pressure, for the sake of simplicity, as wood fuel costs only the labor of cutting it—about $1.00 per cord. For situations where greater economy of steam is important these engines can, of course, be made compound condensing. The main engines are handled entirely by the operator on the upper deck. Here he has a full view of his work, and can see the buckets for their whole length and the tailings conveyor as well.

The winch is on the main deck directly under the operator, so that the levers for its various motions can be conveniently placed. It has six drums each with independent friction clutch and brake, as follows:—One headline, one ladder hoist, two forward side lines and two after side lines. By means of these steel wire rope lines, the position and feed of the dredge is under perfect control.

The water supply for the screen and tables is furnished by an independent centrifugal pump with 10″ discharge, and having direct connection with the engine.

Steam is furnished by one boiler of the Worthington water-tube type of 125 h.p. It is, especially, adapted for burning inferior wood, as the firebox is large and roomy, and covers the entire bottom area of the boiler. The boiler has a steam and water drum of sufficiently large dimensions to prevent sudden fluctuations of pressure and water-level. The consumption of green pine wood will run from 2 to 2½ cords per shift of 12 hours, steady working. This is sufficient to show the remarkable economy of this dredge. Assuming the actual output of the dredge to be 1,000 cu. yds. per shift of 12 hours (which is half its theoretical rate, and is a low average in practice), and the cost of fuel to be 2½ cords of wood at $1.00 per cord, we have a fuel cost of one-quarter of a cent per cubic yard of material handled.

The gold-saving tables are arranged on both sides of the after deck, under a distributing-box of special design, by means of which the wash from the entire length of screen is mixed and distributed uniformly to the tables.

To save a high percentage of gold requires, first, thorough washing of the gravel; second, proper concentration; third, thorough mixing and even distribution of the concentrates over the tables; and fourth, a riffled surface on the tables, that in area, slope, and type of riffle are well adapted to the particular material to be dealt with. A correct understanding of the principles of gold-washing is necessary, as well as a correct diagnosis of the local conditions to be met. What will suit one locality may be a failure in another. The system of tables adopted in this dredge is a flexible one that can be adapted to any material and hold any kind of riffle. There are 28 tables, each 1½ ft. x 8 ft., or a total surface of 336 square ft. In addition, there are 94 sq. ft. of riffles in the distribution and tailings sluices, or a total of 430 square feet of riffle surface.

To carry off the coarse tailings a stacker or tailings conveyor 70 ft. long is employed. This is of the rubber belt type, driven by an independent engine. The belt is 30 inches wide and the end of the conveyor is 25 feet above the water level. The load of all the parts is well balanced on the hull so that it sits level at a uniform draft of 3 feet.

The increasing use of the dredge for working low-lying and low alluvial ground has opened up a wide field for this class of mining. Formerly ground that would not pay over 25 cents a cubic yard was not considered profitable, and this is probably still true in the far north and in localities where freight, fuel and labor are expensive, but under ordinary conditions ground which was formerly thought worthless can now be worked at a profit.

"THE EARLY USE OF IRON."*

By Bennett H. Brough.†

R.S.M., F.I.C., F.G.S. F.C.S., we have received an advance proof of his address before the West of Scotland Iron and Steel Institute, on "The Early Use of Iron." With the present remarkable development that is occurring in the iron industry of Canada, we reproduce the same, as being of, probably great interest to those of our readers who are keen followers of the fortunes of that industry.

In accepting the invitation with which I have been honoured by the Council to give a lecture to the West of Scotland Iron and Steel Institute, I feel that an apology is needed for having chosen a literary and antiquarian subject, that is inconsistent with the essentially practical nature of these meetings, and possibly with the very objects of the Society. At the same time, I think that many of the members will be willing to devote an hour to inquiring into the obsolete practices of their earliest predecessors, and to casting a glance backwards to the beginning of the great industry with which they are all so intimately connected. The subject of the early use of iron has already been ably dealt with in papers read before the Philosophical Society of Glasgow, by St. John Vincent Day in 1871, and by Professor A. Humboldt Sexton in 1900. Since the publication of these papers, however, much fresh light has been thrown on the subject by numerous archæological and literary researches. I propose, therefore, to give a brief summary of the results of these researches, and to set forth, as fully as possible in the time available, the existing knowledge of the metallurgy of iron and steel prior to the introduction of the blast furnace.

The date of the discovery of iron has long been a matter of controversy; and it is generally believed that the iron first used by man was of meteoric origin. In support of this view Mr. Otto Vogel has given quotations from the earliest Finnish poem; and Sir Henry Bessemer in 1895 adduced evidence to show that the tools used in the construction of the pyramids must have been made of a meteoric nickel-iron alloy. The theory is, however, open to considerable doubt, in view of the difficulty of working meteoric iron. Indeed, many authorities have denied that meteoric iron is malleable. The hypothesis is, nevertheless, an attractive one. Blocks of meteoric iron, though not very numerous, have been found in all parts of the world. The British Museum collection, which includes specimens of nearly all the meteoric irons known, numbers 229, one of which fell in Great Britain, at Rowton, Shropshire, on April 20, 1876. The most remarkable of the larger masses was found in West Greenland, whence it was transported in 1894 by Captain R. E. Peary to the American Museum of Natural History in New York. It is of very irregular shape, 11 feet long, 7½ feet wide, and 6 feet thick, and weighs nearly 50 tons. The knowledge that iron and stones from time to time fell from heaven is very old. The meteorite still revered by the Moslems as one of their holiest relics, of which the history goes back far beyond the seventh century, is the oldest preserved. A fall mentioned in old Chinese manuscripts happened about 644 B.C. The oldest undoubted meteorite still preserved was seen to fall on November 16, 1492, at Ensisheim, in Alsace, where it was long suspended by

*Advance copy.

†Through the courtesy of Mr. Bennett H. Brough, Assoc.