extent. Some of the bucket dredges are fitted with a perforated flat screen with a vibratory motion for the grading of the material, whilst others employ a perforated revolving cylinder or grizzly. Experience shows that the revolving cylinder disintegrates and washes the material more effectively and with less wear-and-tear to the machinery than the flat screen. In 1896 a San Francisco firm constructed a dredge modelled on the lines above suggested. This dredge apparently overcame many of the difficulties previously experienced in gold-dredging in this country, and reduced the cost of working from 10 cents to 15 cents per cubic yard to 3 cents and 5 cents, according to conditions. This dredge operated so successfully that there are now thirteen in actual operation, and two more are in course of construction. They are distributed throughout the various States of the Union as follows: Seven in California, one in Oregon, one in Idaho, three in Colorado, and one in Alaska. This dredge, being a very modern and admittedly a very close gold-saver and a very economical operator, will bear a more or less technical description. The dredges vary somewhat in details to suit them to the various local conditions. The hull is constructed of heavy timbers, 80 ft. long by 30 ft. wide and 6 ft. deep. The ladder, built up as a heavy lattice girder, is hung at the stern end by means of a bar fixed across a heavy wooden framing. On the lower end of the ladder is a five-sided tumbler, the ladder itself being suspended by a system of blocks and tackle to a cross-beam. A wire rope attached to the bottom end of the ladder runs through the blocks to the winch, hereafter described, and enables the ladder to be raised or lowered at will, according as may be necessary to suit the conditions and depth of the ground in which the dredge may be operating. The top tumbler is carried by the tumbler-framing some 3 ft. above the top end of the ladder, and is driven through a rope transmission and heavy gears by a vertical compound condensing-engine, which also operates the pump. A friction-clutch is placed on the countershaft, which slips, and thus prevents breakage in the event of any obstruction being encountered. The continuous-bucket chain comes up the top side of the ladder on rollers round the top tumbler and back in a catenary curve to the lower tumbler. The buckets, varying in capacity from 3¼ cubic feet to 7 cubic feet, according to the size of the dredge, are built of steel plate, and are riveted on to steel links bushed with manganese steel, of which last-mentioned material the pins are also made. The buckets are connected by means of the links, and are thus formed into a continuous belt of great weight, and capable of standing very hard usage. The buckets, at the rate of fifteen per minute, dump on to a delivery-plate, from which the material passes by gravity into a revolving screen or grizzly. This screen, which is perforated, the size of the holes depending entirely upon the class of gold to be saved, is set on an incline, so that the material, whilst revolving, gradually passes through, and is thoroughly washed and disintegrated during the process by means of a heavy stream of water under pressure from a perforated pipe running the whole longth of the screen. The gold and all fines pass through the perforations into a distributing-box, the coarse material being conveyed by gravity into an elevator or stacker, also of the continuous-bucket type, but close connected, and thence dumped at the required height above the surface of the water. From the distributing-box the gold and fines pass through a number of adjustable doors in a thin and constant stream on to the various sections of the gold-saving tables. The tables are made of cast-iron, and are covered with cocoa-matting and expanded metal, and are so arranged that any one section can be cut out and washed up without interfering with the operation of the dredge. The excellence of this gold-saving device is evidenced by the fact that nearly all the gold is caught near the head of the table, which is 8 ft. long, and has an area of 200 square feet. The sand and waste fines pass over the tables into a sluice fitted with angle-iron riffles, and thence overboard astern of the dredge. The sluice is really a conveyor for the waste fines, and not a gold-saver, as the tables practically catch all the gold. Steam is supplied by a horizontal return tubular boiler consuming 2¾ cords of wood per day in the case of the 3¼-bucket dredge, and slightly more in the case of the larger dredges. The crew necessary to operate this dredge consists of two men on each shift — a winchman and an engineer. The winchman has complete control of the dredge by means of the winch, which has six independent barrels: four of these barrels control lines running from the four corners of the dredge; the fifth carries the head-line, the resiliency of which greatly relieves the digging-buckets of much unnecessary strain, and enables bed-rock to be more easily cleaned than when a "spud" or "sett" is used. By means of these five lines, all of which are fastened to dead-men on shore, the dredge can rapidly be made to take up any position. The sixth drum carries the ladder-line, and enables the ladder to be raised or lowered at will. With this pattern of dredge almost any alluvial deposit can be worked, provided there is a sufficient quantity of water on the ground to float the dredge, or provided a sufficient quantity can be brought to the land for that purpose.

In consequence of the low cost of operating, and of the fact that inland ground can be worked where the water-level is or where it can be artificially raised to within 18 ft. or 20 ft. of the surface of the soil, thousands of acres of auriferous gravels in running rivers, old channels, and ancient deposits, many hundreds of feet above the present river-channels, averaging 10 cents to 25 cents per cubic yard, have become suddenly valuable, and will yield handsome returns when operated by means of the modern dredge.

Gold-saving on Dredges.

The following paper has been contributed by Mr. J. P. Smith, M.A.Inst.M.E., of Dunedin, a gentleman who has given a considerable amount of thought to the subject of gold-saving in connection with the dredging industry:—

The quantity of gold saved in proportion to that lifted by a dredge is dependent upon several factors, which may be classified as follows: (1) The nature of the drift in which the gold occurs; (2) the nature of the gold; (3) the efficiency of the gold-saving appliances in use; and (4) the experience of the men employed. In this paper it is not proposed to deal with the latter factor in more than a cursory manner, as the number of dredges equipped during the past few years has made it impossible to man them with experienced men.