(*b*) As against par-interstitial particles (see p. 05) the order is as in *a*.
(*c*) As against subinterstitial particles (see p. 05) the order depends not only upon relative sizes of penetrant and medium particles, but upon the chemical composition of the penetrant, and upon the composition, specific gravity, and chemical composition of the interparticle liquid. For details see discussion of particular machines.

Classification of processes and apparatus based on the type of medium employed for separation, follows:

BEDS:

Compacted (Stationary):
None. Jigs with a sub-bed of ragging (Art. 13) are the closest approach.

Dilated (Semistationary):
PULSATED:
Jigs.
SHAKEN:
Shaking table, pan, rocker, vanner.
STIRRED (vibrated).
Sluice, kieve.

QUICKSANDS:

Artificial:
Chance cone.

Self-made:
Robinson washer, diamond pan.

Suspensoids:
Heavy-media cones, differential-density separators.

LIQUIDS:

Heavy:
Sink-float with aqueous solutions and with heavy organic liquids.

Water:
Buddles, strakes. Also used as the interparticle liquid in all previous classes.

GAS:
Blowing. Also used to form semistationary beds on some forms of jigs and shaking tables, and an air quicksand.

BEDDED MEDIA

The processes and apparatus using dilated beds as the principal means of separation comprise a majority of the older machines. Jigs utilize pulsated beds in which the impregnating fluid is usually water, but may be air. Pans, rockers, shaking tables, and vanners use beds formed and maintained by shaking as the primary separating means, supplementing them by film sizing for cleaning concentrate. The kieve and the sluice use beds formed and maintained by stirring; the former utilizing a paddle, the latter the scouring and eddying impulses of water flowing with considerable velocity.

JIGGING

2. PRINCIPLES OF JIGGING

A jig is a mechanical concentrator that effects separation of heavy grains from light by utilizing differences in the abilities of the grains to penetrate a semistationary bed. Essentially it is a box with a perforate bottom and no top, in which a relatively short-range separating bed is formed by pulsating water currents. These currents may be all upward, all downward, or alternately upward and downward; if the last, they may have equal accelerations and velocities in both directions, but usually do not. The velocity of the water currents is variable throughout each cycle. Diagrammatic curves for the three cases stated are shown in Fig. 1.

Terminology. The bed is the entire mixture of solid and liquid in the jig box; it is LOADED when operating with continuous feed and discharge of products; it is UNLOADED when pulsating normally but neither being fed nor discharging; it is EXPANDED when loosened by pulsation, and COMPACTED when

the grains have all settled back into positions so that the jig box constitutes their entire support. A LAYER is a stratum of a bed in which all of the particles are of substantially the same specific gravity. The grains being treated are referred to as SUBINTERSTITIAL when of such size that they can pass through the interstices of the bed without other than glancing contacts. SUPERINTERSTITIAL particles are those too large to penetrate the interstices without displacement of the bed particles. PAR-INTERSTITIAL grains penetrate the bed along interstitial passages without apparent displacement of the bed particles, but with constant scraping and turning, stopping each time the bed compacts; they are the particles ranging in size from the interstitial spacing in a fully expanded bed to something slightly larger than the spacing in a compacted bed. When expansion is effected by moving the jig box up and down in a body of water, the jig is of MOVABLE-SIEVE type; when the box is fixed and the water is moved, the type is FIXED-SIEVE. A PLUNGER JIG is one in which the water movement is caused by a reciprocating plunger; in a PADDLE JIG, by a paddle; and in a DIAPHRAGM JIG, by a diaphragm. In a PULSATOR JIG water impulses are due to pressure changes caused by a rotating valve between a pressure source and the water.

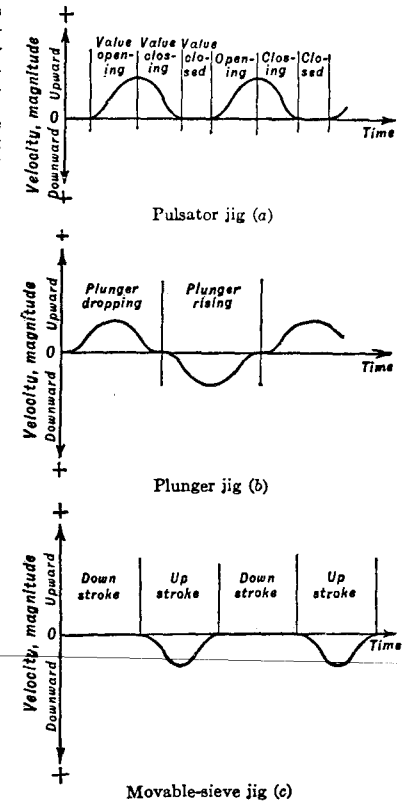

FIG. 1. Diagrams of jig currents.

Action in a jig. A dangerously simple picture of action in a jig may be had by charging a hand screen with a short-range pulp coarse enough to be retained and moving the screen up and down in water in a tub, at such a rate that the screen support drops from the bed on the down stroke, with such an amplitude that water does not flow in over the top of the screen on the down stroke nor does the surface of the bed emerge from the surface of the water on the up stroke. Following such treatment the bed will be found sorted into layers, the bottom one composed of the heaviest mineral, the top of the lightest mineral, the middle a mixture, indefinitely layered, of free minerals of intermediate specific gravities, and of locked-middling grains.

But while this pictures the performance of a hand jig (Art. 12), it does not represent the essential actions of a continuous jig. In such a jig the sorted bed already exists, and the new feed, comprising grains of all of the different sizes and varieties of those of the bed (and usually some finer), is flowed continuously into one end of the box, reject is overflowed continuously from the other end, and material is also continuously drawn from the bottom layer. A diagrammatic sketch of this action is shown in Fig. 5. (See detailed discussion of the figure.) At the moment it is sufficient to note that the bottom layer is the separating layer; that, in effect, it is a constant body of semifluid character and relatively high effective density; that when feed is presented to it, it takes in particles of the same specific gravity as that of its constituents, while all particles of lower specific gravity float on it and flow as a plastic stream to the overflow weir.

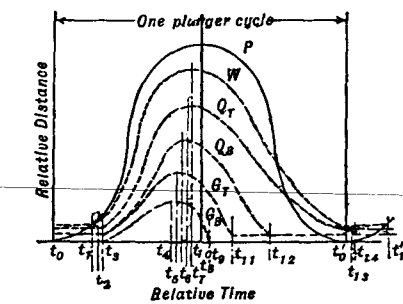

FIG. 2. Diagrammatic analysis of movements in a plunger-jig bed.

Vertical movement of the layers in an unloaded bed in a plunger jig (Arts. 3 to 6) is indicated in Fig. 2. *P* represents the motion of the plunger, plotted as though it underlay the screen. Its amplitude is greater than that of any part of the bed. Water (curve *W*) starts to rise at time t_1. The lag is due to slow return of water through the bed, loss over the tailboard during the stroke, and open flap valves on the jig plungers. The water starts upward