operating mechanism of a predetermined activity and moment connecting the directive factor of the compass with a relatively immovable or stationary part, such part serving as an anchor or abutment for developing the necessary force reactions.

It will be readily seen that I have thus secured a simple gyro compass and for the first time in the history of the art, a forced and greatly accelerated orientation coupled with perfect freedom from numerous disturbances and errors above pointed out for it is clear that a part for instance in a state of neutral equilibrium or "indifferent equilibrium," as Foucault forcibly puts it, cannot respond to the disturbances named owing to the fact that it is not possessed of ballastic properties which is the source of the difficulty. One detail remains to be added to make the apparatus complete, viz: that the anchor should turn around in azimuth with the gyro wheel so as to be always on hand to operate as a base for the positive orienting, restraining and correcting element. In avoiding mercury floats and employing Foucault's filament suspension, it is also necessary that no torsion should accumulate therein as the ship turns. To provide against this a sensitive and simple following up device has been adopted which instantly responds to the slightest azimuth movement of the wheel and therefore never permanently changes its azimuth relation therewith, thus accomplishing a number of essential functions among which are its use as the anchor for the positive orientation and correction element and at the same time as a support for the torsion suspension whereby the two ends of the torsion element practically always move together, barring a trifling lag existing for an instant between them and before the responding member has caught up, amounting usually to less than one-tenth degree. Therefore no permanent torsion can exist and the suspension is always held in the condition of maximum sensitiveness and in readiness to instantly respond equally to motion in either direction. The rigidity of this supporting and anchoring part will be seen to be more than sufficient for all needs when it is stated that it is geared solidly to a stationary part secured to the supporting body and positively driven as by a power motor.

The acceleration pressures mentioned are due principally to three causes, first, that of getting under headway, or while stopping either forward or backward; second, centrifugal forces in turning, while moving in either direction; and third, the acceleration pressures emanating from oscillation where the compass is located at a distance from the center of such oscillation.

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GEOLOGY

# Wind May Have Blown Chilean Salts from Rocks and Sea

AGREEMENT is being reached as to the most scientific explanation to account for the formation of the valuable constituents—nitrate and iodine—in the vast natural chemical storehouse that stretches for nearly five hundred miles along the length of the "tapeline" republic of Chile. A plausible theory at first advanced averred that guano, deposited by the birds that inhabit the coastal region, was responsible.

Some scientists then claimed that an upheaval of the sea bed had occurred, resulting in the exposure and decomposition of seaweed—a theory that accounts also for the presence of iodine.

Fixation of atmospheric nitrogen by lightning formed the basis for a third supposition, and still another claimed that the deposits were caused by the action of nitrifying bacteria on alluvial soil.

Then came the suggestion that volcanoes, of which the Andean region has many, were responsible. The contention was raised that nitric acid, formed by the oxidation of released ammonia, combined with alkaline earths from rock formation and resulted in nitrate. This seemed a logical explanation, but it failed to account for the presence of the iodine.

A recent supposition, which seems to meet all objections advanced to date, emphasizes the value of an intimate knowledge of local conditions in a study of this character. A Scandinavian geologist, Bjarne Hofseth, was impressed with the strength and regularity of the winds that commence each day at noon to blow over the pampas, as the stretch of desolate waste is called. He estimated that a daily wind movement occurred of about one hunderd kilometers, carrying minute amounts of dessicated salines, the products of rock decomposition and evaporated sea spray. Basing calculations on the assumption that the deposits have taken 100,000 years to form, Mr. Hofseth shows that a crust of nitrate and other soluble salts accumulating at the rate of only one-tenth of an inch every fifteen years would be sufficient to account for the existing and exploited reserves, the commercial development of which began about a century ago.

A heavy dew characteristic of this region, known as camenchaca, may well have effected dissolution of the salts and their precipitation in the ground. Periodic changes of climate, caused by the conflict of the Humboldt current from the cooler, southern seas, and a warm current from the north, known as El Nino, bring torrential rains at fairly regular intervals of about fifteen years, to vary the monotony of daytime aridity. A concensus of opinion is favoring the assumption that at such periods a further dissolution and recrystallization of nitrate occured; and so the deposit was finally formed as it is now being mined. It is a narrow horizontal stratum, or rarely two or more superimposed strata, usually at a maximum of only a few yards below the surface.

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