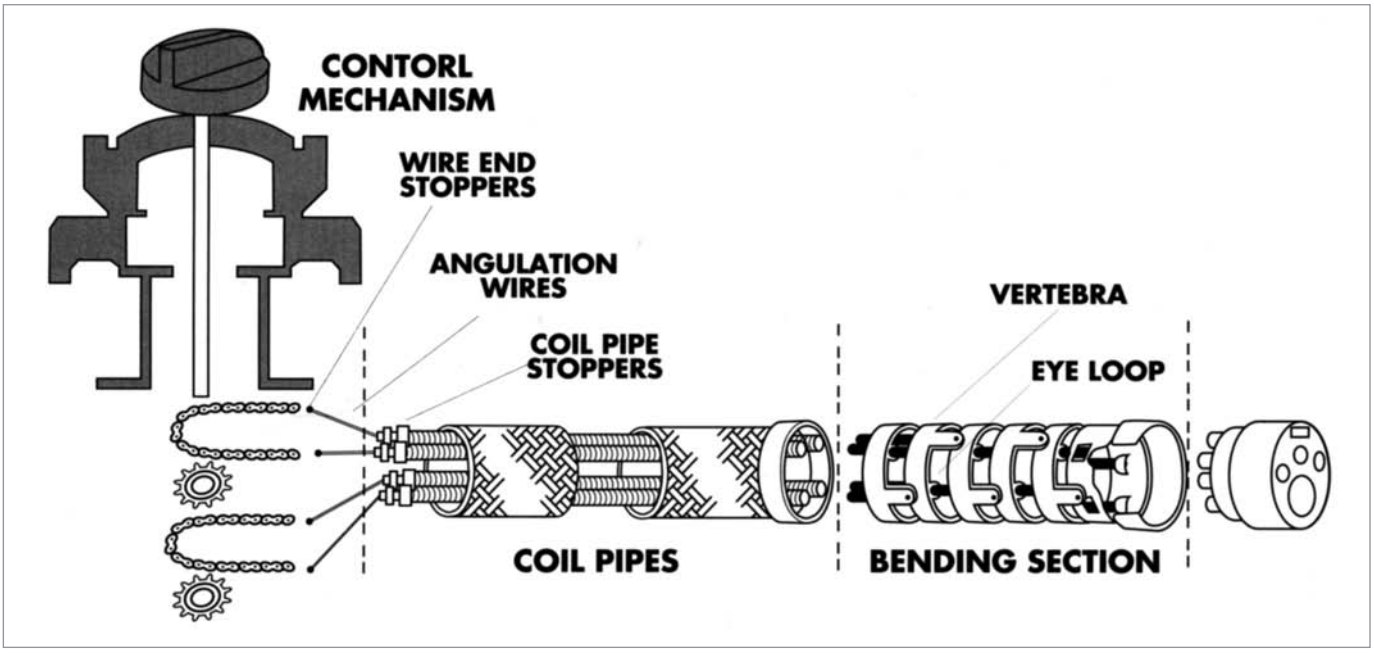
FIBERTECH MEDICAL, U.S.A.

How it Works

PART ONE

The Angulation System

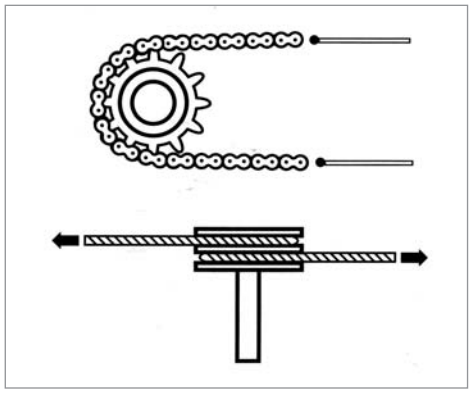


FiberTech first exhibited at a regional SGNA show in 1989. Our plan was simple: have an open endoscope lying on our display table and explain to the exhibit participants how the internal components work together. We showed pictures of the inside of biopsy channels and had samples of channels with glutaraldehyde build-up. Our display booth was teeming with curious customers who wanted to know how their scopes worked and how to keep them in good working order. FiberTech's success had begun! This new series is dedicated to those curious individuals who want to know more than what the operator's manual tells them.

Everyone wants to know how their endoscopes work and the angulation system is especially intriguing. To be capable of rotating a knob in your hands while watching the tip articulate back and forth as far away as two meters, makes a scope seem like a video game operated with a "joystick". The angulation system can be broken down into three areas; the control mechanism, the coil pipes and the bending section.

CONTROL MECHANISM

Scopes can be articulated by either a wire pulley assembly or a chain drive. The wire pulley is the most commonly used assembly on flexible scope models. Olympus switched to a chain drive system on the larger endoscope models when they introduced their submersible OES generation in 1983.



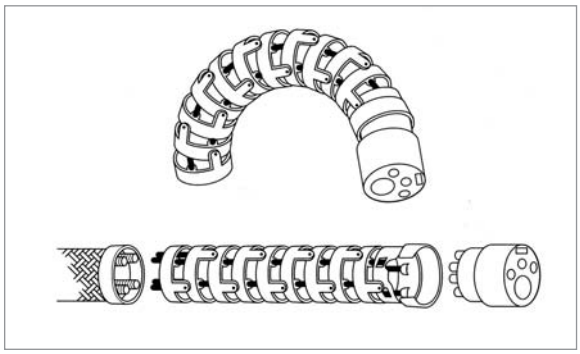
The pulley system utilizes a pair of multi-stranded wire cables attached to a two-slotted pulley and terminates with a solid stopper on the other end. The wire is wound around the pulley like a Yo-Yo. Force applied to the angulation knobs turn the pulleys which pull the wires as they wind themselves up. The other slot of the pulley releases tension by feeding out wire to give slack to the opposite side. There is one pulley for the up and down angulation and another for left and right angulation (if the scope has left/right capabilities). A shaft in the control body connects the pulleys to the control knobs.

The current Olympus models have replaced the cable and pulley with a chain and sprocket system similar to that of a bicycle. The chain wraps around the sprocket and moves in the direction it is turning. The chain and the angulation wire inside the insertion tube are attached together.

Both systems require regular maintenance to reduce “free play” which may cause a malfunction or contribute to component wear. Cable guides provide a track to keep the movement running smoothly and to prevent the cables and stoppers from catching on one another. Adjustments as to how far the distal tip can bend are made by installing stop plates which catch the wire end stoppers and restrict how far the wires can travel.. This adjustment is important because over-angulating can cause the wire to break.

The next components are the angulation wires and coil pipes. Coil pipes are flexible springs attached to the inner wall of the insertion tube. They direct the wires in the proper direction. When an insertion tube snakes into and “S” shape, the coil pipes have been crossed or have become detached. The angulation wires pass through the coil pipes which offer protection to the internal elements from the up and down sawing motion of the wires. They are in constant movement while steering the distal tip through the lumen. If the angulation system stiffens and becomes difficult to achieve sufficient tip deflection, there may be a problem related to the coil pipes. Most service companies do not attempt intricate repairs such as angulation wire or coil pipe replacements. A thorough knowledge of scope operation is necessary otherwise the condition of a scope may deteriorate after a repair attempt.

BENDING SECTION



The bending section is the “vertebrae” of the endoscope. Several metal bands are hinged together in a manner that alternates vertebra-air space-vertebra. This configuration enables the vertebrae to move vertically and horizontally.

IN CLOSING

The knobs turn and then a wire wraps around a pulley or a chain around a sprocket that pulls the wire up through the coil pipes. The wire is threaded through and eye loop on each vertebra down to the distal tip where it is attached. This tension reduces the air space causing the distal tip to bend in that direction. By turning another knob, a wire bends the tips in another direction. A combination of up/down and left/right allows the tip to bend in any direction. By pushing the insertion tube a little, you can steer and advance through most intricate lumens of the body as far as the instrument’s length will allow.