

Abstracts of English and colonial patent specifications relating to the preservation of food, etc. : compiled from original documents, or their printed copies, lodged in the Patent Office attached to the Registrar-General's Department, Melbourne / by William Henry Archer.

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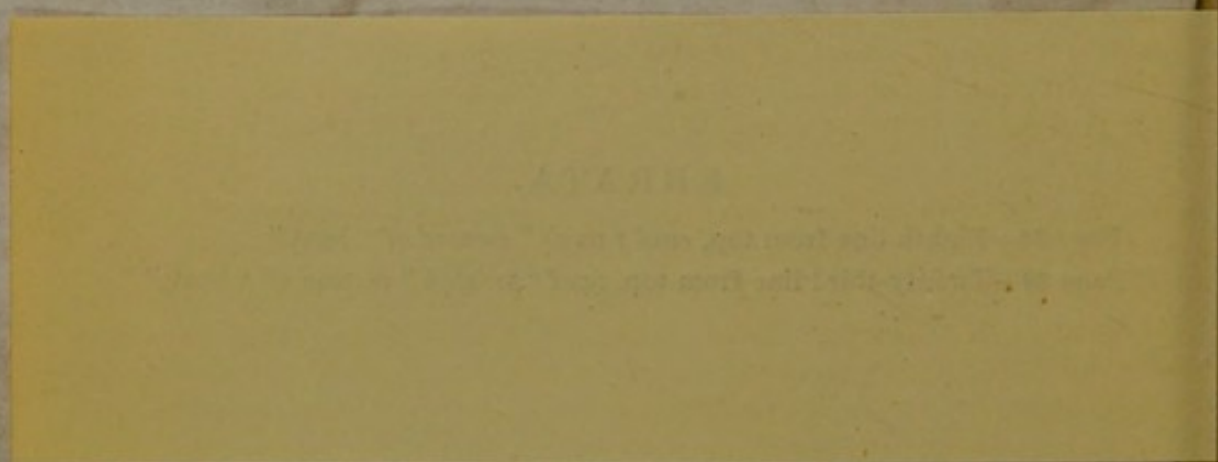


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ERRATA.

Page 24—Eighth line from top, *read* “meat” *instead of* “heat.”

Page 38—Twenty-third line from top, *read* “treated” *instead of* “heated.”



ABSTRACTS OF PATENTS ON PRESERVATION OF FOOD, ETC.

* * * The letters "U.K." imply that the patent was applied for in the United Kingdom; "N.S.W." in New South Wales; "Vict." in Victoria.

A.—REDUCTION OF TEMPERATURE.

1. COOLING BY VENTILATION.

T. STEVEN and C. BATTY. Patent refers to this method of producing cold.—[U.K. 1864, April 14. No. 937.]

2. COOLING BY AIR, ETC., ARTIFICIALLY REDUCED IN TEMPERATURE.

H. E. SYMONDS. "Causes currents of refrigerated air to pass over meat to be preserved, by mechanical means, such as fans, or blowing or "exhausting machinery." The method is stated to be peculiarly applicable to preserving meat on board ships.—[U.K. 1853, June 10. No. 1418.]

A. V. NEWTON. Cools the air previous to its entry into the preserving or curing apartment, by causing it to pass between the interstices of pieces of ice.—[U.K. 1856, January 7. No. 85.]

A. and E. M. DENNY. Causes a liquid at a very low temperature, to the action of which bacon to be preserved is subjected, to circulate through pipes. The same specification also includes improvements in the construction of houses for manufacturing or curing bacon.—[U.K. 1864, February 11. No. 361.]

A. V. NEWTON. Secures a low temperature by causing the water used for refrigerating purposes to first pass, by means of pipes, to a considerable depth in the earth; on shipboard he effects the same object by making compressed air circulate, before being used, through pipes arranged round the keel.—[U.K. 1865, March 14. No. 719.]

R. A. BOYD. Reduces the temperature of rooms in which bacon is cured, by causing air to enter therein through pipes or narrow passages cooled in ice or freezing mixtures.—[U.K. 1866, March 10. No. 737.]

3. APPLICATION OF ICE TO THE SUBSTANCES TO BE PRESERVED.

J. LINGS. Employs ice by placing it in a box within a safe containing the substances to be preserved. The safe is made outwardly of wood and inwardly of galvanized iron; between the two cases there is a space filled with some non-conducting substance —[U.K. 1845, July 21. No. 10,781.]

W. E. NEWTON. Proposes to preserve fruit and vegetables by exposing the same to a temperature "nearly approaching the freezing point of water, but which will not actually freeze them." The object is attained by means of a kind of ice-house, properly constructed with non-conducting sides, &c., the ice used for cooling being placed in an upper compartment, and the fruit, &c., to be preserved, below.—[U.K. 1846, September 17. No. 11,372.]

C. BRAY. Manufactures ice-safes with an outer case of wood lined with felt and an inner case of metal. The safe is divided into chambers for containing the articles to be cooled and also the ice.—[U.K. 1858, July 19. No. 1621.]

J. MANSFIELD and W. MOWER. Make use of cow-hair as a non-conducting substance wherewith to fill up the spaces between the inner and outer walls of vessels used for preserving ice. They also employ a perforated false bottom, so that the water flowing from the partially liquefied ice may be removed.—[Vict. 1860, August 8. No. $\frac{378}{361}$.]

M. A. F. MENNONS. Patents "an improved combination of cooling and filtering apparatus, forming a safe for the preservation of solid and liquid provisions." The safe combines an ice-case, reservoir, central chamber, and base with movable table and shelves.—[U.K. 1862, March 18. No. 746.]

T. HARRIS. Combines an ice-room above, with curing or preserving rooms below, the whole being surrounded with double walls, between which are placed non-conducting substances.—[U.K. 1864, December 1. No. 2995.]

G. HASELTINE. Patents an invention for preserving fruit, &c., very similar to the foregoing. The matters to be preserved are kept on shelves in the lower chamber, in which are a number of shallow troughs containing chloride of calcium, for the purpose of absorbing the moisture of the air.—[U.K. 1865, January 24. No. 207.]

C. FALCK. Constructs ice-safes with double sides, the space between which is filled with charcoal or other non-conducting substance.—[U.K. 1865, January 26. No. 230.]

W. R. LAKE's method of preserving fruit or other perishable substances is almost identical with those of T. Harris and G. Haseltine.—[U.K. 1865, November 27. No. 3043.]

H. CLIFTON. Patents an improved kind of ice-safe, which is divided into two portions, one containing ice, the other the substance to be preserved.—[U.K. 1867, March 21. No. 818.]

4. PRODUCTION OF COLD BY MEANS OTHER THAN THE NATURAL TEMPERATURE OF THE ATMOSPHERE.

4A. *Employment of Freezing Mixtures.*

H. BENJAMIN and H. GRAFTON. For producing the cold required, make use of a mixture of ice and salt or other freezing compounds.

The "fish" or other matters to be preserved are placed in a metallic vessel, which is then deposited in the refrigerating mixture.—[U.K. 1842, January 27. No. 9240.]

J. BRIDGMAN. Employs a cooling mixture composed of ice and salt, or of ice, salt, and acids. The brine used for the preserving of the meat is passed through this mixture by means of pipes, as is also the air admitted into the preserving chamber.—[U.K. 1858, May 6. No. 1011.]

H. C. ASH. Conveys the necessary agitation to freezing mixtures by means of a loosely fitting perforated piston.—[U.K. 1860, July 25. No. 1804.]

G. BURNARD and L. KOPPEL. Preserve milk and cream for transport by means of a peculiarly constructed can and the use of a mixture of sal-ammoniac and nitre as a cooling agent.—[U.K. 1866, April 28. No. 1198.]

W. G. PRAAGST. "Preserves fowl, fish, meat, and other animal food" by congealing by means of cold, covering with a coat of ice, and subsequently packing the substances in suitable non-conducting packages. The cold is stated to be produced artificially, but by what means is not specified.—[Vict. 1866, September 15. No. $\frac{279}{58}$.]

J. WHITFORD. Ice-making apparatus is constructed with an outer and inner vessel, the latter of which may be rolled to and fro. Water is placed in the interior vessel and a freezing mixture between the two, or *vice versa*.—[U.K. 1867, July 8. No. 1989.]

4B. *Freezing by alternate compression and expansion of air or gases.*

B. G. SLOPER's invention, of which Fig II. is a plan, may be thus described:—"A is an air-pump," with stuffing-box B, and piston-rod C, resting on the bed-plate D D. "F F are two exhaust-valves opening outwards. G G, H H¹, I I¹ are six valve-chests containing slide-valves worked by the valve-rods J. The valves G G have side openings at *n n*¹, allowing the passage of the external air into their interior. K K are air-chambers of much smaller capacity than that of the air-pump, opening at their ends into the valve-chests G G¹, H H¹. The valve-chests I I¹ have air passages from their interior into the interior of the air-pump. L L¹ are two ice-chests, the cover of L being removed to show the interior. M M¹ are pipes of communication connecting the valve-chests H H¹ with the interior of the ice-chests. N N¹ are pipes of communication connecting the valve-chests I I¹ with the interior of the ice-chests." These ice-chests are divided by partitions, as seen by the interior view of L, so that the expanding air is obliged to sweep round the ice-bags R R. "Both the chests are made air-tight by their covers, when the ice is being made, and are surrounded by mattresses stuffed with a non-conducting material. The bags R R are made of American canvas, open at the

"top, and with iron rings at top and bottom." These are so suspended that their bottoms do not quite touch the bottoms of the ice-chests. The valve-slides are worked by rods and excentrics. The mode of operation is as follows:—"The air-pump being set in motion," and the piston moving upwards, the air within is "forced out through the exhaust-valve F¹. While this is taking place the exhaust-valve F and the valves in the valve-chest G H¹ I¹ are shut, and the valves in valve-chest G¹ H I are open. The effect of this is that the air in the air-chamber K passes into the ice-chest L, expands, circulates round the ice-bags R R containing the water to be frozen, and a part of it is drawn into the interior of the air-pump cylinder A. When the reverse action of the piston takes place, the valves in the valve-chests G H¹ I¹ open, and the valves in G¹ H I shut; the air drawn into the air-pump cylinder from the air-chamber K is forced out through the exhaust-valve F, while atmospheric air enters the air-chamber K through the open valve in the valve-chest G, and is ready to be expanded at the return stroke of the air-pump piston when the valve in G is shut and the valve in H opens, and the measure of air in the air-chamber K rushes into the partially exhausted ice-chest L, and circulates, as before described, until it is drawn into the cylinder A. By these means the expansion of a measured quantity of air from the air-chamber K in the ice-chest L produces intense cold, which gradually extracts the heat from the water contained in the ice-bags R R and converts it into ice."—[Vict. 1858, September 7. No. $\frac{1}{3}\frac{2}{1}$. N.S.W. 1858, November 1. No. 14.]

J. D. POSTLE. Produces cold to be applied to the preservation of meat, &c., by condensing atmospheric air, removing the increased temperature imparted to the same, and taking advantage of the absorption of latent heat consequent upon such compressed and cooled air returning to its natural condition; or by passing air through tubes immersed in ether caused to boil *in vacuo*.

In an amended specification the inventor lowers the temperature of the compressed air by the admission into the cylinder of a jet of water at each stroke of the piston. The receiver is so arranged that the air, previous to expansion, has to pass through a series of tubes immersed in water. By means of an expansion cylinder, similar to the cylinder of a steam-engine, the force of the expanding air is utilized. In the drawings attached to the amended specification, Fig. VII.^A is a plan of the steam-engine and refrigerating apparatus, &c., VII.^B a back elevation of "pump and expansion cylinder," and VII.^C a front elevation of "receiver and expansion cylinder."

The details of the apparatus are described at length in the original specifications.—[Vict. 1867, November 6. Nos. 1069 and 1069^A.]

J. D. POSTLE. Improves the preceding patent; by making the pump and expansion cylinder with jackets; between these and the inner walls water is allowed to flow, so as to cool the compressed air; by a new kind of valve for regulating the admission of air into the cylinder in which

the air expands; by employing a novel apparatus for cooling the compressed air; and by an improved method of employing the cooling property of the air for the refrigeration of any substance.

Figs. VIII.^A, VIII.^B, VIII.^C, VIII.^D, and VIII.^E, are respectively a longitudinal section, a side elevation, a transverse section, an inside elevation showing the cover, and an end elevation showing the spaces in sides of the pump. Figs. VIII.^F, VIII.^G, and VIII.^H, are a longitudinal section, a transverse section, and a side elevation of the cylinder. Figs. VIII.^I, VIII.^J, VIII.^K, and VIII.^L, are sections, elevations, &c., of improved valve. The various details of these contrivances are described at length in the specifications.—[Vict. 1868, May 21. Nos. 1116 and 1116^A.]

D. LITTLE. Reduces the temperature for the making of ice, or for preservative purposes, by the expansion of compressed atmospheric air. The air is compressed into a vessel, formed after the manner of the surface condensers used in steamers, being deprived of its moisture by contact with concentrated sulphuric acid. The increased heat consequent upon the compression is removed by the application of water or other suitable cooling agent to the condenser. After the condensed air has its temperature reduced to that of the atmosphere, it is allowed to escape into and expand in the rooms, &c., containing the matters to be submitted to the action of cold.—[Vict. 1868, January 8. No. 1082.]

T. S. MORT and E. D. NICOLLE. Diminish the temperature of air, water, &c., by "the application of the well-known natural law, that a "reduction of the volume of any permanent gas, and simultaneous "removal of the sensible heat caused thereby, results, upon expansion, "in a capacity or power for taking heat from the bodies with which it "comes in contact." The invention patented provides certain means for bringing about the required compression, expansion, &c., in an efficient and economical manner. Fig. V.^A is an elevation partly in section of one form of the apparatus made use of.

A A are two strong hydraulic cylinders, air and water tight, and capable of resisting a pressure of 600 lbs. to the square inch.

B is another cylinder of similar strength.

C C, two gas desiccators charged with chloride of calcium, or other substance having a strong affinity for water.

D, temperature exchanger.

E, compressed gas or air receiver.

F¹, pipe for conveying compressed air to refrigerator F.

F², section of portion of spiral channels between the two casings of refrigerator.

F³, pipe for conveying away the expanded air to be re-compressed.

To set the apparatus in action, water is forced (by means of certain pumps, &c., not shown in the drawing) through the pipe *b*, the chamber B, and the pipes *a*¹ *a*¹ alternately, into the right and left hand cylinders A A. The air in the upper part of such cylinders is compressed as the water rises. In the meantime it is kept cool by currents of cold water

continually running through the double spirals $a^2 a^2$, and, having been deprived of its moisture in the desiccators C C, passes through the temperature exchanger E, whence it is allowed, by opening certain valves, to flow into and expand within the spiral chambers surrounding the refrigerator, thereby absorbing heat and reducing the temperature. The air so used is re-pressed in a similar manner after having been re-admitted into the hydraulic vessels A A.

The specification contains minute descriptions of details, both of apparatus and mode of action, of a contrivance for compressing the air by means of a column of water (Fig. XI.^B), of an arrangement for applying the cold produced to the manufacture of ice, and of the use of screw propellers attached to sailing ships for the purpose of giving motion to the machinery described above; the whole being illustrated by elaborate plans and drawings, from which those given are selected.—[Vict. 1868, August 10. No. 1139.]

4 c. *Refrigeration by liquefaction and subsequent evaporation of certain gases and liquids, such as ammoniacal and nitrous oxide gases, ethers, &c.*

J. HARRISON'S patent, as producing cold, is applicable to this portion of the meat-preserving process. The principle of this invention is founded on the fact that certain volatile fluids, such as ether, absorb large quantities of heat, if evaporated in vacuo, which heat is afterwards given off when the vapors thus generated are reduced to a liquid state under pressure.

In order to apply this principle, the apparatus is constructed as shown in Fig. I.^A The parts are thus described by the inventor:—

“ A is an evaporating pan of tinned copper

“ B, cistern containing water to be frozen.

“ C, compressing gasometer working in D, a bath of mercury.

“ E, valves opening for the admission of vapor from A.

“ F, valve opening for the admission of the condensed vapor.

“ G, the condenser surrounded by water.

“ H, vessel for receiving the condensed liquid.

“ I, floating valve, which will open when a sufficient depth of liquid accumulates in the vessel; the valve then rising, the liquid will rush through the tube J into the evaporating pan, and be delivered on the shelf a , and fall through the holes bb , and then over the frets cc to the bottom of the pan.

“ K is a piston-rod connected with a steam-engine or other motive-power.

“ L is a three-way cock for shutting off the communication between the two parts of the machine.

“ The apparatus is set in motion by pouring ether through the orifice d , the cock e being shut. The cock L is turned so as to shut off communication with the left-hand side of the apparatus and to open communication with the air. Heat is then applied to the vessel H, and the air is forced out by the vapor of the ether. The cock L is

“ then turned so as to shut off the communication of the right-hand
 “ apparatus with the air, and to open the communication of the left-hand
 “ part of the apparatus with the air ; heat is then applied to A, and the
 “ air is expelled ; the cocks L and e are turned so as to open the communi-
 “ cation throughout the whole of the apparatus ; water is admitted into
 “ B and M ; the motive-power connected with K ; and the apparatus set
 “ in full operation.”—[Vict. 1856, January 16. No. 18.]

This invention has also been patented both in England and New South Wales. In these latter cases some modification as to details have been adopted. Figs 1^B and 1^C represent the apparatus, as patented in the latter place, in section and plan. It will be seen that the principle involved is the same in both the Victorian and the New South Wales patents, the two simply differing in details and in improvements for carrying out the plan more effectually. In these drawings, B is the boiler wherein the ether is vaporized, the same being surrounded with salt water, which, being cooled to below freezing point, is made to pass round and absorb heat from a number of tinned vessels containing the water, &c., to be frozen. A is an air-pump, and F the vessel in which the vaporized ether is again condensed. Ether in a liquid form being a solvent of oil, two vessels, *g g*, are made to collect any oil flowing from the piston of the air-pump, so as to prevent the same entering any part of the apparatus wherein the ether exists in a liquefied state.—[N.S.W. 1860, September 14. No. 36.]

J. R. RICARDS' invention “ consists of certain arrangements of
 “ machinery for applying ether to vessels containing water whereby the
 “ water is converted into ice.” The means adopted are thus described :—
 “ I employ a square cistern, the sides and ends having a double wall of
 “ about one foot in width, between the space of which pulverized charcoal
 “ is placed. In the inner part there are placed six rows, each row contain-
 “ ing twelve cast-iron freezers capable of holding as much water as will
 “ make about 30 lbs. of ice. These freezers are twelve inches long, twelve
 “ inches deep and six inches wide ; around each of them is a flange which
 “ projects about half an inch and which rests upon bars running at right-
 “ angles, and they form a channel or passage between each of them of
 “ about one inch ; there is also a space between the bottoms of these
 “ and the bottom of the vessel in which they are placed. The operation
 “ is as follows :—A steam-engine works an air-pump until a vacuum is
 “ formed in a vessel containing ether to which the pump is attached ;
 “ when the vacuum is perfect the ether is pumped from this vessel and
 “ forced around the vessels containing the water amongst them and
 “ returns into the vacuum vessel and the heat thus becomes extracted,
 “ and the operation is continued until the water is frozen into ice. The
 “ arrangement is calculated to save the ether from wasting in exhausted
 “ air.”—[Vict. 1859, February 25. No. $\frac{218}{61}$.]

E. D. NICOLLE and J. H. WILLIAMS. Make use of, for the production of cold, certain gases susceptible of liquefaction by pressure and of resuming their gaseous state by removal of the pressure.

The gases used for the purpose are sulphurous acid, deutoxide of azote, ammoniacal and hydrochloric acid.

The apparatus employed is represented by Figs. III.^A and III.^B, in which Fig. III.^A is a section of the whole and Fig. III.^B a plan of the refrigerating vessel. A is the furnace, B damper, C C boilers, D perforated pipe, E ascending pipe, F F bent pipes, G G stop-cocks, H pressure-gauge, I thermometer, J screwed plugs for filling boiler, K brickwork, L L L L upright pipes connecting the hemispherical boxes M M, N water-vessel, O supplying water-pipe, Q let-off pipe, R inclined pipe, S double stop-cock, T bent pipe forming connection with gas-receiver, gas-receiver Y, Z wooden vat; *a a a a* are tinned-iron moulds filled with water to be frozen, which rest against the outer and inner circles of the gas-receiver; *b* is a space filled with water strongly saturated with salt or alcoholized.

To carry out the operation of freezing, the boilers are filled with water up to the level shown in the drawing. This water is saturated with either of the gases used. The boilers are then heated, and the contained gas is driven off, passing upwards by the pipes F F and M into the condensing tubes M M. The aqueous vapor contained in the gas is here reduced to water, which runs by the pipe E into the boilers C C, the thoroughly dried gas passing in to the gas-receiver Y Y, where it assumes, by pressure, a liquid form. The boilers are now allowed to cool, or are cooled hastily by means of cold water applied to them externally, when, the pressure being removed from the liquefied gas, the same will resume the gaseous state, by so doing absorb a vast quantity of latent heat, and, rushing from the gas-receiver through the pipes R and L, will, the stop-cocks G G being closed, enter the boiler by the pipes E and D, and be completely re-absorbed by the water.—[Vict. 1861, October 22. No. $\frac{552}{500}$.]

E. D. NICOLLE and R. DAWSON patent the same invention.—[N.S.W. 1861, September 13. No. 47.]

E. D. NICOLLE, W. H. WILKINSON, and J. H. WILLIAMS. Patent an improvement on the former patent of E. D. Nicolle and J. H. Williams. The principle, that of liquefying and restoring to its gaseous form ammoniacal gas, is the same in both instances. A number of boilers A A A (Figs. IV.^A and IV.^B) are so arranged as to be heated by steam generated in the steam-boiler B. The gas is thus liberated from the ammoniacal liquor in the boilers, and passes through a series of refrigerators, condensers, &c., into the freezing vessel C, where it is allowed to expand and thus absorb heat from the matters to be frozen. The freezing vessel is shown on an enlarged scale by Fig. IV.^C.

In the original specification long and elaborate descriptions are given of the details of the apparatus by which the above objects are effected.—[Vict. 1863, March 12. No. $\frac{631}{613}$. N.S.W. 1863, February 13. No. 64.]

W. E. NEWTON. Manufactures ice and refrigerates other substances by compressing carbonic acid gas, and releasing it from pressure after

bringing it into contact with the matters to be cooled.—[U.K. 1867, March 30. No. 952.]

H. FRANCIS. Patents an invention the object of which would seem to be the introduction of the water to be frozen into the refrigerating vessel as a fine spray instead of in bulk, as in the usual manner. The apparatus employed is shown in Figs. XIV.^A and XIV.^B and is thus described by the patentee:—"Take a large, strong, cylindrical air-tight vessel, which will withstand the pressure of the atmosphere. One end of this is fitted with an air-tight cover, made so as to be easily removed, for the purpose of taking out the contents. In the inside of the cylinder, at the upper part, there is a tube or tubes, made with fine perforations, through which the fluid to be cooled or water to be frozen is to be supplied. There is also a series of tubes fixed above or near the supply-tube, in which tubes intense cold is produced by partly filling them with ether and evaporating it in vacuo, or by the liquefaction and expansion of ammoniacal gas, or by such other materials as are equally well known and in general use, for the purpose of condensing gases and refrigeration." The vessels may be made double, and other arrangements may be adopted for the purpose of imparting the necessary cold to the water, &c., to be treated.—[N.S.W. 1863, April 30. No. 77.]

A. M. CLARKE. Patents certain "improvements in refrigerating apparatus applicable to the making of ice and other refrigerating purposes."—[U.K. 1867, August 10. No. 2303.]

E. J. WELCH. Patents improvements in apparatus for producing artificial ice, &c., in which the condensation and evaporation of ether or other hydro-carbons in the form of vapor is used as the refrigerating medium.—[U.K. 1867, September 9. No. 2544.]

T. S. MORT. Patents a self-acting method of and apparatus for preserving fish, flesh, &c., by a process of refrigeration. The principle of the invention is founded on the circumstance that certain gases may be liquefied by pressure, and that they subsequently absorb heat, when, being freed from pressure, they are suffered to return to a gaseous state. Preference is given to ammoniacal gas, both because it is highly soluble in water and that it absorbs a great quantity of heat in passing from the liquid to the gaseous form.

Figure VI. represents a transverse section of the apparatus as fitted to be used on shipboard. A is the separator two-thirds filled with aqueous solution of ammonia; B, a Liebig's condenser for cooling the temperature of the gas ere it enters the desiccator C, which is a spiral coil of pipe completely immersed in cold water; D is the liquefying coil, offering a large cooling surface to the desiccated gas, which, by the cold thus imparted, together with the pressure, is made to assume a liquid form, and passes into the liquefied gas-receiver E. F is the feeder, by means of which the separator is supplied by fresh ammoniacal liquor. G G are two coolers for depriving the spent liquor in A of its temperature as it passes

towards the re-invigorator H, and I I I are receptacles for the meat, &c., to be preserved. These receptacles are made with a double casing, having a vacant space between them, the outer one being completely covered with some non-conducting substance, the inner being in contact with the air surrounding the meat.

In order to set the apparatus in action, aqueous solution of ammonia is introduced into A, F, and H, in each up to two-thirds of their capacity. Heat is then applied to A, by admitting steam through the worm I, in order to set free the ammoniacal gas held in solution. The gas so liberated passes through the Liebig's condenser B, where, and in the subsequent passage through the desiccator C, it is deprived of much of its moisture, which falls back into the separator. Under the joint influences of cold and pressure, the gas, by the time it reaches the liquefier D, assumes the liquid form, and in such form is stored up for use in the liquefied gas receiver E. From this receiver it is allowed to flow at pleasure through the pipe E¹ into the spaces between the two cases of the meat receivers, and, the pressure being removed by closing the connection with E and opening one with H, the liquid assumes a gaseous form, and doing so absorbs heat from the meat receptacles.

The spent ammoniacal liquor in A is afterwards forced through the coolers G G G into the "re-invigorator" H, which it enters through the perforated ring A¹ at the same time that ammoniacal gas from I I I enters by the perforated tube I¹. The liquor, being thus "re-invigorated," is passed into the feeder F, whence it descends by gravity into the separator A, and is ready to be again heated.

The inventor, in order to dispense with the use of pumps for filling or emptying the various vessels, avails himself of the pressures generated by the action of the gases, &c.; this pressure being conveyed, at pleasure, to any part of the apparatus by means of pipes and stop-cocks described in detail in the specification.

Fig. VI.^B shows a method of conveying heat to the separator A by means of pipes, charged with steam, which occupy the interior.

Figs. VI.^B and VI.^D show a portable meat receptacle for use with any modification of the above-described apparatus.—[Vict. 1867, September 3. Nos. 1039 and 1039^A.]

J. JOURNEAUX. Produces cold, as is also done in Nicolle and Hartwell and Mort's invention, by the alternate liquefaction and rarefaction of ammoniacal gas. In order to carry out the process, the apparatus Figs. IX.^A to IX.^D is used. Figs. IX.^A shows the whole arranged for the preliminary heating, and Fig. IX.^B the same as arranged for the ultimate cooling process. A is a wrought-iron boiler fitted with a spiral tube, and so constructed at the top as to prevent its boiling over into the receiver. B is the receiver, through the centre of which passes the tube B¹. The boiler A being charged with strong liquor of ammonia, and heat being applied until the temperature of the solution reaches 270° Fahrenheit, the gas given off on passing through the tube F is at last liquefied by pressure in the receiver B, the same being surrounded with

cold water. The boiler is next removed from the fire and immersed in cold water, the condenser being at the same time enveloped in a woollen cloth. All pressure being now removed, the gas resumes its gaseous form, and, passing again into the boiler, is re-absorbed by the water, for which it has a great affinity.—[Vict. 1868, September 3. No. 1148.]

B.—DEPRIVATION OF MOISTURE.

1. DRYING BY CURRENTS OF HOT OR DESICCATED AIR, ETC., IN VACUO, WITHIN AN ANTISEPTIC ATMOSPHERE, ETC.

R. DAVIDSON and W. SYMINGTON. Desiccate vegetable matters by causing currents of heated air to pass over them.—[U.K. 1844, March 28. No. 10,126.]

W. T. YULE. Dries animal and vegetable matters for preservation in close vessels, by first cutting such matters into pieces, subjecting them, thinly spread on shelves, to the action of a blower, the air driven by which is made to pass over chloride of calcium. Chloride of calcium is also placed in the vessels in which the matters are subsequently enclosed.—[U.K. 1845, January 28. No. 10,496.]

C. PAYNE. Produces the currents of air necessary for desiccation by means of an exhausting apparatus.—[U.K. 1851, July 3. No. 13,680.]

T. C. BANFIELD's specification refers to a machine for cutting roots, &c., previous to their being dried for preservation.—[U.K. 1853, April 29. No. 1041.]

H. STEVENS. Steams and mashes potatoes, after which they are dried by currents of hot air.—[U.K. 1853, October 5. No. 2278.]

J. L. HERVÉ. After having dried meat, fish, &c., until deprived of two-thirds of their moisture, places the same on a hurdle over sulphuric acid or chloride of calcium.—[U.K. 1855, January 11. No. 70.]

J. BETHELL. Deprives meat, &c., of 80 per cent. of its moisture by exposing the articles, cut into small pieces and laid on perforated trays, to the action of air heated to not more than 100° Fahrenheit, so that the drying may be effected without any coagulation of the contained albumen.—[U.K. 1855, July 12. No. 1559.]

I. WESTHORP. Concentrates milk by heating it *in vacuo*.—[U.K. 1856, February 28. No. 509.]

W. J. CANTELO.—Patents a hot-water apparatus for drying meat, &c.—[U.K. 1856, April 22. No. 955.]

J. B. HEU. Dries animal substances for preservation in an atmosphere of carbonic acid gas, subsequently packing them in powdered bark.—[U.K. 1856, November 14. No. 2690.]

C. W. SIEMENS. Patents an improved furnace applicable to drying food.—[U.K. 1857, May 11. No. 1320.]

W. J. CANTELO. Patents an arrangement of hot-water plates, having enamelled surfaces, for drying vegetable matters.—[U.K. 1857, August 12. No. 2153.]

R. BOWIE's patent provides for the disinfection of clothing, rooms, shops, &c., as also for the preservation of animal or vegetable substances, by means of a current of heated air mixed with antiseptics and forced through the subjects to be acted upon. The means for bringing this about are a furnace through which passes a tube or tubes for heating the air which is impelled through the tube or tubes by a fan, blower, or other suitable contrivance.—[Vict. 1858, April 21. No. 1935.]

R. A. BROOMAN. Preserves animal and vegetable substances by treating them with high-pressure steam admitted into a hermetically sealed vessel.—[U.K. 1859, May 13. No. 1202.]

T. DON, T. SMITH, and L. HORSEFIELD. Propose to dry grain by causing it to descend through a case in which are a number of tubes filled with superheated steam.—[U.K. 1861, April 11. No. 892.]

W. E. NEWTON. Desiccates and torrifies farinaceous and other substances in a vessel provided with means for agitating the substances and heated by a bath of oil.—[U.K. 1861, April 29. No. 1076.]

W. CLARK. Dries substances to be preserved by placing them in an exhausted oven heated by steam.—[U.K. 1862, April 29. No. 1252.]

W. GOSSAGE. Dries vegetable productions by currents of heated air.—[U.K. 1863, September 14. No. 2259.]

W. CLARKE. Desiccates animal, vegetable, and other matters by certain improvements, part of which consist of means for securing freedom from atmospheric air, superheated apparatus, &c.—[U.K. 1864, June 2. No. 1374.]

A. H. HASSALL. Dries meat, at a temperature below that at which albumen coagulates, and afterwards reduces it to powder.—[U.K. 1865, October 17. No. 2677.]

DON. F. LECOCQ. Abstracts moisture from the meat, &c., to be preserved, by means of a constant current of air at a low temperature; the substances thus partially dried are coated with flour or malt dust.—[U.K. 1866, January 15. No. 138.]

T. AMEY. Dries milk for preservation by means of a revolving cylinder which at each revolution subjects a portion of the milk to the action of a current of hot air.—[U.K. 1866, September 26. No. 2478.]

W. R. LAKE. Patents "improved modes of and means for drying, preserving, &c., meat, fruit, vegetables, &c."—[U.K. 1867, October 25. No. 3006.]

C. A. LA MONT. Preserves eggs by beating them up thoroughly, and then drying the resulting batter in a thin film upon metallic plates made

to revolve in a current of pure air, heated or otherwise. "Sulphate* of lime, or other preservative chemical," may be added to the batter.—[U.K. 1868, July 28. No. 2367.]

J. BANCROFT. Proposes to desiccate meats, vegetables, &c., for preservation, by means of an apparatus of which Fig. X^A is an elevation, Fig. X^B a plan, Fig. X^C a longitudinal and Fig. X^D a transverse section. A is an enamelled or other iron tray, with flanges B, and discharge-cock C, placed over the steam-box E; F, a safety-valve; G, entrance to steam-box from boiler; H and I, condensed steam pipes; D, fan revolving in a circular chamber, formed by the curling upwards of the end of the plate A, and heated by an extension round it of the steam-box E.

The meat to be treated is first cut into pieces or minced, and placed upon the tray, steam being admitted into the steam-box and heated air being driven over the surface by the fan.—[Vict. 1869, March 3. Nos. 1221 and 1221^A.]

See also—D 3; J. J. B. M. de Lignac, U.K. 1847, No. 11,892. J. J. B. M. de Lignac, U.K. 1855, No. 2422. E 1; R. A. Brooman, U.K. 1855, No. 2116. J. Dewar, Vict. 1868, No. 1137. E 2; J. Bethell, U.K. 1848, No. 12,250. C. L. Marle, U.K. 1856, No. 1332. C. F. Vasserot, U.K. 1856, No. 2976. R. A. Brooman, U.K. 1858, No. 101. S. Osler, U.K. 1858, No. 1198.

2. DRYING BY MECHANICAL MEANS, ETC.

T. DELABARRE and L. BONNET. Deprive meat of a portion of its moisture by means of a wheel revolving at a great speed (the result is brought about by the action of centrifugal force), after which the meat is dipped in gelatine, hung up in a room, and dried.—[U.K. 1854, July 21. No. 1600.]

G. DAVIES. Deprives meat of its moisture by covering it with powdered talc.—[U.K. 1858, February 6. No. 223.]

P. DUFOUR. For treating skins, &c., makes use of a powder composed of plaster of Paris and file dust, in equal quantities, to which is added "an eighth portion of powdered charcoal." This powder "is spread on the skins, and dries them in a short time."—[Vict. 1858, September 22. No. $\frac{207}{162}$.]

A. G. BRADÉ's method of depriving meat of its superfluous moisture is an application of the force of endosmosis and exosmosis, and is accomplished by placing the same in certain solutions containing less water than the meat itself, by which means the superfluous moisture is extracted. The meat so treated is subsequently immersed in thicker solutions, and must be kept totally submerged so as to prevent contact with the air.†

The materials used for the solutions are gum-senegal, starch, dextrine, or decoctions of seeds, roots, &c.

* Sulphite of lime would seem to be intended.

† See Introduction.

Instead of the above, the meat may also be treated with dry flour, starch, pulverized pumice stone, &c.—[U.K. 1861, March 7. No. 576.]

E. D. NICOLLE and T. S. MORT. Patent an "improved method of" and apparatus for separating the aqueous portions of fluids and juices," the principle of which consists in applying cold to the solution, &c., so that the contained water may be converted into ice, and, subsequently, be removed; the remaining portion of the solution is still further deprived of its moisture by being brought into contact with desiccated air. The apparatus employed is shown by Fig. XIII. In this drawing—1 is a filter, from which the liquor to be treated passes into the temperature exchanger 2; this exchanger is constructed with two concentric series of spiral channels, in one of which flows cold water and in the other the solution to be cooled. The solution thus partially deprived of its heat flows into the "parting-tank" 3, this being constructed with a double casing, between the inner and outer walls of which some freezing medium circulates. The water of the solution thus changed into ice is removed by means of the "skimmer" 3a, and passed through the shoot 4 into the apparatus 5, where the ice thus formed is deprived of the liquid adhering to it by centrifugal force. The solution, meanwhile, passes onward from the parting-tank into the second temperature exchanger 6 (formed like 2, only that the cold water in the former is substituted by warm water in the latter); after the solution is, by this means, raised in temperature, it flows into the vessel 7, where it is subjected to the action of desiccated air, the air so used and charged with watery vapors being again desiccated in the upper vessel 8.—[Vict. 1867, October 17. No. 1058 and 1058^A.]

3. DRYING AFTER PREVIOUS PREPARATION.

J. GRAEFER. Proposes to preserve vegetables, &c., by first immersing them in hot salt and water for about a minute, then subjecting them to sun or artificial heat until perfectly dry. If the substances are required for exportation, they are subsequently removed to a damp room, to absorb a certain degree of humidity, necessary in order to render them less liable to crumble to pieces.—[U.K. 1780, December 30. No. 1275.]

J. DONALDSON. Appears to coat the vegetable substances with a preserving matter composed of "wheat or barley meal with a solution of common gum or mucilage," after which they are dried in the same way as malt.—[U.K. 1793, February 19. No. 1933.]

W. NEWTON. Prepares milk for preservation by evaporating it to the consistency of honey, cream, or even of dry powder, after a sufficient quantity of loaf sugar has been added.—[U.K. 1835, March 11. No. 6787.]

T. S. GRIMWADE. Mixes saltpetre with milk, evaporates the superfluous moisture, and encloses the result in bottles from which the air has been previously exhausted.—[U.K. 1847, May 14. No. 11,703.]

R. DAVIDSON and W. SYMINGTON. In their patent suggest that "yolks and whites of eggs" should be mixed with flour, ground rice, &c., dried, reduced to a state of flour, and in that state packed up for use.—[U.K. 1847, November 6. No. 11,947.]

F. H. F. LOUIS. After mixing milk with sugar, evaporates it to dryness in shallow pans with steam-jackets.—[U.K. 1848, May 26. No. 12,166.]

E. MASSON. Dries and compresses vegetable substances to be preserved, first moistening them with diluted vinegar. Stalks of cabbages are ground to powder, and pease and beans are immersed in boiling water previous to desiccation.—[U.K. 1850, November 12. No. 13,338.]

J. MURDOCH. Exposes animal and vegetable substances in a close chamber to a forced current of dry air, the carcasses of animals being previously injected with a solution of chloride of aluminum, chloride of sodium, and nitrate of potash.—[U.K. 1851, January 30. No. 13,477.]

A. M. FATEO and F. VERDEIL. First sprinkle meat with salt, and afterwards dry by subjecting it to the action of heated steam. The invention, with a few modifications, is applicable to the preservation of vegetables.—[U.K. 1854, January 31. No. 231.]

L. A. CHENU and F. F. PILLIAS. Immerse meat for two minutes in boiling water, drain it for a minute; plunge for a second into a bath composed of water and sal-ammoniac; and, having spread it on a sieve or riddle, leave it to dry in a stove or drying-chamber maintained at a temperature of about 180° Fahrenheit.—[U.K. 1854, October 20. No. 2242.]

T. S. GRIMWADE. Treats milk with carbonate of soda or potash and refined sugar, removes the cream, evaporates at 160° Fahrenheit to a dough-like substance, cuts this into slips, dries, reduces to powder, and packs in air-tight vessels.—[U.K. 1855, October 31. No. 2430.]

E. V. J. L. GORGES. Surrounds animal substances to be preserved with a porous covering of linen, sand, or porous charcoal, bakes them in an oven, and dries them in open air.—[U.K. 1857, January 1. No. 14.]

S. CAMPBELL. Preserves potatoes and carrots by dipping them in a solution of salt and water, subsequently in one of pearl barley or gum-arabic and carbonate of soda, after which they are granulated and dried.—[U.K. 1857, March 19. No. 771.]

J. J. RIDGE. Treats farinaceous substances by drying and then mixing with matters of an alkaline or saccharine nature.—[U.K. 1862, October 27. No. 2891.]

V. MIRLAND. Preserves rhubarb by drying the pulp, making it into a paste, and mixing it with sugar, &c.—[U.K. 1862, December 9. No. 3296.]

L. BRUNETTI. Embalms bodies and prevents the decay of animal substances by removing the blood by injections, and the fat by injections of alcohol and sulphuric ether; tans by a solution of tannin; and finally desiccates in an oven.—[U.K. 1867, June 25. No. 1850.]

4. EXTRACTING THE NUTRITIVE PRINCIPLE FROM MEAT, ETC.

J. ROBERTON. Places pieces of meat divested of fat into pans having perforated false bottoms; the meat is then pressed by a plate of wood or metal acted upon by a handle; the extracts are thus forced through the perforations, the superfluous water being removed by evaporation.—[U.K. 1851, August 21. No. 13,723.]

G. BORDEN, JUN. Macerates meat by heat or steam; strains the extract, which, being skimmed of the fat, is mixed with breadstuffs, and dried in a chamber or oven.—[U.K. 1851, September 5. No. 13,741.]

R. JOLLEY. Patents an apparatus intended, among other purposes, for drying and extracting.—[U.K. 1861, July 3. No. 1692. Also, 1861, December 7. No. 3069.]

J. BAKER. Patents a method of concentrating beef-tea.—[U.K. 1862, March 29. No. 882.]

J. IVES. Expresses juice from vegetable substances by means of rollers kept in contact by springs.—[U.K. 1862, June 13. No. 1765.]

H. JOSEPH. Proposes to utilize the "educts" of boiling-down establishments, by preparing from them an article suited to consumption as human food. To effect this, the residuary liquid, after being separated from the tallow, is filtered and pressed from the fibrous portion of the meat, and, having been flavored with salt, pepper, &c., is evaporated, at a temperature not exceeding 212° , almost to dryness, and packed in bladders, skins, or suitable vessels.—[Vict. 1862, March 11. No. $\frac{488}{331}$.]

R. MORSEN. Obtains extracts of meat by boiling in fat and running the result into boiling water, when, on the whole being allowed to cool, the fat separates and floats, whilst the extract and water remain combined.—[U.K. 1865, October 5. No. 2558.]

T. REDWOOD. Immerses meat in paraffine, wax, or spermaceti, at a temperature of 240° Fahrenheit, in order to remove the aqueous parts, after which the same is coated with paraffine. The extract of the meat is removed by boiling in paraffine at a temperature of 212° .—[U.K. 1865, November 10. No. 2892.]

A. H. HASSALL. First minces the meat, dries it at a low temperature, grinds, and again dries.—[U.K. 1866, February 15. No. 483.]

D. T. LEE. Combine extracts of meat with flour, meal, &c., and subsequently form the whole into biscuits, lozenges, &c.—[U.K. 1867, September 21. No. 2661.]

A. McCUBBIN. Mixes breadstuffs with the essence of meat, using it instead of water for the preparation of dough, to be made into biscuits, &c. "In order to procure the extract, a gallon of water to every ten pounds of lean meat is placed in a suitable vessel, and boiled for eight hours; more water is then added, and the whole boiled for two hours; the liquor is then drawn off, and, a smaller quantity of water being added to the meat, it is again boiled for one hour. After subjecting

“the residue to pressure very little extract will remain. The liquors thus collected may be condensed by boiling to any strength required, and flavored with vegetables, sugar, spices, &c.”—[Vict. 1867, March 15. No. 996 and 996^A.]

H. JOSEPH. Obtains an article of food from the boiling-down of carcasses, by “heating the flesh, properly divided, in water, by means of steam, variously applied, to about 160° Fahrenheit. The extract thus obtained is allowed to stand, so that the solid particles may settle, and, being filtered, is evaporated by steam, &c., until it forms a pasty mass containing about 5 per cent. of water, when it is placed in tins or bladders. The solid residue remaining from the first solution is then treated in the usual manner of boiling-down, by applying the steam direct for extracting the balance of the tallow.”—[Vict. 1867, August 9. No. 1031.]

J. VAN HEMERT's invention is intended to simplify the process of boiling-down and steaming carcasses. The apparatus employed is represented, in elevation, partly in section, by Fig. XI^A and by Fig. XI^B in plan. A is the safety valve; B, the manhole through which the carcasses are introduced; C, vat and boiler; D D, cocks for drawing off tallow; E, permeable movable false bottom, capable of being raised or lowered, for the purpose of inspecting and removing any sediment that might accumulate on the main bottom F O; G, the furnace; H, ash-pit; I, discharging-door through which the refuse is removed; J, gravity-cock for drawing off meat extract; and K, the chimney. The boiler having been filled with water to the depth of about twelve to eighteen inches, the carcasses are introduced by the manhole B, the cover of which being closed down, heat is applied, and the steam raised to a pressure of forty pounds per square inch. The novelty of the invention is that none of the steam is allowed to escape. The carcasses of sheep require five to six and those of cattle seven to eight hours' steaming. The steam is then blown off through the safety-valve, and pure cold water is introduced to check the boiling, purify the tallow, and raise it above the level of the tallow-cocks, by which it is run off into suitable casks, &c.—[Vict. 1867, August 27. No. 1036.]

H. W. LANGLANDS and J. F. DROOP. Add to the boiler of their apparatus, the details of which appear to resemble very closely the foregoing, a false bottom underneath the perforated plate, between which and the real bottom is a water-space. In the centre of the false bottom is an opening, to which is attached a vertical tube rising to the top of the boiler, where the safety-valve is placed. Near the top there is attached a bent tube, which descends through the carcasses and ends immediately under the perforated plate.—[Vict. 1867, October 1. No. 1050.]

T. BUSS. Extracts the juices from animal and vegetable matters, and filters liquids, by atmospheric pressure, after which such juices are concentrated by evaporation or otherwise.—[Vict. 1868, January 23. No. 1085.]

W. H. BARNES. Adopts, for the purpose of "boiling-down carcasses "and producing clear oil or tallow in one process," an apparatus in which there are "four or five main parts, namely, steam-boiler, vat, "settlers (if required), receivers, and coolers. There may, of course, "be more than one of either of these parts, the object and purpose "of which are indicated by their respective names."—[Vict. 1868, February 20. No. 1093.]

5. MANUFACTURE OF MATTERS TO BE TREATED INTO NEW SUBSTANCES.

M. DIOSY. Preserves potatoes by manufacturing from them vermicelli.—[U.K. 1858, May 12. No. 1064.]

M. SMITH. Makes potatoes into paste, forces the paste through perforated plates, and dries.—[U.K. 1863, August 8. No. 1965.]

C.—SALTING.

1. USE OF SIMPLE SALT, NITRATE OF POTASS, ETC.

B. BATLEY. Patents a method of curing herrings, &c., with salt.—[U.K. 1800, September 11. No. 2441. Also, 1801, January 20. No. 2465.]

G. DODI. Completely removes blood by repeated immersions in brine or pickles, and boils the brine, so that it may be used again.—[U.K. 1860, August 15. No. 1975.]

A. and E. M. DENNY. Maintain a constant circulation of the brine or preserving fluid within the tank, &c., containing the carcasses to be cured, by taking it away at the bottom and supplying it at the top.—[U.K. 1862, August 4. No. 2194.]

W. E. NEWTON. Uses nitrates of various bases for preservative purposes.—[U.K. 1862, December 8. No. 3289.]

W. C. THURGAR. Preserves eggs by adding salt and sugar after beating the whites and yolks together.—[U.K. 1865, January 6. No. 47.]

See also—B 3 ; A. M. Fateo and F. Verdeil, U.K. 1854, No. 231. S. Campbell, U.K. 1857, No. 771. D 3 ; C. M. P. de Kermoal, U.K. 1854, No. 1874. E 1 ; L. E. Seignette, U.K. 1836, No. 7036. And E 2 ; A. Cockburn, U.K. 1763, No. 793. J. Horsley, U.K. 1847, No. 11,691. I. Leys, U.K. 1856, No. 2138. C. F. Vasserot, U.K. 1856, No. 2976. S. Osler, U.K. 1858, No. 1198. R. A. Brooman, U.K. 1863, No. 2338. F. M. Moore, Vict. 1868, No. 1086.

2. IMPROVED METHODS OF APPLYING THE SALT AND OTHER INGREDIENTS MADE USE OF.

D. R. LONG. Injects an "antiputrescent" solution, such as water, salt, saltpetre, spices, and vinegar, into the blood-vessels by means of a force-pump.—[U.K. 1834, November 13. No. 6711.]

C. PAYNE. Impregnates the substances to be preserved with salt by placing them in brine, within a closed vessel, which is exhausted by a suitable pump, so that the pressure of the air on its re-admission may force the liquor into the pores of the substances.—[U.K. 1840, October 13. No. 8658.]

S. CARSON. For impregnating meat with a preservative liquid, makes use of atmospheric pressure, centrifugal force, or the impetus of the weight of a column of the liquid suddenly stopped while in motion.—[U.K. 1842, August 3. No. 9435.]

R. RETTIE. Patents certain improvements, which may be applied to salting, including, as it would appear, the formation of a vacuum.—[U.K. 1846, June 12. No. 11,240.]

A. TOOTH. Forces a saline solution into the carcasses of the animal just killed by means of the veins and arteries.—[U.K. 1855, July 21. No. 1650.]

J. MORGAN. Uses a solution of chloride of sodium and nitre, or solutions of an analogous nature, forced into the carcasses of dead animals by means of the circulatory system.—[U.K. 1863, February 14. No. 412.]

R. J. PEARCE for Dr. J. MORGAN. Injects a solution of saltpetre, sugar, and a decoction of allspice, pepper, &c., into the arterial system by means of a pressure-tube attached to the aorta.—[N.S.W. 1865, July 24. No. 115^A.]

W. SMITH. Proposes to preserve animals by injecting, by means of tubes and pressure, a weak solution of salt and water through the arterial system. When the solution commences to flow clearly from an incision made near the right auricle of the heart, the whole of the blood is known to be forced out of the carcass, and there is then injected by the same means the salted juices of meats previously cured.—[Vict. 1866, March 9. No. $\frac{897}{892}$.]

C. E. BROOMAN. Impregnates meat with a saline solution or other preservative fluid by means of atmospheric pressure acting upon the fluid in closed vessels, previously exhausted of air, in which the meat is placed.—[U.K. 1867, April 25. No. 1200.]

C. E. RICHARDSON and G. T. WATERMAN propose, by their invention, to "overcome an objection which has hitherto proved practically "fatal to the pickling and preservation of beef, pork, and other meats "during seasons of the year when the temperature is very high, and to

“render the process of preserving meats in brine or other liquids as safe
 “and certain of success during the summer months and in tropical
 “climates as during the winter.”

The *modus operandi* is stated to be as follows:—“The meat, when
 “fresh killed, is cut into pieces of the usual size and shape, the bones
 “remaining in their natural positions, and placed in a metallic vessel,
 “care being taken to leave small openings between the contiguous pieces.
 “The metallic vessel or freezer is provided with a suitable cover, and is
 “placed within a larger vessel, which may be of wood; the space
 “between the two vessels is now filled with any suitable freezing mix-
 “ture; a mixture of pounded ice and common salt as practised in the
 “ordinary mode of making ice-cream will answer well in practice. The
 “air is then excluded; the mixture of ice and salt produces a tempera-
 “ture equal to the zero of Fahrenheit, and the meat remains subject to
 “the cooling process until it is frozen, every piece being frozen hard and
 “solid at the centre as it is on the outside. Great care must be taken
 “that the meat remains long enough in the inner vessel to become
 “solidly frozen throughout. The effect of this freezing of the blood,
 “water, serum, and other liquids contained in the flesh, is to increase
 “their bulk or volume and distend all the pores and cavities within the
 “meat. While the pores are filled with ice and distended, as above
 “stated, the pieces of meat are removed from the freezer and at once
 “immersed in saturated brine. The frozen meat begins to thaw imme-
 “diately, and the solution of salt that surrounds it is absorbed and
 “penetrates every part until the whole is completely impregnated. The
 “brine is prepared by dissolving one bushel of salt in sufficient water to
 “form a saturated solution, and adding thereto half an ounce of saltpetre
 “with about one and a half pound of sugar. The meat is then packed
 “in barrels for use or transportation. With reference to the economy of
 “this process, it may be mentioned that the salt which, mixed with the
 “broken ice, forms the freezing mixture, is subsequently used for making
 “the brine in which the meat is salted.

“The process may be applied to the curing of fish and other animal
 “matters, and solutions of other chemical substances may be used and
 “varied in any required manner.”—[Vict. 1868, October 29. No. 1179.]

See also—A 2; J. Bridgman, U.K. 1858, No. 1011. E 2; J. Morgan, Vict. 1865, No. $\frac{831}{850}$.

3. USE OF MATERIALS WHICH OBVIATE THE NECESSITY OF OVERSALTING.

W. CLARK. Plunges the meat to be preserved into molasses, by which means the necessity for using salt is obviated.—[U.K. 1859, November 19. No. 2616.]

W. CLARK. Treats the meat, first, with sugar or salt; second, with salt and vinegar; and thirdly, with tale, sulphate of baryta, carbonate of lime, &c. The object appears to be to desiccate the meat so treated as speedily as possible.—[U.K. 1861, February 6. No. 309.]

4. REMOVAL OF THE SALT FROM MEAT, ETC., PREVIOUS TO ITS CONSUMPTION AS FOOD.

A. WHITELAW. In order to separate the salt from brine, &c., subjects it to the process of dialysis. In describing his invention the patentee says—"The process of dialysis takes place when a fluid mixture of so called colloid and crystalloid substances is on one side of a suitable diaphragm, which has water on its other side. Under these circumstances, the crystalloid substances, or a large portion of them, pass through the diaphragm into the water, leaving behind the colloid substances. Brine is a mixture of colloid juices and crystallized salts, which I find may be separated sufficiently and satisfactorily by this process of dialysis. The membrane or material by means of which the dialytic separation is effected may be a soft substance of close texture, such as 'parchment-paper,' vellum, bladder, skin, or other animal membrane; or a soft gelatinous substance combined with a woven fabric; or again a porous material such as porous earthenware, having the pores filled with size or the like gelatinous substance. Moist clay or other suitable plastic material may be used in forming dialytic partitions or envelopes."

The mode most commonly adopted appears to be to place the brine to be treated within bladders immersed in water, the water being changed once or twice a day until the third or fourth day, when the principal part of the salt will be found to be removed, leaving the juice of the meat contained in the brine nearly free from saline matter. The juice so obtained is afterwards partially evaporated, so as to form soup, or to a greater extent, so as to change it into a kind of meat extract.—[U.K. 1863, December 30. No. 3295.]

F. HAUDUCOEUR's invention is an improved method of washing the salt out of butter.—[U.K. 1868, May 28. No. 1758.]

See also C 1; G. Doidi, U.K. 1860, No. 1975.

D.—EXCLUSION OF AIR.

1. USE OF SOME IMPERVIOUS SUBSTANCE IN WHICH THE MEAT IS IMMERSSED.

W. JAYNE. Preserves eggs by immersing them in a mixture of water, salt, and cream of tartar.—[U.K. 1791, February 8. No. 1791.]

F. PLOWDEN. Proposes to preserve animal and other substances by enclosing them with a substance capable of "resisting the effects of atmospheric air," and which "will not communicate any noxious quality to its contents." The substances, by preference, "are dressed, wiped dry, put into a vessel in a cold state," and the preservative substance poured upon them. "The vessels used are best of wood, and should be kept as dry as possible."—[U.K. 1807, June 13. No. 3051.]

L. GRANHOLM. Preserves animal and vegetable substances by pouring hot melted fat or hot animal jelly into the vessels in which the substances are packed, so that the interstices between the pieces may be filled up and the air excluded; or the substances are covered with melted suet, and, being packed in suitable vessels, the interstices are filled up with a saturated solution of salt.—[U.K. 1817, August 5. No. 4150.]

R. WARINGTON. Prevents contact with the air and consequent putrefaction "by coating the substances to be preserved with common glue, gelatine, or concentrated meat gravies; by dipping into warm solution of such substances"; or he dips the same matters into thin cream of plaster of Paris, which, when set, is saturated with melted suet. The substances so treated may be first wrapped in waterproof cloth, &c., or coated with a varnish of caoutchouc or gutta-percha; or the same substances are immersed in glycerine, treacle, elaines, oils, and other matters not liable to oxidation.—[U.K. 1846, March 5. No. 11,120.]

J. TRAVIS and J. MCINNES. Patent a method of packing lard in woven fabrics coated with a mixture of "animal gelatine, with farina or starch paste," and subsequently dipped in a "saturated solution of common salt and alum."—[U.K. 1848, December 21. No. 12,381.]

T. DELABARRE and A. BONNET. Previous to drying meat, poultry, &c., to be preserved, cover them with a varnish made by boiling "flesh and bones," clarifying the same "by aid of albumen, and, while still warm, adding alcohol."—[U.K. 1855, January 6. No. 36.]

M. B. RENNIE. For excluding air, makes use of a coating, employed in a liquid state, of jelly mixed with albumen or alcohol.—[U.K. 1855, January 19. No. 153.]

E. HARTNALL. Uses, for preservative purposes, baths composed of gelatine and treacle, with, at times, a small quantity of alcohol and isinglass. When the first coating has hardened, the substance is re-dipped, and the surface covered with charcoal powder.—[U.K. 1855, February 5. No. 269.]

J. WOTHLY. Treats animal substances with sugar and salt; removes blood or serous matter by pressure or moderate cooking; envelopes the substances with greased paper; having packed them in a cask, pours melted tallow into the interstices; encloses this cask in a second, and fills up the intervening space with lime, sand, or melted fat.—[U.K. 1855, February 20. No. 375.]

J. TAYLOR. Preserves eggs, &c., by placing them into moulds into which plaster of Paris is poured so as to form blocks. Certain substances require to be first covered with tinfoil or woven fabric previous to being enclosed in the plaster.—[U.K. 1855, March 8. No. 519.]

R. S. BOUTËT and H. E. I. DOUEIN. Applies a layer of collodion to the substances to be preserved.—[U.K. 1855, December 11. No. 2800.]

G. WARRINER. Immerses the substances to be preserved in glycerine, &c., to which sugar and salt may be added. They are then packed in casks with powdered charcoal, or are covered with a mixture of glycerine or osmazome.—[U.K. 1856, August 25. No. 1982.]

A. C. DANDRAUT. Avoids contact with the atmospheric air by plunging the substances to be preserved into a bath of melted resin.—[U.K. 1857, February 11. No. 399.]

W. CLARK. Surrounds butter to be preserved with paper prepared with albumin (from eggs), chloride of sodium, and nitre. The paper is heated before and after its preparation with a hot iron.—[U.K. 1858, May 27. No. 1192.]

S. DREYFOUS, G. RICHER, and E. CORMIER. Preserve eggs, &c., by wrapping them in paper, and packing with powdered charcoal, in boxes of plaster of Paris or other matters capable of being hermetically sealed.—[U.K. 1859, March 26. No. 764.]

W. E. NEWTON. Uses hydro-carbons, and removes the disagreeable taste thereof by treatment with sulphuret of carbon.—[U.K. 1859, October 17. No. 2367.]

E. A. S. BURGESS-BURGESS. Preserves anchovies by placing them in air-tight vessels with spiced vinegar or best Lucca oil, with the addition of bay leaves.—[U.K. 1859, November 12. No. 2573.]

E. CORMIER. Covers eggs, for preservation, with copal varnish or other similar substance.—[U.K. 1859, December 15. No. 2854.]

R. A. BROOMAN. Effects a superficial desiccation of meat by a current of hot air; immerses it in a bath of tannin, and, when the meat contains large vessels, dips it into melted fat; covers with successive coats of gluten and "sugar of lime (*sucrate de chaux*)";* and, if the meat is to be exposed to a damp atmosphere, covers it with coats of varnish.—[U.K. 1861, August 20. No. 2067.]

J. STENHOUSE. Renders substances less pervious to air, &c., by means of paraffine, beeswax, stearine, stearic acid, &c.—[U.K. 1862, January 8. No. 55.]

D. W. REA. Packs animal matters in a mixture of lard, lard oil, suet, fat, or other like substance, and grated horseradish.—[U.K. 1863, November 24. No. 2951.]

T. NICHOLS. Coats eggs with "gum-damar" dissolved in benzine, or gum-arabic dissolved in water, a little soda and syrup being added.—[U.K. 1864, July 1. No. 1642.]

R. T. MONTEITH. Smears the eggs with butter or grease and immerses them in lime water, milk of lime, or lime water and albumen.—[U.K. 1864, August 13. No. 2026.]

W. E. NEWTON. Preserves eggs by means of "quick (slacked) lime, salt, soda, saltpetre, cream of tartar, and borax, which being dissolved in water harden the shell."—[U.K. 1866, August 23. No. 2172.]

* Saccharate of lime.

E. C. DAWSON. For holding preserved meat, uses cases composed of wood lined with plaster of Paris. A covering of paper, leaves, &c., is placed on the meat, &c., and a coating of plaster of Paris is poured over it.—[U.K. 1866, October 12. No. 2639.]

T. REDWOOD. Prevents the meat to be preserved from coming into contact with atmospheric air, by immersing it in a substance, such as paraffine, wax, spermaceti, or stearic acid, capable of being liquefied by heat. The heat is kept in this substance, heated to about 100° centigrade for some time. The operation drives out the contained air, concentrates the juices, and, when the meat is taken out and allowed to cool, leaves a thin film of impermeable substances completely covering the surface. If the meat is required to be more completely deprived of its contained juices, the paraffine, &c., may be heated to from 115° to 120° centigrade, and the operation continued for a longer period.—[Vict. 1866, May 15. No. $\frac{905}{910}$.]

J. HOOD. Preserves meat, fish, game, &c., by covering the same, when fresh, with pure paraffine or other hydro-carbon, fat or oil, in a fused state. When required for use, the articles preserved must be immersed in boiling water long enough to remove the preserving substance.—[Vict. 1866, May 18. No. $\frac{943}{944}$.]

J. C. MARTIN. In order to pack animal size, casts it into blocks, and encloses it in a case or bag of some flexible material sufficiently waterproof to exclude moisture and air.—[U.K. 1867, March 5. No. 607.]

T. REDWOOD. Preserves meat, &c., by enclosing in air-tight vessels containing paraffine, subjecting to heat, and then coating the meat, &c., with a transparent film of gelatine or glycerine.—[U.K. 1867, July 15. No. 2079.]

J. M. SPENCE. Prevents contact with atmospheric air by immersing the meat in melted tallow.—[Vict. 1867, September 23. No. 1047.]

W. THOMSON and W. L. MORTON. Propose to preserve animal carcasses by injecting, immediately after death, pure melted tallow or fat, through the aorta, until the whole of the blood-vessels are filled with it. The carcasses so treated are subsequently packed in casks or vessels filled with the same melted substance.—[Vict. 1868, March 18. No. 1100.]

G. E. GREEN. Covers any meat, &c., either cooked or uncooked, to be preserved, with a coating of "sperm"; in some cases, previously curing the meat, &c., with salt, &c. The articles so treated are subsequently placed in casks, &c., the interstices between the pieces being filled up with "sperm," fat, oil, pickle, gelatine, size, or any antiseptic fluid, so as to render the articles impervious to external air or any other detrimental influences.—[Vict. 1868, March 24. No. 1103.]

See also—B 2 ; T. Delabarre and L. Bonnet, U.K. 1854, No. 223. B 3 ; J. Donaldson, U.K. 1793, No. 1933. B 4 ; T. Redwood, U.K. 1865, No. 2892. D 3 ; P. A. Le C. de F. Moreau, U.K. 1853, No.

11467. E 1; J. H. Johnson, U.K. 1857, No. 951. A. Hett and F. W. Bassett, N.S.W. 1864, No. 95. I. Baggs, U.K. 1865, No. 2812. H. Medlock and W. Bailey, U.K. 1866, No. 1707. R. Caldwell, Vict. 1868, No. 1142. And E 2; C. L. Marle, U.K. 1856, No. 1332. H. Leys, U.K. 1856, No. 2138. R. A. Brooman, U.K. 1858, No. 101. J. Morgan, U.K. 1866, No. 1904.

2. ENCLOSURE IN SUITABLE VESSELS MADE AIR-TIGHT.

J. WALKER. Patents an improved kind of tube, applicable to various uses; among others, to the preservation of vegetable substances, apparently by its ability to exclude air.—[U.K. 1812, July 16. No. 3585.]

Æ. MORRISON. Cooks the meat, &c., to be preserved, in vessels rendered air-tight by means of a cork coated on the under part and sides with bladder, and covered at the top with a lute.—[U.K. 1819, March 23. No. 4350.]

J. VALLANCE. Patents a method of preserving hops by packing them in air-tight cases.—[U.K. 1820, June 20. No. 4480.]

C. E. DEUTSCHE. Patents a mixture composed of gums, resins, turpentine, &c., wherewith to coat the outsides of preserve tins, &c.—[U.K. 1842, October 8. No. 9487.]

J. COOPER's invention relates to the closing of vessels, bottles, &c.—[U.K. 1843, December 5. No. 9970.]

W. FARMER. Patents an improved kind of vessel for holding provisions. It appears to be formed with two outer walls, between which is a space containing water; into this water a flange on the cover is made to dip, thus effectually shutting out the air.—[U.K. 1853, September 24. No. 2205.]

C. F. STANSBURY. Patents an improved method of closing jars, pots, &c., by means of an annular groove filled with various substances, as mercury, glycerine, &c., or, if a permanent enclosure be intended, with melted solder; into this groove the edges of the cover are placed, and the joint is consequently air-tight.—[U.K. 1854, August 5. No. 1719.]

W. H. TAYLER. Patents improvements in hermetically sealing preserve canisters, &c., by means of a new arranged screw-cap and fittings; vulcanized caoutchouc, &c., or cement, is used for securing an air-tight joint.—[U.K. 1855, July 16. No. 1590.]

G. H. PERRY's invention is similar to the above.—[U.K. 1855, July 21. No. 1651.]

J. HOUSE. Preserves milk in hermetically sealed tins, after heating it in a vessel provided with a stirrer.—[U.K. 1857, January 1. No. 15.]

L. J. A. DANNE. Patents a method of making gutta-percha glue, and applying it to close preserve tins.—[U.K. 1857, May 27. No. 1504.]

J. COEY. Patents an improved glass case within a wooden one for packing butter.—[U.K. 1859, September 24. No. 2168.]

J. H. GREEN. Patents a composition applicable for coating tins, &c., composed of emery, pumice stone, corundum, Paris white, lamp black, magnesia, india-rubber or gutta-percha cement, mixed and ground together with linseed oil, turpentine, and "slow Japanese varnish."—[U.K. 1859, October 21. No. 2407.]

W. E. GEDGE. Patents an improved box for sardines, by which the opening of the same is facilitated.—[U.K. 1859, December 23. No. 2925.]

L. D'AUBREVILLE. Patents an improved method of soldering preserve tins.—[U.K. 1860, April 27. No. 1059.]

M. V. BOUQUET. Patents a method of stopping the covers for vessels containing alimentary substances.—[U.K. 1860, July 13. No. 1689.]

C. STEVENS.—Treats subjects for preservation with a mixture of water, salt, and parsley, afterwards enclosing them in hermetically sealed vessels.—[U.K. 1860, September 7. No. 2161.]

M. V. BOUQUET. Patents an improved mode of stopping bottles and other vessels.—[U.K. 1861, January 12. No. 96.]

G. T. BOUSFIELD. Patents an improved kind of stopper formed of a hollow cylinder of india-rubber within which is a plug of wood.—[U.K. 1861, December 3. No. 3031.]

A. FORD. Protects beer and other fluids from contact with air by means of a cask lined with an air-proof sack.—[U.K. 1862, June 9. No. 1716.]

J. BOUVET. Patents an improved provision tin, capable of being opened with more ease than those constructed in the ordinary way.—[U.K. 1862, September 19. No. 2569.]

A. FORBES. Patents an improved kind of vessel formed of tin-plate.—[U.K. 1862, October 7. No. 2708.]

F. G. STUBER. Makes boxes, &c., air-tight by means of vulcanized india-rubber interposed between the lid or door and the vessel itself.—[U.K. 1863, January 29. No. 276.]

G. W. YAPP. Places the substances to be preserved in tins filled with water, bouillon mixed with glycerine and an acid, after which the tins are hermetically closed.—[U.K. 1863, November 24. No. 2949.]

T. BATE. Patents an improved receptacle for biscuits, fruits, &c.—[U.K. 1863, December 7. No. 3075.]

A. SIMPSON's patent refers to an improved method of soldering metals especially applicable to the closing of preserve tins. The principal apparatus, &c., employed are shown by Figs. XV.^A to XV.^H. These include means for cutting and bending the tin XV.^C and XV.^H; furnace and melting pots for fuzing the solder XV.^A, XV.^B and XV.^G; soldering

tool XV^F.; and soldering-bolts heated respectively by gas XV.^D, and by charcoal, &c., XV.^E.—[Vict. 1864, February 8. No. $\frac{701}{684}$; and N.S.W. 1864, August 17. No. 97.]

G. K. GEYELIN. Patents a method of making jars for preserving eggs air-tight by means of a cap of india-rubber.—[U.K. 1865, February 27. No. 546.]

S. T. GARRETT. Patents a stopper by means of which the drawing of the contents of flasks, &c., is greatly facilitated.—[U.K. 1865, May 12. No. 1320.]

L. H. GILLET. Patents a peculiar form of provision tin, so formed that the contents thereof may be heated, previous to consumption, by means of ignited charcoal.—[U.K. 1865, September 27. No. 2473.]

G. P. HENNING and H. COLE. Patent a method of securely closing vessels by means of a groove which contains a liquid.—[U.K. 1865, November 20. No. 2986.]

R. YEATES. Patents an improved knife for opening provision tins.—[U.K. 1866, February 27. No. 599.]

J. MACKINTOSH's invention refers to certain improvements, where india-rubber, gutta-percha, &c., are used, to a certain extent applicable to the closing of provision cases.—[U.K. 1866, March 12. No. 748.]

W. E. NEWTON. Patents an improved kind of jar for containing meat, fruit, &c., the principal features of which are a certain shape, offering greater facilities for heating, and a method of securely closing the mouth of the jar by means of a cover fastened with straps.—[U.K. 1866, June 7. No. 1573.]

F. HUTCHINSON. Patents an improved kind of stopper, formed of a cylinder of cork, containing a plug which is ribbed or fluted.—[U.K. 1867, January 24. No. 187.]

J. H. JOHNSON. Uses two tins, one a trifle larger than the other; the larger is made to slip on the smaller, and is soldered at the bottom edges of its sides.—[U.K. 1867, February 5. No. 321.]

N. THOMPSON. Patents a method of closing vessels.—[U.K. 1867, March 28. No. 916.]

A. S. STOCKER. Forms stoppers, for bottles, of cork or a mixture of glue, resin, oil, water, and whiting. They are prepared with screws for fixing them to the neck of the vessel to be closed.—[U.K. 1867, March 26. No. 869.]

W. DENNIS. Patents improvements in bottles.—[U.K. 1867, April 6. No. 1033.]

L. SLATTER. Patents an improved case for transporting butter. No particular preservative agencies are described.—[U.K. 1867, May 24. No. 1546.]

P. SMITH. Patents an improved method of securing the contents of bottles.—[U.K. 1867, June 29. No. 1899.]

H. B. FOX and J. T. HALL. Form stoppers for bottles by combining wood with cork or india-rubber.—[U.K. 1867, July 10. No. 2021.]

R. BEARD. Coats the stoppers of bottles, &c., with some elastic substance which yields to the inequalities of the neck.—[U.K. 1867, October 8. No. 2829.]

L. NEWTON and T. KERSHAW. Obviate the necessity of wiring the corks of bottles by making the aperture containing the cork at right-angles to the axis of the bottles.—[U.K. 1867, October 26. No. 3018.]

C. H. DE CASTELLA. In order to preserve wine, forms a cylindrical vessel of metal, earthenware, &c. The vessel is without a head, but in place of this has a plunger moving freely from top to bottom of the vessel, and fitted with an india-rubber ring, which presses against the sides of the cylinder, thus preventing the ingress of air. Fig. XIX.^A shows a cask so constructed in section; Figs. XIX.^B and XIX.^C are respectively a plan and section of the piston. The larger wheel *a*, shown by a dotted outline, is marked with divisions so as to indicate the quantity of wine or other liquid that has been drawn out.—[Vict. 1863, October 23. No. $\frac{687}{881}$; also, 1867, March 21. No. 998.*]

I. POIRZER. Patents a safety stopper for bottles, &c., formed of an india-rubber tube attached to a metallic ring. The india-rubber tube is made to expand by means of a conical wooden peg turned by a nut.—[U.K. 1868, May 20. No. 1652.]

A. K. SMITH. Preserves wines and other liquids by means of a flexible bag of india-rubber placed within the cask, and made to be filled with water by hydraulic pressure as the wine, &c., is drawn off.—[Vict. 1868, May 28. No. 1118.]

T. C. BLANCHFLOWER. Patents a disc, of glazed earthenware or glass, fitting into preserve jars so as to exclude the air from the substances to be preserved.—[U.K. 1868, June 26. No. 2063.]

M. HENRY. Patents an improved kind of tin or other metal case, which is covered with varnish in order to prevent oxidation. The bottom has an orifice, through which the meat, &c., are introduced; this orifice is afterwards closed by a cap or stopper, so constructed that it may be fastened instantly by means of a heated soldering-iron. Means are adopted for facilitating the opening of the case. The bottom of the case is made convex on the outside, and afterwards (the meat, &c., being introduced whilst heated, drives out the air and forms a vacuum on cooling) assumes a concave form, presses upon the contents, and packs them tightly.—[U.K. 1868, July 3. No. 2131.]

C. J. L. NICHOLSON. Patents a means of forming an air-tight joint for closing cans.—[U.K. 1868, August 1. No. 2421.]

* The second patent is a modification of the first, and of more simple construction.

G. H. BARBER. Places meat, &c., to be preserved within an airtight bag, &c. The bag is placed within a receptacle having open trays or perforated partitions.—[U.K. 1868, August 22. No. 2619.]

G. NUTTING and H. LEEK. Improve the construction of preserve tins by forming the top with an inward flange upon which the cover is made to rest, and to which it is soldered down. A can so constructed is shown by Figs. XVI.^A and XVI.^B where B is the circular cover and AA the flange upon which the cover is fixed when the can is closed.—[Vict. 1868, October 14. No. 1171.]

G. WILSON. Patents a cask which may be used for holding meat, butter, &c; the improvement consists in making the edge of the lid to form a male screw, the threads of which work into those of a female screw cut round the interior of the top of the cask. A section of the cask is shown, with the head in position, by Fig. XVIII.^B Fig. XVIII.^A is a plan of the lid. In these figures A is the interior of the cask; C the lid; BB the thread of the several screws; and D a handle by means of which the lid is screwed into or out of position.—[Vict. 1869, April 30. No. 1235.]

See also—A 4A; G. Burnard and L. Koppel, U.K. 1866, No. 1198. B 4; H. Joseph, Vict. 1862, No. $\frac{488}{531}$. E 1; I. Baggs, U.K. 1865, No. 2812. W. Fox, U.K. 1865. No. 2919. O. C. Hillman, Vict. 1867, No. 1025. E. W. Lang, Vict. 1867, No. 1027. P. Hayes, Vict. 1867, No. 1034. J. Manning, Vict. 1868, Nos. 1101 and 1101^A. G. W. Perry, Vict. 1868, Nos. 1114 and 1114.^A E 2; J. Ryan, U.K. 1846, No. 11,420. F. B. Bekaert, U.K. 1847, No. 11,726. J. Neuenschwander, U.K. 1856, No. 2111. R. A. Brooman, U.K. 1856, No. 2637. C. F. Vasserot, U.K. 1856, No. 2976. J. Neuenschwander, U.K. 1857, No. 697. J. Avery, U.K. 1857, No. 714. P. A. Le C. de Fontaine Moreau, U.K. 1857, No. 1286. M. Semple, U.K. 1857, No. 3090. E. J. Hughes, U.K. 1859, No. 536. J. Morgan, U.K. 1866, No. 1904. (See further contrivances for containing vessels, &c., under the subsequent heading.)

33. EXPULSION OF AIR, OR ITS OXYGEN, PRINCIPALLY BY MEANS OF HEAT OR MECHANICAL AGENCIES.

A. DE HEINE. After placing the substances to be treated in fitting vessels of glass or earthenware, exhausts the atmospheric air by means of a particularly formed exhausting machine.—[U.K. 1810, February 26. No. 3310.]

P. DURAND. Excludes air from the containing vessels of glass, earthenware, tin, &c., by means of corks (“formed of pieces glued together so that the pores of that substance shall be in a cross direction to the aperture into which the corks are driven), ground glass stoppers, or screw-caps. A small aperture is left unclosed whilst the contents of the vessel are heated by means of a bath of cold water, raised gradually to the boiling temperature, a bath of steam, or an oven. The aperture is completely closed as soon the effect of the heat has taken place.”—[U.K. 1810, August 25. No. 3372.]

P. A. ANGILBERT's patent refers principally to the method of closing tins used for preserving. The tins are made with a channel round the top, and the solder placed therein for fastening the cover is melted by means of hot coals arranged round the tops of the tins. In the cover is a small hole through which the atmospheric air is drawn out, which being accomplished, the hole is closed by a small piece of solder.—[U.K. 1833, June 1. No. 6432.]

J. WERTHEIMER. Excludes the air from provision cases by means of a burner. Two apertures are left for some time, through which the air escapes. After these holes are at length closed, the heat is continued for some time, in order that the remaining air in the case may be decomposed.—[U.K. 1839, June 20. No. 8117; and 1840, February 8. No. 8378.]

H. GUNTER. Places the animal substances to be preserved in hermetically sealed tin cases; heats these in a boiler so as to cook their contents; punctures their tops with a small hole, through which the air is driven out by the vessels being placed in a hot sand bath; after which the punctured orifice is soldered up.—[U.K. 1841, January 6. No. 8776.]

S. GOLDNER. For heating the cases so as to expel air, &c., uses a chemical bath composed of muriate of lime, nitrate of soda, &c., and capable of being heated above the boiling point of water, but not sufficiently high to burn the substances treated.—[U.K. 1841, March 8. No. 8873.]

J. WERTHEIMER's invention is exactly similar to the above.—[U.K. 1841, March 8. No. 8874.]

J. BEVAN. Expels air from the cases by connecting them with a vacuum chamber, on the one hand, and with a vessel filled with gelatine, &c., on the other, in such a manner that, by opening the communication, the air escapes into the exhausting apparatus, whilst the gelatine supplies its place. This method is said to admit of the food being cooked at a low temperature.—[U.K. 1842, April 6. No. 9312.]

S. CARSON. Preserves eggs by puncturing one end; packing them, with the punctured end upwards, within tins, similar to those used for preserving meat, which, the air having been exhausted by means of steam, are hermetically sealed down.—[U.K. 1845, November 4. No. 10,922.]

J. J. B. M. DE LIGNAC. Evaporates milk to one-sixth of its bulk, places in sealed tins and heats these to a temperature of 210° Fahrenheit, at which heat they remain for ten minutes.—[U.K. 1847, October 7. No. 11,892.]

W. SYMINGTON. For preserving milk, employs a vessel having a short tube of soft metal; to this tube is affixed one leading to the vessel containing the milk; the vessel, being deprived of air by being heated, or

by an air-pump, is filled with milk by atmospheric pressure, after which the tube is closed by being pinched and subsequently soldered.—[U.K. 1853, February 25. No. 477.]

A. ROBERTSON. Patents an improved vessel intended for holding preserved provisions, and constructed with "a valve or door ground air-tight." The provisions having been placed within this, the air is exhausted therefrom by means of a pump.—[U.K. 1853, June 15. No. 1448.]

P. A. LE C. DE F. MOREAU. Preserves milk and other substances, by covering them with a layer of oil, the air being expelled from the containing vessel by an exhaust-pump, &c.—[U.K. 1853, June 16. No. 1467.]

C. M. P. DE KERMOAL.—Dips the meat in boiling water for a few seconds, boils until partially cooked, cuts in pieces, immerses in preservative "mixture of vinegar and salt and water" in a box, which, after having been heated by steam at 270° Fahrenheit, is hermetically closed, and again heated, so as to cook the meat and "neutralize the oxygen in the remaining air."—[U.K. 1854, August 26. No. 1874.]

G. NASMYTH. Discharges the atmospheric air from preserve cans, &c., through a tube by means of the vapor of alcohol. The alcohol, which vaporizes at a low temperature, may be placed in a separate vessel connected with the meat vessel by a second tube. In this case both vessels are heated, and, the air being driven out of the meat vessel, the tubes are closed by pinching, and afterwards soldered.—[U.K. 1855, February 21. No. 381.]

J. AVERY. Uses an apparatus for exhausting, the principal features of which are, "an air-pump without valves," and "certain devices to hold the plug or stopper during exhaustion."—[U.K. 1855, August 25. No. 1923.]

J. J. B. S. M. DE LIGNAC. Deprives animal substances, by extracting 50 per cent. of moisture by hot air, pressing them into boxes, filling up the interstices with "concentrated liquor," soldering the lid, and submitting the box to a temperature sufficient to produce steam.—[U.K. 1855, October 30. No. 2422.]

R. A. BROOMAN. Obtains a vacuum for preservative purposes by means of water in an arrangement of tubes.—[U.K. 1856, March 6. No. 569.]

E. C. TISDALL. Deprives preserving vessels of their air by placing them, at a high temperature, in a chamber deprived of its air by means of a jet of steam, &c. The temperature is maintained until the oxygen is decomposed, after which the vessels are closed by caoutchouc, gutta-sercha, bladder, &c.—[U.K. 1857, November 25. No. 2948.]

F. CHAPUSOT and V. AVRIL. Exhaust air from preserving vessels by means of the principle of the vacuum of Torricelli.—[U.K. 1858, July 4. No. 1583.]

J. N. RYDER. Preserves fruit by heating in vacuo and then hermetically sealing the enclosing vessels.—[U.K. 1859, March 8. No. 605.]

F. H. TREVETHICK and R. JONES. Patent an improved method of exhausting preserve tins by which the collapsing or bursting of the same is obviated.—[U.K. 1860, July 31. No. 1859.]

G. DAVIES. Expels the enclosed gases from preserve tins by causing them to bubble through water placed in a vessel above the tin. After this is effected the aperture is closed, and the meat, &c., are completely cooked in closed tins.—[U.K. 1861, September 24. No. 2386.]

W. CLARKE. Bakes animal or vegetable substances in a peculiar kind of oven in which a vacuum is produced.—[U.K. 1862, April 29. No. 1252.]

A. F. RÉMOND. Places the provisions to be preserved in tin or other vessels hermetically closed, but with a small hole at the top, having the short pipe *b* (Figs. V^A to V^C) attached. In this pipe is inserted the short pipe *d* of the vessel *c*. Upon heat being applied, by placing the lower vessel in a boiler, or otherwise, the air contained in the vessel *a* is made to bubble up through the water driven from the lower into the upper vessel. At a given period of the operation, the tube *b* is closed by compression, the upper vessel removed, and the now completely sealed lower vessel is subjected to further boiling until the meat within it is completely cooked. When many tins are to be treated at the same time, they are lowered by the chains *dd* (Figs. V and V^C) and the grating *cc* into the trough *b b*, heated by a number of steam-pipes *ee*. The tins are connected by means of the pipes *hh* with the upper vessels *ff*, also heated by the steam-pipes *gg*.—[Vict. 1862, March 20. No. $\frac{490}{533}$; and N.S.W. 1862, July 2. No. 87.]

P. A. LE C. DE F. MOREAU. Expels air from provision cases by introducing fatty substances and carburetted hydrogen gas.—[U.K. 1864, August 17. No. 2043.]

A. C. HENDERSON. Preserves meat by enclosing it in a crust of flour, salt, butter, and eggs, placing it in an open tin case, and subjecting it to the action of heat in an oven, adding a small quantity of brandy, and, the case being soldered down, boiling the whole for two hours in a water bath.—[U.K. 1865, March 8. No. 645.]

R. JONES. Removes the air from preserve tins by aid of a vacuum formed by means of a descending column of water.—[U.K. 1865, November 16. No. 2952.]

E. H. C. MONCKTON. Expels the atmospheric air by means of the vapor of ether (nitric preferred), and then closes the sole remaining orifice of the vessel with a drop of tin.—[U.K. 1867, May 20. No. 1493.]

J. WILKIE. In order to expel the atmospheric air from meat tins forms the cover, which is soldered down, with a short tube of malleable

metal. The air is then driven out by heating the cans, and, this being done, the tube, at first closed by pressure, is afterwards completely sealed by means of solder.—[Vict. 1867, September 17. No. 1046].

See also—B 1 ; R. A. Brooman, U.K. 1859, No. 1202. B 3 ; T. S. Grimwade, U.K. 1847, No. 11,703. E 1 ; R. Jones, U.K. 1864, No. 1523. A. Hett and F. W. Bassett, U.K. 1864, No. 1570. R. Jones, Vict. 1865, No. ~~814~~⁸¹³. And E 2 ; W. Clark, U.K. 1859, No. 330. M. Webb and C. G. Duffy, Vict. 1868, No. 1081.

4. EXCLUSION OF AIR BY MEANS OF AN INERT GAS.

D. CURRIE. Preserves animal and vegetable substances by placing them in vaults, vessels, &c., from which the air has been displaced by carbonic acid gas.—[U.K. 1828, January 21. No. 5614.]

C. COWPER. Proposes to preserve butter, meat, fish, &c., by impregnating the substances with an aqueous solution of carbonic acid, or with carbonate of soda and tartaric acid, or other substances capable, on being mixed, of generating carbonic acid gas.—[U.K. 1853, January 31. No. 246.]

G. NASMYTH. Uses "carbonic acid gas or carbonic acid gas with "vapor or gas obtained from alcohol in a cold or natural state," for filling cases, which are, of course, made air-tight.—[U.K. 1855, August 7. No. 1788.]

W. CLARK. Introduces hydrogen, azote, &c., into hermetically sealed tins containing the provisions.—[U.K. 1860, June 7. No. 1404.]

J. L. W. THUDICHUM. Fills the vessels containing provisions with carbonic acid gas.—[U.K. 1862, December 18. No. 3396.]

D. JONES and B. L'A. BROMWICH. Preserve wines, &c., by filling the space left by drawing off with carbonic acid gas ; also, use a movable head worked by a screw, or insert an air-tight bag to rest on the top of the liquid.—[U.K. 1864, May 10. No. 1188.]

A. V. NEWTON. Deprives substances of their moisture, if animal, by salt ; if fruit, by sugar ; and then places them in closed tins out of which the air has been driven by carbonic acid gas.—[U.K. 1865, December 9. No. 3172.]

A. E. BLAVIER. Uses carbonic acid gas, in hermetically sealed chambers, as a preservative agent.—[U.K. 1866, November 17. No. 3014.]

N. S. SHALER. For preservative purposes, combines the use of chambers maintained at a low temperature with the employment of carbonic acid gas within the chambers.—[U.K. 1866, November 26. No. 3112.]

M. WEBB. In describing her invention says:—"The meat or "other organic matter is let down into a vault or chamber or into "anything answering the purpose. The vault is then enclosed or

“covered with fire, or the fumes of fire otherwise admitted into the said vault or chamber or vacuum, and the meat or other organic matter is preserved by means of fixed air on the principle on which organic bodies have been preserved under the influences of volcanic eruptions.”—[Vict. 1868, April 20. No. 1107.]

C. MANTON. Places the meat to be preserved within suitable air-tight vessels, made of wood, tin, iron, &c., and forces out the contained air by means of compressed carbonic acid gas, after which all openings in the vessel are securely plugged or closed.—[Vict. 1868, October 29. No. 1181.]

See also E 2 ; J. Bethell, U.K. 1848, No. 12,250.

E.—ANTISEPTIC AGENTS.

1. SULPHUROUS AND NITROUS ACIDS, SULPHITES AND NITRITES, SODIUM, AND OTHER SUBSTANCES DESCRIBED AS HAVING AN AFFINITY FOR OXYGEN.

L. E. SEIGNETTE. Steeps the meat, &c., to be preserved, in a solution of salt and nitre, after which the containing vessels are exhausted of air by a pump, or the air is displaced by carbonic acid gas. In other cases a bag of nails or iron filings is placed in the vessel, by which means the enclosed air is deprived of its oxygen. The brine may be substituted by vinegar, and the carbonic acid gas by deutoxide of azote, hydrogen, or azote. In all cases it is advisable to place pieces of charcoal within the vessel, so as to destroy any smell the meat, &c., may acquire.—[U.K. 1836, March 21. No. 7036.]

H. LAMY. Introduces sulphurous acid gas into the vessel containing the substances to be preserved. Any acid taste of the substance is subsequently removed by a solution of baryta or bicarbonate of magnesia.—[U.K. 1854, March 9. No. 570.]

A. E. L. BELLFORD. Uses sulphurous acid for preservative purposes, and, “in order to prevent the sulphurous acid from combining with the bases of the alkaline carbonates found in the meat, and thus giving the meat a disagreeable taste, arising from the sulphite formed, one-hundredth part of hydrochloric acid is added to it. Into this solution the meat is immersed, the containing vessel being afterwards hermetically closed. The substances may be also preserved by immersion for twenty-four hours in the solution, and subsequently, until required for use, in pure water.”—[U.K. 1854, July 12. No. 1534.]

J. HANDS. Treats animal substances to be preserved with “gaseous binoxide of nitrogen, nitrous acid gas, or sulphurous acid gas, alone or separate,” afterwards filling up the spaces of the containing vessels “with nitrogen or carbonic acid gases.”—[U.K. 1855, October 27. No. 2404.]

R. A. BROOMAN. Deprives animal and vegetable substances of their superfluous moisture by means of a fan, or otherwise, after which they are exposed to sulphurous acid gas and to air, and then treated with a preservative matter composed of animal albumen, dissolved in a decoction of mallow root mixed with molasses.—[U.K. 1855, September 19. No. 2116.]

F. M. DEMAIT. Preserves animal substances by hanging them in a room kept at between 60° and 104° Fahrenheit, and containing a fire upon which is thrown "flour of sulphur, chloride of lime, flowers or "roots, and lemon leaves."—[U.K. 1855, October 4. No. 2223.]

J. H. JOHNSON. Excludes air by a coating of gutta-percha, preserved against insects by being mixed with some substance fatal to the insects but innoxious to man. When cavities exist in the matters to be preserved, as in poultry, they are filled with carbon, sodium, iron, potassium, or other substance capable of absorbing oxygen. The articles so treated are either hung, or are packed in sawdust, sand, or powdered charcoal.—[U.K. 1857, April 4. No. 951.]

W. READE. Patents a method of partially charring the skins of pigs previous to curing.—[U.K. 1860, June 25. No. 1547.]

H. MEDLOCK. Checks vinous fermentation by means of sulphurous acid or bisulphite of lime.—[U.K. 1861, March 30. No. 792.]

J. MCCALL and B. G. SLOPER. Dispense with the heating process in driving the atmospheric air out of the cans, and, instead, introduce into the cans some substance having a great affinity for oxygen, such as sulphite of soda, &c. The substance used is enclosed in gelatine, by which, until the gelatine is dissolved by heat subsequently applied, contact with the contained water is effectually prevented. At other times the sulphite of soda is placed within a second and smaller vessel communicating with the larger one by means of holes, at first closed by plugs of easily fusible metal and subsequently melted.—[U.K. 1861, October 24. No. 2665; and Vict. 1862, November 17. No. $\frac{518}{389}$.]

G. DAVIES. Causes a current of electric fluid to pass through a wire enclosed in preserve tins after they are hermetically sealed; by this means the wire is made red hot and consumes the contained oxygen. A substance which, when ignited, has a great affinity for oxygen, is also placed within the tins and ignited by electric fluid.—[U.K. 1862, November 13. No. 3062.]

G. DAVIES for A. H. REDMOND. Subsequently patents an invention which, in addition to the methods adopted in No. 3062, 1862, includes exploding hydrogen in the cases to remove the oxygen; and also expulsion of the contained air by means of boiling water poured through tubes in the cover of the case, which are subsequently hermetically sealed.—[U.K. 1863, January 27. No. 233.]

A. H. REDMOND's invention is identical with the foregoing.—[U.K. 1863, February 21. No. 477.]

J. YOUNG. Uses "sulphides or sulphurets, such as sulphide or sulphuret of calcium," for preserving animal matters.—[U.K. 1863, August 6. No. 1941.]

In a subsequent patent the inventor proposes, in addition, to make use of certain oxides and carbonates, such as protoxide and carbonate of iron.—[U.K. 1864, February 4. No. 299.]

A. HETT and F. W. BASSETT. Make use of solutions of salts, the sulphites or nitrites, preferring sulphites of potash or potassa.—[U.K. 1863, August 25. No. 2099.]

J. S. RICHARDSON. Employs sulphurous and nitrous acid and other gases of an antiseptic character for the purpose of preventing decomposition.—[U.K. 1864, April 7. No. 876.]

W. CLARK. Fills the air-tight tins of provisions with sulphites, hyposulphites, and bisulphites of various bases.—[U.K. 1864, April 16. No. 959.]

R. JONES. Displaces air by the introduction, into preserving tins, of an inert fluid, such as water or oil, in its turn displaced by the introduction of nitrogen (*sic*)* or other gases having an affinity for oxygen.—[U.K. 1864, June 20. No. 1523.]

A. HETT and F. W. BASSETT. Employ solutions of certain salts; exhaust air from cases; introduce sulphurous acid gas; which is replaced by nitrogen or carbonic acid.—[U.K. 1864, June 23. No. 1570.]

J. MCCALL and B. G. SLOPER. Immerse meat, &c., in solution of bisulphite of soda or potash; replace air in containing vessel by carbonic acid gas; introduce dilute sulphurous acid and carbonate or bicarbonate of soda or potash; after which the tins are closed hermetically.—[U.K. 1864, November 10. No. 2794.]

A. HETT and F. W. BASSETT. Steep the meat to be preserved in sulphites or nitrites of potash, mixed or not mixed with mucilage. Atmospheric pressure is occasionally used to force the solution well into the meat; and, in order to prevent a too great evaporation of moisture, the meat is covered with a coating of tallow, suet, or wax, mixed with gum or gelatine to give tenacity, or it is wrapped in cloths, paper, or other coverings coated with tallow, &c.—[N.S.W. 1864, April 16. No. 95.]

N. V. SQUAREY. Employs, "for the preservation of animal substances, "or animal substances used for food," certain salts known as sulphites and nitrites, those of potash being preferred. A solution of the salt is prepared, one ounce of the salt being dissolved in one pint of water, and to this is added a sufficient quantity of gum or mucilage. Into this solution the meat is dipped for about ten minutes. The mucilage is sometimes omitted, and the solution is occasionally used at a high temperature; or the air may be extracted from the meat by a vacuum formed in a closed vessel, into which the solution is then admitted, to be forced by atmos-

* This appears to be merely an awkward expression, meaning nitrogen (which is inert) or other gases having an affinity for oxygen (which they render inert).—G. F.

pheric pressure into the pores of the meat. The meat is subsequently hung up to dry, too great evaporation of the contained moisture being prevented by dredging the surface with flour, or by forming upon it a coating of melted tallow, suet, or wax, either by themselves or mixed with certain matters to give tenacity.—[Vict. 1864, May 9. No. $\frac{710}{714}$.]

In a subsequent patent the inventor proposes to inject the foregoing solution into the carcass of the animal just killed by attaching a pipe, connected with an elevated reservoir or a force-pump, through the left ventricle into the aorta, where it is securely tied.—[Vict. 1864, August 2. No. $\frac{748}{737}$.]

T. B. BELGRAVE. Subjects the meat, &c., to be preserved to the action of "carbonic acid gas in closed chambers, the gas being formed "by the combustion of sulphur within the vessel."*—[U.K. 1865. January 10. No. 79.]

I. BAGGS. Uses preserving vessels lined with a textile fabric, expels air by high-pressure steam, and drives out the steam by a preservative gas, that of burning wood being preferred; or the meat to be treated is dipped in crude pyroligneous acid, gases which do not contain oxygen are introduced, and some substance having an affinity for oxygen, such as sodium, is placed in the vessel. In some cases the containing vessels are filled with a solution of alkaline sulphites or hyposulphites; or the meat, &c., is covered with caoutchouc, varnish, collodion, &c., and treated or not with sulphurous acid.—[U.K. 1865, November 1. No. 2812.]

W. FOX. Uses a preservative vessel having two compartments. The meat, &c., is placed in one, whilst the other is made to contain some deoxidating agent such as bin oxide of nitrogen, sulphurous, or carbonic acid gases.—[U.K. 1865, November 13. No. 2919.]

J. McCALL and B. G. SLOPER. Surround the meat for a short time with a solution of bisulphite of soda or potash in an air-tight case. Having driven out the air by this means, the solution is expelled by the admission of carbonic acid gas, which is continued to be supplied if necessary. Eventually they introduce into the cases a small quantity of dilute sulphurous acid and an equivalent of carbonate of soda or potash, the two being kept separate until the cases are finally and hermetically closed. These operations are in some instances performed by means of two tubes attached to the case. Occasionally sulphurous acid seems to be first admitted, withdrawn, and substituted by carbonate of soda or potash, which being also expelled, the case is filled with carbonic acid gas.

The patentees also provide wooden or wicker linings for the metallic cases.—[N.S.W. 1865, May 6. No. 105.]

R. JONES. "Displaces the air from the vessels containing the substance to be preserved by introducing into such vessel an inert fluid such as water or oil, and then displacing such fluid by the introduction of nitrogen (*sic*) or other gas or gases having an affinity for oxygen."

* The gas so formed would be sulphurous acid and not carbonic acid.

The cans suitable for the above process have two necks. To one of these, after the cover has been soldered down, a pipe is affixed, which completely fills the case with the fluid made use of. A second pipe, connected with a reservoir of nitrogen, is then affixed to the other neck to drive out the fluid. After this is done, a small quantity of sulphurous acid gas or binoxide of nitrogen, 35 cubic inches to the pound of substance to be treated, is introduced into the case. In certain cases the operations are repeated, the gases being driven out by a fresh supply of fluid, which in its turn is displaced by another admission of gas. These operations being completed, the necks or tubes are closed by a pair of pincers or otherwise, and securely soldered.—[Vict. 1865, May 17. No. $\frac{814}{813}$; and N.S.W. 1865, July 5. No. 113.]

H. MEDLOCK and W. BAILEY. Use bisulphite of lime, gelatine, and salt, as preservative agents.—[U.K. 1866, June 27. No. 1707.]

D. NICOLL. Proposes to preserve animal and vegetable substances, for transport, by packing them in air-tight "tanks," after which certain chemical ingredients, such as "sulphides, sulphites, nitrites, and other "substances capable of producing antiseptic gases," are introduced into the tanks, and operated upon by means of "electric or percussive action." —[U.K. 1866, May 10. No. 1349.]

J. and A. GAMGEE. Preserve animal or other substances by means of carbonic oxide, either by causing the "animals to inhale it "as they die," or by placing the articles to be heated in chambers filled with carbonic oxide, either alone or in conjunction with sulphurous acid or other gases.—[U.K. 1866, September 24. No. 2454.]

J. BARKER. Preserves corn by enclosing it in cases filled with air from which the oxygen has been withdrawn by means of "iron sponge." —[U.K. 1866, November 21. No. 3062.]

J. DEWAR. Uses sulphurous acid for the preservation of potatoes.—[U.K. 1867, September 30. No. 2753.]

O. C. HILLMAN. Immerses the meat, poultry, &c., to be preserved, for from ten to fifteen minutes, in a solution of bisulphite of soda or potash, the case or vessel containing which must be capable of being rendered air-tight. This process removes the air in the case. The solution is then withdrawn, being replaced by carbonic acid gas. These operations being repeated as often as may be necessary, there is introduced into the case "a regulated quantity of sulphurous acid gas and an "equivalent quantity of carbonate or bicarbonate of soda," which, however, do not come in contact until the case is hermetically sealed, after which they are made to unite by agitation, and the meat, &c., is bathed with the resulting liquid impregnated with carbonic acid gas. Various expedients are suggested for carrying out these details, such as double-stop pumps, &c. When metallic cases are employed, a lining for the top, bottom, and sides, of basketwork, wood, &c., is provided, in order that the meat may not be injured by contact with the metal.—[Vict. 1867, July 24. No. 1025.]

E. W. LANG. After the carcass of the animal just killed has been washed and hung up for eight or twelve hours, cuts the same into joints, and immerses them for nine or fourteen hours, according to their size, in a blood-warm solution, formed by adding at first hot and afterwards cold water to pounded bisulphite of potassa neutralized by carbonate of potash, in the proportion of one and three-quarters pound of bisulphite to every hundred pounds of meat ; the quantity of water being such as to enable the solution to cover the meat completely. This solution, after being once used, can be employed for a second curing when not more than eight days old, if, having been well boiled and skimmed, it is carefully bottled with the addition of half the above proportions of bisulphite. Subsequent to the foregoing process, the meat is closely packed in air-tight tin cases, jars, or casks. The meat or fish thus preserved must be washed with cold water previous to being cooked.—[Vict. 1867, July 29. No. 1027.]

P. HAYES. In order to prepare meat for preservation in hermetically sealed vessels, provides a suitable chamber in which the meat is placed on a "series of grids." Into this chamber there is then conducted a hot-air blast for a sufficient length of time to drive the moisture out of the meat and form on its outside a charred crust or coating. After being so treated the meat is allowed to cool, and is packed in suitable vessels filled with gelatinous matter.—[Vict. 1867, August 22. No. 1034.]

G. W. PERRY. Employs a solution of a bisulphite, that of lime being preferred. Into this the meat is either simply dipped or has the liquid forced into it by atmospheric pressure. In some cases the liquid is used in a heated state. When required for cooking it is merely necessary that the meat so preserved should be washed and dried with a cloth.—[Vict. 1867, September 17. No. 1045.]

J. DEWAR. Makes use of the sulphurous acid of commerce, at a specific gravity of 1.012, either diluted or not with water or mucilage. The carcasses, &c., of the animals to be preserved are cleaned, and, if large, cut into joints ; subsequently they are immersed into the above liquor for from one to twelve hours, according to their size. If the meat is intended to be preserved in the liquor, the liquor must be still further diluted after the lapse of the above period. In other cases the meat is hung up to dry, by preference in a current of hot air. If mucilage is used in connection with the acid, the whole may be applied to the surface of the meat, &c., by means of a brush. When required for use the meat is washed in cold water, so as to remove the acid and to restore the moisture lost in drying. In some cases the meat is still further dried, powdered, and, being mixed with boiled potatoes, is formed into biscuits, &c., and baked.—[Vict. 1867, December 17. No. 1076.]

J. DEWAR. Uses aqueous sulphurous acid for the preservation of vegetable substances.—[U.K. 1868, June 6. No. 1860.]

J. MANNING. Immerses the meat, which must be quite fresh and free from salt, for six hours in a solution formed by dissolving three-

quarters of a pound of sulphite of potash in just sufficient warm water, and also one pound of sulphate of potash in a similar manner; the two being mixed together, with the addition of three quarts of hot water, are allowed to cool to about blood-heat. The meat so prepared is packed in cases of tin, hermetically sealed, and which are coated within, to prevent the action of the sulphites upon the metal, with a varnish formed of five gallons of spirits of wine, 55° over proof, to which is added two and a half pounds of shellac, the same quantity of sanderach, one and a half pound of dragons-blood, and six pounds of fine sand, the whole being mixed together in a close vessel, shaken for about six days. The clear liquor which will have formed is the varnish required.

When the meat is required to be used it must be washed for a few minutes in salt and water, dilute citric acid, or common vinegar and water.

This invention was subsequently modified, in an amended specification, by substituting for the above solution one composed of one pound of sulphite of potash, two ounces of carbonate of potash, or half an ounce of liquor ammonia, when cold three ounces of caustic potash being added; the use of the alkalies is to take up the "sulphurous acid" set free by the deoxidation of the meat, and also to prevent the generation of sulphuretted hydrogen. Sulphite of ammonia may be substituted for sulphite of potash, one-third part of the former being equal to one part of the latter.—[Vict. 1868, March 19. Nos. 1101 and 1101^A.]

G. W. PERRY. Proposes to preserve animal substances, &c., and also to prevent saccharine running into acetous fermentation, by the use of solutions of bisulphite of lime, or bisulphite of lime and magnesia, in some cases mixed with gelatine, with which the meat, &c., to be preserved, is treated by immersion or other means. The meat may be previously salted or spiced, and, after having being immersed and dried, is packed in cases filled with melted paraffine, or tallow heated to 212° Fahrenheit. In order to check acetous fermentation in wines, &c., the casks containing them are washed over internally with a modification of the above solutions, more particularly described in the specification.—[Vict. 1868, May 15. Nos. 1114 and 1114^A.]

J. DEWAR. Preserves meat, &c., by immersing in strong solution of sulphurous acid, subsequent desiccation, and in some instances pulverization, for the purpose of mixing with flour, &c. He also prepares the blood of newly-slain animals for food by mixing it with meal, flour, seeds, &c., if intended to be preserved, first treating with a solution of sulphurous acid, and afterwards desiccating it. Potatoes are preserved by immersion in diluted sulphurous acid, or they are covered with a mixture of the same acid and mucilage, in both cases being subsequently dried. "Draff and dreg," the refuse of breweries, as food for cattle, grain and seaweeds, are also treated for preservation in a somewhat similar manner.—[Vict. 1868, August 7. No. 1137.]

R. CALDWELL. First subjects the meat to the action of bisulphite of lime, saturating it with a solution of the same, and then envelopes the

meat so treated in melted fat, after which it may be packed in any suitable way.—[Vict. 1868, August 22. No. 1142.]

See also—D 1 ; E. Hartnall, U.K. 1855, No. 269. G. Warriner, U.K. 1856, No. 1982, S. Dreyfous, G. Richer, and E. Cormier, U.K. 1859, No. 764.

2. VARIOUS SUBSTANCES USED FOR PRESERVING, INCLUDING SOME USED IN CONNECTION WITH OR AS SUBSTITUTES FOR SALT, SPICES, ETC.

A. COCKBURN. Cures salmon, &c., with spices, salt, vinegar, &c.—[U.K. 1763, July 29. No. 793.]

J. RYAN. Preserves organic substances by "applying to them a mixture of gases, acids, or vapors non-supporters of combustion," and a mixture of carbonic and chlorohydric acids, or a mixture of carbonic and acetic or pyroligneous acids is preferred. Creosote is sometimes used instead of pyroligneous acid. It is necessary that meat preserved by this means should be placed in air-tight boxes.—[U.K. 1846, October 17. No. 11,420.]

F. B. BEKAERT. Preserves milk by adding carbonate of soda, turmeric, and marigold water, placing in corked bottles, and boiling.—[U.K. 1847, May 29. No. 11,726.]

J. HORSLEY. Uses, as a preservative, ammonia in combination with acetic or purified pyroligneous acid, "in such a way that the principle of decomposition or volatilization of the preservative mixture in cooking shall not be interfered with." After salt has been added to the liquid, the same is injected into the meat, which is either put into vessels and covered with the liquor, or wrapped in cloth saturated with the same and placed between layers of charcoal.—[U.K. 1847, May 6. No. 11,691.]

J. BETHELL. Preserves meat, &c., by impregnating the carcasses of animals just killed with "wood naphtha or fine pyroligneous or pyroacetic spirits, or pyroligneous acid, wood naphtha being preferred, mixed with salt and water in the proportion used for brines ; or places the meat in casks charged with compressed carbonic acid, or cuts it into strips and dries it at a temperature not exceeding 170° Fahrenheit." Modifications of this invention are applicable to the preservation of grain, malt liquors, and milk.—[U.K. 1848, August 21. No. 12,250.]

J. BOILESVE. Employs "chlorine or other sulphurous gas (*sic*) for the preservation of all kinds of vegetable substances, animal coatings, &c., by expanding these gases under a bell-jar, a box, or an air-tight cloth, or any similar apparatus."—[U.K. 1852, October 22. No. 486.]

F. J. ANGER. Uses the principle diastase, for preserving vegetable substances, in shape of a decoction of malt, into which the matters to be

treated are dipped. "Neutralized acids or chemical salts can be used" as substitutes, but "diastase" is preferred.—[U.K. 1855, March 29. No. 695].

C. L. MARLE. After drying animal or vegetable substances in a hot chamber filled with carbonic acid gas, dips them in gelatine and afterwards in tannin.—[U.K. 1856, June 4. No. 1332.]

J. NEUENSCHWANDER. Preserves milk by agitating it with horseradish, parboiling, bottling, and again boiling.—[U.K. 1856, September 10. No. 2111.]

I. LEYS. Impregnates cheese with rum, immerses in bath of salt and saltpetre for ten minutes, dries, covers with boiled linseed oil, and coats with tinfoil.—[U.K. 1856, September 12. No. 2138.]

R. A. BROOMAN. Uses stearine for closing vessels containing provisions which have been previously treated with an infusion of seaweed or other substances containing iodine.—[U.K. 1856, November 8. No. 2637.]

C. F. VASSEROT. Preserves fish by immersing them in a bath composed of salt, water, citron bark, coriander, laurel, clove, &c.; after remaining in this for from two to four hours, they are dried and pressed into jars.—[U.K. 1856, December 16. No. 2976.]

J. NEUENSCHWANDER. Preserves milk by mixing with horseradish, boiling, and bottling; or by bottling "immediately after it is obtained," and boiling for an hour.—[U.K. 1857, March 10. No. 697.]

J. AVERY. Kneads butter with alcohol, wraps in paper dipped in alcohol, and, for long sea voyages, packs in air-tight cases.—[U.K. 1857, March 12. No. 714.]

P. A. LE C. DE FONTAINE MOREAU. Preserves grain and alimentary matters by introducing the vapor of ether, chloroform, and other anæsthetic substances into the air-tight cases containing the grain, &c., by which means any insects, &c., therein are destroyed.—[U.K. 1857, May 6. No. 1286.]

P. A. F. BOBOEUF. Uses essential oils, vegetable or mineral, for preserving purposes.—[U.K. 1857, July 28. No. 2060.]

M. SEMPLE. After placing the vessels containing provisions in an exhausted receiver, subsequently filled with antiseptic gas, screws down the covers of the vessels by means of a rod working through a stuffing-box.—[U.K. 1857, December 16. No. 3090.]

R. A. BROOMAN. Impregnates the meat with acetate of alumina; then immerses in a bath of gum-dragon, gelatine, or paste and acetate of alumina, for two minutes; after which the meat is hung up to dry.—[U.K. 1858, January 20. No. 101.]

E. SLACK. Treats potatoes, &c., to be preserved, with "acids and alkalies, as also with diastase and other" saccharine matters.—[U.K. 1858, January 23. No. 131.]

S. OSLER. Preserves fish, principally by drying and the employment of antiseptics, such as salt, sugar, pepper, &c.—[U.K. 1858, May 28, No. 1198.]

W. CLARK. After exhausting preserving vessels, places therein, but not in contact with the meat, &c., some quicklime, for the purpose of absorbing the carbonic acid and sulphuretted hydrogen generated during decomposition.—[U.K. 1859, February 4. No. 330.]

E. J. HUGHES. Uses as a preservative fluid, tartaric acid, tartrate of potassium, the acid being removed by carbonate of sodium. After saturation, the meat, treated with the above, is placed in hot salt and water, and afterwards in hermetically sealed tins.—[U.K. 1859, March 1. No. 536.]

C. STEVENS. Preserves potatoes by plunging them for five minutes into a boiling solution of saltpetre and chloride of calcium, after which they are cut in pieces by a machine.—[U.K. 1860, July 17. No. 1724.]

W. H. HART, C. E. BRIGHT, and R. BRIGHT. Patent an invention for the preservation of animal and other substances, the clarification of tallow, &c., &c., by the application of "certain organic acids extracted from coal-tar. To obtain the acids the light oils of tar are treated by "a weak solution of an alkali, using in preference caustic soda of a specific "gravity of 1.06, and after having well worked the alkaline solution and "the oils together the alkaline solution is removed from the oily mass. "To the alkaline fluid is then to be added an acid, using in preference "sulphuric acid, which throws up the above mentioned organic acids, "which are then washed until the whole excess of the sulphuric acid is "removed, and then submitted to distillation in a common still. The "impure product which results from this process is called 'terebane.' "To apply terebane to the preservation of animal matters, mix one part "of terebane with fifty parts of water, and after having well stirred "them together, introduce into the solution hides or skins from which "all superfluous flesh, fat, and extraneous matters have been carefully "removed, after steeping them for twenty-four hours allow them to "drain over the fluid in which they have been steeped and dry them in "the air, after which they are ready for shipment or use."—[Vict. 1862, "November 19. No. $\frac{621}{591}$; and Vict. 1863, May 23. No. $\frac{627}{828}$.]

R. A. BROOMAN. Uses a composition of white salt, saltpetre, white-wine vinegar, acetic acid, rectified alcohol, pure white wine, Spanish pepper, black and white pepper, cayenne, paradise seed, cinnamon, ginger, calamint, and pennyroyal.—[U.K. 1863, September 22. No. 2338.]

J. LORIMER, M. MARWOOD, and R. ROME's invention refers to the preservation of hides, skins, wool, tallow, oils, &c., &c., and consists in the treatment of the given matters with a liquid formed by the solution of some compound of magnesium with chlorine, or "double magnesio "zincic, aluminic, sodic, or calcic chlorides," in water. The hides, &c.,

after being properly prepared, are either dipped into this solution, or the same is applied to their surfaces by immersion, aspersion, or friction with a brush.—[Vict. 1863, January 6. Nos. $\frac{547}{604}$ and $\frac{547^A}{604^A}$. Also, N.S.W. 1863, February 9. No. 70.]

J. PROUST. For the preservation of animal matters, such as hides, skins, hair, flesh, wool, bones, &c., makes use of empyreumatick oil, known as heavy oil, and produced by the distillation of coal-tar. The substances to be preserved are allowed to remain in the preserving agent for not less than twelve (12) hours, and are then hanged, so as to allow the superfluous part of the fluid to drip out, after which, if hides, they are to be folded, and will be perfectly preserved.—[Vict. 1863, July 30. No. $\frac{634}{639}$.]

J. MORGAN. Uses a solution of monophosphoric or metaphosphoric acid or lactic acid.—[U.K. 1864, March 21. No. 713.]

J. GAMGEE. Makes use of antiseptic agents, such as tannic and gallic acids, oak bark, cinchona, mimosa bark, &c.; introducing them into the system of the animal during life by means of the food, or injecting them after death through the blood-vessels, &c., &c.—[U.K. 1865, December 20. No. 3293.]

J. MORGAN. Employs, for embalming, preserving, pickling, &c., of the bodies of men or animals—1st, For embalming :—A saturated solution of common salt, one gallon ; nitre, one pound ; alum, one pound ; from two drachms to one ounce of arseniate of potash ; and, for dissecting-room purposes, oil of thyme, one and a half ounce ; oil of winter-green, half a drachm. If desirous still further to preserve the body, solution No. 2 is employed :—Three quarts of methylated spirit, three ounces of tannin, one and a half ounce oil of thyme, three ounces of rosemary, three drachms of oil of cloves, thirty drops of oil of winter-green.

In curing swine, beef, &c., the preservative used is half a gallon of a saturated solution of common salt and two ounces of nitre.

The above are forced by pressure, caused by the liquid itself in an elevated vessel, through the arterial system of the animal just dead.—[Vict. 1865, September 12. No. $\frac{831}{850}$.]

J. DAVIS's invention for treating animal substances appears to relate principally to the preparation of manures, for which purpose he makes use of chlorine, chloric acid, or hypochloric acid, as also charcoal as an absorbent.—[U.K. 1866, March 31. No. 921.]

J. MORGAN. Fills up tins of preserved provisions with a solution of acetate of soda, or with fat ; after which the tins are hermetically sealed, while the contents are boiling, by means of a soft-metal tube.—[U.K. 1866, July 21. No. 1904.]

W. R. LAKE. Injects antiseptic gases through the arterial system, &c., for the purpose of embalming dead bodies or preserving the carcasses of animals. [U.K. 1867, April 6. No. 1044.]

M. WEBB and C. G. DUFFY. Propose to destroy the decaying principle in animal substances, &c., by introducing them into a suitable receiver. "Atmospheric air is then conveyed into the receiver, or the vessel or machine answering the purpose of a receiver, through the vehicle of the element itself, from without, and in the receiver densified or expanded, to suffice for the effectual destruction of the decaying principle in the animal substance or other organic matter operated upon."—[Vict. 1868, January 7. No. 1081.]

F. M. MOORE. Preserves animal or vegetable substances—1st. By the application of sugar, molasses, and lime, in combination with lime-juice, or some weak acid solution, with or without a decoction of camomile flowers—the latter to be employed either hot or cold. 2ndly. By first salting the meat and then immersing it, instantaneously, in a decoction of camomile flowers—either hot or cold. — [Vict. 1868, January 29. No. 1086.]

G. A. THIBIERGE. First immerses animal substances in a solution composed 100 parts of non-arsenical sulphuric acid of 66° mixed with 1000 parts of filtered water, at a temperature of from 60° to 80° Fah. The meat, &c., are allowed to remain in the solution for about five minutes, or, if the temperature is beneath 60°, for a longer period. After which they are washed in filtered water purified by charcoal.—[U.K. 1868, July 24. No. 2329.]

H. A. BONNEVILLE. Having cleaned the meat, deprived it of bones, &c., coagulates the albumen therein by steam. Or he dispenses with this process, and sprinkles the meat, by means of a sieve, with saltpetre, coats it with a thin layer of olive oil, by means of a brush, and afterwards packs the same in bags, arranging these between layers of animal charcoal.—[U.K. 1868, August 4. No. 2440.]

P. HAYES. After keeping the animal to be operated upon without food for ten or twelve hours, causes it to breathe carbonic oxide; upon its falling down, "incisions are made into the left ventricle of the heart, so that the blood of the animal is thoroughly exhausted; a pipe is then passed into the left ventricle of the heart and fastened into the aorta." Carbonic oxide gas is forced through this pipe, by means of a pump, until making its escape at the right ventricle. "The animal is then cleaned in the usual way, and placed in an air-tight chamber. The air is then exhausted by an air-pump, and the aforesaid gas is allowed to fill up the vacuum, and is forced into the chamber. The meat can then be removed and packed for export—that is to say, after it has been subjected to the influence of the gas for twenty-four to thirty-six hours."—[Vict. 1869, March 3. No. 1211.]

T. SIM. In his invention employs "bi- or proto-sulphides of carbon, or carbonylic sulphide, applied in a gaseous form so as to permeate the meat or animal body to be preserved"; with these he combines "any suitable product of the destructive distillation of wood"; patenting, at the same time, "a novel apparatus for carrying the operations into effect."

In the accompanying drawings, Fig. XVII.^A is a plan, partly in section, of one form of apparatus used. Fig. XVII.^B a vertical section, on the plane indicated by line *x x*. Fig. XVII.^C, Fig. XVII.^D, a vertical section on line *y y*; and Fig. XVII.^E an elevation of the meat vat and its accessories.

Meat being introduced into the vat A, and hung therein upon a series of hooks, the vat is exhausted of air through the pipe *b*, by means of the air-pump B. The sulphides of carbon are then introduced in a gaseous form, "either with or without an admixture of phenic acid, methyl (*sic*), or other products of the destructive distillation of wood or coal, which, if used, is employed in the proportion of about one ounce thereof to one hundred cubic feet of the gaseous sulphide of carbon."

In order to produce the sulphides by means of the apparatus represented in the drawings, the retort C is charged with charcoal and heated to redness, sulphur is then introduced through the pipe D, conducting "down to a well *d*, in which the sulphur is burned. The sulphur vapor "passing through or in contact with the incandescent charcoal is converted "into bi-sulphide of carbon. This gas is then conducted into the gas-holder E, of common construction, the lower part of which is, in the "first instance, filled with water for the purpose of excluding air. The "said water being afterwards drawn off and replaced by the gas.

"At the time of introducing the gas into the exhausted receiver, "both gas and the receiver or vat should have a temperature of from "90° to 120° Fahrenheit (averaging 104°); and to guard against the "danger of cooling the meat to an injurious extent by the expansion in "vacuo of the gas within the vat," a quantity of gas, equal to double the capacity of the vat, is provided and admitted into the latter instantaneously, pressure being applied by means of a pump P, so as to make the influx of the gas more rapid and facilitate the curing process by continued pressure.

"The gas-holder and the vat can be heated by hot water, in the "chamber H, which circulates through the pipes G H, connecting with "a reservoir I, from whence the water passes to and through the furnace "F, and back to the reservoir through the pipe or pipes J J. M is a "barometer to indicate the pressure, and N a thermometer to indicate "the temperature."

"The methyl (*sic*), or other vapor, may be applied by placing an open "vessel of suitable liquid within the vat A."

The great difference between this process of meat preserving by chemical agents and others that have been attempted is said to be "that "by the use of the sulphides of carbon, either with or without phenic "acid or methyl," there is effected "a complete dialysation (*sic*)* of the "gases contained within the meat, which otherwise would produce "putrefaction," and that "the application of the sulphides in a gaseous

* Evidently meaning dialysis, but the real effect endeavored to be described is correctly called "transpiration."—G. F.

“form, while it affects the dialysation (*sic*) of deleterious matter,
 “does not remove or injure any portion of the meat which it is desired
 “to preserve, and when the process is completed no sulphide remains
 “within the meat, but is all driven off or changed by dialysation (*sic*),
 “and meat treated by this process is permanently preserved from decom-
 “position, and is not materially affected by atmospheric changes. The
 “effects of this process are much more lasting than those of any other
 “known process.”—[Vict. 1869, June 8. No. 1252.]

See also—B 1 ; J. B. Heu, 1856, No. 2690. R. Bowie, Vict. 1858,
 No. 95. B 3 ; J. Murdoch, U.K. 1851, No. 13,477. L. A. Chenu and
 F. F. Pillias, U.K. 1854, No. 2242. T. S. Grimwade, U.K. 1855, No.
 2430. E. V. J. L. Gorges, U.K. 1857, No. 14. S. Campbell, U.K. 1857,
 No. 771. J. J. Ridge, U.K. 1862, No. 2891. L. Brunetti, U.K. 1867,
 No. 1850. C 1 ; W. C. Thurgar, U.K. 1865, No. 47. D 1 ; E. A. S.
 Burgess-Burgess, U.K. 1859, No. 2573. R. A. Brooman, U.K. 1861, No.
 2067. D. W. Rea, U.K. 1863, No. 2951. G. E. Green, Vict. 1868,
 No. 1103.

A D D E N D A.

** * * The following abstracts were omitted from their proper places in
 the preceding pages. The letters and numbers attached indicate the
 class or sub-class to which the inventions severally belong.*

B 4.

B. C. WETTERSTEDT. “Mixes animal and vegetable substances
 “with flour of corn, or potatoes and other edible substances,” dries, and
 encloses them in vessels capable of excluding air. He also employs
 powdered coke for filling up the spaces between the meat, &c.—[U.K.
 1851, September 4. No. 13,722.]

A. SOYER. Prepares osmazome to be preserved and eaten separately,
 or to be made use of as a basis for soups, &c.—[U.K. 1853, March 2.
 No. 520.]

J. McCALL, and B. G. SLOPER. Desiccate and reduce to fine pow-
 der the meat itself, or the concentrated essence of the same. One or
 both of the powders so obtained are mixed with dried and powdered
 vegetable substances ; the whole is then subjected to pressure, and
 covered with a gelatinous or other protecting coating.—[U.K. 1864,
 April 29. No. 1082.]

D 1.

F. C. BLUMENTHAL, and M. L. J. CHOLLET. Desiccate meat in
 small pieces, reduce to powder, and again desiccate. They also propose
 to combine fat with vegetable tablets, “prepared in the ordinary manner,”

by submitting them to successive immersions in soup, and then drying them in currents of air ; by this means "a coating is formed over the entire tablet, and coverings of lead or paper may be dispensed with."—[U.K. 1854, December 7. No. 2572.]

T. REDWOOD. Meat is first heated in wax, paraffine, &c., and subsequently covered with those substances, so as totally to exclude the air.—[U.K. 1865, November 23. No. 3009.]

E 2.

M. FITCH. "Places wood, and in preference oak, within a retort with a refrigerator, and distils into a receiver containing a solution of salt or sugar, treacle or saltpetre ; the product is then used for preserving meat or fish."—[U.K. 1844, September 19. No. 10,322.]

R. A. BROOMAN. In describing an invention entitled "Certain improved modes of applying electro-chemical action to manufacturing purposes," states that the same is applicable to the preservation of animal matters, such as meat, by forming an antiseptic compound in the meat itself. "In setting up this electro-chemical action, such acids and bases which, when united, form well known antiseptic salts or compounds," are chosen.—[U.K. 1851, December 8. No. 13,845.]

G. F. LINDEN. Places meat "in a receiver of any convenient shape, connected by a pipe with a reservoir containing certain preservative condiments either in a liquid or a gaseous state. The air and moisture in the cellular tissue of the meat, which contain the principles of fermentation, are extracted by the air of the receiver being exhausted by mechanical force, and the preservative, on the other hand, rushes through the meat and fills the exhausted tissue. The extracted moisture and liquid from the fresh meat is concentrated and re-used in preparing new preservatives."—[Vict. 1869, March 18. No. 1227.]

[The specification is illustrated by drawings, which are omitted, as they came in too late for publication.]

APPENDIX.

LIST OF PATENTS RELATING TO THE PRESERVATION OF FOOD,
CHRONOLOGICALLY ARRANGED.

* * * This list indicates all patents relating to preservative processes which have been applied for in the United Kingdom, New South Wales, and Victoria. In many instances the inventions would seem somewhat foreign to the subject of the present pamphlet, but as those applied for in the United Kingdom have all been classed under the heading of "preserving" in the indexes issued by the English Commissioners of Patents, it has been thought advisable to include them in this Appendix, although only such as have appeared to bear upon processes likely to be adopted in this colony have been abstracted for the preceding pages. Those not abstracted are marked with an asterisk instead of a number. The titles of the English patents are merely epitomes of the originals. In the lists of colonial patents all titles are given in full.

UNITED KINGDOM.

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| Preserving flesh, fish, &c.; Porter, T., and White, J.; 1691, October 7. No. 278 * | |
| Curing salmon, &c., with spices; Cockburn, A.; 1763, June 29. No. 793 ... | 41 |
| Drying and preparing vegetables; Græffer, J.; 1780, December 30. No. 1275 | 14 |
| Preserving eggs; Jayne, W.; 1791, February 8. No. 1791 ... | 21 |
| Preserving animal and vegetable substances; Donaldson, J.; 1793, February 19. No. 1933 | 14 |
| Curing herrings, &c.; Batley, B.; 1800, September 11. No. 2441 ... | 18 |
| Curing fish; Batley, B.; 1801, January 20. No. 2465 ... | 18 |
| Preserving meat, &c.; Plowden, F.; 1807, June 13. No. 3051 ... | 21 |
| Preserving food, &c.; Heine, A. de; 1810, February 26. No. 3310 ... | 29 |
| Preserving food; Durand, P.; 1810, August 25. No. 3372 ... | 29 |
| Tubes applied to preserving food; Walker, J.; 1812, July 16. No. 3585 ... | 25 |
| Preserving animal and vegetable food, &c.; Granholm, L.; 1817, August 5. No. 4150 | 22 |
| Preserving animal and vegetable food, &c.; Morrison, Æ.; 1819, March 23. No. 4350 | 25 |
| Packing hops; Vallance, J.; 1820, June 20. No. 4480 ... | 25 |
| Preserving potatoes, &c.; Roberts, T. A.; 1825, April 23. No. 5156 ... | * |
| Preventing injury to corn; Vazie, R.; 1827, July 12. No. 5523 ... | * |
| Preserving grain, &c.; Currie, D.; 1828, January 31. No. 5614 ... | 33 |
| Closing preserve cans; Angilbert, P. A.; 1833, June 1. No. 6432 ... | 30 |
| Injecting antiputrescent fluids into meat; Long, D. R.; 1834, November 13. No. 6711 | 19 |
| Preserving milk; Newton, W.; 1835, March 11. No. 6787 ... | 14 |
| Preserving meat, fish, &c.; Seignette, L. E.; 1836, March 21. No. 7036 ... | 34 |
| Improvements in preserving animal and vegetable substances; Wertheimer, J.; 1839, June 20. No. 8117 | 30 |
| Burner for excluding air from preserve tins; Wertheimer, J.; 1840, February 8. No. 8378 | 30 |
| Preserving potatoes; Edwards, D.; 1840, August 8. No. 8597 ... | * |
| Salting animal matters; Payne, C.; 1840, October 13. No. 8658 ... | 19 |
| Preparation of potatoes for food; Grellet, C.; 1840, November 25. No. 8717 | * |

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| Preserving animal substances ; Gunter, H. ; 1841, January 6. No. 8776 ... | 30 |
| Bath for heating matters to be preserved ; Goldner, S. ; 1841, March 8. No. 8873 ... | 30 |
| Bath for heating matters to be preserved ; Wertheimer, J. ; 1841, March 8. No. 8874 ... | 30 |
| Preserving animal and other matters by cold ; Benjamin, H., and Grafton, H. ; 1842, January 27. No. 9240 ... | 2 |
| Expelling air from preserve tins ; Bevan, J. ; 1842, April 6. No. 9312 ... | 30 |
| Injecting pickles, &c., into meat, &c. ; Carson, S. ; 1842, August 3. No. 9435 ... | 19 |
| Materials for excluding air ; Deutsche, C. E. ; 1842, October 8. No. 9487 ... | 25 |
| Manufacturing flour of lentils ; Nevill, A. H. ; 1843, March 24. No. 9677 ... | * |
| Cooking apparatus ; Cooper, J. ; 1843, December 5. No. 9970 ... | 25 |
| Drying sugar, &c., &c. ; Davidson, R., and Symington, W. ; 1844, March 28. No. 10,126 ... | 11 |
| Preventing decomposition in provisions ; Fitch, M. ; 1844, September 19. No. 10,322 ... | 48 |
| Drying vegetable and other matters ; Yule, W. T. ; 1845, January 28. No. 10,496 ... | 11 |
| Safes, &c., for preserving perishable matters ; Lings, J. ; 1845, July 21. No. 10,781 ... | 1 |
| Packing eggs, &c., <i>in vacuo</i> ; Carson, S. ; 1845, November 4. No. 10,922 ... | 30 |
| Coating matters with impervious substance ; Warrington, R. ; 1846, March 5. No. 11,120 ... | 22 |
| Salting, arrangement for ; Rettie, R. ; 1846, June 12. No. 11,240 ... | 19 |
| Preserving fruit, &c., by cold ; Newton, W. E. ; 1846, September 17. No. 11,372 ... | 2 |
| Preserving fat ; Palmer, W. ; 1846, October 15. No. 11,414 ... | * |
| Preserving substances by gases, &c. ; Ryan, J. ; 1846, October 17. No. 11,420 ... | 41 |
| Ammonia and acetic acid, &c., as a preservative ; Horsley, J. ; 1847, May 6. No. 11,691 ... | 41 |
| Preserving milk ; Grimwade, T. S. ; 1847, May 14. No. 11,703 ... | 14 |
| Preserving milk ; Bekaert, F. B. ; 1847, May 29. No. 11,726 ... | 41 |
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| Preserving breadstuffs, &c. ; Davidson, R., and Symington, R. ; 1847, November 6. No. 11,947 ... | 15 |
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| Preserving corn, meat, &c. ; Bethell, J. ; 1848, August 21. No. 12,250 ... | 41 |
| Packing lard ; Travis, J., and McInnes, J. ; 1848, December 21. No. 12,381 ... | 22 |
| Kitchen ranges, &c., for cooking ; Britten, J. ; 1849, March 28. No. 12,548 ... | * |
| Preserving leaves, flowers, &c. ; Brindley, W. ; 1849, November 17. No. 12,850 ... | * |
| Drying and compressing vegetable matters ; Masson, E. ; 1850, November 12. No. 13,338 ... | 15 |
| Drying and injecting animal matters ; Murdoch, J. ; 1851, January 30. No. 13,477 ... | 15 |
| Drying animal and vegetable matters ; Payne, C. ; 1851, July 3. No. 13,680 ... | 11 |
| Extracting albumen, &c., from meat, &c. ; Robertson, J. ; 1851, August 21. No. 13,723 ... | 16 |
| Mixing animal matters with corn, &c., for preservation ; Wetterstedt, B. C. ; 1851, September 4. No. 13,732 ... | * |
| Combining concentrated portions of flesh with flour, &c. ; Borden, jun., G. ; 1851, September 5. No. 13,741 ... | 16 |
| Electro-chemical action applied to preserving ; Brooman, R. A. ; 1851, December 8. No. 13,845 ... | * |

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| Preserving grain, &c., in hermetically sealed chamber ; Vittrant, L. C. A. ; 1852, October 12. No. 351 ... | * |
| Chlorine as a preservative agent ; Boileve, J. ; 1852, October 22. No. 486 ... | 41 |

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| Refrigeration applied to preservative purposes ; Vion, H. C. ; 1853, January 15. No. 106 | ... | ... | ... | ... | ... | ... | * |
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| Extracting juices ; Moreau, P. A. Le C. de F. ; 1853, June 16. No. 1468 | ... | ... | ... | ... | ... | ... | * |
| Preserving provisions (cases) ; Farmer, W. ; 1853, September 24. No. 2205 | ... | ... | ... | ... | ... | ... | 25 |
| Preparing potatoes ; Stevens, H. ; 1853, October 5. No. 2278 | ... | ... | ... | ... | ... | ... | 11 |
| Preserving seeds, &c., from mildew, &c. ; Jackson, C. S. ; 1853, October 12. No. 2348 | ... | ... | ... | ... | ... | ... | * |
| Preserving animal substances, &c., by heated steam ; Fateo, A. M., and Verdeil, F. ; 1854, January 31. No. 231 | ... | ... | ... | ... | ... | ... | 15 |
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| Sulphites as a preservative ; Bellford, A. E. L. ; 1854, July 12. No. 1534 | ... | ... | ... | ... | ... | ... | 34 |
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| Air-tight vessels ; Stansbury, C. F. ; 1854, August 5. No. 1719 | ... | ... | ... | ... | ... | ... | 25 |
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| Preserving meat by desiccating ; Blumenthal, F. C., and Chollet, M. L. J. ; 1854, December 7. No. 2572 | ... | ... | ... | ... | ... | ... | 47 |
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| Preserving fish ; Hervé, J. L. ; 1855, January 11. No. 70 | ... | ... | ... | ... | ... | ... | 11 |
| Preserving vegetables, &c. ; Warnecke, G. ; 1855, January 13. No. 95 | ... | ... | ... | ... | ... | ... | * |
| Preserving meat, &c., by means of gelatine, &c. ; Rennie, M. B. ; 1855 ; January 19. No. 153 | ... | ... | ... | ... | ... | ... | 22 |
| Preserving meat, &c., by means of gelatine, &c. ; Hartnall, E. ; 1855, February 5. No. 269 | ... | ... | ... | ... | ... | ... | 22 |
| Preserving meat, &c., by means of sugar, salt, and fat ; Wothly, J. ; 1855, February 20. No. 375 | ... | ... | ... | ... | ... | ... | 22 |
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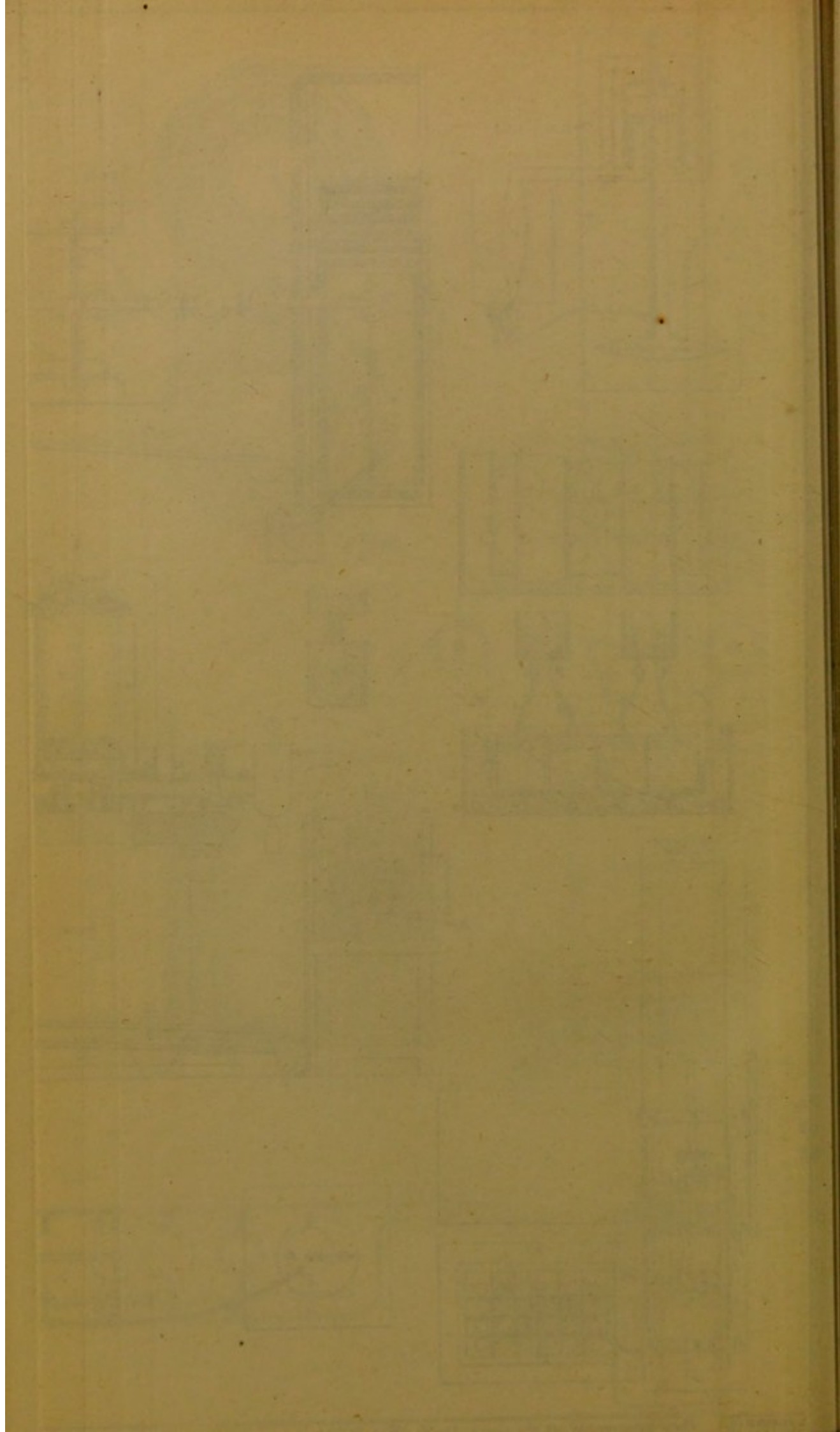
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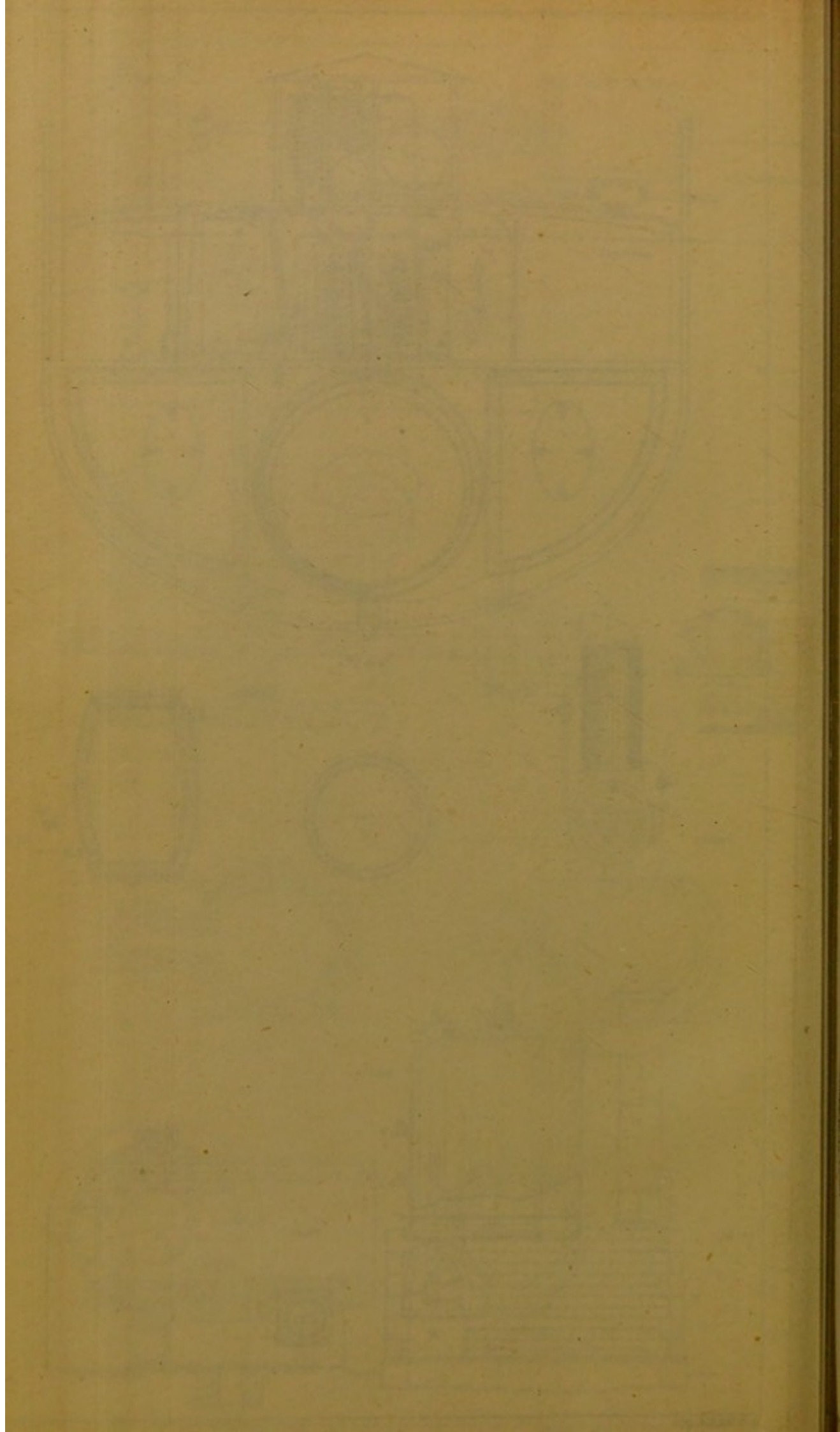
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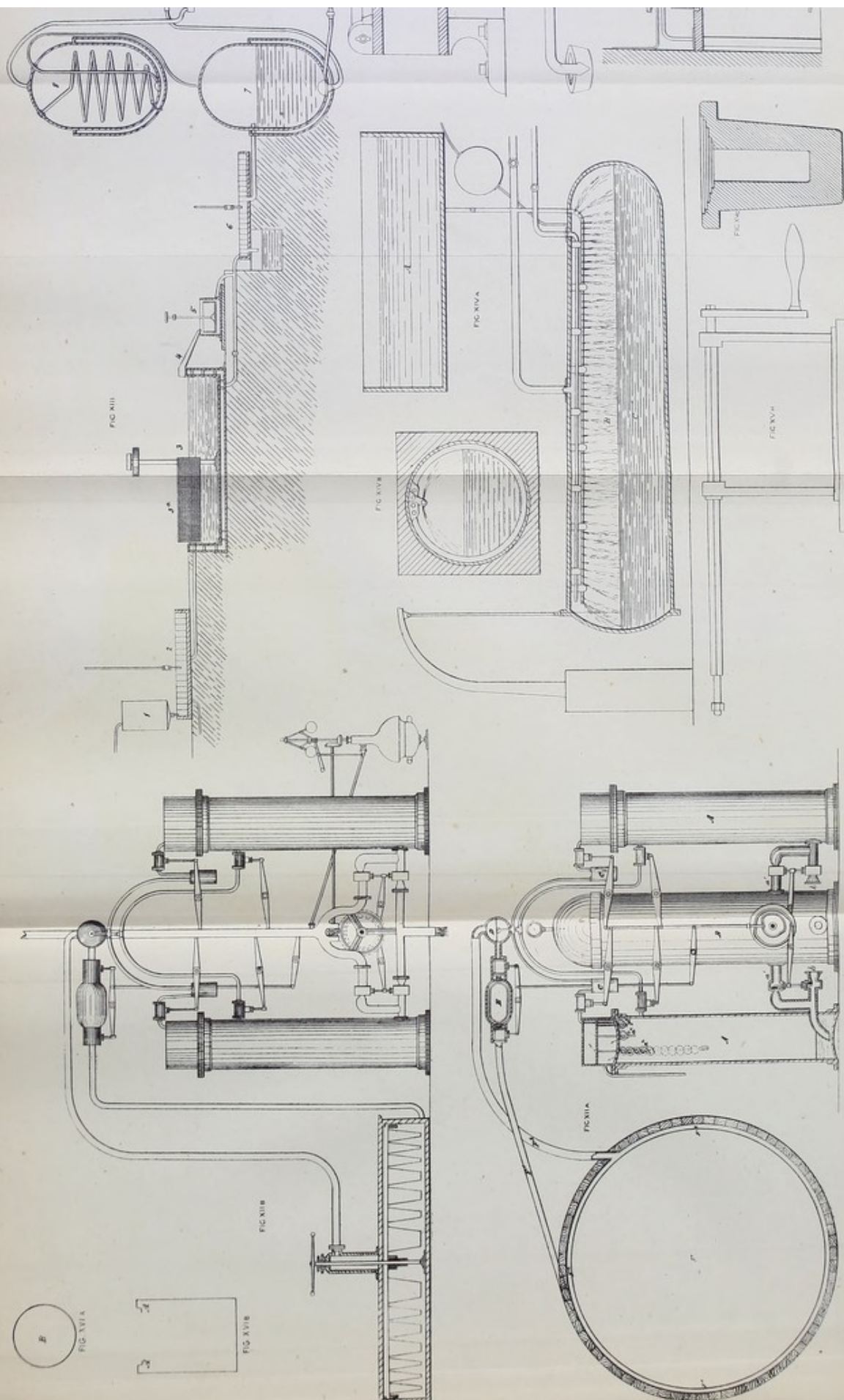
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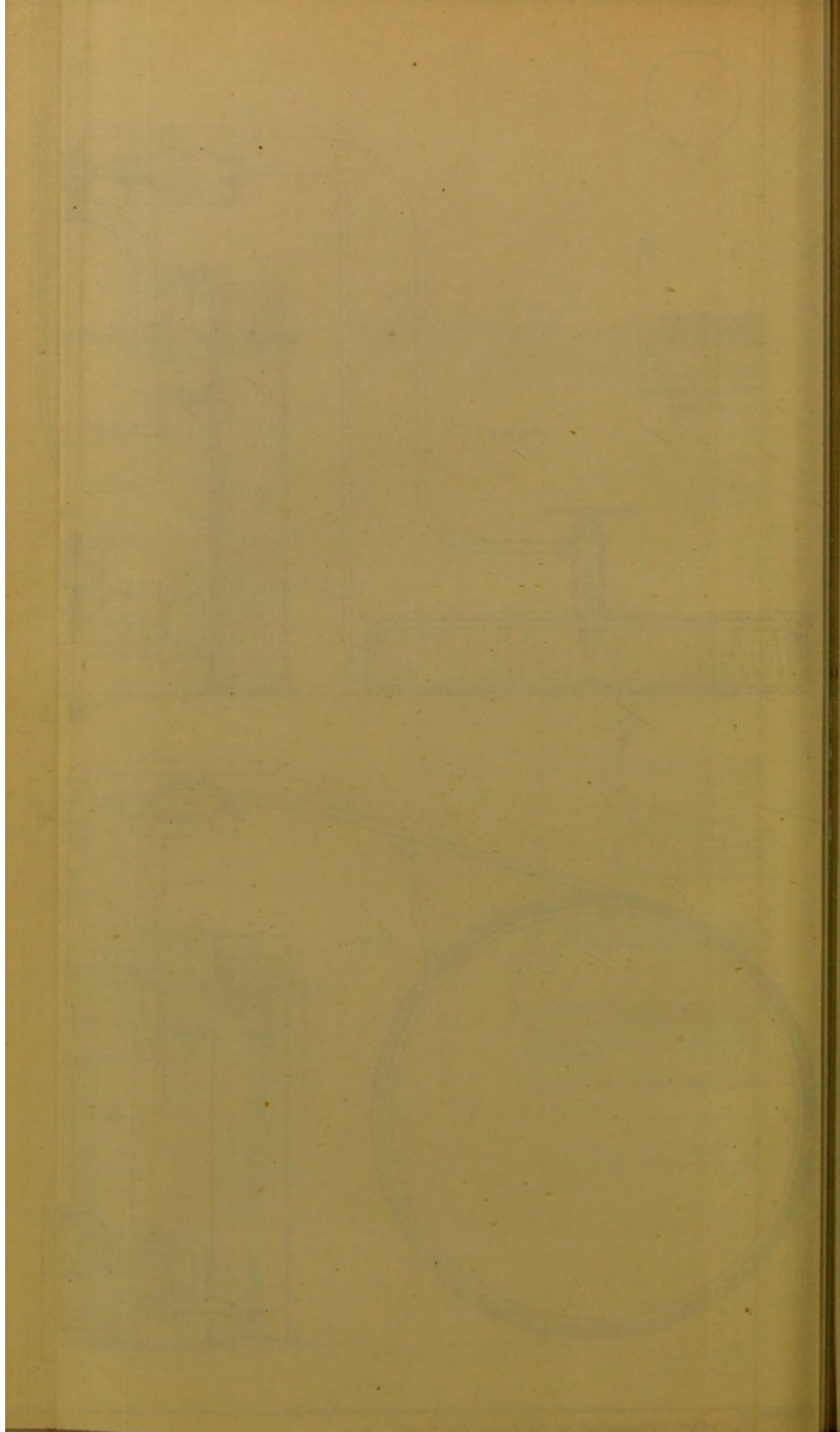
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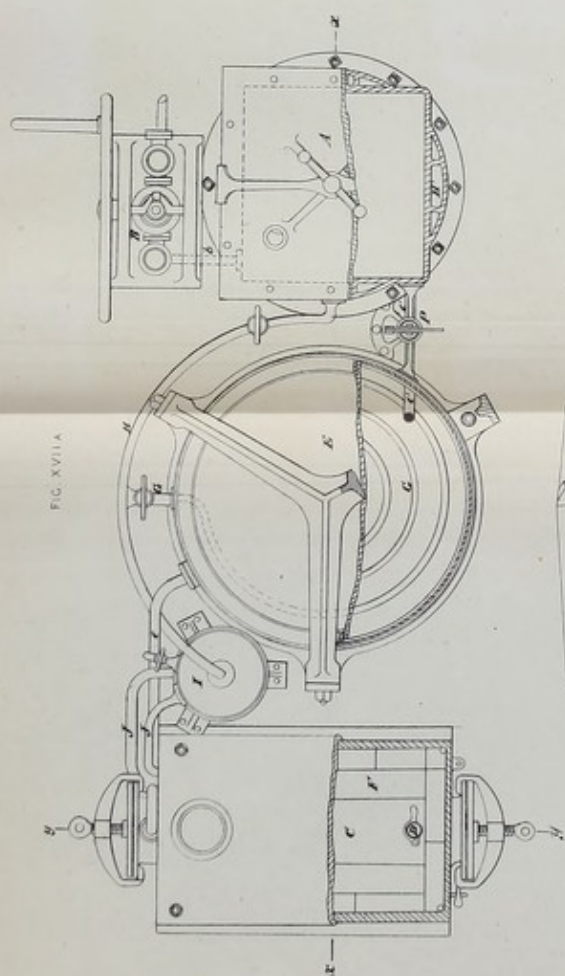


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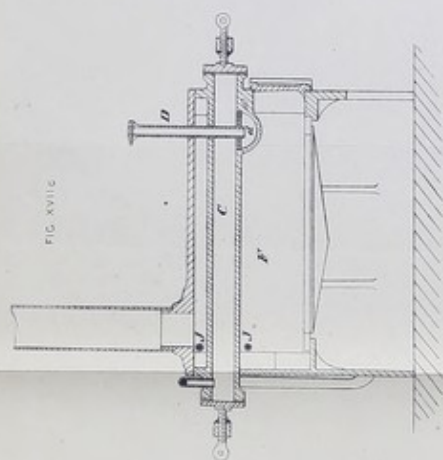


FIG. XVII C

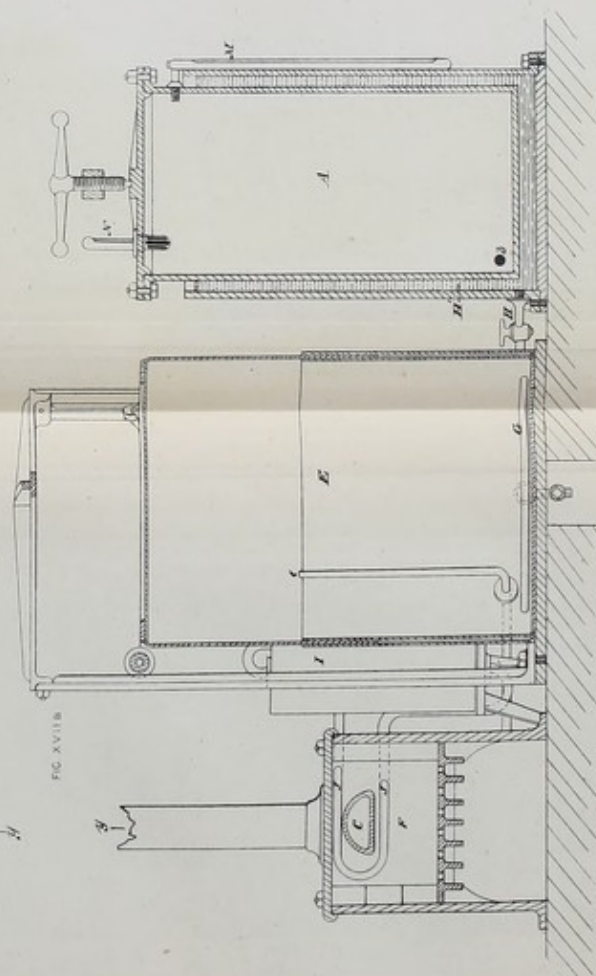


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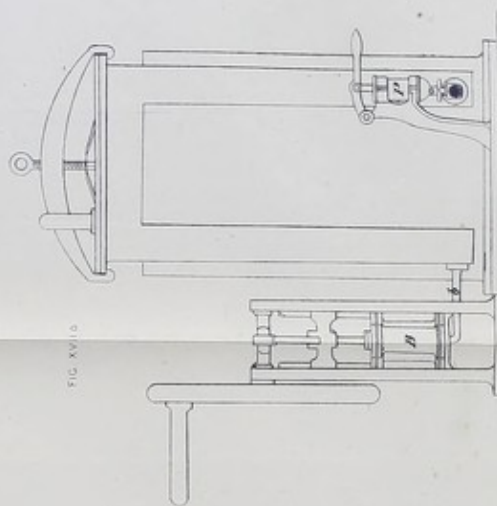


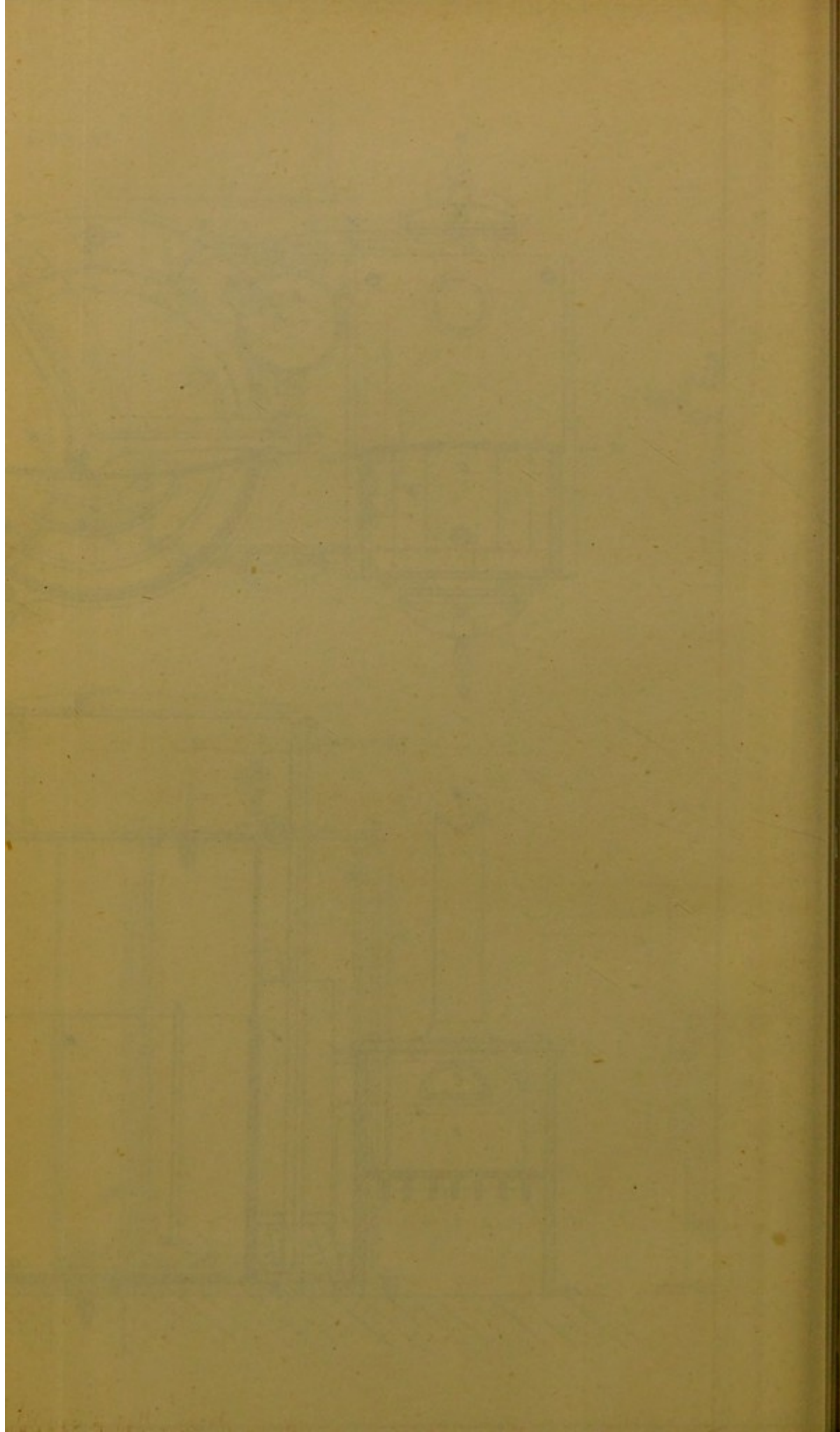
FIG. XVII D



FIG. XIX B



FIG. XIX C



S U P P L E M E N T

TO

ABSTRACTS OF PATENTS ON PRESERVATION OF FOOD, ETC.

** * * The following abstracts of specifications, English and Colonial, have come to hand since the pamphlet was printed. They are arranged according to the method of classification therein adopted.*

The letters "U.K." imply that the Patent was applied for in the United Kingdom; "Vict.," in Victoria.

A 2.

W. A. SMITH. In order to preserve meat, fish, &c., during their carriage by railway, makes use of "a closed chamber formed as a railway carriage or truck, in which the meat, fish, or other article is placed, and through which a current of air, cooled by a refrigerating apparatus, and driven by a fan, is caused to pass, whereby the said article of food becomes frozen, or partially so."

If fish are to be preserved, they are placed in a case filled with water, which is subjected to the action of cold until the whole contents become frozen. To prolong this frozen condition the cases may be wrapped in felt, or other non-conducting material.—[U.K. 1869, Feb. 2. No. 319.]

A 4c.

E. J. C. WELCH. Patents an invention for producing cold in an economical manner. "The refrigerating effects are produced by the evaporation of ether, or some other similar or analogous hydro-carbon, and the condensation of the resulting vapour."

The apparatus used for the purpose is represented on Sheet 5, where Fig. I.^A is a section, and Fig. I.^B a plan of the freezing vessels employed. *a* is chamber containing water or other matter to be frozen. This is surrounded by *b b*, holding ether in a state of vapour; *c c* a chamber filled with some non-conducting substance, such as powdered

charcoal, and made to intervene between the ether chamber *b b* and another ether chamber *d d*; *e e* is a coil of double pipes, the outer of which pipes contains water for cooling the ether, restored to a liquid state, occupying the inner one.

Fig. I.^c represents an arrangement of a pump, which is set in motion either by the handle and fly-wheel *w*, or by means of water pressure acting upon the piston of the upper cylinder *t*.

Ether being introduced into the chamber *b*, a vacuum is formed by means of the pump, communicating with the chamber through the tube *i*. Consequent upon the formation of a vacuum the ether evaporates, absorbs heat from the adjacent surfaces, and, rising in the form of vapour, passes into the pump, by which it is subsequently forced through the coil of pipe *e e*, and, having been there deprived of the heat acquired by condensation, is conveyed into the second ether chamber *d d*, running, in a liquid form, into the vessel *k*, whence it is again made to enter the first ether chamber *b*, through the pipe *j*.—[U.K. 1867, September 9. No. 2544.]

J. JEFFREYS. In order to preserve meat, freezes it "in flat boxes, "of say a yard square and 5 to 10 inches deep, the broader sides, being "the freezing surfaces, are made of sheet iron, the narrow sides are of "deal board for non-conduction."

"To preserve the flavor of the meat, and keep it from being bruised, "it is embedded in seasoned soup made of all available parts of the "slaughtered animals not packed as meat." The blood of the animals is "mixed with slaked lime and sulphate of lime," forming a cement for rendering the boxes soup-tight and even air-tight.

The packages of meat are then so arranged on shipboard, &c., that currents of "freezing air can be made to pass over them."

"As a source of cold, for freezing, ether is preferred," the object sought for being effected by means of a peculiar arrangement of pumps, tubes, condensers, &c.—[U.K. 1868, October 6. No. 3052.]

F. McDUGAL. Patents a "self-acting freezing apparatus," which he describes as being "worked by the direct action of boiling water and "steam on a boiler containing liquid ammonia. The ammonia being "converted into a gas, passes into a pipe, then into a condenser, thence "to the receiver, from which it passes through a valve into a pipe leading "to the congelator; above the congelator is a small tap fixed to the pipe "above, which must first be turned to allow the liquid ammonia into it. "After the freezing process has been gone through the liquid becomes a "gas, and passes through a pipe leading into the liquefier, where, being "converted again into the liquid, it passes into the return pipe, then, "upon turning a tap attached to a jet, leading from the condenser and "joining the return pipe, the liquid ammonia is drawn back to the "boiler, thus continually supplying itself and dispensing altogether with "the use of a pump. By these means no gas escapes, and to the return "pipe is attached a cleanser, as may be seen in the diagram."

This invention is illustrated by Drawing Fig. II., Sheet 5, but no letters of reference appear either on the original drawing or in the original specification.—[Vict. 1869, October 4. No. 1309.]

B 1.

W. R. LAKE. Proposes to preserve fish by taking them "either fresh or salted," removing the skin and bones by a machine, desiccating slowly by "spreading the mass upon a metal stove or other suitable surface heated by means of steam pipes." The substance is then placed in "close paper or wooden boxes to prevent absorption of moisture or unpleasant odour;" or is "packed in metal boxes tightly closed for shipping. Fish that are very fat and oily may be subjected to pressure after being ground, to remove the superabundance of oil," and are then "dried and packed."—[U.K. 1868, October 19. No. 3194.]

C 2.

C. J. GUNTHER. In describing his invention, says, "When salting meat in the usual manner, by strewing or rubbing it over with salt, the meat loses 22 per cent of its juice; out of this meat juice and the salt a brine is formed which contains a portion of the nutritive salts and of the extractive principles of the meat. The object of the process is to retain in the preserved meat the nutritive value of fresh meat, and it consists in the use, for salting meat, of a saturated brine of pure salt, to which the constituents of the meat juice are added in such proportions that this brine contains more of these constituents than the meat itself."

The following are the ingredients of the various brines made use of:—

A. 36 lbs. chloride of sodium (common salt) and $\frac{1}{2}$ lb. of crystallized phosphate of soda dissolved in 10 gallons of water, allowing the whole to stand until clarified.

B. The above yields $11\frac{1}{2}$ gallons of salt water, to which are then added 6 lbs. of extractum carnis, $1\frac{1}{2}$ lb. chloride of potassium, and 10 ozs. of nitrate of soda, the latter ingredient giving color to the meat.

If the meat is to be injected by Morgan's process, $4\frac{1}{2}$ lbs. instead of 6 lbs. of extractum carnis are added to every $11\frac{1}{2}$ gallons of salt water.

"After the meat has remained sufficiently long in the brine, it is smoked or sulphurized by suspending it in rooms or chambers into which is introduced a dish of burning sulphur."

Instead of being smoked or sulphurized, the meat may be treated with a solution of 8 lbs. of chloride of sodium dissolved in 3 gallons of water, to which is added 3 ozs. of crude pyroligneous acid, a small bag containing finely powdered shining lamp black being suspended in the whole for twenty-four hours, the mixture being, meanwhile, repeatedly stirred. The meat is subsequently hung up in an airy place.—[U.K. 1869, January 13. No. 98.]

R. JONES. Places the substances to be cured within a "suitably sized tank capable of being closed air-tight, and which is also filled with brine or curing matter supplied from a suitable reservoir." A portion of the liquids are then withdrawn from the reservoir by means of a pipe "descending to about 32 feet into an open well or receiver. The pipe is kept closed by a suitable tap or valve until the tank is filled and closed air-tight, then by opening the tap or valve the weight of the column of liquid in the pipe will produce the desired extent of exhaustion, so as to cause the brine or curing matter at once to flow into the tissues and passages of the matter under operation. The matters under operation are supported on reticulate or open-work shelves in the tanks."—[U.K. 1869, January 28. No. 267.]

D 1.

A. ECCLES. Places meat to be preserved within an air-tight vessel. This vessel, having been exhausted of air, is filled with "tallow or other matter rendered sufficiently fluid by heat or otherwise. The whole having been allowed to cool, so as to solidify the tallow or other substance, the tubes are to be disconnected and proper plugs inserted into the corresponding holes, so that the meat may be kept or exported in the vessel containing it; or the vessel being taken to pieces the contents may be withdrawn *en masse* and placed in another vessel for use or export."—[Vict. 1869, July 3. No. 1261.]

D 3.

L. N. LEGRAS. For preserving meat, &c., on shipboard, arranges three chambers, the one inside the other. The space between the walls of the outer and second chamber is filled with some non-conducting substance; between the second and third some refrigerating mixture or medium is made to circulate, whilst the meat, &c., to be preserved is placed within the central compartment. This central compartment must, after the introduction of the meat, &c., be made air-tight, when a vacuum is formed by burning spirit of wine in a separate vessel, made to communicate with the central compartment. Salts of calcium are introduced into the meat vessel with a view of "absorbing both air and moisture therefrom."—[U.K. 1869, February 16. No. 469.]

D 4.

G. SPENCER. Preserves animal and vegetable substances by placing them "in a suitable air-tight vessel, from which atmospheric air is partially or wholly withdrawn by any convenient means, and replaced by filling the containing vessel with ether, carbonic acid gas, or carbonic oxide gas."—[U.K. 1869, March 10. No. 738.]

E 1.

C. HARVARD AND M. X. HARMONY. "Impregnate meat, &c., with a gelatinous solution containing bisulphite of lime or equivalent substances, for which purpose the meat, &c., is placed inside an air recep-

“tacle, from which the air is first exhausted and the solution is then forced in. The meat, &c., is afterwards dipped in a similar solution containing glycerine or equivalent substances, and is then dried.”—[U.K. 1868, September 16. No. 2846.]

F. PERRY's patent appears to be identical with that of G. W. Perry, described at p. 40.—[U.K. 1869, January 1. No. 9.]

* * *Professor Gamgee's process for preserving meat, briefly alluded to at page 38, having attracted considerable attention both in England and in this colony, it has been deemed advisable to give the latest report upon the same, as furnished through the Agent-General of Victoria, and published in the "Government Gazette" of 4th March 1870.*

Theory of the process.

Carbonic oxide gas combines with blood or flesh coloring matter, so as to enable this to resist the reducing or decomposing action of sulphurous acid; well-burned and dry charcoal absorbs 65 times its volume of sulphurous acid. In this way a compound is obtained of uniform strength, great affinity for oxygen and moisture, and which can easily be measured, weighed, or handled in boxes for the purpose of meat preservation; a gradual, certain, and sufficient diffusion of a given quantity of sulphurous acid is thus obtained in chambers in which meat is suspended. The sulphurous acid is prevented from injuring the aspect and taste of the meat in a great measure by the previously secured actions of the carbonic oxide. It attacks the surface, however, is dissolved, and penetrates gradually to the deeper parts of the tissue, and into the bones. It remains in the meat partly unchanged in solution, and partly in combination with soda and potash in the form of sulphites.

Practical application of the process.

Animals to be preserved are caused to inhale carbonic oxide by enveloping their heads in an air-tight hood, which communicates with a gas-bag or gasometer charged with the gas; when insensible—and in bullocks or sheep the inhalation occupies from 50 to 70 or 80 seconds—the animals are bled; they are then dressed as usual. Pigs are dressed in the usual way; the kidneys, as well as other internal organs, are removed. Animals that have been shot or otherwise slaughtered are subjected in chambers to the action of carbonic oxide gas, which is readily absorbed by the blood and tissues. Having secured this preliminary condition, the carcasses are hung up in chambers full of carbonic

oxide, pure or in combination with other gases, and boxes containing from two to three pounds of charcoal, well charged with sulphurous acid, for every hundred pounds of meat are placed therein. The whole is left undisturbed for seven or eight days in the case of sheep, ten days for pigs, and eighteen or twenty for bullocks.

Apparatus used.

Originally, metal receivers, air-pumps, gasometers, tin cases, and other expensive machinery were used, but the requirements of the American trade compelled improvements, which may be said to have been concentrated in the apparatus erected near the Columbia market. It has been fitted up as required in the hottest climates, and for the purpose of instructing colonists and others in the difficult art which has been so long in process of development. The preserving chambers are of concrete (2), and wood (1). They measure respectively 12 feet in length, 3 feet 6 inches in width, and 8 feet in height. They have a metal roof, over which brine coming from a sieve refrigerating machine on the ether principle. This brine flows over one or all the roofs at the wish of the operator, and passes into a tank containing pipes through which the gases pass, and are cooled before entering the chambers. From this tank the brine passes back to the refrigerator. A three-inch pipe passes from the floor of each chamber in front, being provided with a stop-cock externally, and communicates with a blower. From this the air is carried either round to the cold tank to be used in establishing a circular current for refrigerating purposes, or through a furnace. From the furnace there is a communication with pipes in the cooling tank, and from there with the chambers a three-inch pipe opening just below the roof in the rear part of each, being likewise provided with a stop-cock.

When the blower is set in motion the air is drawn from one or all the chambers, as the operator chooses, and is driven unchanged through the cooling tank, or, if made to pass through the furnace containing hot charcoal, converted into nitrogen and carbonic oxide, back into the chambers again. The refrigerating machine is only needed in hot climates, and used only to set the meat, and so lower its temperature as to favor gaseous absorption. The cooling occupies only a few hours, must never proceed to the freezing point, and indeed only to 50° Fahr.

According to the experiences of London brewers, who cool their liquor by means of other* machines, the cooling of 500 sheep to the required temperature would not cost two pounds in any part of the world. The apparatus, therefore, consists in preserving chambers which should hold the amount of meat to be packed in a single day; provision for external circuit of cooled water or brine, and internal currents of cooled air or burned air when the meat is put in the chamber with a box or boxes containing the required amount of charged charcoal; the doors are jammed tightly against indiarubber washers, and the blowers set in

* "Ether machines" would seem to be intended.

motion. So long as the air is burning in the furnace there is outward pressure, as indicated by a relief-valve on the blower. When the valve is quiet the blower is stopped. Time is allowed to facilitate the actions of carbonic oxide on the meat's surface, and then by means of a leather thong, which works through a "stuffing-box," the lid of the charcoal-box is removed. This completes the process.

Labor and expense involved.

In addition to the butchers needed to slaughter and dress the sheep, the largest establishment can only need one man to drive the freezing machines and blower, and another to attend the charging of the charcoal.

In England the expense of preserving amounts to two or three pence for a sheep, and about a shilling for a bullock.

Transportation of the meat.

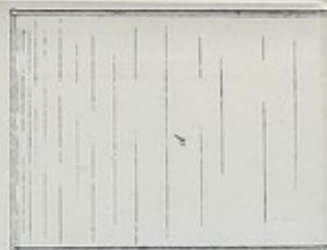
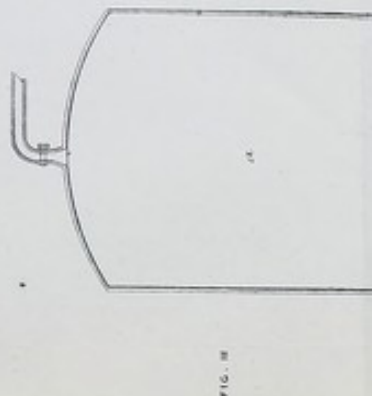
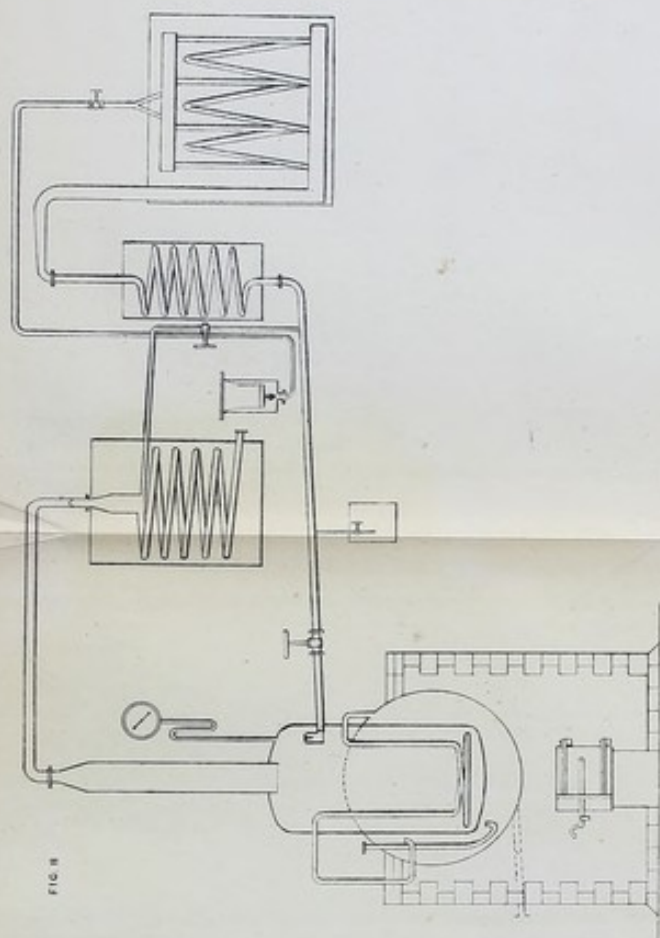
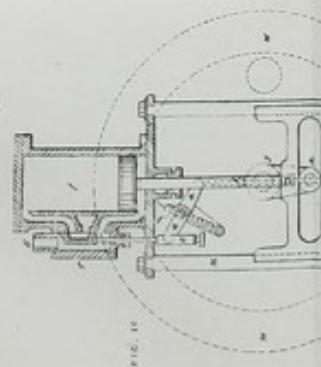
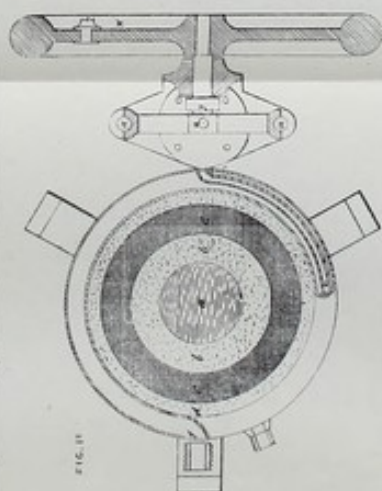
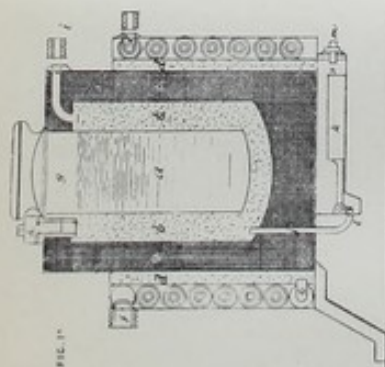
The meat remains unchanged for weeks and even months in the open air. Consignments from Western America have been in quarters and entire carcasses, packed in cloths and common deal boxes. Experiments on a satisfactory scale are being instituted as to the best means of packing the meats for Australian purposes.

Packing in pots has succeeded well, but it is desired to convey the carcasses, if possible, so as to secure a freshness of surface suited to the ordinary butcher's shop.

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* * *For List of Drawings on other sheets see page 66.*



By Authority: JOHN FERRES, Government Printer, Melbourne.