

The slippers gradually accelerate the outer portion of the clutch, and the machine, which it drives to full speed; they then drive without any slip but can be designed to commence slipping at any desired overload, thus acting as an automatic overload device. Sudden shocks or variations in load are not transmitted to the motor, but are taken by the clutch which acts as a flexible coupling. The action is entirely automatic, and the only wearing parts are the faces of the slippers which can be renewed for a trifling sum. They last a long time under the worst conditions, and their renewal can be easily and speedily accomplished.

If desired the shoes can be fitted with springs, as shown in Fig. 3, to enable the motor to attain a certain pre-determined speed before the slippers engage. This arrangement is of special importance for use with single-phase motors, or where two or more motors of any type are driving the same shaft or machine. The motors can be run singly or together as required, and considerable economy is effected by this

The Standard Clutch Pulley, illustrated in Fig. 2, can be fitted with springs if desired. In this form it makes an ideal means.

driving pulley for single-phase and similar motors having low starting torque.

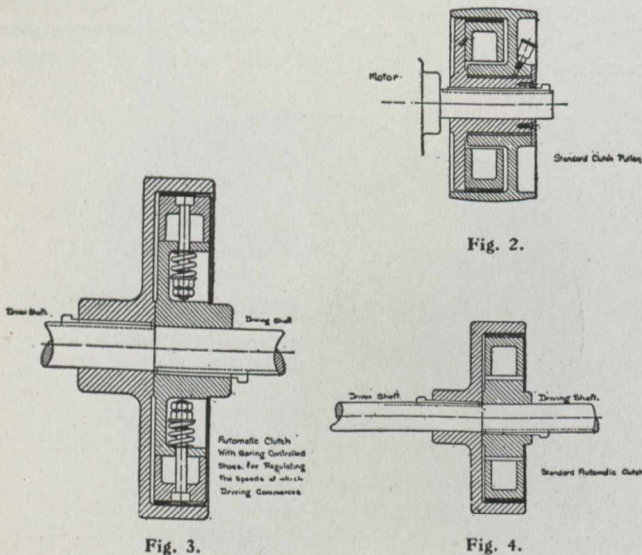


Fig. 3.

Fig. 4.

The electric capstan is an excellent example of the utility of the clutch, and among other advantages may be enumerated: gradual starting without excessive current, the rate of starting is entirely automatic and independent of the operator, starting current cannot exceed a certain set value, motor cannot be dangerously overloaded.

An entire absence of complicated switch-gear, with its attendant coils, resistances, etc., to give trouble, the switch-gear being of the simplest possible type, i.e., an ironclad quick make and brake main switch operated by a pedal protruding through the capstan lid.

The outer rim of the clutch pulley is utilized for an electric brake, which is applied instantaneously when the switch pedal is released, and the capstan head is brought to a standstill independent of the motor, thus ensuring sensitive control with safety.

The armed boss carrying the slippers is keyed to the motor shaft. Suitable slides are arranged at the bottom of the capstan box to enable the motor to be moved back and the clutch disengaged when required.

This clutch, known as the "Broadbent Automatic Centrifugal Clutch," is the result of considerable experiment on the part of Thos. Broadbent & Sons, of Huddersfield, England, who, when designing their electric hydro-extractors or centrifugals, some ten years ago, were

confronted with the problems referred to in the beginning of this article, i.e., how to start and accelerate a load requiring a large starting torque without using special switch-gear, and with a minimum starting current. The clutch is made in sizes from $\frac{1}{2}$ h.p. to 1,500 h.p., and is noteworthy for simplicity of construction, fewness of parts, and adaptability.

EFFICIENT BOILER OPERATION.*

All boiler fittings and accessories in the boiler-house should be maintained in a clean and good condition. Great care should be exercised to see that the safety valves are ample in size and always in good working order. They should be tried at least once every day to see that they act freely and are not overloaded. When the safety valve is blowing off the same pressure should be recorded by the pressure-gauge; if not, one is wrong and the pressure-gauge should be immediately checked with a correct one. With no steam in the boiler the pressure-gauge should register zero.

Carelessness in regard to the water-gauge is the source of many accidents. Besides the annoyance of burst gauge glasses, a faulty water-gauge may place the attendant under continual danger from scalds and flying glass and may be the direct cause of a disastrous explosion. The water-gauge must be kept clean, blown-out frequently, and its passages kept clean. Before starting a fire under a boiler which has stood unused for some time the water-gauge should be tested as to its cleanliness and freedom of the water and steam passages. Water-gauge cocks are so constructed that when necessary a piece of wire may be inserted right through the water-way.

For greater safety there should be two methods of feeding a boiler. The feed pump or injector should be of ample size, and should receive regular and strict attention. The check valves and self-acting feed valves should be frequently examined and cleaned. In case of low water the fire-box doors should be opened, the damper shut down, and the fire immediately covered with ashes (wet if possible), or with any earth that may be convenient. If nothing else is at hand then the fire should be smothered with fresh coal. The feed-water must not be turned on, neither must the engine be started or stopped or the safety valve lifted until the fire is drawn and the boiler has cooled down. The fire should be drawn as soon as it is possible to do so without increasing the heat.

Should foaming occur within the boiler it may be stopped by reducing the outflow of steam; should this fail then the draft and the fires should be kept checked. The fires must be attended to regularly; the coal applied evenly, a little at a time, and not kept too thick. The grate should be evenly covered, no air holes allowed in the fire, and the fire well spread to obtain best results. The dead plate should be kept free from fuel, and the fires should not be cleaned too often.

The heating surfaces of the boiler (outside and in) must be kept clean or there will be a serious waste of fuel. The frequency of the cleaning of the boiler will depend upon the nature of the feed-water and the fuel used. Scale has a serious effect, and in all cases it must be treated as a dangerous enemy. It is difficult to obtain a feed-water which does not contain some proportion of dangerous compounds, either in suspension or in solution; and these not only tend to lower the efficiency of the boiler but form a source of considerable danger. The scale formed within the boiler pre-

* Abstracted from Science and Art of Mining.