safety valve is used, but a hole of larger diameter, covered by a plug laid loosely over it, prevents the accumulation of more than one-quarter of a pound gauge pressure. Ordinarily the pressure in the boiler is just sensibly less than that of the surrounding atmosphere, so that the plug is held down by the pressure of the latter. Practically however, the internal pressures are balanced so there is no pressure whatever tending to burst or collapse the boiler. The surface condenser is a casting open at the top, and provided with tubes in which the exhaust steam is condensed, the water and air being removed by a small, single-acting air-pump, of the plunger type. The top of the condenser is above the water level in the boiler, and the overflow from the condenser is at the top. The small head of water in the condenser (above the water level in the boiler) is utilized for feeding the boiler as follows: Connection is made between the top of the condenser and the water space in the boiler by means of a small pipe. In this pipe is a cock controlled by a float in the boiler. When the water falls in the boiler the cock is opened, the water running in by gravity. When the water rises the cock is closed. The water level is thus automatically maintained without the use of a pump, or any attention from the attendant. A glass panel in the side of the boiler provides for observing the water level. The condensing water may be taken direct from the service pipes in cities, or where this is not practicable, a small pump driven by the engine may be used for circulating the water. When the engine is used for pumping water the water may be passed through the condenser. When water is scarce it may be used over and over by standing long enough to cool; or the condenser may be located directly in a tank of water. The engine is double-acting, with diameter of cylinder sufficient to give the rated power at a mean effective pressure of eight or ten pounds, which is easily maintained by the air pump. The cylinder is brass bushed, and the piston is of brass, no lubrication being required. The cylinder is steam jacketed around the body and at the ends. In general construction the engine does not differ materially from any small engine.

The speed is controlled by a sensitive governor, which responds as quickly to changes of load as if controlling steam of high pressure. The wearing parts are large doing away with the probability of causing trouble from heating. It is arranged to burn either hard or soft coal, wood or coke, and petroleum or common gas may be used by conducting pipes into the fire box. The manufacturers claim that when hard or soft coal or coke is used, the cost will not exceed one cent per horse power per hour. Although new in this country, these engines have already come considerably into use in Great Britain and France, published tests of their performance showing good economical results. They are suitable for all kinds of light work, including furnishing power for small electrict light plants, as in country residences, and seem to be particularly suited for households purposes, where their absolute safety will commend them.

CASTING AND FORGING.

A very general misapprehension exists in regard to the value of cast iron articles and the same description of articles forged from wrought iron. There is a mistaken idea, also, that it is less expensive to cast than to forge. This error is not confined to the unmechanical public, but it is shared by many mechanics; perhaps the possibilities and facilities of drop forging are not sufficiently understood; but it is true that many articles can be drop forged from tough wrought iron cheaper than they can be cast from brittle cast iron. The range of purely cast iron work is great—from a single casting of thirty or more tons to pieces that weigh less than a quarter of an ounce—and its cost varies from a price barely above that of the pig iron delivered to sixteen, eighteen, and even twenty cents a pound. But many small articles are cheaper forged than cast, and almost immeasurably superior. The cost and value of the forgings give them a superiority over the castings, especially when one pattern is required in large numbers. For each single casting or plate of castings a new mould is required; moulding costs money and requires jud ment if not skill, and even with the mechanical appliances for bench moulding the losses from defective casting are very great. But in drop forging the mould—dies—will do for hundreds, thousands, of pieces, and the percentage of loss by imperfection of work is very slight. Nor does plain drop forging require the highest grade of mechanical skill.

There are many small articles of common use in the market, some of them coming under the designation of tools—which, from a mistaken notion of cheap production and low price, are made from cast iron or from cast iron made malleable. Many of these could have been made from wrought iron, or at least from machinery steel, and sold at the same price for as large a profit; or with a few cents added to the price could have been sold at a greater profit. When cast iron thumbscrews with quarter inch shanks are put upon the market the folly of cast iron must have reached its limit.—*Scientific American.*

THE INTERNATIONAL YACHT RACE

Probably no former event in the history of yacht racing has attracted so much attention as the trial for the championship between British and American yachts in the vicinity of New York during the week commencing Sept. 7. The arrangements for the contest were not made without a great deal of correspondence, extending through many months. The race was for the possession of the prize cup won by the yacht America, in a contest with a fleet of British yachts off Cowes, England, in 1851; and its having remained on this side of the Atlantic for the thirty-four succeeding years as a standing challenge for British yachtsmen, made the latter extremely cautious in their preparations for an effort to win back the cup this year. The New York Yacht Club has held the cup under a deed of gift from the original owners of the America, under the condition of its remaining a perpetual challenge cup, not being the property of any boat winning a match in which it is the prize, but of the club to which such boat belongs, and subject to future competition for its possession. The New York Club, therefore, invited all regular organizations of American yachtsmen to unite with them in preliminary trials, with the view of selecting the best American yacht to defend the cup against the British yacht Genesta, which had been chosen to compete for it as the best representative "all-around" yacht of the different British yacht clubs.

When the challenges for this race were issued, it was quickly concluded that there was no centerboard sloop in this country of sufficient length to match against the Genesta, whereupon the flag officers of the New York Club ordered such a one built, and about the same time some members of the Eastern Yacht Club also ordered another, both being centerboard sloops. Of these two yachts, the Puritan, of the Eastern Yacht Club, was selected to sail against the Genesta.

The Puritan is of wood, and was built at South Boston. Her dimensions are: 93 feet in length over all, 81 feet at the water line, 22 feet 7 inches extreme beam, and 8 feet draught. Mast, 78 feet long; topmast, 44 feet long; and bowsprit outboard, 38 feet; mainboon, 76 feet; gaff, 47 feet; and spinaker boom, 64 feet. All her spars are of Oregon pine. She was not selected for the trial until after a contest with the Priscilla, built by the New York yachtsmen, and minor changes in her sails, ballast, and some other details were being made up to within a few days of the race, every precaution being taken to have her in the best possible condition to creditably represent American yachting interests.

The Genesta, which has come over here to race for the cup, is owned by Sir Richard Sutton, of the Royal Yacht Club; she was designed by J. Beavor-Webb, and built on the Clyde, being of composite build, with steel frame and elm and teak planking. She is 96 feet long over all, 81 feet on the water line, 15 feet extreme beam, 11 feet 9 inches depth of hold, and 13 feet 6 inches draught.

The great difference in width and draught of the two yachts at once mark the broad distinction between the two classes of vessels, the Genesta being of the cutter, or "knife blade" style, while centerboard sloops like the Puritan are sometimes styled in yachting vernacular "skimming dishes."

The particulars of the Genesta's spars are given as follows: Masts from deck to hounds, 52 feet; topmast from fid to sheave 47 feet; extreme boom, 70 feet; gaff, 44 feet; bowsprit, outboard, 36 $\frac{6}{10}$ feet; spinaker boom, 64 feet; club of topsail, 42 feet. While the Genesta has not always been successful heretofore, she is to be credited with a long list of victories, under the most diverse conditions, since her first race, at the regatta of the New Thames Yacht Club, in the spring of 1884. Her passage across the Atlantic from Queenstown was made in twenty-four days under jury rig, that is, a mast and bowsprit two-thirds the length of her racing spars and a small mainsail. *Scientific American.*