
The Browning Electric System 3-Speed

Operations, Installation
and Maintenance Manual



CONGRATULATIONS

The Browning ES-3 represents a significant advancement in bicycle technology. Ten years of careful engineering and development make the ES-3 the newest, most efficient method of changing gear ratios. This gives you the ultimate in reliability and high performance.

This unique mechanism uses new terminology and procedures that you need to know. This manual is a key element in the understanding, installation, and maintenance of your new transmission. PLEASE READ THE MANUAL CAREFULLY.

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Safety Instructions

- 1- The installation instructions in this manual are intended as a reference for skilled bicycle mechanics only.
- 2- This manual contains a list of recommended accessories which are required to ensure the safe operation of the transmission.
- 3- The Browning Transmission must be kept clean. Please refer to maintenance instructions for specific details.

Proper Shifting

Here are some important rules you should follow while shifting your bicycle:

- 1- Anticipate your shifts. The idea of multiple speeds on a bicycle is to allow the rider to maintain his or her pedal cadence over a wide range of terrain conditions. If you see a hill coming, shift to a lower gear before your cadence becomes too slow. When coming to a stop, shift to a low gear before the stop so you will be in the proper gear when you start riding again. The ES-3 has been designed to shift under any possible conditions, regardless of pedal pressure. However, you will still want to anticipate your shifts.
- 2- Avoid extreme crossovers. Do not ride with the chain on the largest chainring and the largest freewheel sprocket. Do not ride with the chain on the smallest chainring and on the smallest freewheel sprocket. Both these situations put the chain at an excessive angle and will cause accelerated wear.

Off-Road Riding

The introduction of the all-terrain bicycle has brought the cyclist into the forests and mountains. If you intend to ride your ATB off-road, please follow this guide to safe off-road riding:

- 1- Always wear a helmet and protective clothing.
- 2- Always Yield. Trails are shared by hikers, horses and bikers. Move off trails to allow horses to pass and stop to allow hikers adequate room to share the trail. Simply yelling "bicycle" is not acceptable.
- 3- Keep Groups Small. Riding in packs degrades the outdoor experience for others, can disturb wildlife, and often leads to greater resource damage.
- 4- Avoid Riding on Wet Trails. Bicycle tires leave narrow ruts in wet trails which concentrate water runoff and accelerate erosion. Postponing a ride during wet conditions will preserve trails for the future.
- 5- Stay on Trails. Riding cross-country damages natural resources and is illegal.
- 6- Control Your Speed. Excessive speed endangers yourself and other forest users.

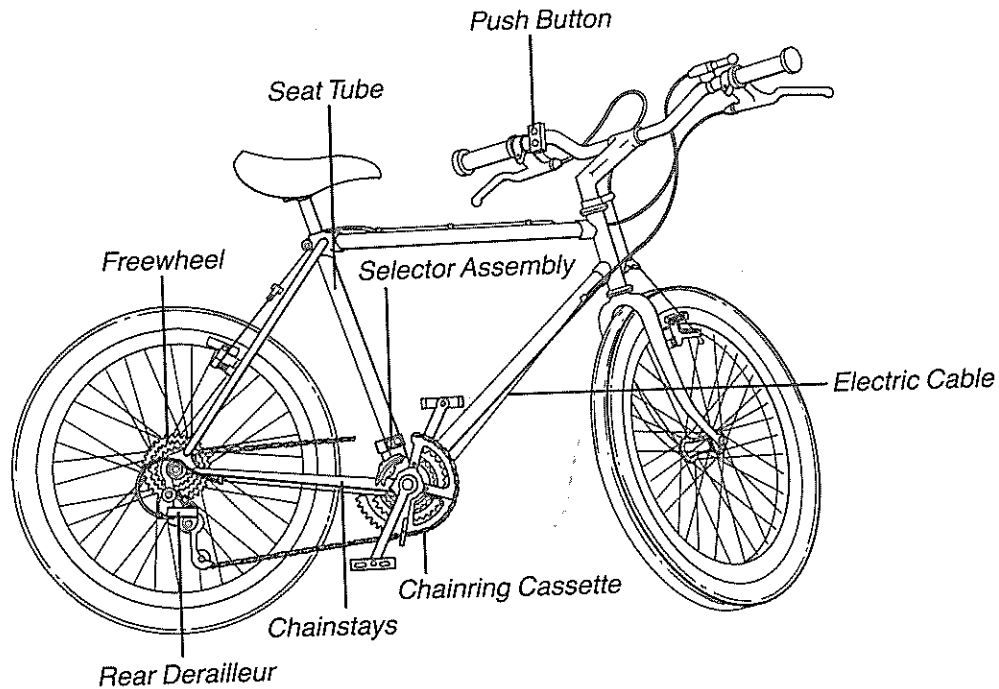


Illustration #1: Bicycle Components

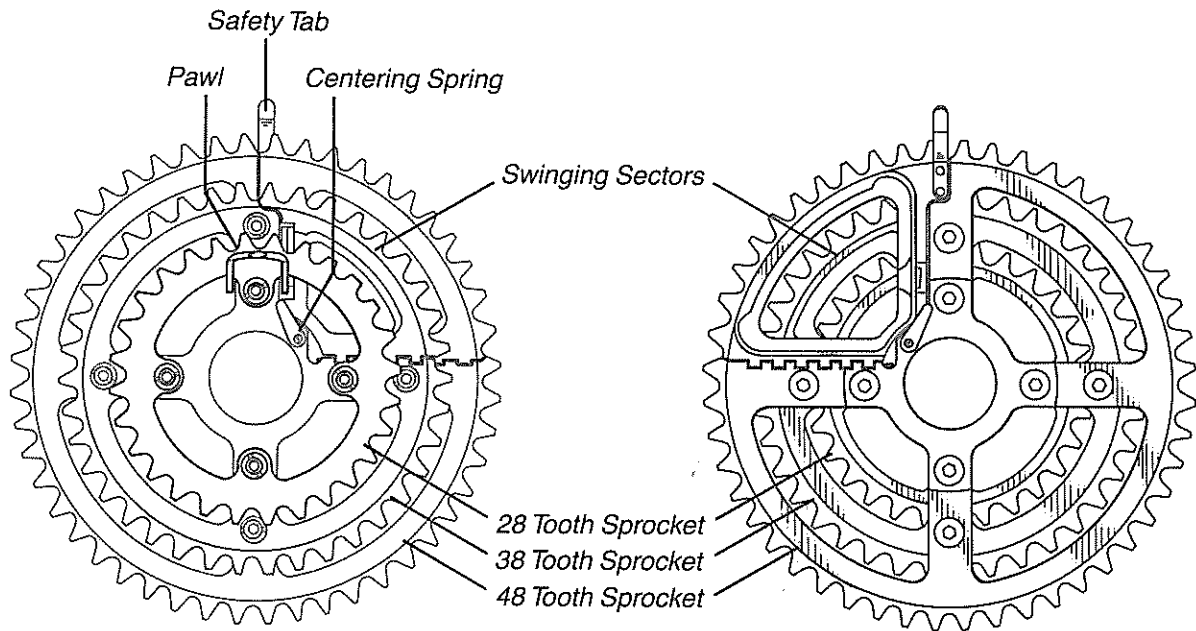


Illustration #2: Rear View of Chainring Cassette

Illustration #3: Front View of Chainring Cassette

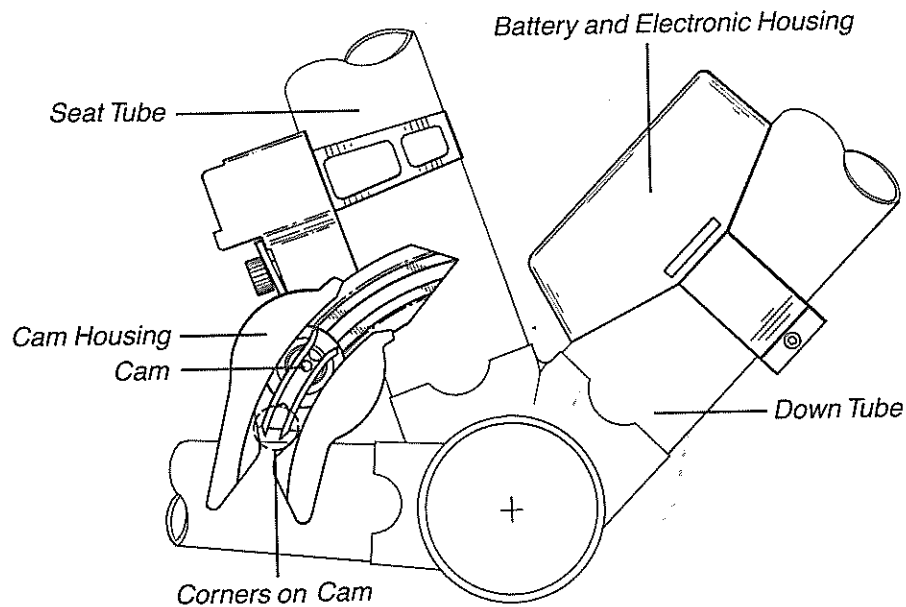


Illustration #4: Front View of Selector Assembly in Position on Seat Tube

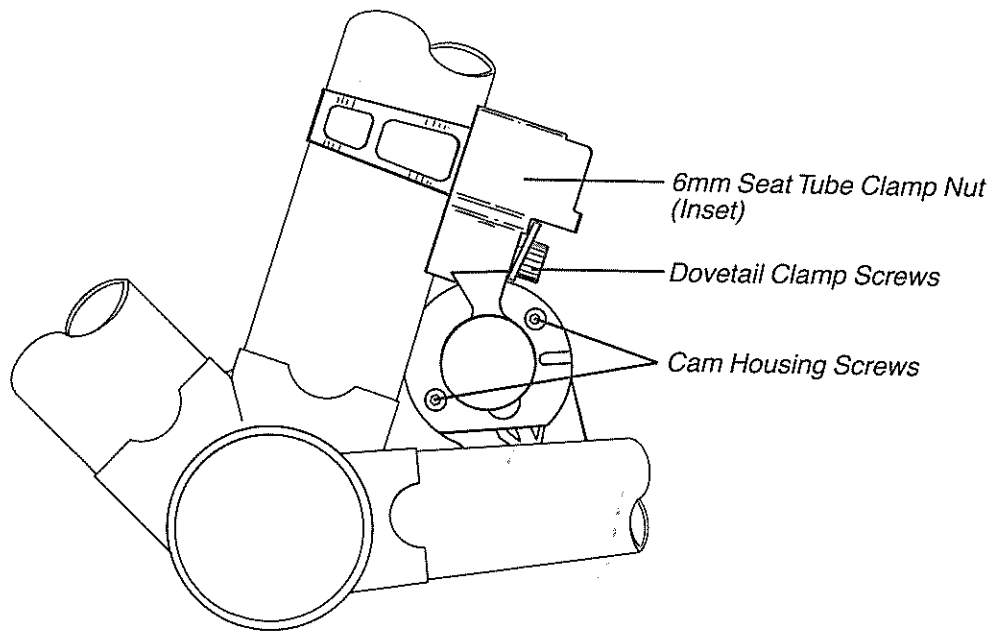


Illustration #5: Rear View of Selector Assembly in Position on Seat Tube

Transmission Operation

The Browning ES-3 Transmission is an entirely new method of switching gear ratios on a bicycle. The rider may switch up or down while turning the crank with full pressure on the pedals. The transmission requires no skill or special procedures to operate and is therefore ideal for the difficult conditions of various off-road riding.

- 1- When the "down" button is depressed, the chain will switch to, and stay in, the next adjacent smaller sprocket (Illustration #6).
- 2- When the "up" button is depressed, the chain is switched to, and will stay in, the next adjacent larger sprocket until another gear is selected (Illustration #7).

The gear switch is achieved only when the crankarm is turning in the forward direction. Pedal rotation can be reversed at any time during the switching mode without damaging the mechanism.

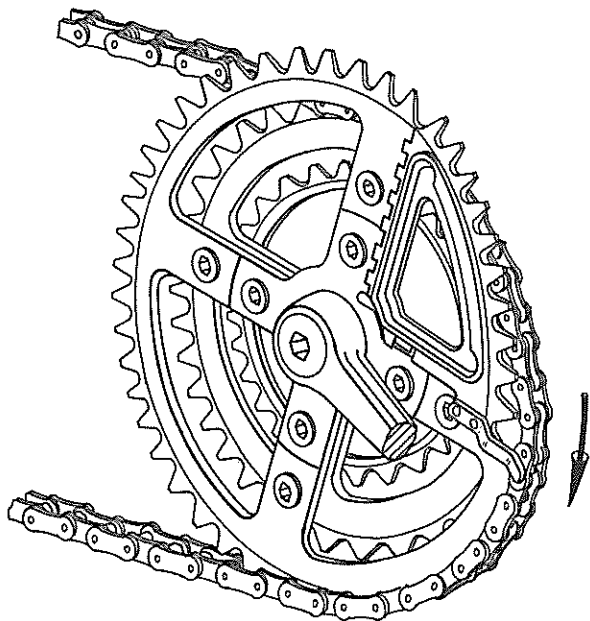


Illustration #6: Side View of Chain Being Switched Down to a Smaller Sprocket

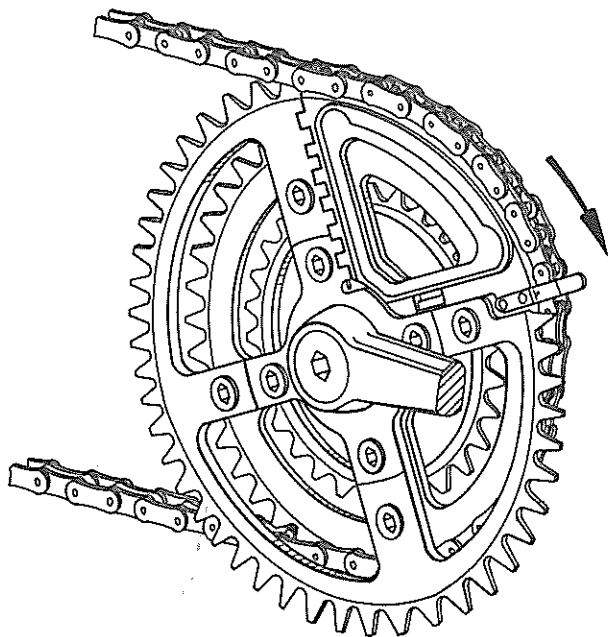


Illustration #7: Side View of Chain Being Switched Up to a Larger Sprocket

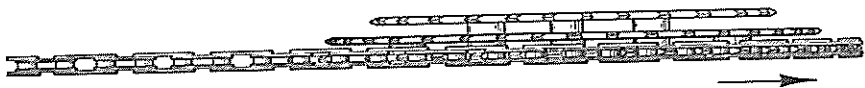


Illustration #8: Top View of Chain on Large Sprocket



Illustration #9: Top View of Chain Being Switched Down to a Smaller Sprocket



Illustration #10: Top View of Chain Being Switched Up to a Larger Sprocket

If the sprockets of the Browning Transmission assembly are compared to parallel railroad tracks, then the swinging sectors on the two larger sprockets of the transmission are the same as a switch between the railroad tracks. Just as the train is switched from one track to the other without derailing, the swinging sectors move the chain from one sprocket to the other without ever letting go of the chain. The railroad train is switched by moving a part of the track. The transmission switches the chain by moving a part of the sprocket.

The movable parts of the sprockets are called the swinging sectors. On the Browning Transmission, the swinging sectors are moved by a lever called the pawl to switch the chain up or down. When the pawl pivots up and out toward the sprocket teeth, the swinging sector swings away from the bicycle and the chain moves from a large sprocket to a small sprocket. When the pawl pivots in and down from the sprocket teeth toward the hub, the swinging sector swings toward the bike and the chain moves from a small sprocket to a large sprocket.

The pawl is pivoted up or down by the cam in the selector assembly. The cam and the grooves in the cam housing hold the pawl in the "Up" or "Down" position for the time necessary to accomplish the switching operation. The cam has three positions: Neutral (Illustration #11), Switched "Up" (Illustration #12), and Switched "Down" (Illustration #13).

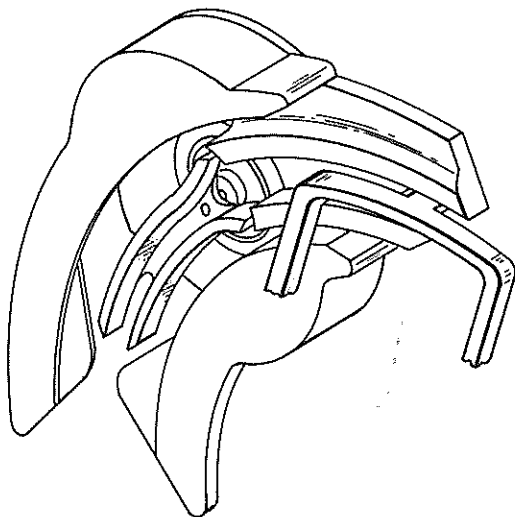


Illustration #11: Cam in Neutral Position

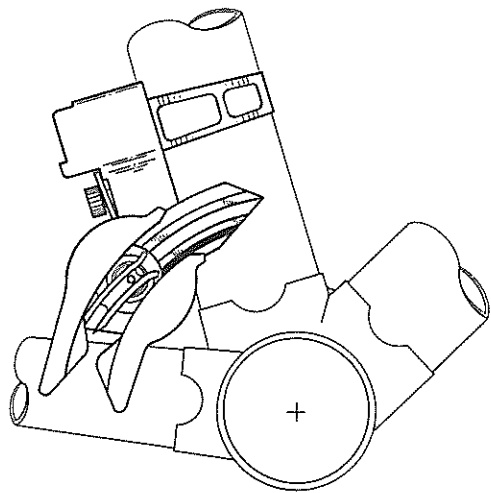


Illustration #12: Cam in Switched "Up" Position—
Pawl will Track Lower Groove

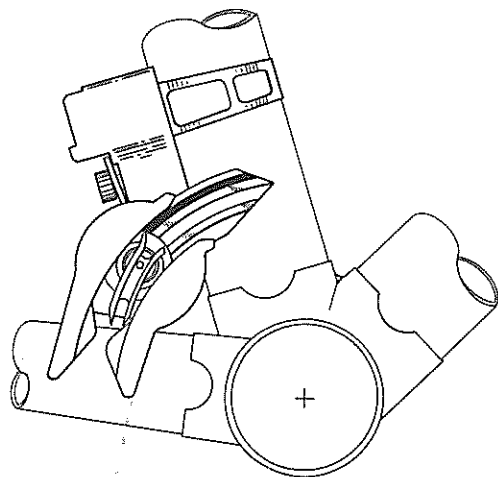


Illustration #13: Cam in Switched "Down" Position—
Pawl will Track Upper Groove

Installation on Bicycle

List of items in Box:

- Mounting Bracket Assembly
- Selector Assembly
- Electronic/Battery Box
- Push Button Switch and Necessary Wire
- Chainring Cassette and Left Crankarm
- Registration/Warranty Card

Other items required for installation: (Not included)

- Chain: We recommend the Sedisport $1/2'' \times 3/32''$ (12.7mm \times 2.38mm)
- Bottom Bracket Assembly with appropriate length spindle: We recommend the *Specialized* 120mm or 125mm spindle (see step 4).
- Freewheel Spacers (not required for all installations)
- 9 Volt Alkaline Battery

Step 1—Removal of Existing Crankarms

On assembled bicycles the existing crankarms must be removed.

Step 2—Inspection

Examine the Browning Chainring Cassette. The movement of the pawl and the swinging sectors should be free in both directions. The swinging sectors should pivot easily 5 degrees in both directions. The return spring should snap the sectors back to the center position in a lively manner.

Step 3—Mounting the Chainring Cassette

Mount the Chainring Cassette onto the right spindle and tighten to approximately 18-20 ft-lbs. torque.

Step 4—Chainstay/Pawl Clearance

Slowly rotate the Chainring Cassette and Crankarms. The pawl on the sprocket assembly must clear the right chainstay (Illustration #14). Clearance between the pawl end and chainstay may be as little as .020" (.5mm).

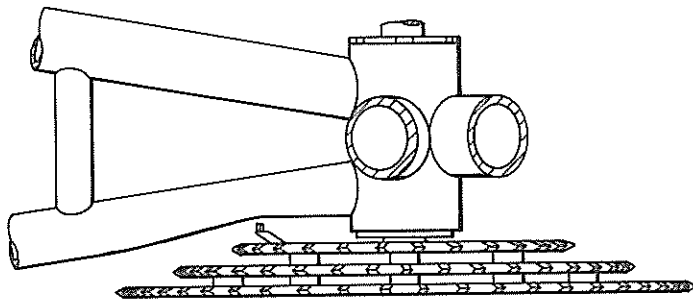


Illustration #14: Pawl Clearance in Relation to Right Chainstay

If the chainstay interferes with the pawl you can achieve the proper clearance in one of three ways:

- 1- Install a Bottom Bracket spindle of a different length. Avoid radical changes in spindle length which could adversely affect chain alignment. Chain alignment must be maintained (Illustration #15). Freewheel spacers can be used to compensate for misalignment on conventional freewheels.
- 2- Use the Browning Dimpling Tool to dimple the right chainstay (Illustration #16). Instructions are on page 19.
- 3- Combination of steps 1 and 2.

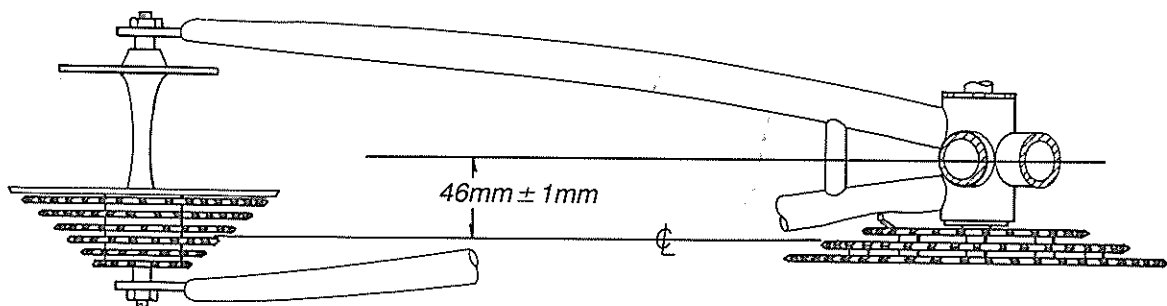


Illustration #15: Alignment of Centerline with the Rear Freewheel

Browning Dimpling Tool

The dimpling tool has been designed to “dimple” the right chainstay in order to provide clearance for the pawl. The use of the tool is as follows:

- 1- With the chainring cassette installed, slowly backpedal the crankarms until the pawl touches the chainstay. Notice how much clearance will be needed for the pawl to clear the chainstay. Remove the chainring cassette.
- 2- Remove the bottom bracket (BB) assembly from the bicycle.
- 3- Remove the “U” bolt from the dimpling tool.
- 4- Insert the main shaft through the BB assembly from the right side and thread on the large knurled nut until snug.
- 5- Position the base plate parallel with the right chainstay.
- 6- Place the “U” bolt around the right chainstay and position back into place on the base plate and hand tighten.
- 7- Using a socket or a box end wrench, turn the bolt so that the die shoe dimples the right chainstay by the amount required.
- 8- Remove the “dimpling” tool in reverse order and re-install the BB assembly.

Dimpling Tool should not be used on heat treated aluminum frames.

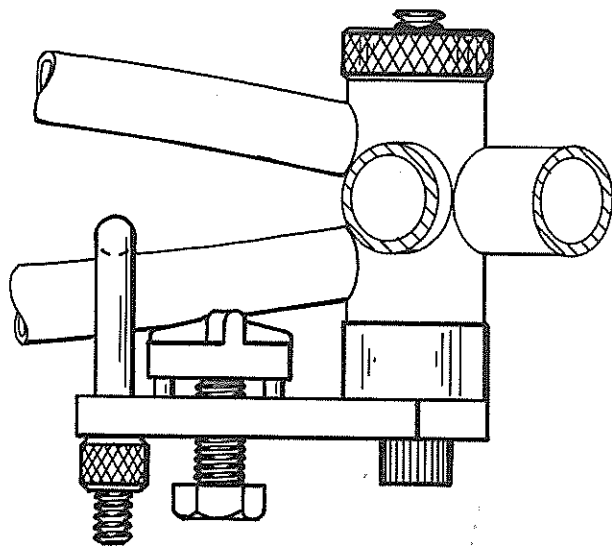


Illustration #16: Dimpling the Right Chainstay using the Browning Dimpling Tool

Step 5—Mounting the Selector Assembly

- 1- Remove the rear wheel.
- 2- Assemble the endless band on the seat tube.
- 3- Install the 6mm seat tube clamp nut on the endless band but do not tighten.
- 4- Attach the selector assembly to the bracket by placing the dovetail clamp over the dovetail on the selector assembly and tighten the dovetail clamp screws only enough to hold the selector assembly in the dovetail groove. This will facilitate the lateral adjustment of the selector assembly.

Step 6—Adjusting the Selector Assembly

Now adjust the mounting bracket and the selector assembly on the seat tube until the centerline of the selector assembly is on a 2" radius from the centerline of the bottom bracket. The pawl, which travels on a 2" radius around the axle, can be used as a guide to obtain this adjustment, or the Browning Alignment Gauge can be used.

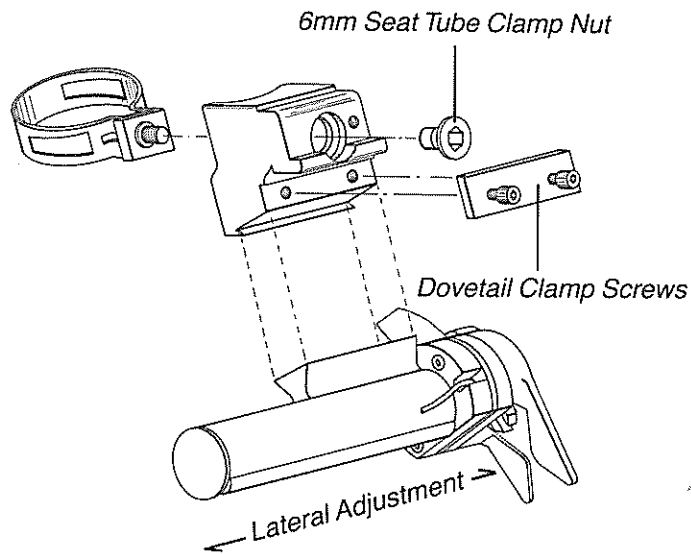


Illustration #17: Mounting of the Selector Assembly Unit to the Mounting Bracket

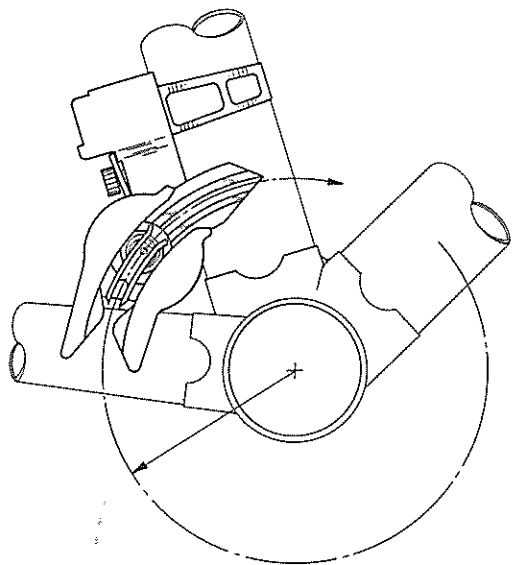


Illustration #18: Selector Assembly in Position Allowing 2" Radius

Step 6A—Adjusting the Selector Assembly Without the Alignment Gauge

The Browning ES-3 Selector Assembly can be adjusted in 3 directions (Illustration #19)

- A- Radially by loosening the cam housing screws and rotating the cam housing.
- B- Laterally by loosening the dovetail screws and sliding the selector assembly.
- C- Up and down by loosening the 6mm seat tube clamp nut on the seat tube.

All necessary adjustments can be made using the chainring cassette and the pawl as a guide.

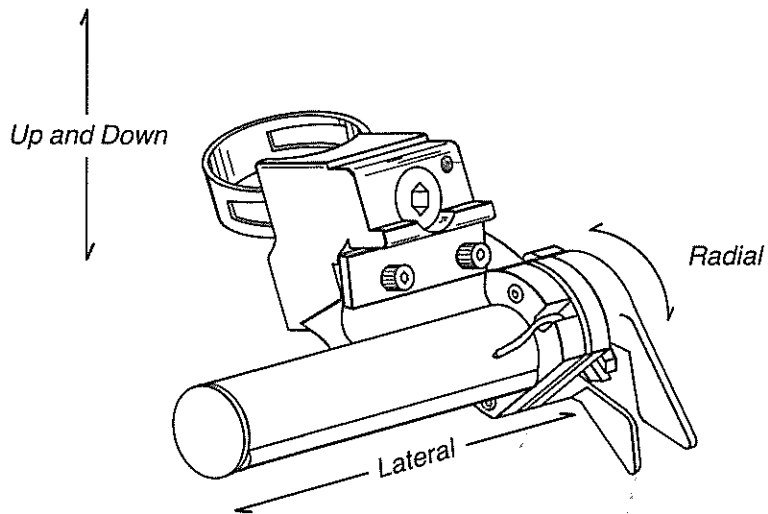


Illustration #19: Radial, Lateral, and Up and Down Adjustment of the Selector Assembly

- 1- Install the chainring cassette ensuring clearance between the pawl and the right chainstay as described in step 4.
- 2- Slowly backpedal while observing the position of the pawl as it approaches the cam housing. The pawl must enter the center groove of the cam housing and pass freely through the entire cam housing.
- 3- By moving the selector assembly up or down on the seat tube, in and out laterally, and rotating the cam housing clockwise or counterclockwise, the proper alignment can be achieved. While making these adjustments remember that the cam housing face must remain parallel with the chainring to maintain constant penetration of the pawl as it passes through the cam housing (Illustration # 21).
- 4- The pawl must penetrate the cam housing groove as far as possible without the pawl shoulder contacting the cam housing (Illustration # 20). If the pawl penetrates too deeply causing the pawl shoulder to touch the cam housing, loosen only the dovetail clamp screws and laterally move the selector assembly until proper penetration is achieved.
- 5- Tighten the 6mm seat tube clamp nut, the cam housing screws, and the dovetail clamp screws.

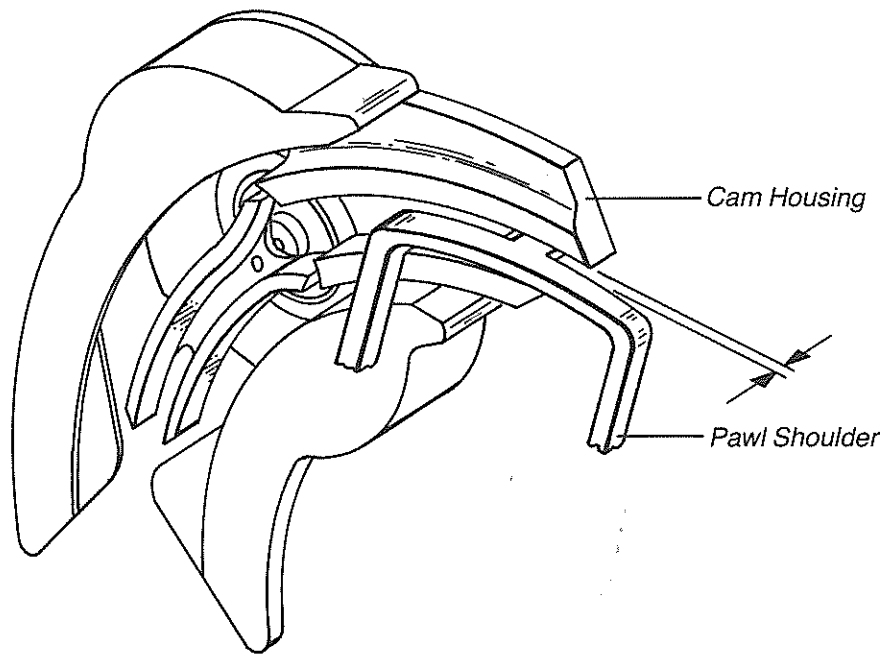


Illustration #20: Penetration of the Pawl into the Cam Housing

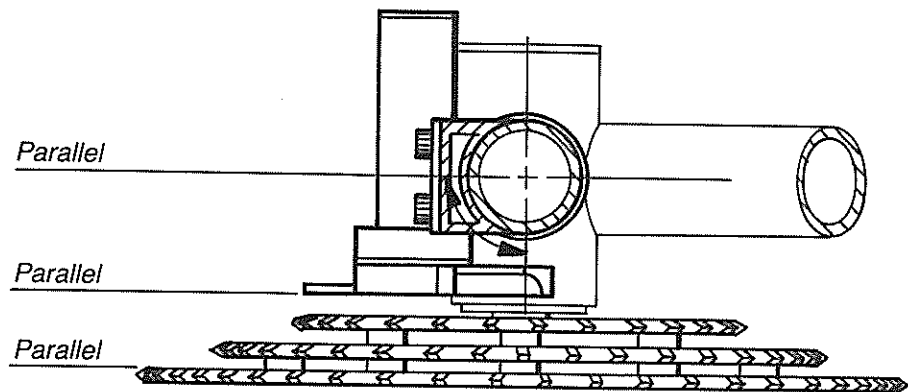


Illustration #21: Cam Housing Parallel with Chainrings

Step 6B— Adjusting the Selector Assembly Using the Alignment Gauge

The alignment gauge will establish all the necessary settings for the selector assembly with the exception of the lateral position adjustment.

- 1- Remove the right crankarm and mount the alignment gauge on the spindle.
- 2- Loosen the cam housing screws. By turning the alignment gauge in a backpedaling direction, position the simulated pawl into the front center groove of the cam housing.

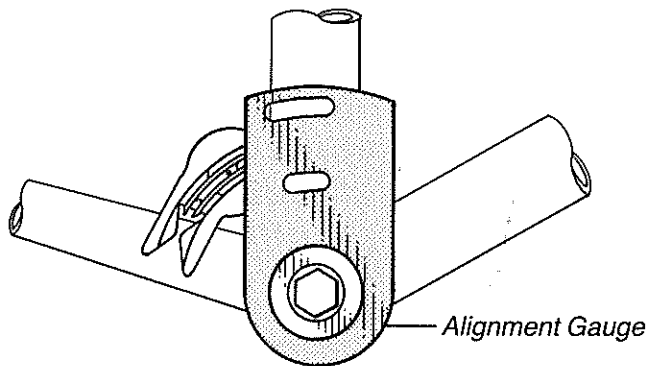


Illustration #22: Alignment Gauge Entering Center Groove of the Cam Housing

- 3- With the cam housing screws loose, rotating the cam housing clockwise or counterclockwise will align the simulated pawl with the center groove of the cam housing.
- 4- Loosen the dovetail clamp screws. Press the back of the motor housing so that the selector assembly slides forward making the cam housing flush or parallel with the inside face of the gauge (Illustration # 23). Rotate the gauge in a backpedaling direction until it stops. **Do not force.** By moving the complete assembly up or down on the seat tube while rotating the cam housing clockwise or counterclockwise and by keeping the cam housing face parallel with the alignment gauge face, the correct alignment will be made.
- 5- Tighten the dovetail clamp screws, the cam housing screws and the 6mm seat tube clamp nut.
- 6- Remove the alignment gauge and remount the chainring cassette and crankarm.
- 7- Slowly rotate the chainring cassette while observing the pawl as it passes through the selector assembly. The cam housing face should be parallel with the chainrings and the pawl should pass freely through the center groove of the cam housing. The pawl must penetrate the cam groove as far as possible without the pawl shoulder contacting the cam housing (Illustration #20). If the pawl penetrates too deeply causing the pawl shoulder to touch the cam housing, loosen only the dovetail clamp screws and laterally move the selector assembly until the proper penetration is achieved.

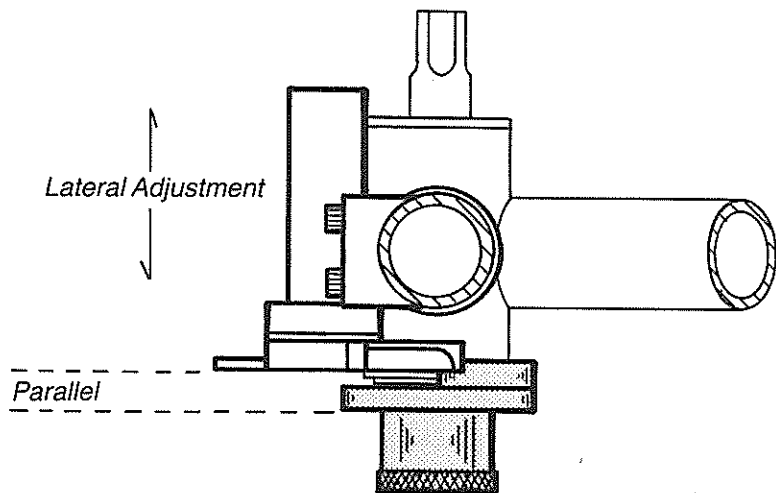


Illustration #23: Face of the Alignment Gauge Parallel with the Cam Housing

Step 7—Push Button Control and Cable Connection

- 1- Place the push button control in the desired position on the handlebars.
- 2- Insert the female end of the cable into the male end on the button and place the cable in the recess.
- 3- Attach the push button control back and tighten the screws.

Step 8—Electric Cable Placement

Placement of the electric cable is variable and dependent upon individual taste. One suggested placement is to position the cable along the back side of the handlebar and down the side of the head tube. It is advisable to then make a small loop and continue down the down tube until you reach the battery/electronic box. You may want to use the rubber channel with double stick backing or “Zipties” to secure the cable. Slowly rotate the handlebars while inspecting the cable for clearance.

Step 9—Attaching the Left Crankarm

Attach the left crankarm and tighten to 18-20 ft-lbs torque.

Step 10– Battery/Electronics Box Assembly and Placement

- 1- Attach the female ends of the cables from the push button control and selector assembly into appropriate connections in the battery/electronics box.
- 2- Attach a 9 volt alkaline battery to standard terminals in the box and attach the cover. The battery/electronics box should be positioned on the bottom of the down tube.

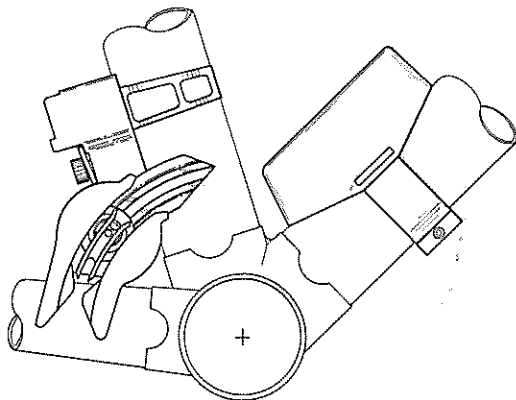


Illustration #24: Battery/Electronics Box Mounted on the Down Tube

Step 11 – Mounting the Inside Chainguard

With the chain on the small front chainring and large rear freewheel cog, mount the chainguard using the screw and washer provided (Illustration #25). Mount the chainguard as close to the chain as possible while allowing free movement of the chain. This will prevent accidental derailing under severe shock conditions.

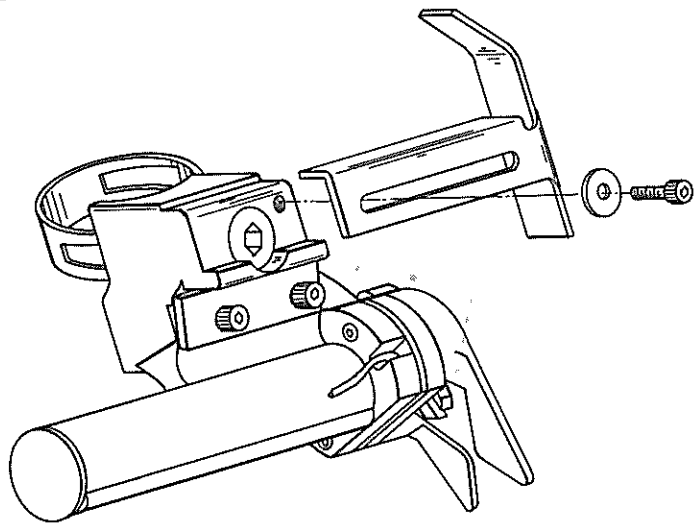


Illustration # 25: Mounting the Inside Chainguard on the Selector Assembly

TEST STAND PROCEDURES

All tests should be done with the bike on the test stand.

- 1- Push the “down” button and revolve the chainring forward letting the pawl enter and pass through the selector assembly. The swinging sector should momentarily move “out” and then realign back to its original position.
- 2- Push the “up” button and revolve the chainring forward letting the pawl enter and pass through the selector assembly. The swinging sector should momentarily move “in” and then realign back to its original position.

In both cases the pawl should reset the cam back to a neutral position.

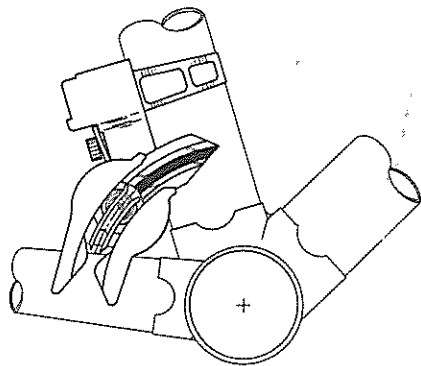


Illustration #26: Cam in Neutral Position

- 3- Depress the “up” button and rotate the crank backwards several turns. The pawl will make a slight click as it tracks back through the cam housing; otherwise the crank will rotate freely.
- 4- Remove the chain and push the “up” switch.
- 5- Slowly rotate the chainring in the forward direction so that the pawl enters the selector assembly. Gently continue the forward rotation until the swinging sector is in its extreme inward lean position.
- 6- Gently push in on the 48 tooth swinging sector. There should not be any noticeable movement in the swinging sector. If movement occurs, it is necessary to reposition the selector assembly down on the seat tube until movement is eliminated. Please be certain that the lateral position is correct (Illustration # 20). This insures that the chain will be transferred “up” in extreme chain angle conditions.
- 7- Depress the “down” button and rotate the crank backwards several turns. The pawl will make a slight click as it tracks back through the cam housing; otherwise the crank will rotate freely.

Maintenance Instructions

The only general maintenance requirement for the Browning Transmission is to keep it clean. Every 24 months, remove the cam housing and replace the compression spring (ATB-184).

Chain

Maintenance of the chain is especially important with the Browning Transmission which employs a chain tensioner. Spray the chain with a degreaser, wipe clean, and spray with a chain lubricant.

Sprocket Assembly

Keep the sprocket teeth and pawl clean and dry. Spray with degreaser if necessary and wipe clean.

Selector Assembly

The selector assembly may be removed from the mounting bracket for easier cleaning. It is removed by disconnecting the electrical/battery box connection and loosening the two dovetail screws (Illustration #17). While cleaning the selector assembly, examine the operating corners of the cam (Illustration # 20). If the operating corners are worn or damaged, the cam must be replaced. To remove the cam, grasp one of the rails of the cam and pull firmly. Do not spray or oil any part of the selector assembly. Do not immerse the selector assembly in any liquid or clean with a wire brush. On a regular basis, brush dirt and dust away with a small inexpensive paint brush. Reinstall the selector assembly and reset the lateral adjustment.

Battery Condition

Use a new 9 volt alkaline. Battery life is approximately 30,000 shifts or the shelf life of the battery. As the battery gets weak, the Browning Transmission will favor a shift in one direction (upshift or downshift). To achieve a shift you will be forced to press the shift button twice in the weak direction. When this condition occurs, remove the electrical/battery box cover and replace the battery.

Chainring Fixing Bolts

Regularly inspect these bolts to make sure they are tight.

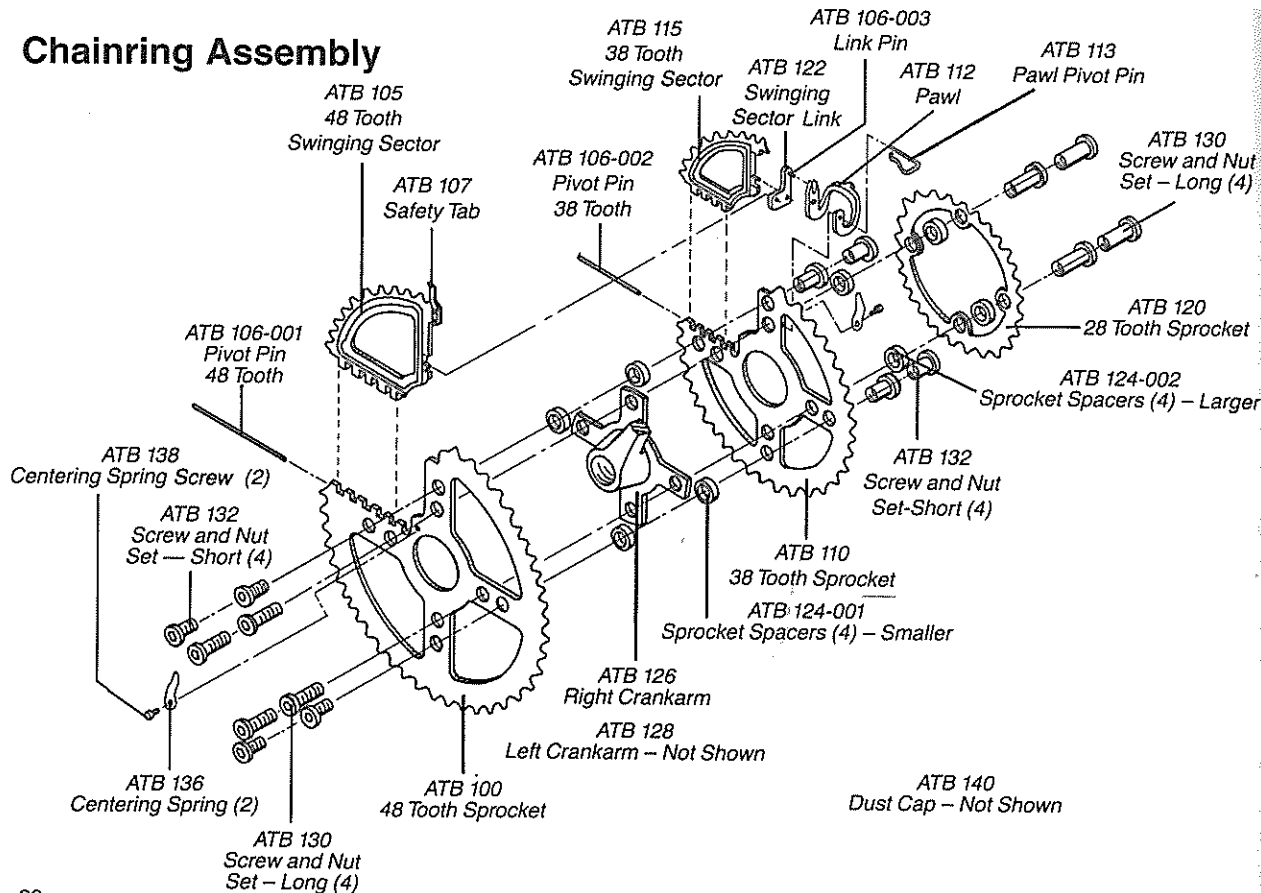
Dovetail Bolts and Cam Housing

Keep tight.

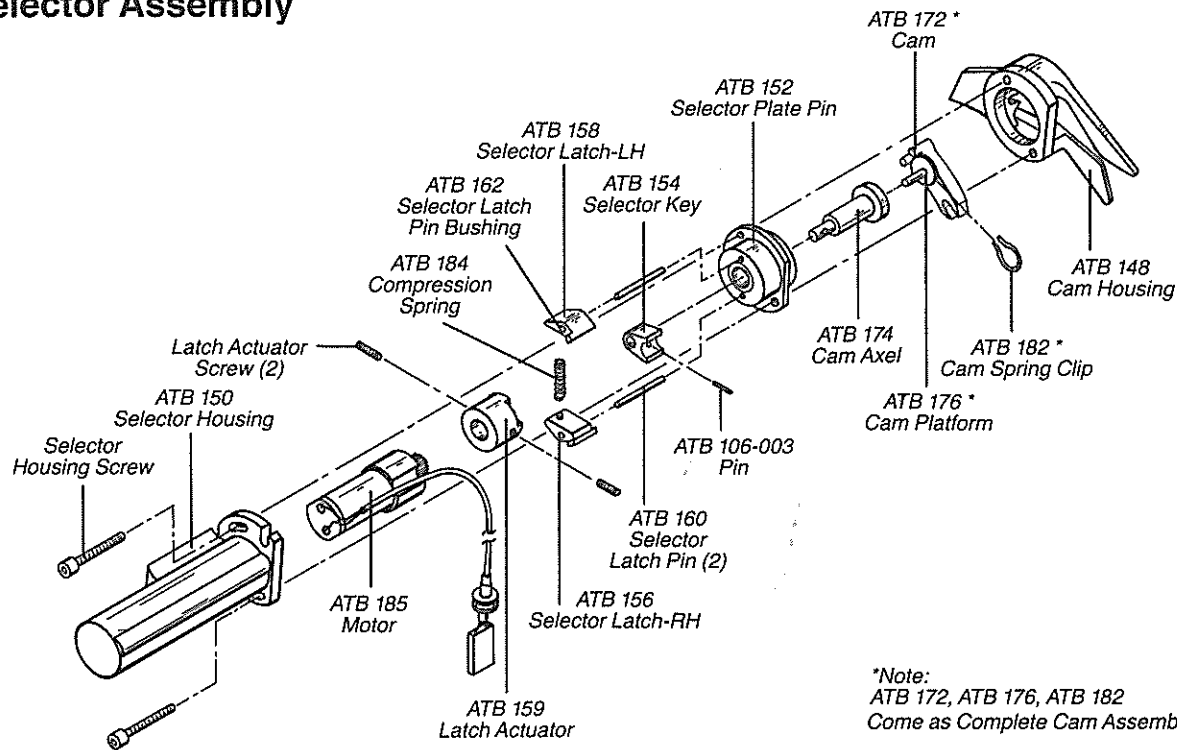
Push Button Assembly and Wires

Replace if damaged, torn, or crimped.

Chaining Assembly

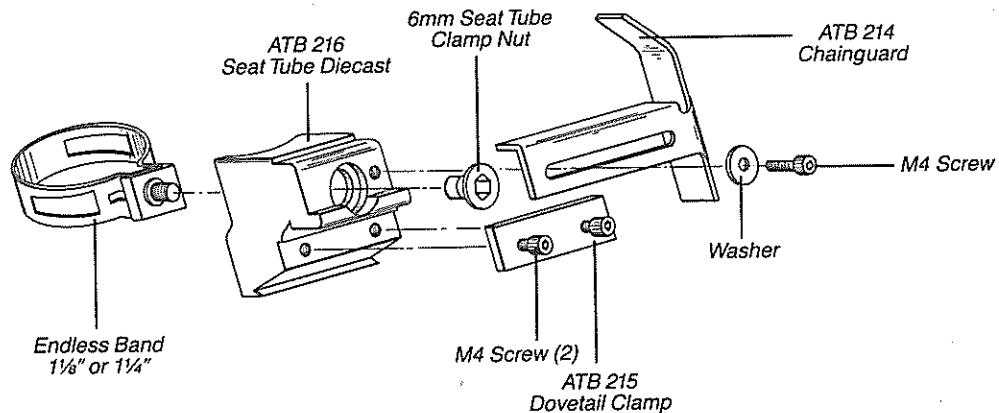


Selector Assembly



*Note:
ATB 172, ATB 176, ATB 182
Come as Complete Cam Assembly

Seat Tube Clamp Assembly



Notes



BROWNING

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