quick stirring, and when thoroughly mixed must be at once applied. This is said to yield an excellent cement.

Gutta Percha Cement.—This highly recommended cement is made by melting together, in an iron pan, two parts common pitch and one part gutta percha, stirring them well together until thoroughly incorporated, and then pouring the liquid into cold water. When cold it is black, solid, and elastic; but it softens with heat, and at 100° Fah. is a thin fluid. It may be used as a soft paste, or in the liquid state, and answers an excellent purpose in cementing metal, glass, porcelain, ivory, etc. It may be used instead of putty for glazing windows.

Iron Cement for Closing the Joints of Iron Pipes.—Take of coarsely powdered iron borings, 5 lb.; powdered sal-ammoniac, 2 oz.; sulphur, 1 oz.; and water sufficient to moisten it. This composition hardens rapidly; but if time can be allowed it sets more firmly without the sulphur. It must be used as soon as mixed and rammed tightly into the joint.

2. Take sal-ammoniac, 2 oz.; sublimed sulphur, 1 oz.; cast iron filings or fine turnings, 1 lb. Mix in a mortar and keep the powder dry. When it is to be used, mix it with twenty times its weight of clean iron turnings, or filings, and grind the whole in a mortar; then wet it with water until it becomes of convenient consistence, when it is to be applied to the joint. After a time it becomes as hard and strong as any part of the metal.

Kerosene Oil Lamps.—The cement commonly used for fastening the tops on kerosene lamps is plaster of Paris, which is porous and quickly penetrated by the kerosene. Another cement which has not this defect is made with three parts of resin, one of caustic soda, and five of water This composition is mixed with half its weight of plaster of Paris. It sets firmly in about three quarters of an hour. It is said to be of great adhesive power, not permeable to kerosene, a low conductor of heat, and but superficially attacked by hot water.

Cement for Uniting Leather and Metal.—Wash the metal with hot gelatine; steep the leather in an infusion of nut galls (hot) and bring the two together.

Cement for Leather Belting.—One who has tried everything says that after an experience of fifteen years he has found nothing to equal the following: Common glue and isinglass, equal parts, soaked for 10 hours in just enough water to cover them. Bring gradually to a boiling heat and add pure tannin until the whole becomes ropy or appears like the white of eggs. Buff off the surfaces to be joined, apply this cement warm, and clamp firmly.

Litharge and Glycerine Cement.—A cement made of very finely powdered oxide of lead (litharge) and concentrated glycerine unites wood to iron with remarkable efficiency. The composition is insoluble in most acids, is unaffected by the action of moderate heat, sets rapidly, and acquires an extraordinary hardness.

Cement for Attaching Metal to Glass.—Copal varnish, 15; drying oil, 5; turpentine, 3. Melt in a water bath and add 10 parts slaked lime.

Paris Cement for Mending Shells and other Specimens.—Gum arabic, 5; sugar candy, 2; white lead, enough to color.

Porcelain Cement.—Add plaster of Paris to a strong solution of alum till the mixture is of the consistency of cream. It sets readily, and is said to unite glass, metal, porcelain, etc., quite firmly. It is probably suited for cases in which large rather than small surfaces are to be united.

Soft Cement.—Melt yellow beeswax with its weight of turpentine, and color with finely powdered Venetian red. When cold it has the hardness of soap, but is easily softened and moulded with the fingers, and for sticking things together temporarily it is invaluable.

Soluble Glass Cements.—When finely pulverized chalk is stirred into a solution of soluble glass of 30° B. until the mixture is fine and plastic, a cement is obtained which will harden in between six and eight hours, possessing an extraordinary durability, and alike applicable for domestic and industrial purposes. If any of the following substances be employed besides chalk, differently colored cements of the same general character are obtained: 1. Finely pulverized or levigated stibnite (gray antimony, or black sulphide of antimony) will produce a dark cement, which, after long burnishing with an agate, will present a metallic appearance. 2. Pulverized cast iron, a gray cement. 3. Zinc dust (so-called zinc gray), an exceedingly hard gray cement, which, after burnishing, will exhibit the white and brilliant appearance of metallic zinc. This cement may be employed with advantage in mending ornaments and vessels of zinc, sticking alike well to metals, stone, and wood. 4. Carbonate of copper, a bright green cement. 5. Sesquioxide of chromium, a dark green cement. 6. Thénard's blue (cobalt blue), a blue cement. 7. Minium, an orange colored cement. 8. Vermilion, a splendid red cement. 9. Carbon red, a violet cement.

Sorel's Cement.—Mix commercial zinc white with half its bulk of fine sand, adding a solution of chloride of zinc of 1·26 specific gravity, and rub the whole thoroughly together in a mortar. The mixture must be applied at once, as it hardens very quickly.

Steam Boiler Cement.—Mix two parts of finely powdered litharge with one part of very fine sand, and one part of quicklime which has been allowed to slake spontaneously by exposure to the air. This mixture may be kept for any length of time without injuring. In using it a portion is mixed into paste with linseed oil, or, still better, boiled linseed oil. In this state it must be quickly applied, as it soon becomes hard.

Turner's Cement.—Melt 1 lb. of resin in a pan over the fire, and, when melted, add ¼ of a lb. of pitch. While these are boiling add brick dust until, by dropping a little on a cold stone, you think it hard enough. In winter it may be necessary to add a little tallow. By means of this cement a piece of wood may be fastened to the chuck, which will hold when cool; and when the work is finished it may be removed by a smart stroke with the tool. Any traces of the cement may be removed from the work by means of benzine.

Wollaston's White Cement for Large Objects.—Beeswax, 1 oz.; resin, 4 oz.; powdered plaster of Paris, 5 oz. Melt together. To use, warm the edges of the specimen and use the cement warm.

The Steam Fire Engine.

The following suggestions to engineers who have not had much experience in running engines are taken from the general orders of the New York Fire Department, and contain hints that should be useful in the care of all kinds of steam machinery:

1. In laying your fuel in the fire-box first lay plenty of shavings, then light dry kindling wood, filling your furnace full, which in most cases will give you steam enough by the time you arrive at a fire to commence work, provided you light your fire when you leave the house, which, as a general rule, is advisable.

2. If you use coal, be careful to keep a thin fire and not clog it. Use the coal in as large lumps as possible, and do not break it up unnecessarily in the furnace. The best coal for this purpose is clean cannel in lumps free from dirt and dust.

3. Be careful not to let so much fire collect under your engine as to burn the wheels. When working for a long time at fires there is some danger of doing so.

4. The Amoskeag boiler is an upright tubular boiler, with a submerged smoke-box and fire-box, surrounded with water. When the engine is running the water in the boiler should be carried so as to stand at the third gauge cock, which is placed near the top of the tubes, and it should never be carried below the center of the tubes, at which point the first gauge cock is located.

5. Avoid using an unnecessary amount of steam, the tendency is to use more than is required. From sixty to eighty pounds is as much as you will generally require to do good fire duty.

6. The engine has two suitable feed pumps for supplying the boiler with water. One of the pumps should be worked nearly all the time in order to keep water in the boiler at the proper height, and to preserve an even pressure of steam.

7. If brackish water is used for supplying the boiler, or if the boiler becomes foul from long use without being blown off, it is likely to foam or prime. If foaming occurs while the engine is working at a fire it may be prevented or diminished by opening the surface blow-off cock. After the engine is returned to the house, the water should be blown entirely out of the boiler through the blow-off cock near the bottom of the boiler with a steam pressure of about twenty pounds, and the boiler refilled with fresh water. This process may be repeated until the boiler becomes clean.

8. The pump upon the Amoskeag engine is a vertical double acting pump, with the cylinder surrounded by a circular chamber, divided vertically outside the cylinder so as to answer both for the suction and discharge chambers of the pump; it has a separate valve plate at the top and bottom of the pump carrying both the suction and discharge valves, the suction valve upon one side of the plate and the discharge valve upon the other. Each of those valve plates can be reached by taking off the top and bottom of the pump, which is so constructed as to be readily removed. The discharge and suction parts of the water chamber surrounding the cylinder are connected by a valve in the vertical partition which is called a relief valve.

9. With a single long line of hose it may be necessary to open your relief valve a little, but at all other times be particular to have it closed, except when you want to feed your boiler without forcing any water through the hose.

10. In the smokepipe, directly over the upper flue sheet, a valve is placed which is called the variable exhaust valve. By operating this valve the size of the aperture for the escape of the steam from the steam cylinder is increased or diminished, thus regulating the draught of the chimney and the heat of the fire. This valve should be closed when the engine is started until a fair working pressure of steam is obtained, after which it may be opened.

11. Care should be taken to have the suction hose and its connections air tight.

12. Open your discharge gate and cylinder drain cock before starting your engine.

13. Don't let the flues of your engine get filled up.

14. Be particular to take your engine off the springs before you work it and to place it on the springs again when done working.

15. With a long line of hose on be particular to open your throttle gradually. If you open it too suddenly you are liable to burst your hose.

16. The pumps of the engine should be examined at least once in six months to see that the valves and all parts are in good condition. The pump valves should have a lift of about three-eighths of an inch and the suction valves the same lift.

17. The inside of the steam cylinders and the steam valves should be oiled or tallowed always after the engine has been worked at a fire, and as often as it may be necessary to keep them well lubricated, and all the parts of the engine where liable to friction should be kept well oiled. Be particular to use an abundance of oil on the link block, where there is more friction than in any other part.

18. The running gear and every part of the engine liable to disarrangement or accident should be thoroughly examined every time after the engine has been out of the house, whether it has been worked at a fire or not.

19. Whenever your engine is repaired try to help to do it yourself, as by so doing you get familiarity with it that you can in no other way obtain. If the feed was turned on and the feed pumps were at work, but if the water did not run into the boiler, what would be done in such a case? To examine the hydrant and see if it was turned on or off; examine the check valve to see that it was in operation; this can be done by applying the ear to the chamber and ascertaining if the valve rises and falls at each stroke of the pumps, and also apply the hand to the pipe below the check valve in order to ascertain if it is cool; if they are all right, examine the blow-off cock and all other connections with the boiler to ascertain if they were closed; and if they are closed, the pumps must be pumping air into the boiler instead of water; also examine the pumps and induction pipes, in order to ascertain if they were not leaking, and if so stop the leak. If the check valve should not be in operation, examine the pumps, also the pump valves, and see if they were not bursted, either of which causes prevent the pumps from delivering water to the boiler.

There are four causes for feed pumps becoming hot, namely: 1st. There may be so small a quantity of eye detious water used to cause it. 2d. It may be carried from muddy water or tight packing. 3d. The check valve and relieving valve may be caught up or very breaky, allowing the hot water from the boiler to run back to the pumps. 4th. External application of heat, the pumps being situated near the boiler.

Steam is a thin elastic fluid generated by the application of heat to any fluid (water generally used); the power of steam is its expansion; superheated steam is any steam which has been heated in a separate state to a high degree of temperature under pressure; in this condition its mechanical and chemical power are wonderfully increased. Water will boil at 212° Fah.

The following are the supplies which every engine in the department is furnished with: 20 feet of suction hose, a suitable brass strainer for suction hose, a brass hydrant connection for suction hose, a brass signal whistle, two plated gauges, one to indicate the pressure of steam upon the boiler and the other the pressure of water at the pumps or leading hose; two discharge pipes for leading hose, with a complete set of changeable nozzles, from ⅞ inch diameter to 1¼ inches diameter inclusive; two brass-bound fireman's hand lanterns, a large brass oil can, a jackscrew for convenience in oiling the axles, a coal shovel, and fire poker. A small tool-box furnished with such small tools as may be required about the engine when in use, such as hammers, wrenches, and the like.

Dimensions of a second-class double plunge engine, crane neck frame: Height from floor to top of smokestack, 8 feet 8 inches; length over all, including tongue, 23 feet 2 inches; diameter of boiler, 2 feet 7 inches; diameter of pumps, 4¼ inches; stroke of pumps, 8 inches; diameter of steam cylinders, 6⅞ inches; number of discharge gates, 2; capacity in gallons per minute, 700; weight, about 5,400 pounds. Second-class double pump crane neck engine: Diameter of grate surface, 32 inches; size of door, 8 by 12 inches; number of tubes, 258; diameter of tubes (internal), 1⅛ inches; bottom of boiler to bottom of fusion pipe, 20 inches; bottom of fusion pipe to 1st gauge cock, 12 inches; distance between gauge cocks, 5 inches; number of gallons to 3d gauge cock, 40 cubic feet; steam room, 3 feet.

American Losses by Fire.

The amount of losses in the United States by fire during 1879, as reported to insurance companies, was $77,703,700; add to this the uninsured losses that are not reported, and it will fall but little short of the $100,000,000 claimed as the annual loss in this country. Canada is not included in these reports.

In the four years, 1875–6–7 and 8, there were burned wholly or in part, in the United States: 1,354 hotels, 263 churches, 182 school houses, 40 court houses, 42 alms houses, hospitals, and asylums—1,883 in all. It would naturally be supposed that buildings of the character named would be built with more than ordinary care, but the record does not show such to be the case. Indeed, the more pretentious the building, the more careless seem to be the owners.

AGRICULTURAL INVENTIONS.

Mr. Joseph Custer, of Goshen, Ohio, has patented a seed planter, so constructed that it may be used for planting potatoes and small seeds, as required.

Mr. Nathan L. Brass, of Juniata, Neb., has patented an improved sulky-harrow, which is simple and convenient in use, being easily raised from the ground and adjusted to work at any desired depth in the soil.

A combined scraper and fork, patented by Mr. George P. Ruhle, of Swengel, Pa., is intended for use as a scraper, hay lifter or fork, and dung fork; and the invention consists in a novel combination and arrangement of parts, whereby the apparatus may be conveniently used for the purposes named.