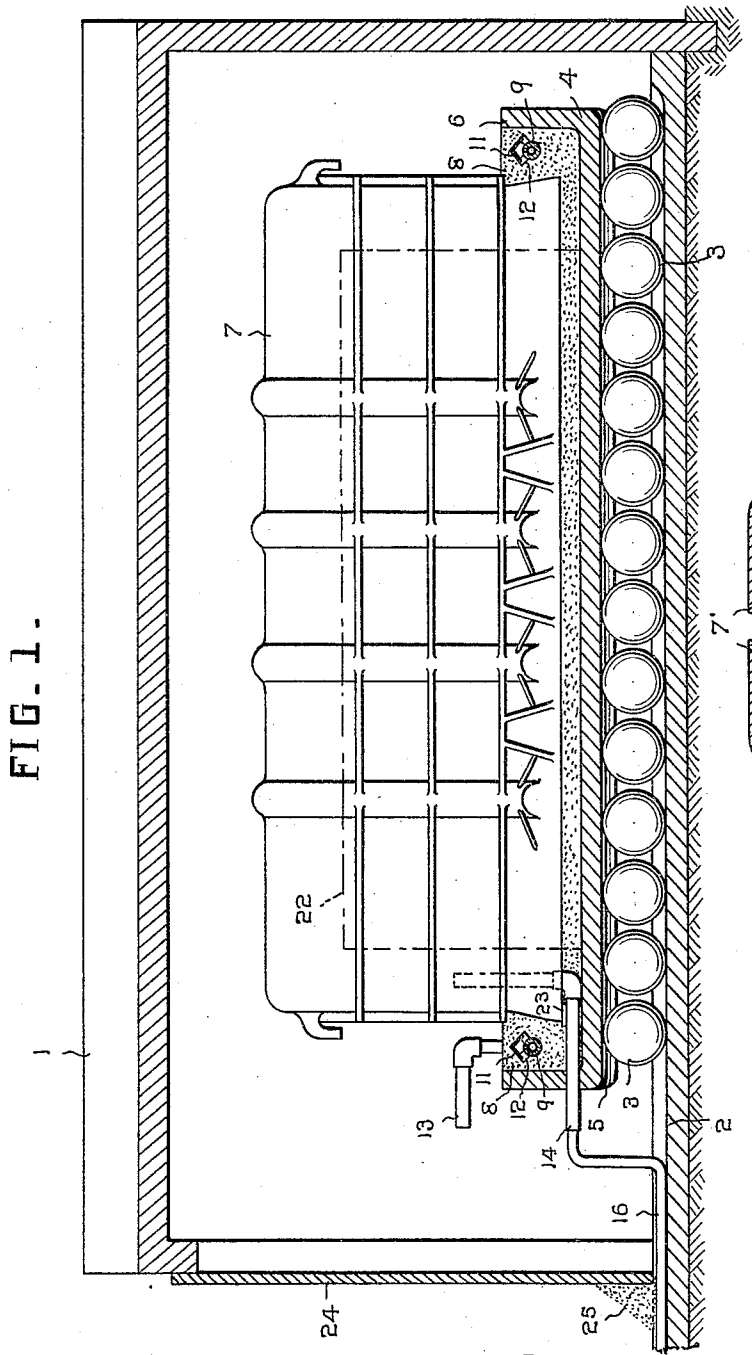


FIG. 1.

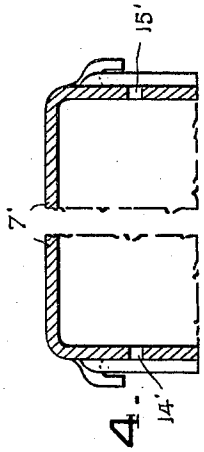


FIG. 4.

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FIG. 2.

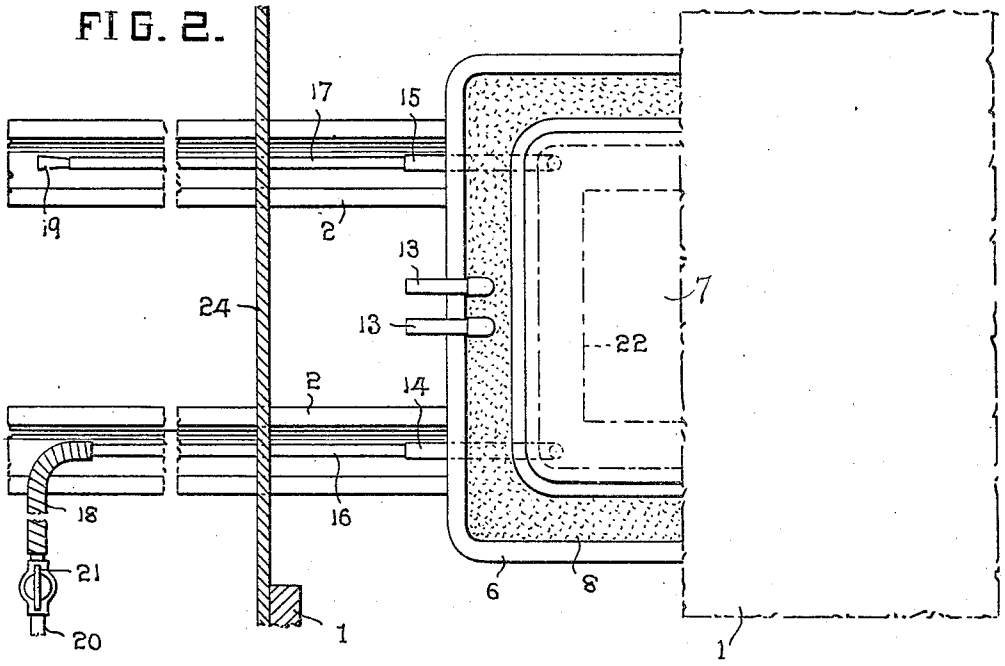
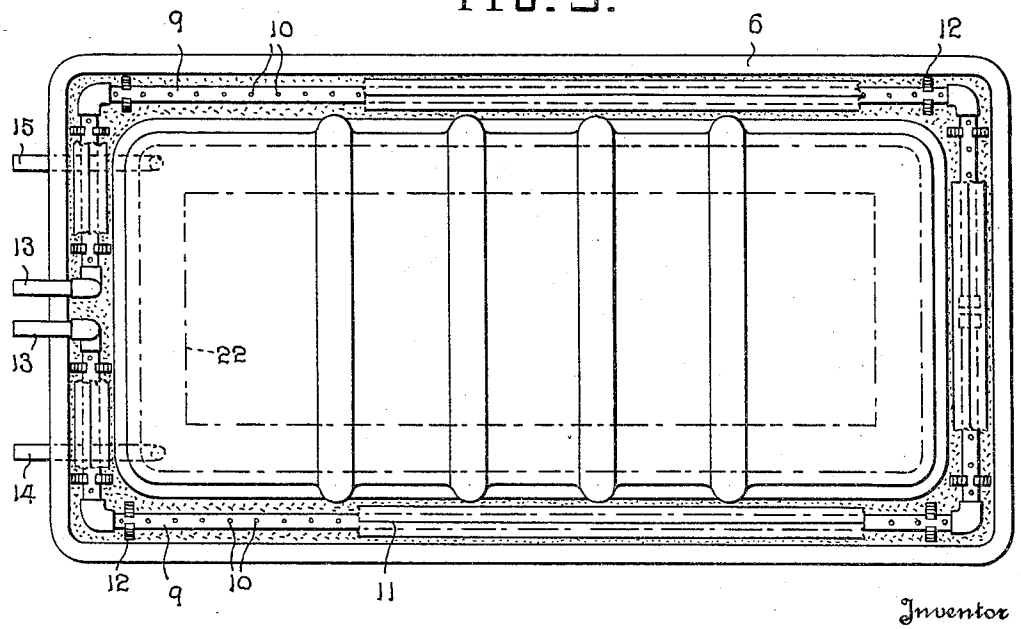


FIG. 3.



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UNITED STATES PATENT OFFICE

LESTER L. LEWIS, OF NEW CASTLE, PENNSYLVANIA, ASSIGNOR OF TWO-THIRDS TO BLAIR STRIP STEEL COMPANY, OF NEW CASTLE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

ANNEALING ART

Application filed September 3, 1930. Serial No. 479,537.

This invention relates to improvements in the art of bright annealing and apparatus for practicing such art, and refers more particularly to the treating of metal for eliminating discoloration and increasing ductility beyond the results obtainable by the practicing of the invention of my co-pending application filed December 2nd, 1929, Serial No. 411,179.

In said co-pending application there is disclosed an art and apparatus for bright annealing metal work which is unusually successful and far superior to the former standard practice and known or proposed processes and apparatus in the annealing art; but, according to the invention of my said co-pending application, residual oxygen or discoloration agents initially in the pot or on the work are not necessarily to be eliminated, and no provision to that end is made subsequent to the beginning of the heating operation, so that, while bright work results from the invention of my said co-pending application, some touching of the edges of the work is liable to and frequently does occur.

It is an object of the present invention to eliminate all discoloration and incident to this object it is a more detailed object of the present invention to actually remove and effectively dispose of all discoloration-producing agents from within the housing or on the work at the time of the beginning of the heating operation.

With these and other objects in view as will in part hereinafter become apparent and in part be stated, the invention includes both the art of physical removal of discoloration agents from contact with work combined with preservation of the work free from such contact during the cooling operation subsequent to annealing temperature, and the combination of cooperating parts well adapted for effecting these results.

As set forth in greater detail in my above-identified, co-pending application, standard practice includes raising work to be annealed to an annealing temperature for the requisite time, and then cooling of the work all while the work is held in a housing or container commonly referred to as an annealing pot, and it is also standard practice to endeavor to prevent access of air or other discoloration agents to the work by sealing the joint of the pot with its supporting tray by applying comminuted material, such as iron filings, sand, or the like; and it has, furthermore, been proposed to further aid in eliminating discoloration by discharging residual gases and moisture from the pot during the heating operation, and by supplying gas to the interior of the pot during cooling operation; but these proposed modes have not successfully prevented discoloration, largely due, very probably, to ingress of air and other discoloration agents through the comminuted seal during the cooling of the annealed work. By providing for supplementing the comminuted seal with a gaseous seal permeating the comminuted seal, as disclosed in my above-identified, co-pending application, I have been able to successfully prevent access of discoloration agents through the seal to the work as it is being cooled in the annealing pot, and have, accordingly, been able to produce uniformly bright work of an especially high degree of ductility, but, as practiced in accordance with the disclosure in my said co-pending application, the invention of that application does not wholly eliminate discoloration, and the object of the present invention includes complete freedom from coloring of the work.

The invention includes the art or method of annealing work whereby elimination of discoloration-producing agents from the annealing pot during the baking of the work and the sealing of the work against ingress of discoloration agents during cooling is obtained, and also includes certain novel constructions, combinations, and arrangements of parts well adapted for practicing said method; and, since the method or art will most readily be understood by reference to the specific construction preferably employed in the practicing of the method, reference will be had to the accompanying drawings in which,—

Figure 1 is a sectional elevation through a part of a furnace and the tray of an annealing pot, parts being seen in elevation.

Figure 2 is a fragmentary plan thereof, parts being broken away and parts seen in section and other parts in top plan.

Figure 3 is a plan view of the pot and tray after removal from the furnace and while in condition for cooling, except that parts of the comminuted seal have been omitted, and parts of the shield for the gas-distributing pipes have been broken away for disclosing the gas distributor.

Figure 4 is a fragmentary, vertical section through an annealing pot similar to that seen in Figure 1, except being provided in the pot itself with intake and exhaust ports.

Referring to the drawings by numerals, 1 indicates any well known or standard annealing furnace having the usual grooved tracks 2, 2, in the grooves of which are arranged the balls, or other roller bearings, 3, 3, on which latter is mounted the tray 4, which is of customary or standard form. The under face of tray 4 is provided, as usual, with ball-receiving grooves 5 to enable the balls 3 to guide the tray 4 in its movement along tracks 2. The tray 4 is formed with a marginal, upstanding flange 6 extending completely about the tray, the tray being of sufficient size to receive and accommodate the annealing pot 7 with a space between the outer surface of the pot and the inner surface of flange 6, which space, during heating and cooling of the work being annealed, is supplied, preferably filled, with comminuted material 8. Embedded in the material 8, preferably between pot 7 and flange 6, are gas jetting pipes 9, 9, having discharge openings or jets 10, 10, preferably discharging upwardly toward an angle baffle 11 sustained by appropriate brackets 12, 12 disposed between the baffle 11 and the respective parts of pipes 9 and resting on the pipes. Pipes 9 are adapted to receive gas from a source, not illustrated, through supply connections 13, 13, but, as will be hereinafter pointed out, the gas is supplied only during the cooling operation. The seal 8 is preferably located on the tray 4 in part before the pot 7 is lowered onto the tray, so that the free margins of the pot rest on a portion of the seal and compress the seal to aid in excluding interchange of atmosphere between the interior and exterior of the pot.

The structure thus far disclosed is identical with that set forth in my above-identified, co-pending application, and may be employed for the practicing of the invention of said application.

In combination with said parts I employ apparatus for treating the contained work within the pot 7 during the heating operation and for protecting such work during cooling as a supplement to the protection afforded by the operation of the parts above described. It will be understood, of course, that after the pot 7 has been lowered, the balance of the seal 8 is located in place, and during the placing of the seal the pipes 9 are disposed to be embedded in the seal. With the larger sizes of pots, which are liable to distribute an enormous amount of heat when first drawn from the furnace, it is preferable to place the gas distributing pipes 9 and to cover the same with the comminuted seal before the parts are inserted into the furnace; but it is preferable in handling smaller pots, or where the conditions are such that the heat does not prevent adjacent operations, to only partially fill the space between flange 6 and pot 7 with the comminuted seal until the pot is withdrawn from the furnace, and to then locate the gas distributing pipes and cover the same with the comminuted material to the condition seen in Figures 1 and 2.

An intake pipe 14 extends from the exterior to within pot 7, and a similarly arranged discharge pipe 15 correspondingly extends from within pot 7 to the exterior thereof. The location of pipes 14 and 15 is capable of a wide range of variation, and any serviceable arrangement may be employed so long as care is exercised to avoid injuring, altering or molesting the seal 8 after the parts have been withdrawn from the furnace. As one convenient arrangement or location of pipes 14 and 15, each may consist, as seen in the drawings, of an L-shaped piece of tubing having a horizontal portion extending through the flange 6 outward beyond the front of the tray 4, the inner portion of the tubing 14 or 15, as the case may be, upstanding within the pot 7 and having an open, inner end. A slip joint extension 16 and a similar extension 17 are provided, the former for pipe 14 and the latter for pipe 15, each being so located as to lie within the groove of the respective track 2 when the parts are in the furnace, said extensions being inserted preferably manually into respective pipes 14 and 15 and extending outwardly therefrom so as to extend beyond the wall of the furnace for observation and treatment during the course of the heating of the annealing pot and its contents. A flexible hose or other appropriate supply pipe 18 connects with the outer end of extension 16 and a plug or other appropriate shut-off 19 is provided for the pipe 17. Flexible connection 16 receives a gas supply from any appropriate source through a pipe 20 valved at 21, so that the supply of gas through pipe 14 may be turned on and off, as required.

The present improved art will be readily and fully understood by reference to the preferred mode of operation of the parts described.

It should be understood that the present invention does not contemplate any change or modification from standard practice so far as temperature ranges are concerned or the time required for heating the work being an-

nealed or for cooling the same. In fact, one of the great advantages of the present invention and of the invention set forth in my above-identified, co-pending application is the fact that both lend themselves effectively to successful use with standard equipment operating under standard conditions, and in accord with well known practices, modified only in matters of control which require practically no modification of the equipment already in use save for slight additions thereto with apparatus which does not call for structural change in such equipment.

It should be understood that the present invention is applicable for effective use and highly gratifying results are obtained in the treating of various classes of work, and, in fact, no work to be annealed fails to come out in a superior condition when treated according to the present invention from that obtained by standard practice. For example, deoxidized steel or clean cold rolled plates annealed according to the present invention will be found to be perfectly bright throughout, and black iron sheets will respond to the extent that, when completed, they will be found to have a clear grey color free from spots, stains or black portions. The process is the same for any class of material as for all others, and variation in time of treatment and degree of heat employed will be the same as now commonly employed as standard practice.

Work, such as coils or plates, is arranged on tray 4, as indicated by the dot-and-dash line 22, and a portion of the sand or other comminuted material 8 is located about the margins of tray 4 outward of work 22. This is done, of course, outside the furnace. The pipes 14 and 15 are positioned, if not already in place, and the pot 7 is lowered onto the tray to enclose the work 22 and rest on the seal 8. Then additional comminuted material is introduced to the required level between flange 6 and pot 7, and then the pipes 9 are preferably positioned, although this may be done later where conditions, such as heat emanation, permit effective operation as near the pot as required for locating the pipes 9. If the pipes are not to be located until after the heating operation, the sand or other comminuted material is left at about the level where the pipe 9 is to rest, and the pipe is located in place and the comminuted material filled in upon it and on the baffle 11 after the heating operation; but for larger pots and for usual conditions, it is preferable, before the pot is moved into the furnace, to locate the pipe 9 with its baffle 11 and fill in the comminuted material on top of the same and tamp it down, so that the space between flange 6 and pot 7 is completely filled with comminuted material. As a precaution against possible injury to pipes 14 and 15, because of the weight of pot 7, a block of iron or like support 23 is preferably provided adjacent each pipe 14 and 15 on which the edge of pot 7 may rest to avoid pressure on the pipe and, though the block 23 and pipe 14 are seen in Figure 1 as if no sand or other comminuted material was in contact therewith, in fact both the block and pipe are carefully packed in the comminuted material so as to seal up the complete line of jointure between pot 7 and tray 4. The parts being in this condition outside the furnace and the tray 4 resting on balls on track 2, the tray and parts carried thereby are moved along the balls through the doorway of furnace 1 to the position seen in Figure 1. As soon as this position is reached, the operator removes those balls 3 which are in the way and inserts the extension pipes 16 and 17 respectively into pipes 14 and 15, and then closes the door 24 of the furnace 1. As the door must close above the tracks 2, it is preferable to seal the joint of the door by filling in with sand or like comminuted material 25. The parts are left in the furnace in this condition until the requisite temperature is attained and maintained for the required time for annealing. As the temperature begins to rise, the moisture, lubricant, and other agents on the surface of the work or in the fiber of it, as well as residual air in pot 7, will begin to expand, and, therefore, to discharge through pipe 15 and its extension 17, the plug 19 being left out. The discharge through the pipe 17 will be manifest by the issuing of fumes, (smoke and vapor), varying in color at various times according to the substances being discharged. As the fumes begin to issue from pipe 17, gas is turned on at the valve 21, the flexible connection 18 having been connected up with pipe 16, and the parts are left in this condition with gas feeding through pipes 16 and 14 to the interior of pot 7 and fumes exhausting through pipe 17 until no further exhaust occurs. The gas employed may be natural gas, producer gas, or any other appropriate gas so long as it is neutral in its action on the contained work. Natural gas and producer gas may require drying by known processes to free them from discoloration-producing agents, and, of course, whatever gas is employed will be rendered neutral before being supplied to the pipe 20. As the heating of the work continues, the exhausting fumes through pipe 17 will diminish until cessation occurs so far as visibility is concerned. The operator then tests for the presence of fumes exhausting from pipe 17, and such tests should continue from time to time until no further exhaust occurs. Any acceptable or known tests may be employed, it being preferable by me to place a plate or sheet of metal or other appropriate material across and slightly spaced from the open end of pipe 17 from time to time and observe the collection of moisture or of carbon or other fumes

deposits thereon. When no deposit occurs on the testing plate, the operator inserts the plug 19 and turns off the valve 21. The work is then left in the furnace under the required temperature for the necessary time for annealing, according to standard practice, and then the tray 4, pot 7, and connected parts are withdrawn from the furnace by being moved on balls 3. It will be understood by those familiar with this industrial art that balls along track 2 are removed when the door 24 is to be closed, and when door 24 is opened for the withdrawal of the pot, the extension pipes 16 and 17 will be rotated to an upper position without disconnection from pipes 14, and the formerly removed balls will be replaced on the tracks so that the pot 7 can be readily moved out to the cooling position. As the pot 7 reaches the cooling position, gas connections (not illustrated) are applied to the pipes 13 and gas is turned on under pressure sufficient for causing the gas to discharge through jets 10 and be distributed within the comminuted seal 8 and rise therein against air pressure. The gas escaping from the seal 8 is preferably ignited and burns with a blue flame. If a yellow flame should appear at any point that would indicate a breach in the seal which should be immediately repaired by applying additional comminuted material. It is not a necessary pre-requisite that the gas be ignited, but the burning gas affords a reassurance that gas is being effectively distributed throughout the seal, and after the gas has burned for perhaps an hour or such a matter to absolutely assure the operator of proper conditions, he may, if he desires, momentarily cut off the supply of gas so as to extinguish the flame and then turn the gas on again without ignition. The unignited gas, of course, may be supplied only with safety where effective provision is made for ventilation, since the pot is cooled in the open air but customarily under cover, that is, within the general enclosure of the plant.

The gas supplied through pipes 13 is preferably also neutral gas, but ordinary natural gas may be used, or other gases untreated, such as should not be ordinarily used through pipe 15, because gases delivered through pipe 13 are subjected to such high temperatures within the sand or other comminuted material 8 that whatever gas seeps through the sand to the interior of pot 7 as vacuum tends to form therein with the cooling down of the parts will be thoroughly dried and rendered neutral before reaching the interior of the pot. As a matter of precaution, it is well, of course, to be certain that the gas is neutral before it is delivered to pipes 13.

The discharge of gas through pipes 13 continues and the seal 8 is supplemented by the sealing action of the thus delivered gas for the period of cooling down, that is, from the time the pot is removed from the furnace to the time the pot is ready to be lifted from the work. When the pot is removed from the work, after the practicing of the invention as set forth, it will be found that the plates, coils, or whatever the work may be, will be clean and bright and free from discoloration of any kind or marginal defect, and there is no loss of material from lack of brightness.

In those instances, such as when handling small pots, where it is practical for the workman to operate near the pot when it is first withdrawn from the furnace, it is possible to defer positioning the pipes 9 until the pot is withdrawn from the furnace, and in that case the pipes 9 are applied and the additional comminuted sealing material supplied as promptly as possible after the removal of the pot from the furnace, and the operation is carried out thereafter as above described.

Among the many, almost limitless, demands for bright annealed products is wire to be copper-plated and other articles to be treated where brightness is a pre-requisite, and by the present improved process and apparatus I am able to produce products of a brightness obviating necessity for supplemental cleansing or abrading. Ordinary cold rolled material or deoxidized plates come out as bright and shining as new aluminum, while black iron annealed according to the present invention presents the appearance of a grey plate fully equal to the modern deoxidized plate produced according to standard practice.

It is not necessary to locate the exhaust from the pot, exemplified in exhaust pipe 14, at any exact place or to limit the form of exhaust pipe or even to check exhaust during the heating of the work except insofar as the plugging of the exhaust port affords saving in the consumption of gas. Also, it should be apparent that the gas supply may be introduced into the pot at any convenient and available point. As illustrative of modified locations of intake and exhaust for the annealing pot, there is shown in Figure 4 an annealing pot 7′ identical with annealing pot 7, except that an exhaust port 15′ is provided through the rear end wall, and an intake port 14′ is provided through the front end wall. With these ports may be connected any appropriate piping, such as will supply gas through port 14′ and will lead the fumes from port 15′ to any desired place of discharge. In fact, port 15′ may be left just as is shown in Figure 4 with no pipe connections, and the fumes may exhaust directly into the furnace, but in this event there must be a continuous supply of gas through port 14′ throughout the heating operation and until the annealing pot is withdrawn from the furnace and the port 15′ closed. It will be understood, of course, that no discoloration

of the work occurs while the work is in the furnace and subjected to annealing temperature, but the deposits on the work begin to occur as the work begins to cool, so that it is entirely feasible to withdraw the pot 7′ from the furnace with port 15′ open, and then plug or otherwise close the port 15′ before the work has an opportunity to begin cooling. The other steps of the art will be practiced as above described.

What is claimed is:—

1. The art of bright annealing metal work, comprising raising the work to annealing temperature in a container and maintaining the work at such temperature for a sufficient period for annealing, exhausting fumes from the container during the heating and maintenance of the heated condition of the work, sealing the work with a comminuted seal, gas treating the seal for preserving the container against access by discoloration-producing agents, and cooling the work while maintained thus sealed.

2. The art as claimed in claim 1 wherein the exhausting of the fumes is accompanied by the supplying of a neutral gas to the container for the work.

3. In the art of bright annealing metal work, raising work to an annealing temperature in a container and maintaining the work at the requisite temperature for the required period for annealing, exhausting fumes from the container for the work during the heating operation, sealing the work with a comminuted seal against access of discoloration-producing agents from the exterior of the container, cooling the work, and permeating portions of the comminuted seal with a supplemental sealing gas during cooling of the work.

4. The art as claimed in claim 3 wherein the exhausting of fumes is accompanied by the introduction of a neutral gas to the container for the work.

In testimony whereof I affix my signature.

LESTER L. LEWIS.