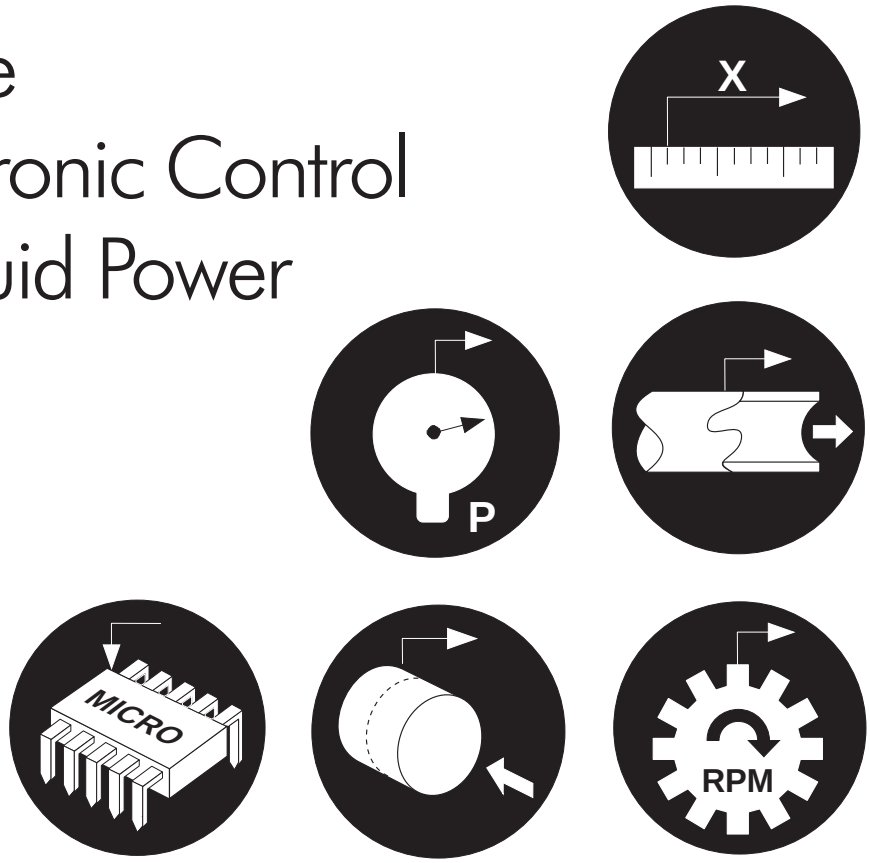
Your Guide to the Electronic Control of Fluid Power



The members of the National Fluid Power Association (NFPA) have prepared this application as an introduction to the electronic control of fluid power. The application and components described here are representative — electrohydraulics and electropneumatics can be effectively utilized in countless processes, and components are available in many different sizes and configurations.

NFPA's manufacturers invite you to contact them for additional information.

National FLUID POWER Association®

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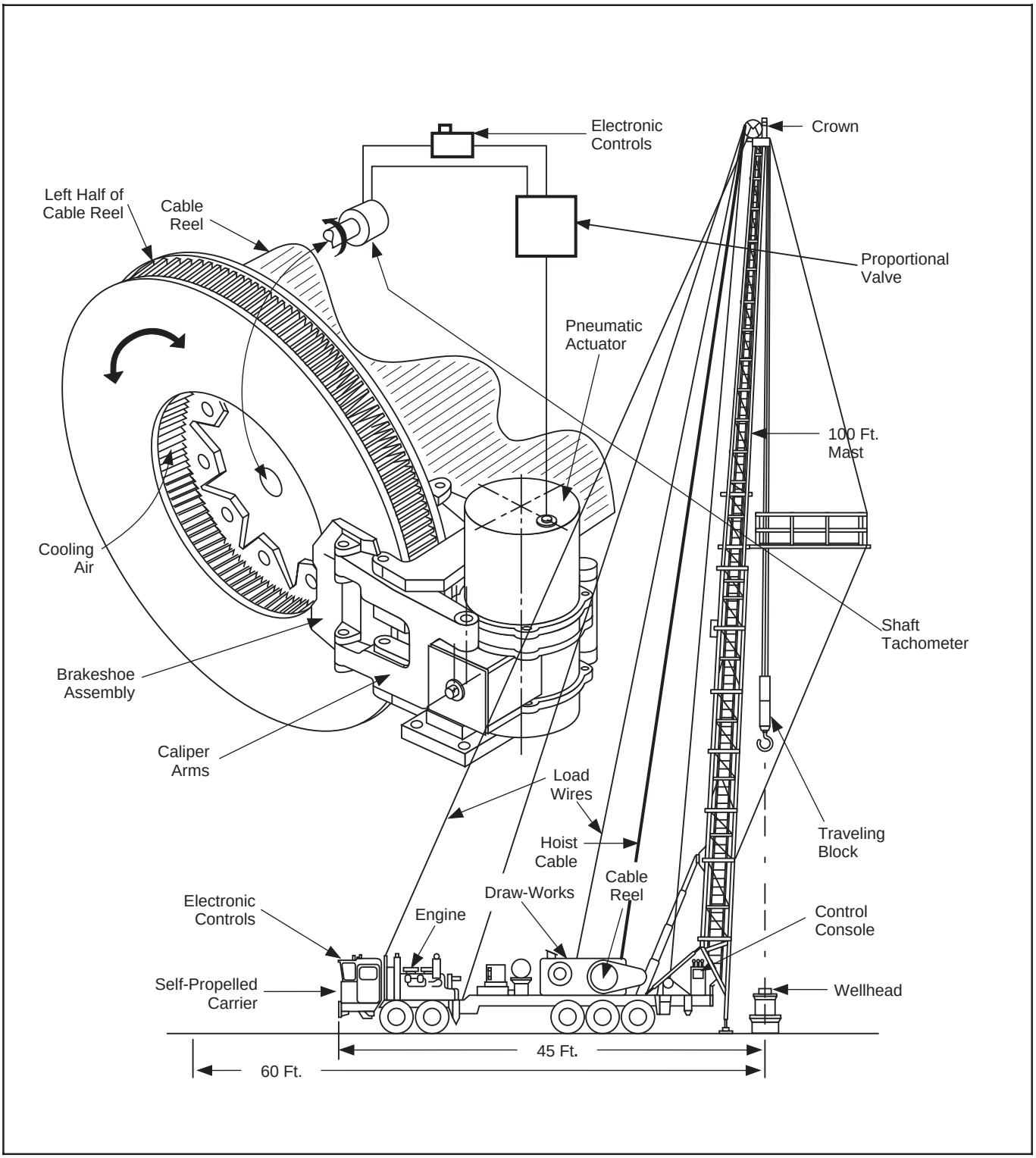
Electropneumatics at Work

Well-digger Brake



The Problem

Deep water and geothermal well drilling often requires a high degree of operator skill because casings—up to 30 feet long and twenty four inches in diameter—are lowered as a single unit, by winch-drawn cable, into holes

many thousands of feet deep. The operator must maintain a constant speed as each of these casings initially is raised into position by a hoisting hook, then threaded to the previous section and lowered into the hole. Otherwise there is the risk of having thousands of pounds of piping pull apart at a joint, possibly caused by induced vibration.

Cable speed typically was retarded by mechanically or hydraulically assisted winch brakes, which are manually controlled with foot or hand levers by the operator. The brake was applied repetitively during the two to three seconds it takes for each section to be lowered from the top of the 50 to 100 foot tower, down to a point just above an elevator collar in the ground. There, the pipe was held while awaiting the next section. This effort became extremely tiring.

Its Solution

To help decrease operator fatigue, an electronically controlled, pneumatically operated disc-brake system was developed. Cable speed is held constant by monitoring cable drum rpm, and automatically increasing or decreasing the braking force accordingly.*

Normal operating force against the disk brake is applied by pneumatic cylinders, which are controlled by a standard electropneumatic converter (electronic proportional pressure control valve). It accepts a varying input voltage or current, and converts it to a proportional output air pressure.

Drum speed is monitored with a speed sensor (shown conceptually as a shaft tachometer in the illustration). Typically, it generates an output analog voltage ranging from zero to 10 V in direct proportion to the zero to 500 rpm of the cable reel. This voltage is fed into the electronic proportional pressure control valve, which outputs a pressure that ranges from zero to 100 psig, thus increasing the braking effort in proportion to the rpm of the cable reel.

Lighter loads require less braking force than heavier loads, and there are other situations where braking force needs to be modulated in special ways. So, a potentiometer is included in the circuit to let the operator choose the pressure range that the regulator delivers.

As the reel approaches zero speed, the tachometer signal is not sufficient to automatically control the proportional pressure control valve and the operator must activate the manual braking system.

Related Applications

Winches, cranes, hoists, elevators, gravity-force conveyors and even windmills can benefit from electropneumatic braking technology such as this. The systems can include override mechanisms that allow the operator to manually control the pressure and thus adjust braking force at will. Other systems can regulate pressure constantly to hold drum rpm below a set maximum.

How Electronics Improved This Application

- Automation
- Adjustable control ranges
- Flexible placement of control
- Standard components

Components Used in Pneumatic Systems*

Actuators
After Coolers
Air Compressors
Air Dryers
Air Line Lubricators
Controls (electronic) and Software
Cylinders
Filters
Filters/Regulators
FRLs
Fittings
Gauges
Grippers
Hose
Manifolds
Motors
Mufflers
Regulators
Rotary Actuators
Seals
Shock Absorbers
Slides
Switches
Tubing
Vacuum Products
Valves

***Click here to access the NFPA Fluid Power Product Locator, which includes information about and links to NFPA member companies.**

*Note: Override by the operator is always an option, and there also is a spring-applied, air-released holding brake that immediately stops drum rotation when the air pressure to its control chamber is released. Our discussion, however, is about only the normal electropneumatic brake.

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