Now let the ball move out 2 in. n being still 200 revs. per min., a is then 8.82 in., $r = 14$ in. and hence $Sa = 441$, which tends to draw the ball inward while $C = .0000284\,wrn^2 = 397.6$ pounds tending to force the ball outward and hence the ball will return to its original position at 12 in. radius unless a force of 43.4 pounds be interposed to prevent this. On the other hand if the ball is rotated in a circle of 10 in. radius we would have $Sa = 241$ pounds and $C = 284$ pounds, so that a force of 43 pounds is urging the ball outward and hence there is only one position at this speed in which it can remain or the arrangement is *stable*.

Now let $S = 24$ pounds, then if equilibrium is to be maintained at $r = 12$ as before we find $a = 14.2$ in. or when the ball is at O the spring will have an elongation of 2.2 in. At 14 in. from the centre $C = 398$ pounds and the spring pull $Sa = 388.9$ or the ball will stay at the outer radius whereas if $r = 10$ in. $C = 284$ and

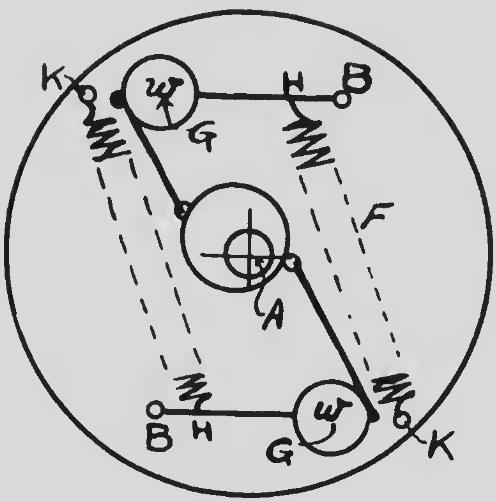

Fig. 41.

$Sa = 292.8$ pounds or the ball will stay at the inner radius. Hence, if in this case the ball be disturbed at all it will immediately fly outward or inward having no tendency to return to its proper position at 12 in. radius, in other words the equilibrium is *unstable*.

This is very nicely illustrated by a study of the C curves, Fig. 40, in each case.

It is further to be noted that with $S = 50$ we could only have the ball remaining at 14 in. from O when $n = 211$ revs., and at 10 in. when $n = 184$ revs. Hence, if this represents the necessary range of travel of the ball the sensitiveness is $2\left[\frac{211 - 184}{211 + 184}\right] = 15\%$. Where, however, $S = 24$, the corresponding speeds will be 198 revs. for $r = 14$ ins., and 203 revs. at $r = 10$, with the curious result