NOTES ON THE THEORY OF SHAFT GOVERNORS.

weight toward the centre, but this force must be entirely expended in overcoming the velocity of the weight outward, which it had when at the point g, therefore the movement of the weight is outward during the whole revolution. The same action occurs in succeeding revolutions, and the weight describes a spiral outward, finally reaching its outer stop.

If we start the analysis from g, we find by similar reasoning that the weight describes a spiral inward.

The reasoning in the case of starting from g or a, which does not permit the ball to return to its starting point, is found to be rational, when compared with the case of any weight moved in a straight line, with no resistance except that of inertia, by an accelerating force, and stopped by an equal retarding force. The weight comes to rest, and no work is gained or lost, yet the weight is found in a new position.

Again, if we consider the weight to start, with no radial movement, from any other points intermediate between its positions, a, g, and j, d, it will be found to describe a spiral outward when the first position is taken at the right of the axis, and inward when at the left. These spirals are, as will be seen by consideration of the forces of inertia, in no case regular spirals, but are merely of spiral nature, not re-entering.

The conclusion to be derived from this analysis seems to be that the problem has no true solution, or if any expression based on correct reasoning could be found for the curve, it would be irrational.

Moreover, under the conditions of perfect isochronism assumed, one would be led to expect the motion of the ball to be erratic; as, for instance, it might first move in the outer spiral, when, reaching the outer stop, it may be compelled to move horizontally at the point j, which might start it in the eccentric circle. Slight disturbing influences, as of the atmosphere, would probably change it from this to other of its paths. This expectation seems to be to some extent verified by the experiment of Professor Robinson, for we find in his table of results the remarks "spiral inward," "spiral outward," "steady," etc.

The practical conclusion to be derived from this analysis is that an unbalanced weight in an isochronous shaft governor is not feasible. E, B nu th ce tin

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