AIRFLEX

(Who Are We?)

What is now the Airflex Plant of the Eaton Corporation was an original venture by Mr. Thomas L. Fawick. (slide of Mr. Fawick) Mr. Fawick was an inventor of great imagination and a compatriot of Thomas Edison, Henry Ford, Harvey Firestone, etc. The initial development work of the Airflex Clutch by Tom Fawick dates back to the summer of 1936.

The practicality of the clutch idea was demonstrated by the successful installation of several expanding-type units on a drilling rig manufactured by Young Engine Corporation of Canton, Ohio. So you can see that the association between Airflex and oil field applications goes back a long way.

The first Airflex units were of the rubber-faced type. This is what the early models looked like. (slide of "Fawick First") This was a 24 inch diameter by 4-3/4 inch wide expanding unit. The tube was vulcanized to a cylindrical steel rim which was then riveted to the stamping of a Ford truck wheel.

At that time, an air pressure of 50 PSI was used as opposed to the 110 to 125 PSI used today. This first unit proved very successful in transmitting the power from a 185 HP engine at 400 to 450 RPM's. This unit compares to our present 24ER475 element assembly.

In order to make the clutch more universally acceptable in those early days, it was found necessary to add asbestos lining to the friction surface. The early units of all sizes had the friction block molded into the tube, as seen here. (slide of 4EB) It was quickly seen that when the friction material wore out, the whole unit would have to be replaced.

This would be great for spare parts business, but expensive for the machine owner, so Mr. Fawick decided to make the shoes replaceable for both the expanding and constricting type clutches. After many unsuccessful tries at various fastening methods, the present shoepin and lockwire arrangement was decided upon as being best. (slides of EB & CB showing shoe)

As mentioned earlier, the use of Airflex Clutches on oil drilling equipment started very early in the development. Engineering layouts were made for engine clutch applications in early 1939 and for pumps and engine compounding in early 1940.

In the fall of 1941, the Oilwell Supply Company of Oil City, Pennsylvania, successfully installed two (2) 26 x 6-1/2 constricting elements as master clutches on their No. 64 drawworks to transmit 400 HP at 400 RPM.

Late in 1943, the Unit Rig and Equipment Company of Tulsa, Oklahoma, applied their first 16 x 5-1/2 constricting units as engine clutches on a medium sized rig. At about the same time, a 36 x 6 constricting unit was used by the International Hoist and Derrick Company of Beaumont, Texas, as the hoist clutch on their newly designed M10,000 rig.

The Houston and Los Angeles Divisions of Emsco Derrick and Equipment Company began using Airflex in early 1944, followed closely by the Torrance California Division of Ideco in 1945 and National Supply Company in 1946.

The success of these early units led to the adoption by all major rig manufacturers of Airflex as standard equipment for the pump drive, engine compounding, master clutch, high and low drum clutches, rotary as well as, for the inertia brake.

Through the years, the Airflex Clutch construction has evolved to its present, sophisticated state. The units are manufactured at the Airflex Plant of Eaton Corporation in Cleveland, Ohio. (slide of aerial view & front entrance - insert slide 13 & 14 Group I)

The plant has in excess of 210,000 square feet of manufacturing space in two buildings. 410 people are employed, doing nothing but making clutches.

The Airflex Plant is equipped with some of the most modern machinery in the Northern Ohio area. Turning operations are performed quickly and efficiently on this bank of five 56-inch Giddings and Lewis, tape-controlled VTL's (slides of VTL's) Precision drilling and tapping is done without the need of expensive drilling fixtures on two Burgmaster and one Avey tape-controlled, six and eight spindle drills, and soon to be installed - an Avey N.C. Drill for excess of 100 in. in diameter. (slide of drills - need) For high volume parts requiring milling, drilling, reaming and tapping, we use this G & L tape-controlled Numericenter (slide of Numericenter), which can perform 40 different operations with as many different tools, 20 tools per magazine, without removing the part from the machine.

For low quantity runs, our newly acquired Warner and Swasey SC15 Automatic Turret Lathe has been a godsend. (slide of SC15)

Parts can be machined here by proper programming of the controls without the need for expensive tooling or prolonged set-up time. To machine large quantities of smaller parts, we have 11 Warner and Swasey AC's and Acme bar machines. (various slides of W & S)

Milling operations are performed on two G & L numerically-controlled milling machines, (slide of G & L-need) and one new G & L Fraser Mill.

The largest parts presently in our product line, the rims of our 66VC1600 Clutches, are machined on this 86-inch Bullard (slide of large Bullard & Rims-need) acquired new in 1972. This machine can turn a piece having a diameter of approximately 9 feet. A slightly smaller, 76 inch Bullard, was delivered in March of 1974 to add to our turning capacity.

Quality
Capacities
Deliveries

Quality Control

The first step in manufacturing an Airflex element is to make the rim. We start with a formed channel, (slide of straight channel and channel entering bender) of SAE1010-1015 mild steel. This channel is worked into a circular form on two "Buffalo Benders". After the circle has been formed, the ends are welded together (slide of welding fixture) and the rough rims machined (slide of machined rim) to the proper O.D. and I.D. prepared for bonding the rubber tube. Small units, sizes 4CB to 14CB400, use a stamping for the rim.

The finished machined rims are then sent to the Molded Products Plant of Eaton Corporation in Akron, Ohio, to have the tubes bonded to them. (slide of front of Flexi) Molded Products was originally a division of Fawick Corporation - then under the name of Flexi-Grip, the major manufacturer of rubber golf grips in the world. Upon the merger of Fawick into Eaton, the plant became part of the General Products Division. However, just recently it was switched back into the Industrial Drives Division to bring the two related operations (Airflex & Flexi-Grip) closer together.

The Molded Products Plant has a total of approximately 60,000 square feet of manufacturing area of which approximately 12,000 square feet is devoted to the manufacture of Airflex tubes. (overall view of tube area)

The rubber used for the tubes is prepared entirely by Molded Products. Raw neoprene and natural rubber are brought into the plant in large quantities. A Banbury Mixer (slide of Banbury) is used to combine certain ingredients according to a time-tested formula.

Further processing takes place on a rubber mill (slide of rubber mill) to combine all the ingredients into a homogeneous mixture. After passing through a calendaring machine, where useable thickness and width are obtained, the finished rubber stock is ready for use on the Airflex tubes.

Incidentally, both of these pieces of machinery are equipped with Airflex units.

The tube is constructed much the same as an automobile tire. In fact, the cord-ply material, as purchased from one of the major Akron tire makers, is the same material used in car tires. It is purchased in large rolls and is cut to proper dimensions on a custom-built cutting table. (slide of cutting table)

The layers of the ply material are then wrapped around the appropriate diameter "building drums", (slides of building drums) to form the rough tube. Depending on its size, the tube consists of two or four cord plys with a neoprene, air-tight inner tube and outer cover. Neoprene is used because of its excellent oil and heat resistant qualities. The "green" tube is removed from the building drum, ready to be fitted to the rim. (slide of tube coming off drum)

A specially prepared, rubber solvent (slide of goup on rim) is applied to the O.D. of the tube to insure a proper bond between the rubber and steel rim. Much care must be exercised to be certain the valve in the tube lines up with the opening in the rim, (slide 128-group 3), since once the tube sticks to the rim, there is no moving it. The lugs on the I.D. are placed loosely over a fixture which gives shoepin holes the proper spacing. (slide of lugs)

The rim and tube assembly is pressurized to 125 PSI and placed in a stream-jacketed mold for approximately 2 to 3 hours at about 350^{o}F for curing. After coming out of the mold and removing a small amount of flashing, the finished rim and tube is ready to be returned to the Airflex Plant for assembly. (slide of finished rim and tube)

The Airflex Element Assembly is made up of just a few simple parts: the rim and tube, the friction shoes and shoe pins, (slide of components) lockwires and if required, a side connection elbow.

The friction shoe is a stamped, (slide of basket of back plates) cadmium plated steel plate with molded asbestos lining bonded to it. (slide of bonding) (3 insert slide 61 of group 2)

Airflex uses a high quality molded asbestos friction material, as opposed to woven friction material. Mainly because the molded material has a lower coefficient of friction, thereby, imposing lower stresses in the rubber tube. Also we feel that the molded asbestos friction material (although having a lower coefficient of friction) is much kinder to the drum.

The friction material is bonded to a cadmium plated backing plate using a special adhesive under heat and pressure. The finished friction shoe must meet the same quality control requirements as all other Airflex products.

The shoe is attached to the tube with shoepins and the lockwire which are cadmium plated to resist corrosion. (slide close-up of lockwire) The use of the lockwire prevents rotation of the pin during operation. It is desireable to prevent the pin from rotating to eliminate the possibility of wear to the tube and holes in the friction shoes. Only a pair of pliers is needed to install the lockwires - No special tools. We tried snap rings as used by Pneu-Grip many years ago, but discarded the idea because of pin rotation causing premature tube failure.

The final manufacturing step is to balance the unit on one of several balancing machines. (slide of balancer-need at 41) Depending on the size of the element, unbalance is either corrected by weight addition or weight removal. (2 slide of welding lugs onto rim)

A coat of distinctive coppertone paint, (slide painted booth) the application of the Airflex decal, (decal slide) and the unit is ready for the stockroom.

Several million dollars worth of parts are stocked at all times (various slides (5) of stockroom) to satisfy customers' requirements.

To continue to provide a truly quality product and develop new products, we maintain an in-plant test facility (slides (4) of lab) (note Power Flow clutch) equipped with a 300 HP teststand. Here, the bugs are worked out of new product designs and ways are found to improve existing products. Although the basic operating principal of the clutch remains the same, many improvements have been made to the design, construction, and materials throughout the years.

A continuing in-plant R & D Program is maintained to keep pace with todays fast moving technology. For example, we recently purchased a new friction testing machine at a cost of more than $50,000 to more closely evaluate the new materials appearing on the market.

As part of Eaton Corporation, we also have available to us, the Corporate Research Center located in Southfield, Michigan. (slide 2 of aerial views) This facility has the capability to carry out any product research and development which is beyond our plant capacity. To improve manufacturing processes and equipment, we can call upon the expertise of the Eaton Manufacturing Services Center in Cleveland, Ohio.

In conclusion, why buy "Airflex"