May 22, 1923. 1,456,136

J. W. F. MACDONALD

APPARATUS FOR HEATING AND COOLING

Filed Dec. 5, 1918

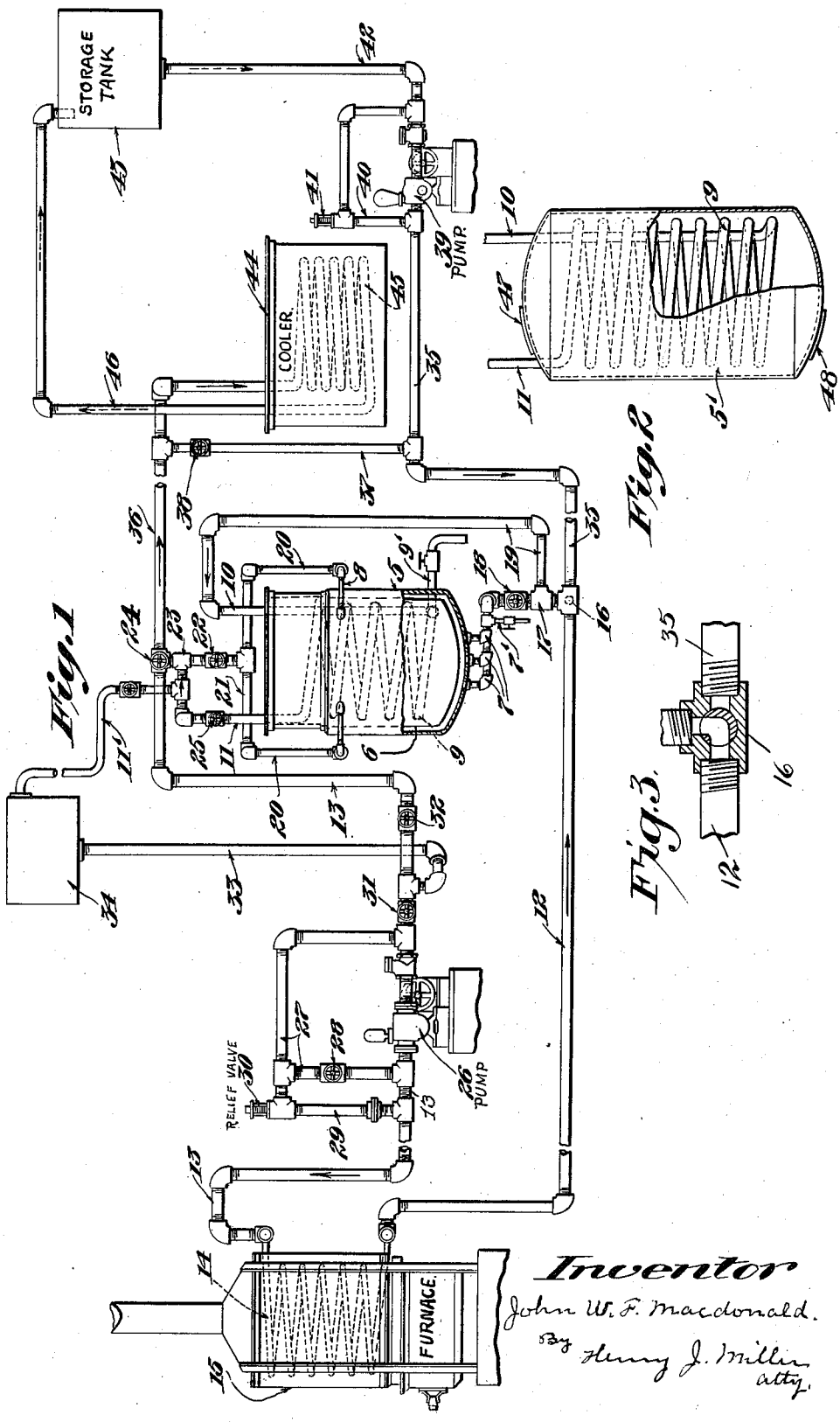


Fig. 1

Fig. 2

Fig. 3.

Inventor
John W. F. Macdonald.
By Henry J. Miller
Atty.

Patented May 22, 1923. 1,456,136

UNITED STATES PATENT OFFICE.

JOHN W. F. MACDONALD, OF BRIGHTON, MASSACHUSETTS, ASSIGNOR TO THE MERRILL PROCESS COMPANY, A CORPORATION OF MASSACHUSETTS.

APPARATUS FOR HEATING AND COOLING.

Application filed December 5, 1918. Serial No. 265,386.

To all whom it may concern:

Be it known that I, JOHN W. F. MACDONALD, a citizen of the United States, and a resident of Brighton, in the county of Suffolk and State of Massachusetts, have invented a certain new and useful Apparatus for Heating and Cooling, of which the following is a specification, reference being had to the accompanying drawings, forming part thereof.

This invention relates to an improved apparatus for treating material of any kind by heating and cooling the same without removal of said material from the container in which the first of said steps, either heating or cooling, has been accomplished.

In the treatment of sodium and other chemicals in the manufacture of explosives and in the chemical treatment of many other materials it is often desirable, in order to facilitate their handling and removal from the container, in which said materials are treated by heat, to reduce the temperature of the material approximately to atmospheric temperature. In the treatment of some chemicals by heat it is necessary to reduce the temperature of the product before the removal of said product from said container or of permitting such product to be acted upon by the atmosphere. In other instances it is a matter of convenience and conservation of the health of operators who are required to enter the container in which the material has been treated at a high temperature, to first reduce the temperature of such product approximately to atmospheric temperature.

In the treatment of some materials, as where it is necessary or desirable to subject material to a considerable range of gradually increasing temperatures, starting with a comparatively low temperature, the initial cooling operation followed by the heating operation is contemplated by this invention.

The object of this invention is to carry out the above described process which object is facilitated by the improved apparatus to be hereinafter described.

The invention consists in the process of treating material to alternate approximately definite temperatures.

The invention also consists in the improved apparatus hereinafter described and claimed.

Figure 1, represents the improved apparatus in front elevation.

Figure 2, represents a front view of a still illustrating a modified construction of container adapted for use with this apparatus, the wall of the still partially broken away to show portions of the conduit coil therein.

Fig. 3 is a detail sectional view of a valve operable alternatively to direct heated or cooled liquid into the container.

Similar characters of reference designate corresponding parts throughout.

As shown in the drawings, 5 indicates a container which may be a kettle open at the top or may be a still or closed chamber depending upon the nature of the material to be treated or upon the specific process to be carried out. Within the container 5 is located and supported in any known manner the lining 6 which, in the structure shown, is spaced from the wall of said container to provide a jacket or compartment adapted to receive liquid from the supply pipes 7, 7 and to deliver said liquid to the outlet pipes 8, 8. As a supplemental liquid circulating means the coil 9 has, in some cases, been located and supported in said container 5, said coil 9 having the inlet pipe 10 and the outlet pipe 11.

The conduit through which heating liquid is circulated to and from the container 5 comprises the supply conduit arm 12 and the return conduit arm 13 connected to the coil 14 of furnace 15 of any well known construction and operation adapted to supply heat to be absorbed by liquid in its passage through said coil 14. Conduit arm 12 communicates through the casing 16, of any known three-way valve, with the T-pipe connection 17 which is connected by the valve casing 18 with the supply pipes 7. Connection 17 also communicates with pipe 19 which is connected with the inlet pipe 10 of coil 9.

Outlet or return pipes 8, 8 have the extension pipes 20, 20 which are connected by the pipe 21 which communicates through valve chamber 22, T pipe connection 23, and the casing 24, of any ordinary three-way valve, with the return conduit arm 13. Coil outlet pipe 11 is also connected with the T pipe connection 23 and said pipe 11 has the valve 25.

Return conduit arm 13 has the casing 26

of any ordinary pump adapted to circulate viscous liquid through said conduit. The conduit arm 13 at the pressure side of said pump 26 is connected by the by-pass pipe 27, having valve 28 with said conduit arm 13 at the suction side of said pump and the former portion of said conduit 13 has the pipe 29 which is connected with the by-pass pipe 27 and has the pressure relief valve 30 of any ordinary construction. This valve 30 may operate to relieve undue pressure in either the by-pass pipe 27 or the conduit arm 13. At times when the liquid in the conduit is unduly viscous or when it is desirable, valve 28 may be opened and the liquid in the conduit may pass from the pressure side of the pump 26 through pipe 27 back to the suction side of said pump.

At the suction side of pump 26 conduit arm 13 has the valves 31 and 32 between which the expansion pipe 33, having the tank 34, is connected with conduit arm 13 in order to maintain a column of the liquid under static pressure to compensate for fluctuations of pressure in conduit arm 13 and to supply additional liquid when necessary.

The system of conduits, pipes and their accessories above described may be considered the heating side or element of the system as the viscous liquid, usually having a high sparking or flash point, preferably a hydrocarbon having a high carbonization point, with which said system of pipes is filled is intended to be circulated through the coil 14 of furnace 15 to absorb heat generated in said furnace and to transport said heat to the jacket of container 5 and to coil 9 thereof in order to heat the contents of said container. After the completion of such treatment of the contents of container 5 by heat, it is often desirable and sometimes necessary to reduce the temperature of such contents as quickly as possible to a predetermined degree. This is accomplished by apparatus which I will now describe.

Connected respectively with the valve casings 16 and 24 are the supply conduit arm 35 and the return conduit arm 36 which are connected by the short circuit pipe 37 having the valve 38. Conduit arm 35 has the pump chamber 39 of any ordinary pump adapted to circulate liquid therethrough and said conduit arm 35 is connected around said pump chamber 39 by the by-pass pipe 40 having the automatic relief valve 41 of any known construction. The suction side of pump chamber 39 is connected with the riser pipe 42 which is adapted to receive liquid from the comparatively large storage tank 43. Conduit arm 36 extends to the cooling tank 44 through which conduit arm 36 extends as the coil 45 terminating in the upwardly extending pipe 46 which ultimately delivers into the tank 43.

Any usual and well known provision may be made for cooling the liquid passing through coil 45 and for maintaining said liquid at a comparatively low temperature in the tank 43. The liquid supplied to the system which includes conduit arms 35 and 36 may be of any known kind preferably adapted to readily absorb heat when circulating through the jacket and coil of the receptacle 5 and to give up such heat as quickly and as fully as practical when said liquid is circulating through conduit arm 36 and coil 45.

In Figure 2 of the drawing is disclosed a modified construction of the container which, in Figure 2, is shown as a chamber 5′ having suitable inlet and outlets respectively closed by any ordinary closures 47, 48. In this modified construction, which is the same as container 5 of Fig. 1 except that it has no jacket, the coil 9 is similar to coil 9 of the structure shown in Figure 1 and has the inlet pipe 10 and the outlet pipe 11. This modified structure, Figure 2, is adapted for use when, after material has been placed in the container and subjected to a high temperature, it is desired to quickly reduce the temperature in the retainer sufficiently to permit an operator to enter the container for the purpose of assisting in discharging the contents of the container. In this latter case it is not necessary to reduce the temperature of the container below the point at which the operator can work without undue discomfort.

In carrying out the improved process the material to be treated is placed in the container 5 and is therein subjected to the action of heat conducted from the liquid in the container jacket and the coil 9, either or both. Continuous renewal of heated liquid in said jacket and coil is effected by the action of pump 26 which operates to force the liquid in the conduit system through the coil of furnace 15 back through conduit arm 12 to said jacket and coil of the container 5.

After the material has thus been subjected to the desired degree of heat for a suitable time the heat of the furnace 15 may be temporarily reduced and the valves 16 and 24 are operated to cut out the container jacket 6 and the coil 9 from the conduit of the heat circulating medium and to connect said jacket and coil with the conduit arms 35, 36 of the cooling circuit whereby the cooled liquid circulated through said pipes 35, 36 by pump 39 may absorb heat from the material under treatment in said container 5.

It is of course evident that the material in said container may be subjected to a succession of alternating heating and cooling operations and that additions may be made to such material from time to time. For instance, the material primarily placed in the container may be subjected to heat for a time to increase the viscosity or the concen-

tration of such material, the temperature of the material may then be reduced to a point at which additional material, of any kind, may be supplied to the container with safety to the operator or without injury to the material primarily treated, and this process may be repeated if desired.

When the heat transporting liquid is forced out of the jacket 6 and coil 9 by the cooling liquid such liquids will to some extent be mixed together in the conduit and ultimately in tank 43 and for this reason said liquids may be of a similar nature although not necessarily of a similar viscosity. For instance, an oil of a high viscosity may be supplied to tank 34 and an oil of a low degree of viscosity may be supplied to the tank 43.

When it is desired to avoid the mixing of the liquid remaining in the jacket 6 or coil 9 after either a heating or a cooling operation with the circulating liquid used in the next succeeding operation, said liquid in jacket 6 or coil 9 may be drawn off through the valved drain pipes 7′ and 9′ with which the inlet pipe 7 and the coil 9 respectively are provided. In this latter case the valve of the air inlet pipe 11′ may be opened slightly for a short time.

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

1. Apparatus for subjecting material to different temperatures comprising a container for the material having a jacket through which liquid may be circulated, two systems of conduits each having a common connection to the inlet and the outlet of said jacket, pumps operable respectively to circulate liquid through the respective conduit systems, a heater for supplying heat to the liquid in one of said conduit systems, means for cooling the liquid in the other conduit system and means operable selectively to establish communication between either of said conduit systems and said jacket and simultaneously to cut off communication of the other system with said jacket whereby in shifting from one circulating system to the other the liquid contained in the jacket will be displaced and circulated with the liquid of the system in which communication with the jacket is established.

2. Apparatus for subjecting material to different temperatures comprising a container having a jacket and an internal conductor through which liquid may be circulated, two systems of conduits connected with said jacket and conductor by common inlet and outlet connections, pumps operable respectively to circulate liquid through the respective conduit systems, a heater for supplying heat to the liquid of one of said conduit systems, means for cooling the liquid in the other of said conduit systems and means operable selectively to connect either of said conduit systems with said jacket and conductor and simultaneously to cut out communication with the other conduit system.

3. Apparatus for subjecting material to various temperatures comprising a container having means through which liquid may be circulated, two systems of conduits connected with said means and having controlling valves, one of said conduits being continuous and having a liquid circulating pump and a point of heat supply, and means to supply liquid to said conduit under static pressure, one arm of the other said conduit having a liquid circulating pump and a supply stand pipe delivering to said pump, a tank for supplying liquid to said pipe, the other arm of said latter conduit having a cooling member and delivering to said tank.

JOHN W. F. MACDONALD.