RECONSTRUCTION OF FARRAGUT'S FLAGSHIP, THE U. S. S. "HARTFORD."

By the kindness of Naval Constructor Frank W. Hibbs, of the Mare Island Navy Yard, we are enabled to present two illustrations of Admiral Farragut's famous old flagship, the "Hartford," one showing her in dry dock for resurvey, preparatory to her reconstruction, and the other representing the ship in her new rig and armed with a modern battery of rapid-fire guns.

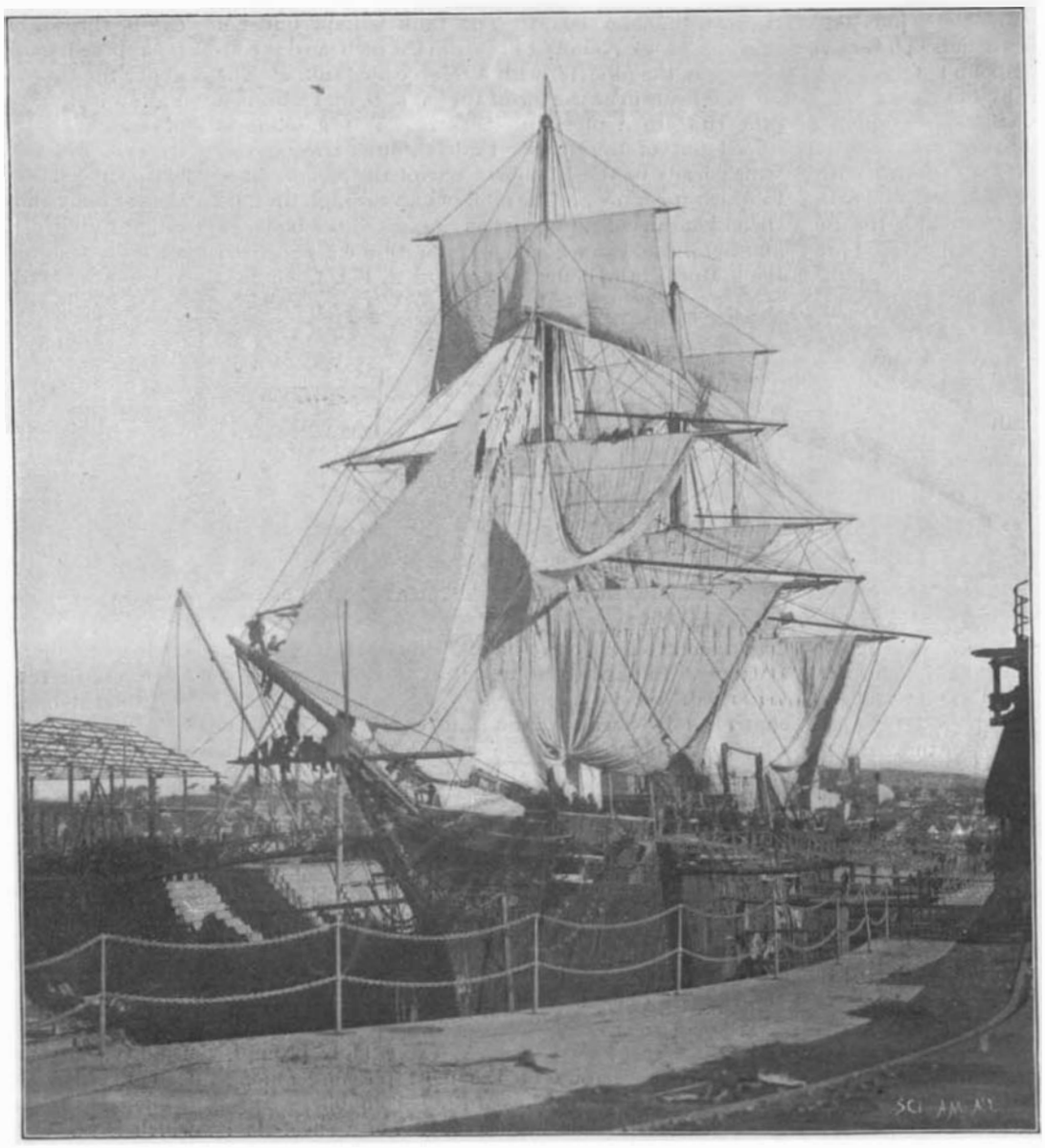
This famous vessel is endeared to the heart of the American people by her association with some of the most stirring scenes and with one of the greatest heroes of the Civil War. She acted as flagship of the fleet which, on August 5, 1864, forced its way through the seemingly impregnable entrance to Mobile Bay, and in so doing achieved one of the most daring and brilliantly successful feats in the history of naval operations.

At this time, when the "Hartford" has just entered upon a new lease of life and is again in commission, it will be in place to give some brief account of her part in the battle of Mobile Bay. The main entrance to the bay is about two miles in width and passes between Dauphin Island on the west and a tongue of land which extends from the eastern shore and terminates at Fort Morgan. The Confederates had narrowed down the available width of the entrance by driving a line of piles, and by laying a double line of torpedoes, until a channel only 300 feet wide was left over against the guns of Fort Morgan for the passage of the blockade-runners. The line of submarine mines consisted of 46 large casks and 134 smaller sheet iron cases loaded with powder. They were placed 7 feet below the surface of the water and were exploded on contact by means of a sensitive trigger. Fort Morgan commanded this channel with seven 10-inch and three 8-inch smooth-bore shell guns and eleven 32-pounders, while of rifled guns there were two 8-inch, two 7-inch, seven 6½-inch, three 5·8-inch. This formidable battery was arranged in three tiers. An exterior earthwork close by contained twenty-nine guns ranging from 32-pounders to 10-inch smooth-bores. Two miles away, on the other side of the channel, Fort Gaines was able to throw shot and shell from three 10-inch and twenty smaller smooth-bore guns. At the inner end of the channel was the Confederate "Tennessee," carrying two 110-pounder rifles, and four 95-pounders in broadside. She was assisted by three smaller Confederate gunboats. These four vessels were so stationed as to deliver a raking fire upon the Northern fleet at the same time that it was exposed to the terrific fire from Fort Morgan. Admiral Farragut forced the passage in line ahead, the monitors leading the way, followed by the unarmored ships of the "Hartford" type, which were lashed together in pairs, the larger and more powerful ship of the two being always placed to starboard, or on the side facing Fort Morgan. By way of protection the chain cables had been fastened along the starboard side of the wooden vessels. Nets were rigged to catch splinters, top hamper was sent down, and sand-bags were placed upon the deck as a protection against plunging shot. Farragut, in order to obtain an unobstructed view of the operations, chose his position in the rigging, and as the smoke mounted he climbed higher into the shrouds, until an officer, fearing that he might lose his balance in the shock of battle, was sent up to lash him in his place.

The "Hartford" suffered terribly in passing the fort and in her subsequent engagements with the "Tennessee." The foremast was struck twice at the first onset, and a shell exploding between the forward 9-inch guns laid out fifteen of the men who served them. The "Brooklyn," which was ahead of the "Hartford," betrayed some hesitation as she entered the channel, and on being ordered to go forward, signaled back the word "torpedoes." This brought forth Farragut's immortal "Damn the torpedoes; go ahead; four bells." At this time the "Tecumseh" was sunk by a torpedo, but the "Hartford," although the sheet iron torpedoes could be heard scraping along her bottom, passed safely over the mine field, and the Admiral was able shortly afterward to gather his fleet in the upper bay. In this engagement the "Hartford" lost twenty-five killed and twenty-eight wounded. Although her hull showed evidence of the terrific fire through which she passed, the chain cables saved it from fatal injury.

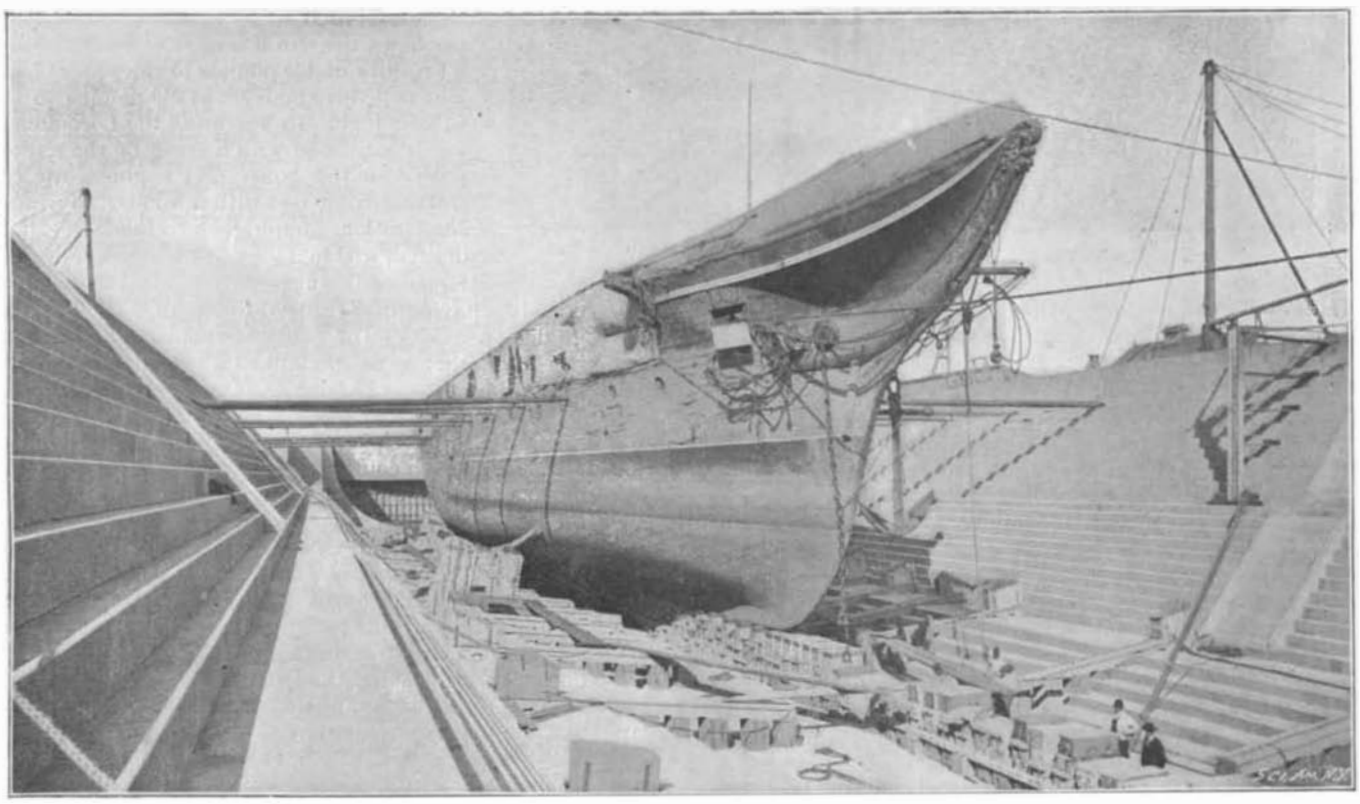
Thanks to the good people of Vallejo, which lies just across the straits from the Mare Island Navy Yard, the "Hartford," which had been laid up many years at that station, was granted a liberal appropriation by Congress for the purpose of thorough reconstruction, $276,000 being granted for restoring the hull, $150,000 for boilers and engines and $150,000 for armament. As originally built, the "Hartford" was a wooden steam frigate, 226 feet long over all, 44 feet beam, 18 feet 2 inches draught and 2,790 tons displacement.

The ship is still on her original lines, her present displacement being 2,799 tons on a normal draught of 18 feet 6 inches, while her length over all is 305 feet. She was originally ship-rigged, but as reconstructed she is bark-rigged, with stump-topgallantmasts. Her original battery at the time she was placed in commission in 1859 consisted of eighteen 9-inch smooth-bore Dahlgren guns in broadside; two 100-pound rifled Parrott guns on the forecastle; two 60-pound rifled Parrott guns



THE U. S. S. "HARTFORD" AS RECONSTRUCTED.

Displacement, 2,799 tons. **Speed,** 12 knots. **Coal Supply,** 258 tons. **Complement,** 244. **Armor:** none; ship constructed of wood. **Armament:** thirteen 5-inch rapid-fire guns; eight 6-pounders, two 1-pounders, automatic; two 1-pounders, Hotchkiss; two 3-inch field guns; two Colt automatic. **Date of Launch,** 1858; reconstructed, 1899.



HULL OF FARRAGUT'S FLAGSHIP "HARTFORD" IN DRY DOCK AT MARE ISLAND FOR RESURVEY.

EXPERIMENTAL BLOWING UP OF AN OLD MAINMAST OF THE "HARTFORD" AT NEWPORT TORPEDO-STATION.

on the poop deck, and three 12-pounder Colt howitzers in the tops. During the ship's reconstruction her top side planking and top timbers, her forecastle and poop deck, her stem, stern post, rudder post and rudder were all renewed. A new gun deck and upper deck were given her; her bulkheads, storerooms and magazines are all entirely new, and the fittings throughout the vessel have been renewed and are of modern type. The principal portion of the old ship remaining is that part of her which lies below her light water line.

The new engines of 2,000 indicated horse power are of the horizontal, back-acting, compound type, with cylinders 35 and 66 inches diameter by 48 inches stroke. She is propelled by a single screw. Steam is supplied by four boilers of the Scotch type, which are 11 feet in diameter by 10 feet in length. She is supplied with steam steering gear, electric lighting plant, and artificial ventilation, and her boilers are fitted for the use of forced draught. Her battery is of the rapid-fire type and consists of twelve 5-inch rapid-fire guns mounted in broadside on the gun deck, one 5-inch rapid-fire gun on the forecastle, eight 6-pounders mounted on the rail of the upper deck, two 1-pounder automatics on the poop deck, two 1-pounder Hotchkiss guns on the rail of the upper deck, two 3-inch field guns on carriages and two Colt automatic guns on the bridge. It will thus be seen that the famous old "Hartford" combines the picturesque features of the fighting ship of the sixties with the aggressive powers of the cruiser of the modern type. Although her spars have been cut down, she carries enough sail to give her crew, which will consist largely of recruits, something of that thorough training aloft which characterized the seaman of an earlier date.

In connection with the reconstruction of the "Hartford," the small photograph of the blowing up with guncotton of an old mainmast of the "Hartford" will be of interest. The mainmast was one removed from the ship before she left for the Pacific, and its destruction formed part of the experimental work of the torpedo station at Newport, Rhode Island.

THE "LOCOMOBILE" STEAM CARRIAGE.

In the early days of the present revival of automobilism, the steam engine was regarded with but little favor as a motor, chiefly because of the weight, bulk and general inconvenience accompanying the use of coal as fuel. With the introduction of liquid fuel, however, with its advantages of light weight and ease of storage and manipulation, the way was opened for the construction of a successful steam carriage, and the joint efforts of inventor and builder have produced some light, compact, powerful, easily managed, and eminently successful steam-driven automobiles.

We have selected for illustration, as combining most of the latest developments of the steam-driven type, the steam carriage which is popularly and commercially known as the "Locomobile." It has been sufficiently long on the road and has been tested under such varying and trying conditions as to prove that it is a thoroughly practical design, and representative of the unquestionable advantages and promising future of oil and steam in the field of automobilism.

THE CAR.—The car herewith illustrated carries two persons, and is of neat and decidedly prepossessing appearance. The body, which completely incloses the machinery, is suspended on a frame of 16-gage tubing by means of a transverse laminated plate spring at the front and two longitudinal springs of the same type at the rear. Above the two axles the frame is formed into two small bowstring trusses, to which the springs are securely bolted. Flexibility is secured by providing each of the two longitudinal members which connect these trusses with a slip joint connection (10 and 11), the end of the tube from 10 to 11 fitting snugly but loosely inside a sleeve at 10, and being held in place by an interior bolt which engages a lug brazed into the main longitudinal tube, and is adjusted by a nut at 11, as shown. This affords a strong but perfectly flexible construction, allowing the wheels to ride over obstructions without bringing any wrenching strains upon the frame or the machinery.

THE BOILER.—The shell, *A*, of the boiler consists of a length of 16-gage seamless, drawn, copper tubing, 14 inches in diameter by 14 inches deep. A half-inch flange is formed at top and bottom, to which the tube-sheets are riveted. A steam-tight joint is secured by brazing in the shell flange between the tube-plate and a steel ring on the under side of the flange, and riveting through as shown in the drawing. The boiler is then put in the lathe and two layers of piano wire, *a*, are wound on the shell under a moderate tension. Copper tubes, to the number of 298, are then expanded into the two tube-plates. This little boiler, as thus completed, has a total heating surface of no less than 42 square feet. It is hydraulically tested to 600 pounds pressure and when ready to be put in place it weighs just 105 pounds. It is covered with a thick layer of asbestos lagging, outside of which is an envelope of Russian iron.

THE FUEL.—The gasoline is carried in a copper tank, *O*, capable of holding three gallons, which is stowed beneath the foot board. The tank is kept under a pressure of 35 pounds to the square inch and is connected by the pipe (16) with a reserve air tank, *P*. The air pipe leads in at the top of the tank, *O*, and a branch pipe runs to a pressure gage, *R*. The gasoline is forced out of the supply tank through the pipe, *S*, which leads to the bottom of one of the boiler flues, to which it connects. The oil flows up through the flue, then by means of a pipe across the top of the boiler to another flue, down which it is led until it emerges from the bottom of the boiler to the pipe, *A*, Fig. 1, where it

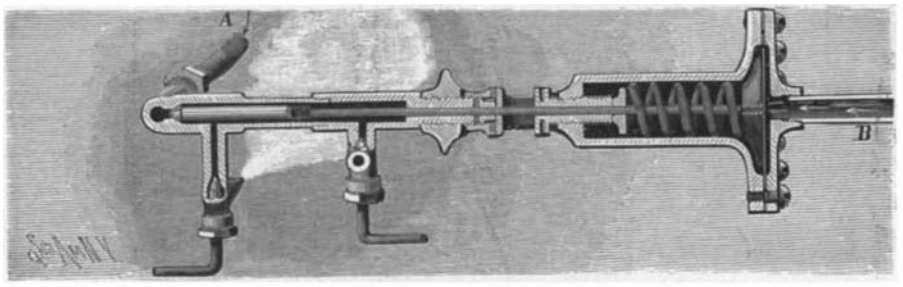


Fig. 1.—SECTIONAL VIEW OF AUTOMATIC REGULATOR.

may be controlled by two hand-operated needle valves, as shown. In passing through the boiler the gasoline is vaporized, and its admission to the burner at (7) is controlled by means of an automatic needle-valve, which is operated by the pressure of the water of the boiler upon the diaphragm, *V*. The diaphragm is so adjusted that when the boiler pressure exceeds 160 pounds, the valve will be closed, shutting off the supply of vapor. The steam pressure is thus automatically controlled through the burner, which, when the boiler has once been started, requires no further attention on the part of the operator. In order to prevent the fire from going out altogether when the vapor is shut off, a bypass of very small cross section is provided on the needle valve, which allows sufficient fuel to pass to keep the burner alight. The operation of the regulator valve is exceedingly prompt, and the device is one of the most pleasing among the many ingenious features of the Locomobile.

THE BURNER.—The burner consists of a sheet-steel cylinder of about the same diameter as the boiler, and is carried, as shown in our illustration, immediately below the latter; within the outer cylinder is a smaller inner one, into which the vaporized gasoline is fed. It is provided with 114 short vertical copper tubes, which extend from the bottom of the burner, where they are open to the air, to the top plate of the inner gasoline vapor cylinder. The air passes in through these tubes, and at the top it meets the gasoline vapor, which issues from the inner cylinder through a large number of small holes around the air tubes, the vapor and the air commingling and burning with the familiar Bunsen flame, immediately below the lower tube-sheet of the boiler. The distance from the base of the burner to the top of the boiler is about 19 inches, which allows it to be placed below the carriage seat and inclosed by the body, as shown.

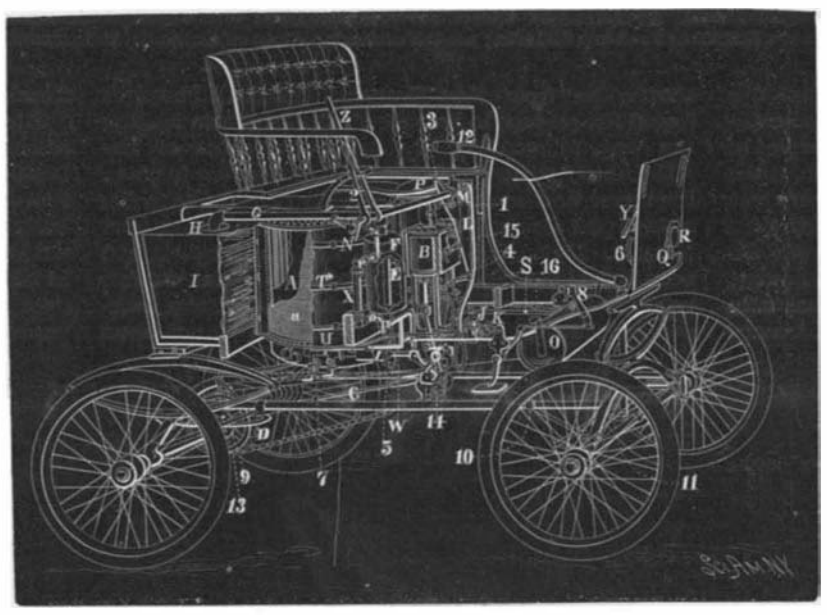


Fig. 2.—OUTLINE DIAGRAM OF THE "LOCOMOBILE."

THE BOILER FEED.—The water for the boiler is carried in a copper tank, *I*, which is placed at the rear of the boiler and partly encircles it. It has a capacity of 15 gallons. The boiler is fed by means of a little feed pump, *J*, which is operated from the cross-head of the engine. The water is led from the tank by means of a rubber pipe, and it may be cut off by a cock, *K*, before the check valve, which is just in front of the pump, is reached. There are three check valves in all between the water tank and boiler, and they all work in the same direction. From the feed-pump the water is forced directly to the boiler. A pipe, *L*, leads from the feed-pump to a by-pass, *M*, which is worked by the lever, *N*, placed conveniently at the hand of the driver. By turning this lever the feed, when the boiler is full, can be thrown back directly into the tank. The boiler is supposed, normally, to carry about 8 inches of water above the tube-sheet, leaving 5 inches of steam space; but an inch or two either way in the water level is not of serious consequence, the boiler steaming satisfactorily even when there is only an inch of water over the lower tube-sheet. A water-glass, *X*, on the outside of the car body shows at a glance the water level. By arranging a mirror, *Y*, on the dash board, the driver can have the water-glass continually under his eye. Check valves are provided above and below the water-glass, so that if the glass should break there would be no rush of steam or water from the boiler.

ENGINE AND DRIVING GEAR.—The engine, *B*, is located in front of the boiler and is secured to the frame of the body. It is shown so clearly in the accompanying engraving as to need no detailed description. It is sufficient to say it is a remarkably well designed and built two-cylinder engine of the locomotive type with Stevenson link motion and ordinary D-valves. The framing is of brass, and a special feature is the fact that the engine has ball-bearings both on the crank pins and the crank-shaft bearings. The engines are bolted to the wooden cross bracing of the body near the cylinders, and the lower part of the engine frame is kept in place by means of a strut, *C*, which extends from the engine frame back to the rear framing of the car. The strut is provided with a right and left hand turnbuckle, which enables the slack of the chain to be taken up when necessary. To allow for the slight movement due to this adjustment, the steam pipe is connected with the top of the steam-chest by means of a U-pipe provided with expansion joints. The driving of the rear axle is effected by means of a twelve-tooth sprocket on the engine shaft and a twenty-four tooth sprocket on the compensating gear-box on the rear axle. The compensating gear is of the usual type and allows of a perfectly independent rotation of the two wheels.

The band brake (9) is operated by a foot pedal (8), which is placed conveniently in front of the driver. The brake is extremely powerful and will bring the car to rest within its own length when it is running at a normal rate of speed. The car may also be brought to a speedy stop by reversing the engines. The reversing lever (2) and the starting lever, *Z*, are both located at the right hand of the driver, the former operating through the crank arms (3 and 4) directly upon the link motion, and the starting lever acting directly upon the throttle valve through the crank arm (1). The pair of cylinders are 2½ inches diameter by 4 inches stroke, with an ordinary cut-off at ⅝ of the stroke. They run at an average speed of 300 to 400 revolutions per minute and develop from 4 to 5 horse power. The cut-off of course can be varied as desired. On a level road, at a speed of 10 or 12 miles per hour, the steam is usually maintained at a pressure of 150 pounds to the square inch. The pop-valve (5) is set at 240 pounds to the square inch. In operating the Locomobile, one is impressed with a sense of the reserve power of the boiler and engines, the car starting from rest with a wonderfully rapid acceleration, jumping up to full speed, if so desired, within a very few lengths. They are remarkably successful as hill climbers, we ourselves having taken one of them up a 12½ per cent grade at a speed of 8 or 9 miles an hour. The same car has on another occasion climbed a grade of from 6 to 7 per cent.

OPERATION.—The boiler may be filled either by attaching a hose to the blow-off valve (14), which is furnished with a coupling for this purpose, or by filling the water tank, from which the boiler will of itself fill by gravity. When the tank is full, the blow-off needle valve is closed. The fire is started by means of a detachable vaporizer and burner, which is inserted into the permanent burner through the orifice (7). As soon as the steam pressure has been raised to 20 pounds or more, the needle valve at (7) to the main burner is opened, and the valve controlling the feed of gasoline to the detachable burner is closed. In about five minutes from the time the detachable burner is inserted, the steam will have risen to 150 pounds, at which point the automatic valve (*V*) will shut down the fire. The carriage is now ready to leave the stable, and beyond the steering, the driver has nothing