WATER WHEEL REGULATION.

The Tuolumne County Electric Power and Light Company has recently installed a three phase transmission plant in Sonora, Cal., which contains several interesting features not found elsewhere. The apparatus used is of the General Electric triphase type, and in addition to lighting the towns of Sonora and Columbia, the company is furnishing power to the Rawhide mine. It is in this mine that a 150 h. p. induction motor has been installed for operating the main hoist. The speed of the motor is controlled by means of a special regulator resembling in outward appearance the latest type of General Electric street railway controller, and consisting of commutating devices by means of which the direction of the motor is controlled and of suitable contacts for cutting equal resistances simultaneously into the three leads of the motor.

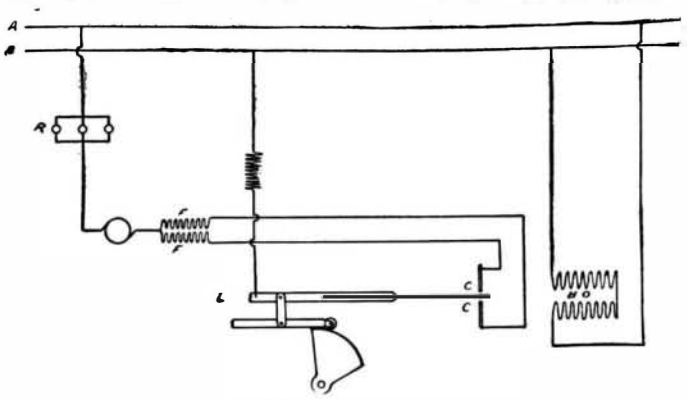


Fig. 2.—OUTLINE DRAWING OF THE LIGHTHIPE WATER WHEEL GOVERNOR.

The generating station is operated by a 48 inch Pelton water wheel running under a head of over 900 feet, and as the keynote of success in the operation of this plant rested in securing the very close regulation of the water wheels, it was determined to depart from the usual types of water wheel governors to satisfy the demands. Accordingly, Mr. J. A. Lighthipe, chief engineer of the Pacific Coast office of the General Electric Company, designed the electric governor illustrated herewith, to meet the exigencies of the case. This governor, which is the first one built, has now been in operation for several months with such success that steps are being taken for its installation in other plants where trouble is being experienced in the governing of water wheels operating under high head.

In principle, the Lighthipe governor consists essentially of a series motor with a double wound field; that is, a field containing two independent windings, each connected in series with the armature in such a way that while the direction flow in the armature is always one way, the polarity of the field is changed according to which of the two field windings is used. To the armature shaft is direct connected a screw carrying a traveling nut which moves backward or forward according to the direction of armature rotation, and by the nut is operated a rod which in turn controls a crank operating the hood or other means of regulating the water supply. From the main shaft of the water wheel is driven a centrifugal governor by belting, and this governor actuates the motor circuit through one or the other of the field windings.

The troubles heretofore experienced in the governing of water wheels have been due to the slowness of the pawl method of actuation and to the fact that "seesawing" is caused by the action of the governor in continuing to deflect the nozzle to a greater extent than that necessary to reduce the power of the wheel to the desired point. The nozzle, therefore, goes over the center as it were, resulting in the speed of the wheel falling below normal, which the governor attempts to correct, and, in doing so, pulls the nozzle back over the center again, giving excess speed. The process is again repeated and the "seesawing" is under full sway, to the utter defeat of satisfactory operation.

The means by which the Lighthipe governor obviates these two troubles will be understood by reference to the accompanying illustrations, from which it will be seen that the fanlike disk operated by the crank attached to the traveling nut on the extension of the armature shaft controls the elevation of a lever that is parallel with and secondary to the governor lever. This disk constitutes a cam of varying radii, as shown in exaggerated form in Fig. 2, and is so adjusted that as soon as the circuit of the pilot motor is closed by the governor lever the movement of the cam by the traveling nut raises or lowers the governor lever in such a way as to break the contact before the water wheel has been brought to the desired speed, thus compensating for the inertia of the moving masses and endowing the governor with amechanical perception of far greater sensitiveness than that heretofore attained.

The diagram appended hereto as Fig. 2 will make clearer the electrical connections and operation of the governor:

A A are the mains from the exciter or other source of direct current supply.

R is a lamp resistance to reduce the current rush on closing the circuit.

F and F are the field coils wound in opposition, and constitute the device for securing reversal with only two contact points.

L is the lever operated by the centrifugal governor.

C and C are the contact points lying within the pole pieces of the blowout magnet, B O, which was added to break the destructiveness of the arc at the contact points.

B is the brake solenoid in series with the motor circuit and arrests the momentum of the armature by bringing it to an instantaneous stop upon breaking the motor circuit.

The governor is exceedingly sensitive and may be adjusted to any desired degree of sensitiveness by adjusting either the contact points, C C, or the link forming the fulcrum between the governor lever and the cam lever, shown in Fig. 1. The contact tips may be adjusted to within $\frac{1}{16}$ of an inch of contact, so that the slightest change of speed will throw the motor into action one way or the other. The ingenious mechanism accomplishes a closeness of regulation heretofore unattained; and while designed primarily for the control of water wheels driving electric generators, it may be used with equal satisfaction in any class of work, as the governor can be operated from a simple battery circuit, as well as from an exciter or an incandescent lighting service. We are indebted to the Journal of Electricity for the cut and particulars.

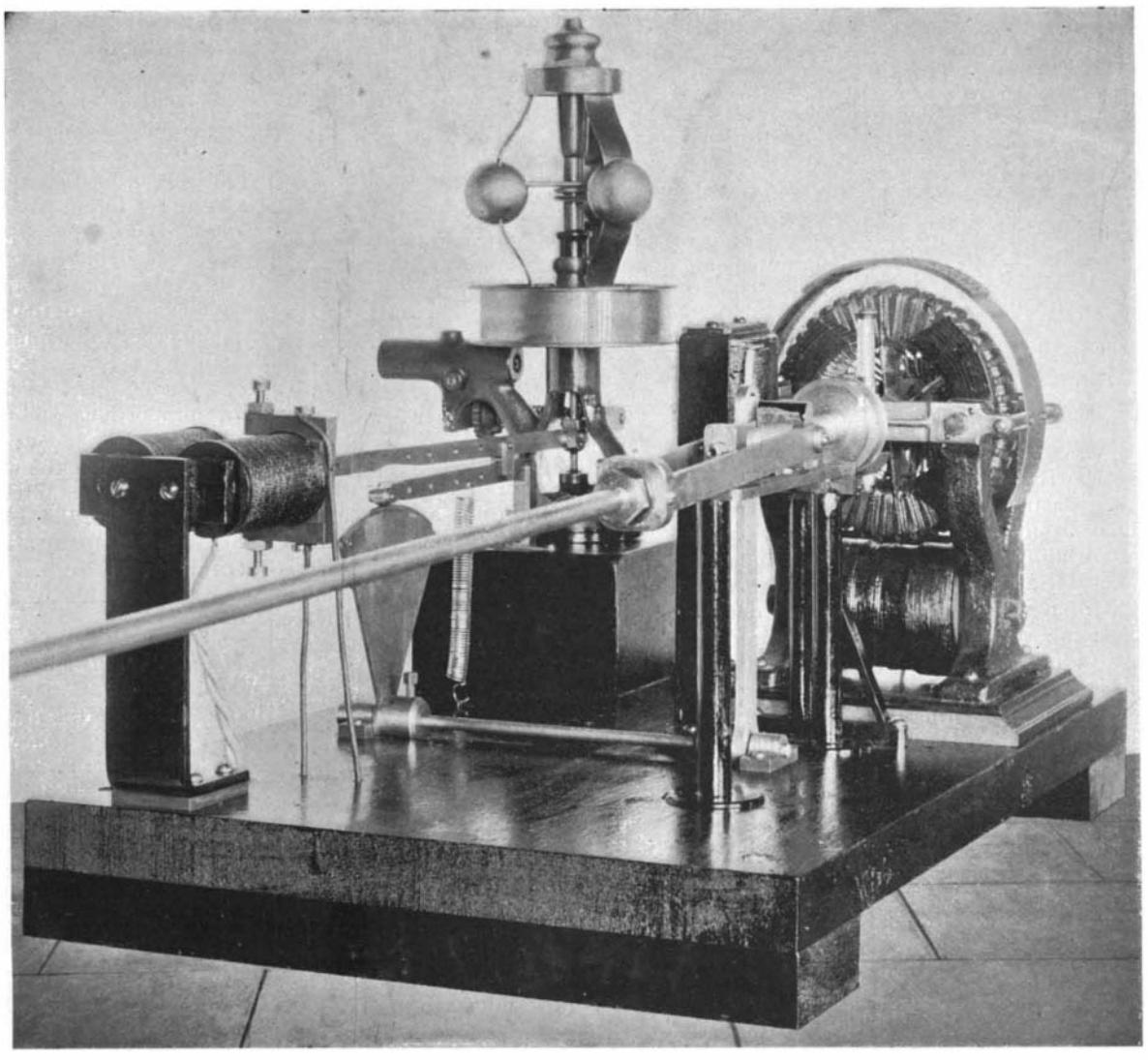
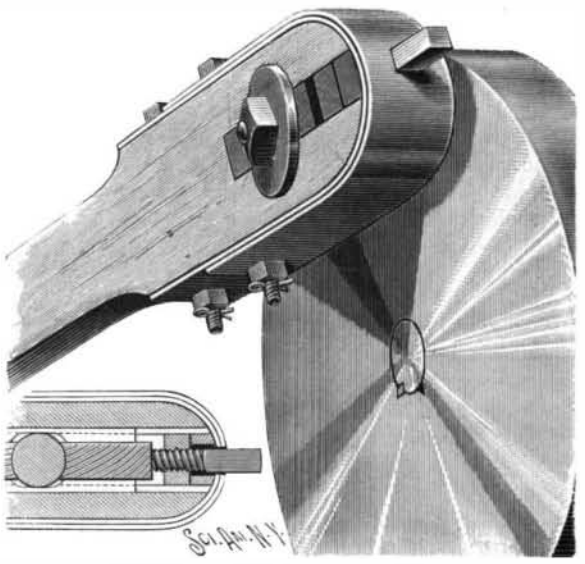


Fig. 1.—THE LIGHTHIPE WATER WHEEL GOVERNOR.

ELECTRIC power for drawbridges is to be adopted for all the bridges over the Chicago River, at Chicago, Ill., replacing the steam plants now required for each bridge.

AN IMPROVED PITMAN.

A pitman of simple and durable construction, with which all wear and lost motion may be readily taken up, insuring at all times a proper transmission of the motive power, is represented in the accompanying illustration and has been patented by John S. Nichols, of Storm Lake, Iowa. The pitman head has a longitudinal slot in which is a pitman box preferably made in two sections, engaging the crank pin on the crank disk, and the box sections are held in place transversely by longitudinal keyways. The outer end of the outer box section, as shown in the small sectional view, is engaged by a screw to prevent longitudinal movement, the screw screwing in a nut sliding in the slot and being prevented from turning in the head by its sides fitting against the sides of the slot. The screw also passes through a washer against which abuts the outer face of the nut, the washer abutting against a strap extending around the head and secured thereto by a bolt. The square head of the screw passes loosely through this strap, but is engaged by an outer strap also secured in place by a bolt, and the latter strap must be removed when it is desired to turn the screw to take up the wear of the box sections. The inventor has also devised an improved construction according to which the pitman blocks may be held in a light and solid malleable iron frame, and a crank disk and pitman thus connected are designed to run noiselessly and without any lost motion.



NICHOLS' IMPROVED PITMAN.

Manufacture of Woad.

The use of woad as a source of indigo is now very limited, says Nature, and most people probably imagine that it died out a thousand years ago or more. Woad appears, however, to be employed yet by some old-fashioned Yorkshire dyers, who use it in conjunction with ordinary indigo, in the so-called "woad vat." Francis Darwin and R. Meldola have recently visited an English woad mill where a primitive method of manufacture is yet conducted. At Parson Drove, near Wisbech, the leaves of the plant (Isatis tinctoria) are wrenched off at the base by the pickers, the root being left undisturbed so as to permit the growth of a second crop. The first process consists in crushing the leaves to a pulp under three hollow wooden rollers, round the circumference of which about two dozen iron cross bars are arranged to serve as effective crushing edges. The resulting pulpy mass is kneaded by hand into balls which are then placed on wooden trays to dry in open sheds. When dry they are again ground up under the rollers, and the crushed material is allowed to ferment after sprinkling with water. This final stage completed, the woad is ready for market. The object of first drying the pulp and then wetting it again before fermentation is not obvious, but the fermentation itself is probably a zymolytic decomposition of glucosides.