CHRONOGRAPH FOR ENGINEERING PURPOSES, WITH THE HIPP ESCAPEMENT.

The two engravings given herewith show the general construction and details of an improved chronograph for engineering and other purposes.

The instrument has been successfully applied to some of the different types of large pumping engines, such as direct-acting fly-wheel engines, geared pumping engines, and the "Davey engines;" it has also been used to determine the motion and relative motion of pump rods and pumps some 2,500 feet below the surface engine driving same, and at intermediate points. The results are exceedingly interesting and instructive, and as numerous indicator cards were taken from the engines and pumps simultaneously with the motion diagrams, nearly all conditions of motion and power, during the time under consideration, were definitely determined, and may hereafter form the subject of other papers.

Some very important results of the elasticity of long pump rods are clearly set forth; in one case, a rod at a point 1,800 feet below the surface showed a positive pause, while the engine driving it was nearly at its point of maximum motion, and pumps attached to the rods may, and do have, strokes in excess of or deficient to the stroke of engines driving same, and to an important extent. Hence it can be definitely stated that any consideration of motion of pumps, or discharge capacity of same, driven by a long line of pump rods based upon the motion or stroke of a surface engine alone, will in no way be even approximate, unless the elasticity and effects of counterbalancing by balance bobs on that elasticity are also considered.

The effects of different degrees of compression upon the engines and motion of the pump rods in passing the centers have been considered, and the diagrams clearly show the importance of considering it in connection with the strength of the rods and balance bobs.

The latest use of the instrument in conjunction with an engine test has been to determine, if possible, the rate of condensation of steam, per second, in the steam cylinders of a pumping engine, where the change of motion, due to each fractional part of the stroke, was determined. Also, a ten-hour experiment trial to show the economy of compression, as compared with a ten-hour trial of the same engine on the succeeding day where no compression was used (otherwise all conditions being similar), has been made, when changes of velocity of piston were determined by the chronograph.

This chronograph has been put to a variety of uses, among which are recording seconds as well as the velocity curve of engines, and timing horse races, etc. It has also been used in the Navy Ordnance Department for determining the speed of projectiles.

In the following paragraphs we give the references by letters to the engravings of the instrument:

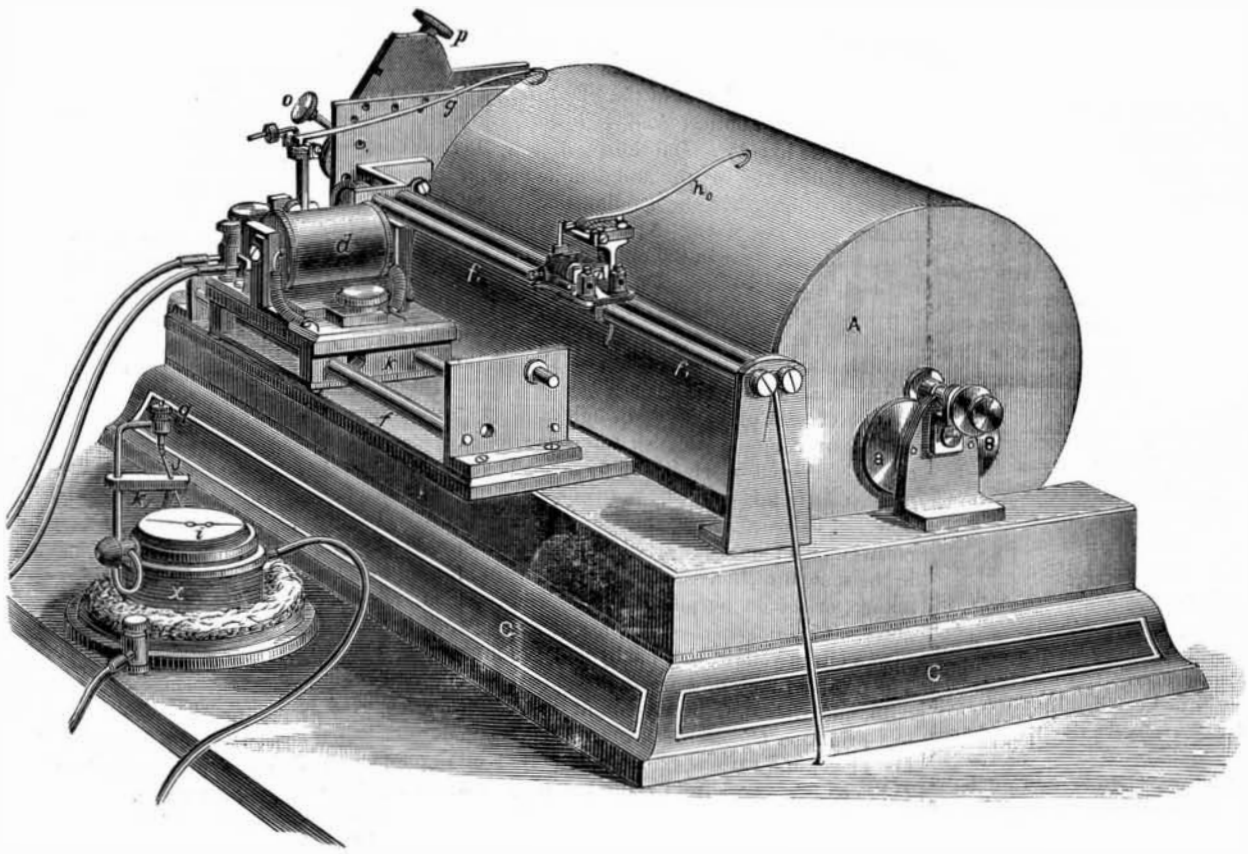

Fig. 2.—CHRONOGRAPH FOR ENGINEERING PURPOSES.

C C, cast-iron baseplate covered with sheet brass, upon which the mechanism is secured.

B, metal frame containing gearing for driving drum, A, and escapement wheel, *b;* motion communicated by means of adjustable weights, D.

A A, light brass drum accurately balanced, revolving on friction rollers. 8 8, at both ends.

f f, parallel guide bars, upon which the tracing point, h_o, and its carriage travel back and forth, receiving motion, in one direction, from the engine or other moving parts, through the cord, P, passing between the bars, *f*, and attached to the tracing carriage; the return motion is derived from a coiled spring in the spring drum, C.

e e, small electro-magnets on tracing carriage, for raising the tracing point, h_o, off the paper and replacing it at any desired point to be especially observed.

d, electro-magnet on separate carriage, *k k*, adjustable on parallel bars, *f*, operating the steel tracing point, *g*, attached to the armature of *d*, for the purpose of recording seconds on the margin of the paper or at other parts of same as required.

i, chronoscope or watch supported on frame, X, the second hand of which swings the light platinum wire, J, breaking contact with the insulated wire, *k*, thereby breaking circuit with *d*, and recording seconds through the tracing point, *g*, on the paper.

q represents the adjusting screw for the wire, J.

a, steel spring of escapement. This spring is securely clamped in Y, its flexibility being controlled to a certain extent by means of the thumbscrews, *o* and *p*. —*W. R. Eckart.*

The Cost of Bombardment.

Speaking of the monetary cost of bombarding the Alexandria forts the London daily *News* says that every round fired from the four 80-ton guns of the Inflexible cost the nation £25 10s. (about $125) per gun. The 25-ton guns, of which the Alexandra carries two, the Monarch four, and the Téméraire four, cost £7 per round per gun. The 18-ton guns, of which the Alexandra carries ten, the Sultan eight, the Superb sixteen, and the Téméraire four, cost £5 5s. per round per gun. The 12-ton guns, of which the Invincible carries ten, the Monarch two, and the Sultan four, cost £3 12s. per round per gun. The Penelope, which alone carries 9-ton guns, has eight of them, which were discharged at a cost of £2 15s. per round per gun. The Monarch and the Bittern each fired a 6¼-ton gun, the cost being £1 15s per round per gun. The Beacon and the Cygnet have two 64-pounders each, the cost of discharging which is 18s per round per gun. The Penelope carries three 40-pounders, the Beacon two 40-pounders, and the Bittern two 40-pounders, the cost of discharging which was just 12s. per round per gun.

Death of a French Electrician.

M. Leclanche, inventor of the Leclanche electric pile and other improvements in electricity, is dead.

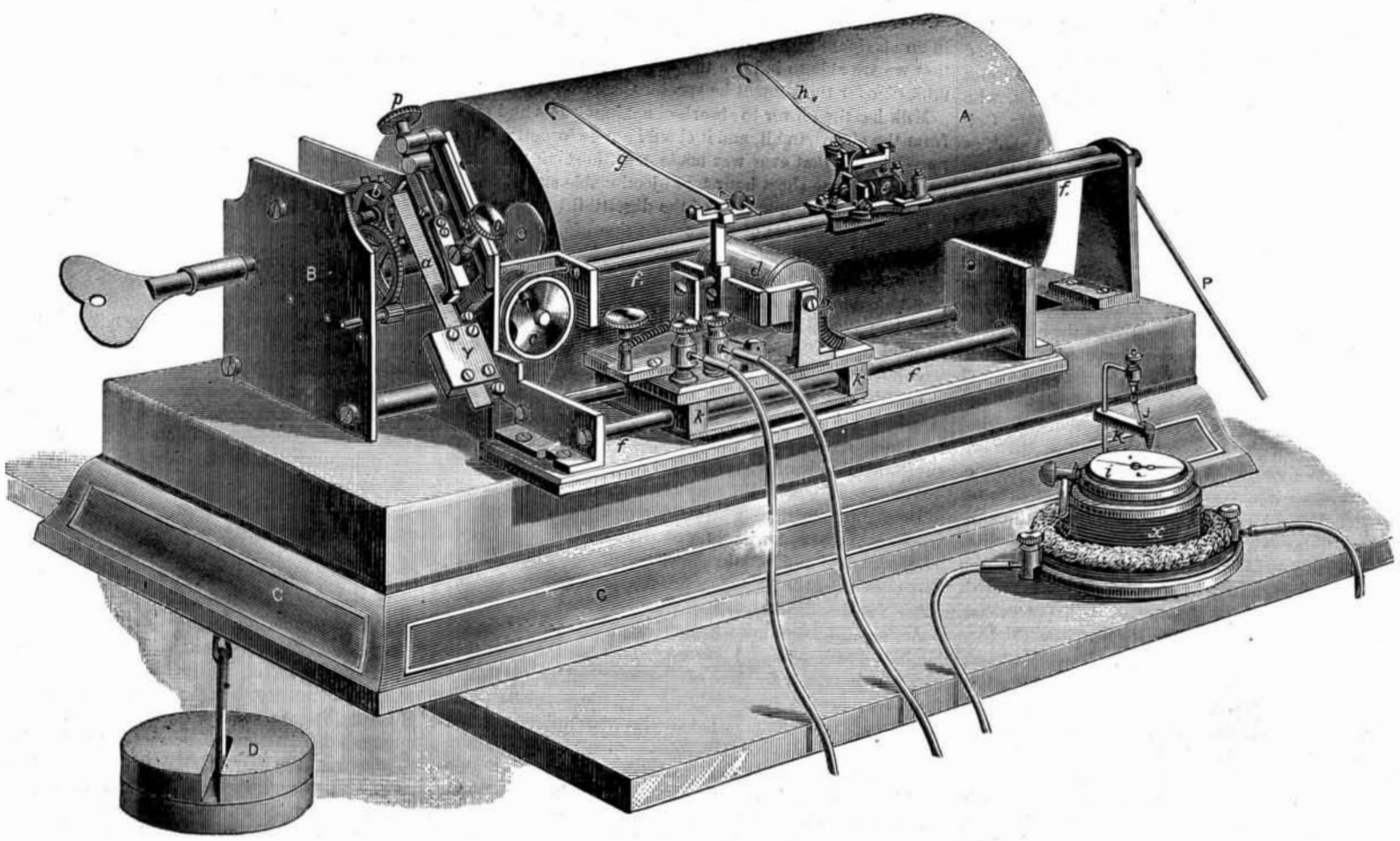

Fig. 1.—CHRONOGRAPH WITH THE HIPP ESCAPEMENT.