Operation of a Coal Washer.—The mine run coal is first crushed to sizes of nut coal and under, and is deposited in a raw coal bin. From the raw coal bin the coal is delivered by automatic feeders to an elevator which supplies the coal to one or more revolving screens which separate it into the desired sizes. From the screens the crushed coal is conveyed to the coal jigs where the impurities are removed. The washed coal is sluiced into the draining screens, from which it is deposited by gravity or is elevated by drainage elevators to the shipping pockets The refuse from the coal jigs is carried by conveyors to the refuse bin.

Design of Coal Washers.—Coal washers must be designed to support the necessary screens, crushers, jigs, conveyors, etc., the exact weights of which should be calculated. Great care should be taken to provide sufficient bracing and to use short members in order that the structure may be rigid. The same stresses and specifications should be used for coal washers as for coal tipples (see Appendix I). Ample room should be provided for the jigs and adequate draining provided for the floors. The washery should be well lighted and heated.

The operation of coal washers will be shown by describing an anthracite coal washer and a bituminous coal washer.

The Capouse Coal Washer.*—Detail plans of the Capouse washery are shown in Fig. 207 to Fig. 209. The material is brought from the culm bank by an endless conveyor which delivers the fine material at the foot of the conveyor to the washer. The washer building is 53 ft. by 65 ft. at the foundation, is 80 ft. high, and has a capacity of 120 tons of prepared coal per hour.

The preparation of the coal at the Capouse washery begins at a point where the scraper-line discharges into a chute leading to the main elevator. A man stationed here throws out large lumps, breaks those containing coal into smaller pieces, which are then thrown into the elevator-boot, *A* (see Fig. 208), removes any pieces of foreign material—wood, iron, slate, etc., and controls the feed of the coal to the elevator. In the washery, the main elevator is 65 ft. long from center to center of sprocket-wheels, and carries 71 water-tight buckets, each 12 by 28 in. in size. The elevated material is discharged into a chute, *B*, which feeds the first shaking-screen, *C*. (In washeries the revolving, circular screen has been almost entirely superseded by those of the

* From a paper by George W. Harris, Trans. Am. Inst. Min. Eng., Vol. 36, 1905.

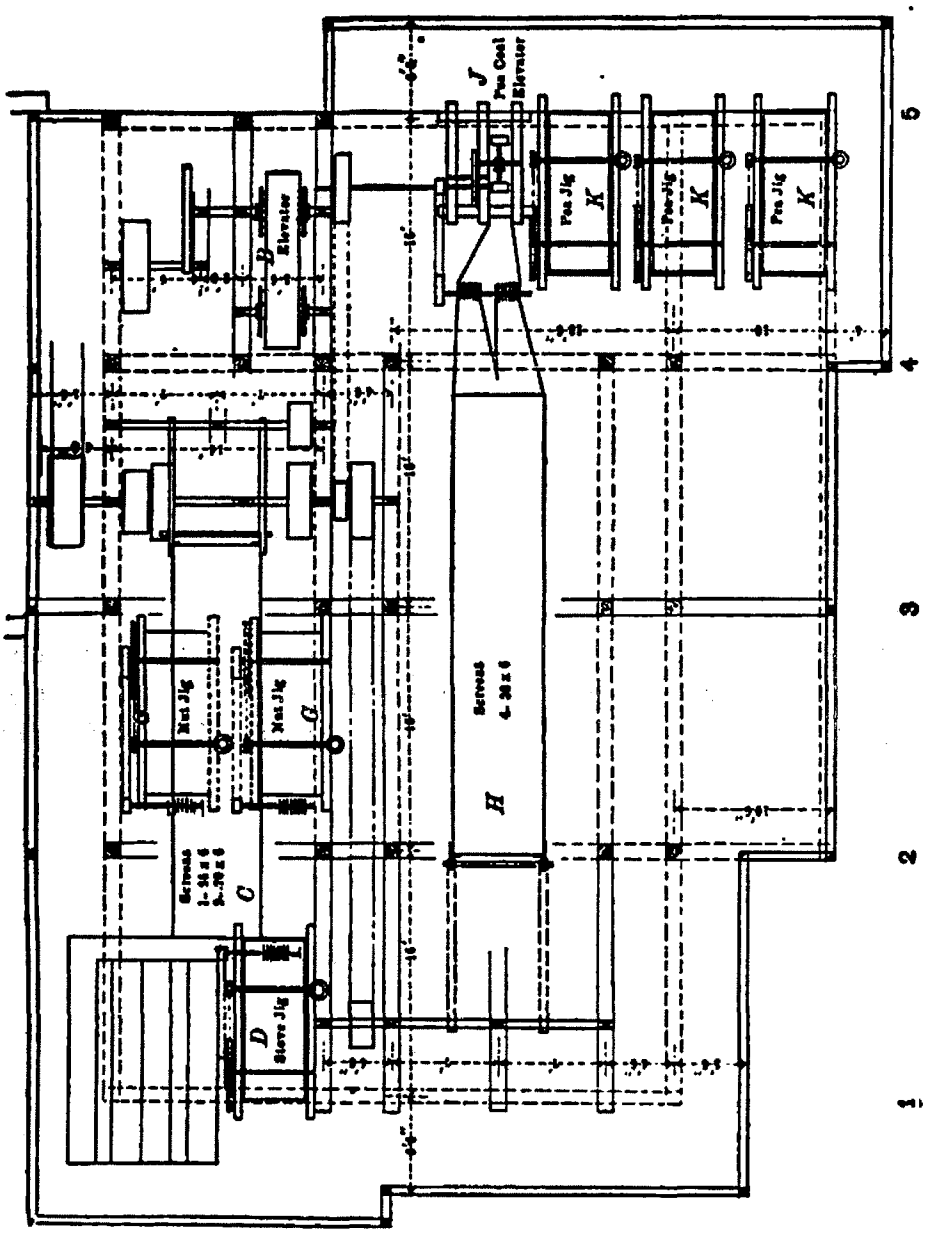

FIG. 207. PLAN OF CAPOUSE WASHERY.

flat shaking type because the fine mesh of the former becomes clogged with dirt, despite all efforts to prevent it.)

The shaker or "mud" screen, *C*, consists of three screens, the top one being 27 by 6 ft., and the two others each 20 by 6 ft. in area. The screens are driven by eccentrics, set so that each one receives a thrust at a different time from the others, an arrangement which is necessary

in order to avoid undue vibration of the framing. As soon as the material strikes the top screen, it is sprayed with water from a perforated pipe; and, passing down the screen, goes under a box from which a copious stream of water overflows. The first 21 ft. of the top screen have 1.5 in. round holes, through which pass chestnut and smaller size pieces to the screen below. Next to the 1.5 in. round holes

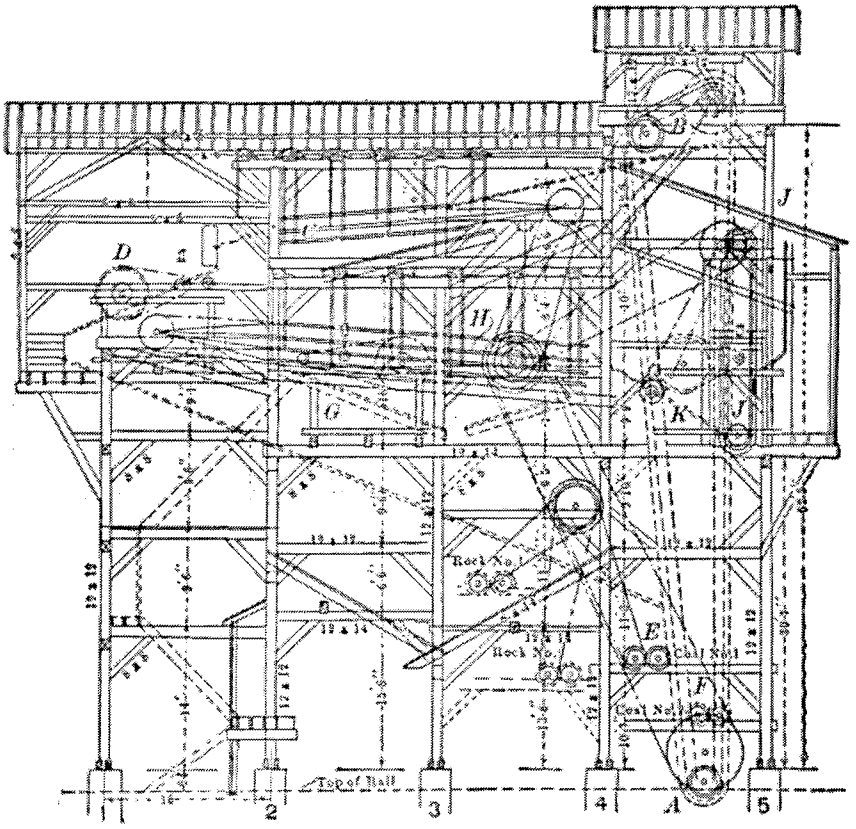

FIG. 208. LONGITUDINAL SECTION OF CAPOUSE WASHERY.

are placed angle-iron, having the angle uppermost, thus, $\wedge$, the edges spaced 0.75 in. apart, which allows flat pieces of slate to fall through. The last 4 ft. of the top screen have 2 in. round holes, which permit pieces the size of stove coal to fall through to a chute; pieces larger than 2 in. pass over the end of the screen to another chute. The stove coal goes to jigs, *D*, thence to rolls, *E* and *F*, and, after being broken to pea size and smaller, to the main elevator-boot, *A*.

The large coal is hand-picked by six men and boys and the slate removed, after which it is sent to the rolls and the main elevators. The

coal that drops through the top screen of the shaker, *C*, falls on the second screen having $\frac{1}{8}$ in. holes, the chestnut-size passing over, and pea and smaller sizes dropping through the lowest screen. The chestnut-size goes to jigs, *G*, thence to rolls, *E* and *F*. The bottom screen has $\frac{3}{32}$ in. holes which permit the fine coal dirt, slush or culm (it is called by all three names) and mud to pass through to a trough which delivers to a settling-pond near the washery where the stream spreads over a large, nearly level area and deposits the suspended materials. The pea-size and smaller sizes of coal pass over the bottom screen to a second shaker, *H*.

The shaking-screen is simple in construction, effective in action, occupies little space and needs few repairs. At the Capouse washery, each screen is suspended by $\frac{1}{8}$" by 8" ash boards, their upper ends being bolted to overhead beams and the lower ends to castings which journal on bars passing under and supporting the screens. Two boards, comprising the hanger on each side, are set at an angle from the vertical so that they act as braces and prevent the screens from swaying sideways. When suspended by rods, the screen travels between guides to insure greater steadiness. Both methods of suspension are used, the boards having the preference.

The shaker, *H*, consists of four tiers of screens, the top one having an area of 30 by 6 ft., the next lower 26 by 6 ft., and the two lower being 20 ft. long by 6 ft. wide. The coal passing through this shaker is separated into sizes as follows: the top screen with $\frac{1}{2}$ in. mesh allows the pea coal to pass over, and No. 1 buckwheat and all smaller to drop through; the next screen, with $\frac{3}{8}$ in. mesh, separates No. 1 buckwheat from the smaller sizes, the latter dropping through to the next lower screen with a $\frac{1}{4}$ in. mesh; this last screen makes No. 2 buckwheat or rice-coal; No. 3 buckwheat or barley passes over the lowest screen which has $\frac{3}{32}$ in. mesh, through which drops the fine coal to be carried by the wash water to settling pond No. 2. The wisdom of keeping the mud from the shaker, *C*, separate from the fine coal of the shaker, *H*, when possible, will be more apparent as time goes on, and this fuel becomes valuable as material for briquettes or for burning as dust.

The 3 buckwheat sizes from the shaker, *H*, go direct to pockets, but the pea coal must be cleaned of slate. After the pea-size leaves the top screen it passes down a chute, in which is a triangular device raised about $\frac{1}{2}$ in. above the bottom, so as to allow flat pieces of slate to pass under while the coal goes to the elevator, *J*, and so to the jigs, *K*.

After leaving the jigs, the coal passes through a Pardee spiral picker for further cleaning and thence to a pocket.

A number of features about this washery are deserving of special mention. The six jigs (of the Christ type and measuring 11 ft. × 5 ft. 4 in. × 6 ft. 9 in.) are driven by a 7 × 8 in. engine. The coal receives a reciprocating motion in a pan immersed in water, which action causes the slate to sink, while the lighter coal passes out at the top. Generally three jigs are sufficient to clean the coal, the others being held in

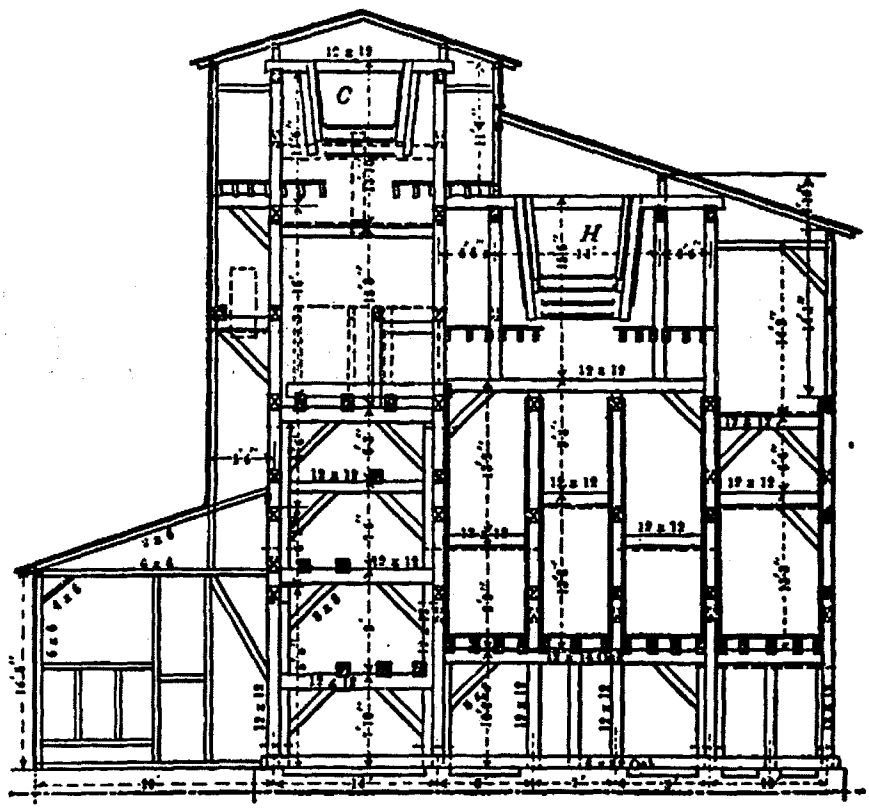

FIG. 209. TRANSVERSE SECTION OF CAPOUSE WASHERY.

reserve. The larger mesh screens on the shakers are of steel, but those of $\frac{3}{32}$ in. mesh, on account of the small perforation, must necessarily have thin metal to prevent clogging, and therefore are made of bronze, in order better to withstand the action of the acid mine water used in washing the coal. At the Capouse washery, the shaker, *H*, has, above the tier of screens, four overflow water-boxes, which are very efficient.

The shaker, *C*, receives from 165 to 170 thrusts per minute and the