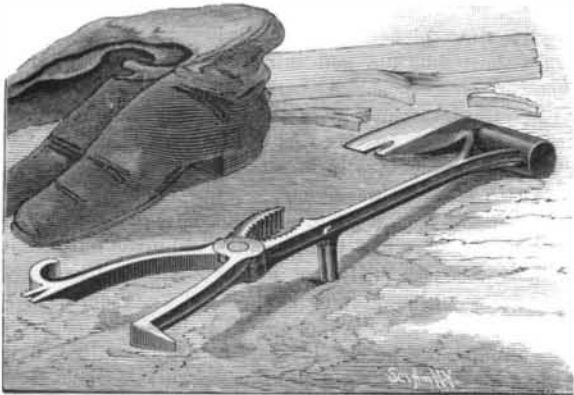


COMBINATION TOOL.

A combination or universal tool for household use recently patented by Mr. George B. Gable, of 1518 Jones St., Omaha, Nebraska, is shown in the accompanying engraving. The hatchet has a malleable iron handle, and is made with a notch for drawing nails. The outer end of the handle is curved to one side, and an arm of corresponding shape is pivoted to the handle, so as to form a boot jack and box holder. The extreme end of the handle is of flat form for use as a stove lifter, notched to serve also as a tack puller, and at one side is a hook for lifting pots. On the outer end of the other arm is a straight hook for use in regulating



GABLE'S COMBINATION TOOL.

stove doors and for use as a screw driver; this arm has a roughened tail piece for use, in connection with the handle, as a nut cracker or wrench. The tool thus constructed is inexpensive, and can be used for twelve distinct purposes, most of which are generally performed by separate tools.

Porosity of Wood.

An unpainted wooden pail showed some of its slaves saturated and others nearly dry. Experiments with wood of the same character—the cucumber wood—showed that pieces sawed from the same board differed in their absorptive qualities as one end or the other was set in water, the trials appearing to suggest that when the wood was placed in water as it grew, butt downward, the water was absorbed more rapidly than when the position was reversed. As a further test two pieces were taken from the same board, and both painted on the outside—both faces—but one had the top end also painted, and the other the bottom, or butt end, painted. The one with the unpainted butt filled and sank, while the other floated. Perhaps differing results

SEAT AND FOOT BOARD FOR ROW BOATS.

The sliding seat, of the usual construction, slides between two tracks held on a suitable frame. From the back of the seat projects a rod whose rear end is pivoted to the upper end of an upright lever pivoted to a bar projecting from the rear of the frame. A spiral spring, surrounding the bar, is held between the rear of the seat and a cross piece. The foot board is secured to a cross piece sliding in longitudinal grooves formed in plates in the boat. The lower end of the lever is connected by rods with the foot board. The pressure of the spring can be varied by a collar on the rod back of the seat.

When the oarsman makes a stroke, the seat is moved back and the spring is compressed, and the rod is moved in the same direction, when by means of the lever the foot board is moved in the opposite direction. As the oarsman recovers, the spring expands and pushes the seat back while the foot board is drawn forward, thereby relieving the oarsman of the necessity of pulling back the seat, and enabling him to expend all his force and power on the stroke. The recovery being very rapid, fast rowing is admissible.

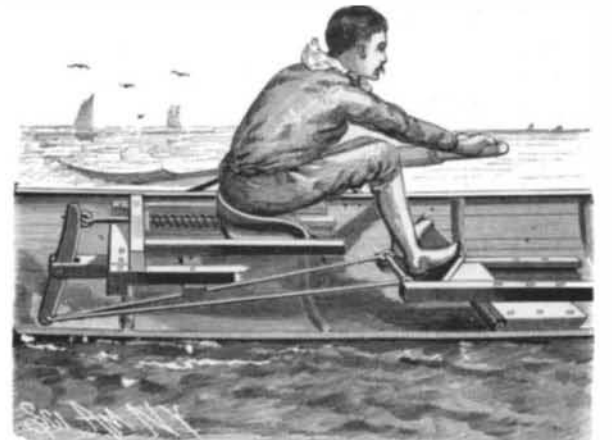
This invention has been patented by Mr. James J. Turpel, of North Starr Street, Halifax, Nova Scotia, Canada.

IMPROVED "RAPID" CUPOLA.

The cupola illustrated by the accompanying engravings is made by Messrs. Thwaites Brothers, of Bradford, Eng., under Stewart's patent. It will be seen that it is of the receiver class—the receiver is separate from the cupola.

The shell of the cupola is of plate iron with butt joints, covered with strips and rings, and riveted together with cup head rivets outside, the heads inside being flattened to allow the brick lining to fit close to the shell, which is of one diameter and parallel inside. There are several rings of angle iron inside shell in the length of the cupola to support the lining. To the shell is attached an annular air belt. Referring to the engravings, which are from *The Engineer*, it will be seen that on each side of the air belt is secured a cast iron quarter bend blast pipe, and to each bend is connected a turned shut-off valve. Inside the shell, and communicating with the air belt, are three rows of cast iron tuyeres. The two bottom rows each consist of three tuyeres, and the top row of six tuyeres. All the tuyeres are fastened to the shell with bolts and an asbestos ring. Opposite each of the top tuyeres in the air belt is fixed a cast iron shut-off turned plug valve. The plugs of these valves come through cover plates fixed upon the top of belt. All the plugs are fitted with small sprocket wheels, and are connected to each other with Ewart's malleable chain, so that all can be controlled from one handle at any convenient position. Oppo-

bottom door, in halves, opening from the center. Each half of the bottom is connected to a shaft, on which is fixed a wrought iron hand lever. A strong wrought iron bolt is shot across the door when closed, securely retaining it in position. A fettling door is provided at the back of the cupola. The base plate of the cupola is supported by four cast iron pillars upon a strong cast iron bed plate. The receiver shell is also made of plate iron, with angle iron ring, top and bottom, and cover plate on top; and provided, as shown, with tapping hole, spout, and fettling door, slag

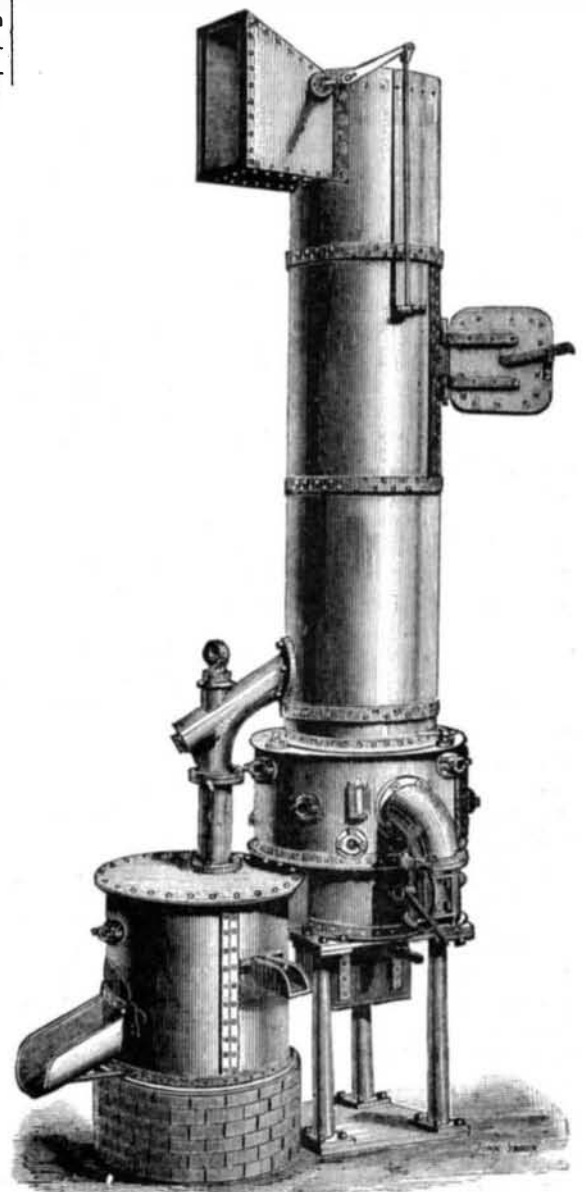
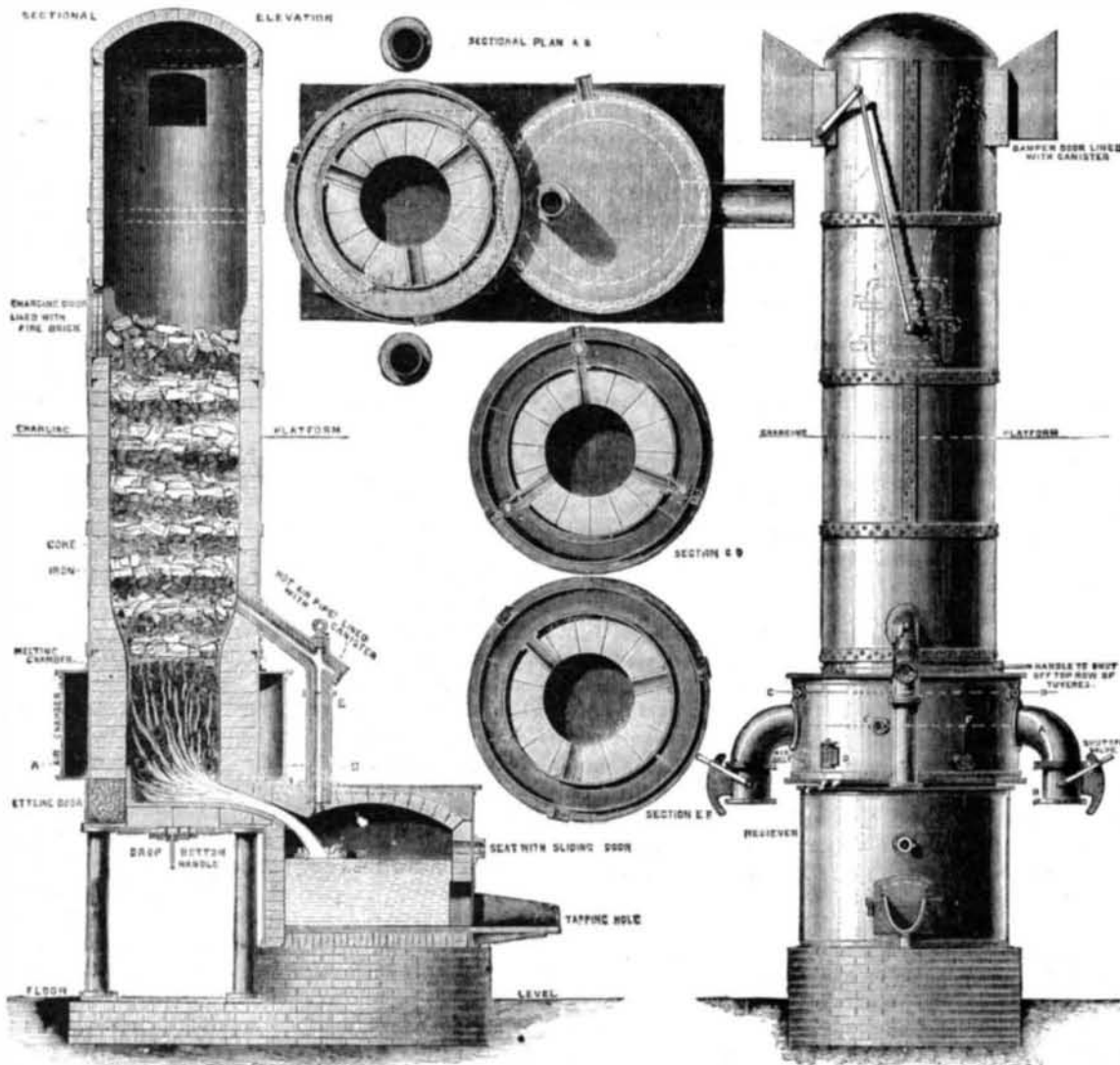


TURPEL'S SEAT AND FOOT BOARD FOR ROWBOATS.

hole and spout, and hot air pipe and plug to convey hot air from the top of the receiver into cupola.

Several advantages attending the use of this cupola are claimed by the makers, not the least important of which is its speed. According to the experiments of Dulong, 1 pound of carbon, combining with the necessary quantity of oxygen to form carbonic acid, develops 12,906 units of heat. The specific heat of cast iron being about 0.13, the melting point 2,190 degrees, and the coke containing 82 per cent of carbon, then to heat a ton of cast iron of a temperature of say 40 degrees to a temperature of 2,190 degrees would require

$$2190 - 40 = \frac{\text{Heat Iron Sp. heat}}{12906 \times 0.82} = 59.1 \text{ lb. coke.}$$



IMPROVED RAPID CUPOLA.

would have been obtained with differing woods. The fact of position affecting saturation seems to be recognized in the frequent custom of reversing fence posts from their natural position and in the driving of piles.

If a man empties his purse into his head, no man can take it away from him. An investment in knowledge always pays the best interest.—Franklin.

site each tuyere is fixed a seat with sliding door, fitted with blue tinted glass peep holes. In front of each glass is a mica disk. Upon the air belt is a blast pressure gauge to indicate the pressure of air in cupola. The upper part of cupola above the belt is provided with charging door—fire brick lined—and with damper door and shield at the top on one side. The cupola stands upon a cast iron base plate. This base plate is fitted with a wrought iron hinged drop

This is supposing that the whole of the carbon is converted into carbonic acid; but if by any means carbonic oxide is formed, a very different result is obtained. Then 1 pound of carbon burning to carbonic oxide only evolves 4,453 units of heat. If, however, by admitting air above the zone where the oxide is formed, we recover 4,478 units, this + 4,453 gives 8,931. This is a little over two-thirds of the available heat to be got out of 1 pound of carbon, allow-