

# Technical Manual

Version 1.0  
7/1/01

**For the Browning SmartShift 400  
Four-Speed Transmission**




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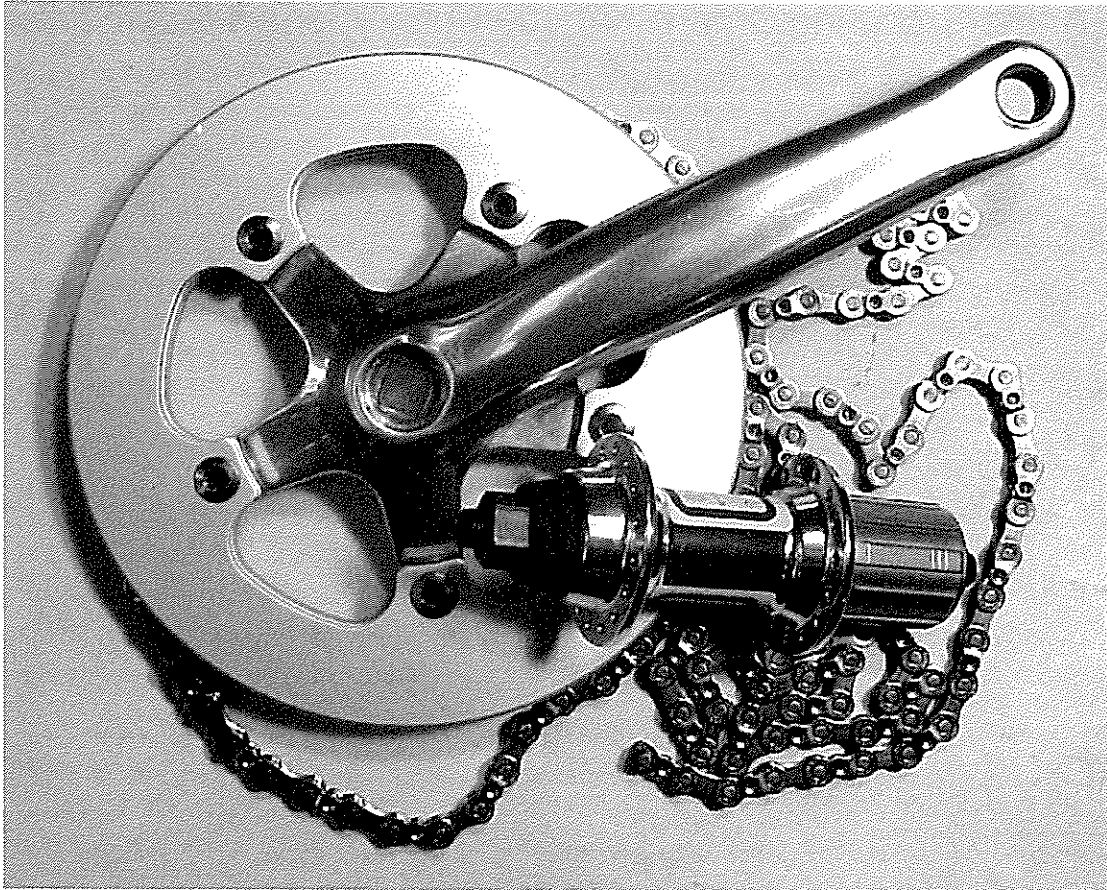
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# Introduction

This Technical Manual has been prepared to provide the detailed information which a frame builder or bicycle manufacturer/assembler will need to correctly assemble bicycles with the Browning SmartShift 400 Four-Speed Transmission.

 **WARNING: Any deviation from the specifications, dimensions or instructions provided in this Manual could result in less than optimal component function, component or frame damage, or serious injury to the bicycle rider.**

Any questions or suggestions should be directed to Technical Support, Browning Bicycle Component, L.L.C. by telephone at 425.637.8637 or by e-mail at [tech@browningcomponent.com](mailto:tech@browningcomponent.com)



## Section 1

### Parts Requirements and Recommendations

## For the Browning SmartShift 400 Four-Speed Transmission

### BRAZE-ON REAR MOUNT

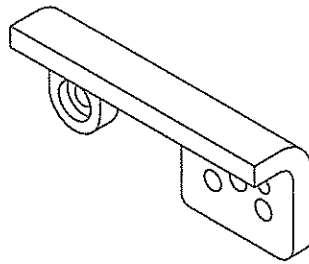


Fig.1-1

Braze on to be mitered to fit Chain stay.  
Rear Mount, Aluminum, Browning Drawing #ABR-11  
Rear Mount, Steel, Browning Drawing #ABR-21

### DROPOUT REQUIREMENTS

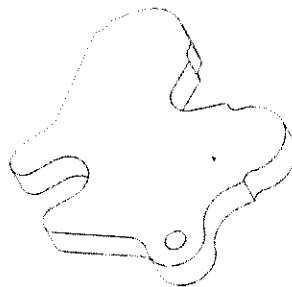


Fig. 1-2

Rear Dropout, Steel, Browning Drawing #ABD21  
Rear Dropout, Aluminum, Right Browning Drawing #ABD41  
Rear Dropout, Aluminum, Left Browning Drawing #ABD51

### CABLE CLIP



Aluminum



Steel

Fig. 1-3

Cable Clip, Aluminum, Browning Drawing #ABE11

Cable Clip, Steel, Browning Drawing #ABE21

### HUB REQUIREMENTS

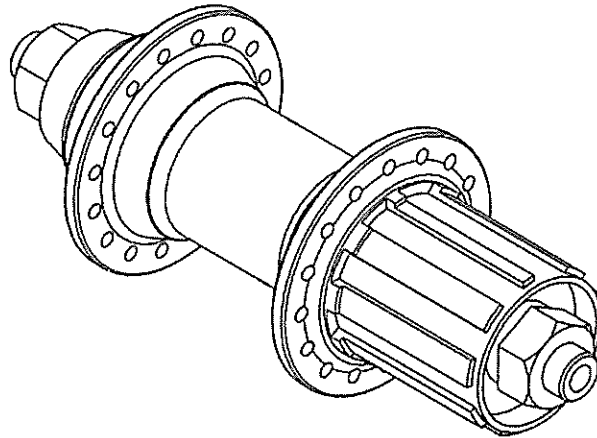


Fig. 1-4

Free hub body for 8/9 speed cassette

Over lock nut dimension: 135mm

Axle diameter: 10mm

Free hub run out must meet JIS standard, 0.2mm

### CHAIN REQUIREMENTS



Fig. 1-5

**Browning-approved Chain:** Yaban Chain Industrial Co. Part # Wind Tunnel 70S2 (1/2x3/32)

**Chain length:** 114 typical (varies with frame/bike components)

**Do not use a Master Link**

**Ideal Chain Specifications Would Be:**

2.7mm (.106) spacing between narrow link

4.38mm (.172) flared entry into the narrow link

.3mm (.012) or closer rivet protrusion (0 or flush is best)

A chain with side-to-side flexibility works better than a stiff chain

## CHAINRING REQUIREMENTS

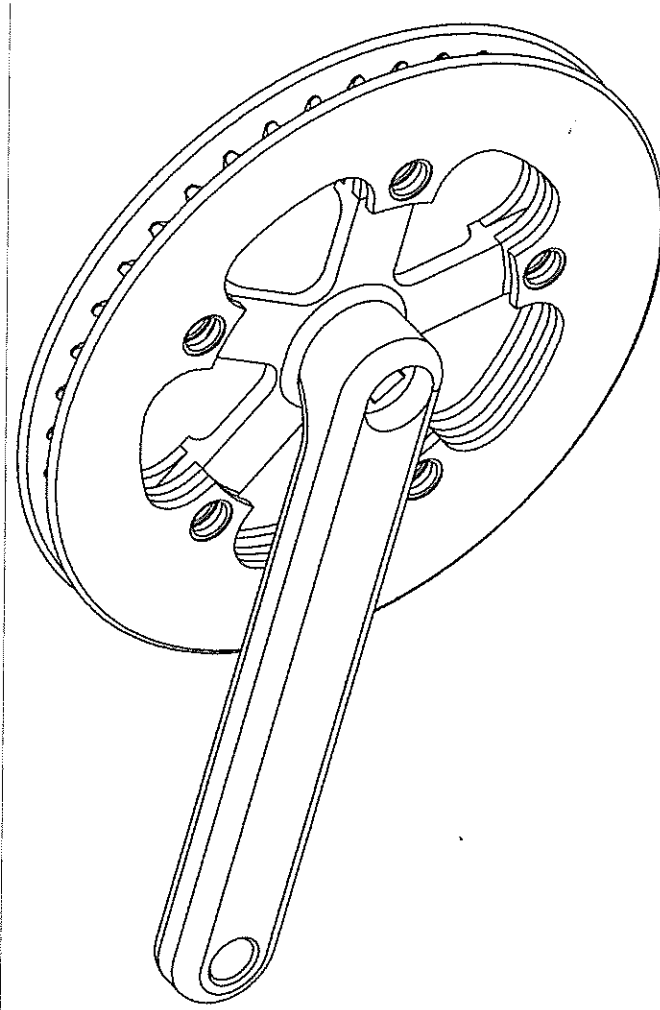


Fig. 1-6

**Maximum Tooth Thickness: 2.1mm (for 8 or 9 speed chain)**  
**Chain Line Requirement: 48.0mm**  
**Recommended Chain Ring size: 42 T for 26" wheel; 54 tooth for 20" wheel**  
**Double Chain Guards are recommended**





## **Section 2**

### **Frame and Braze-On Specifications**

For the Browning SmartShift 400 Four-Speed Transmission

## A. BRAZE-ON REAR MOUNT

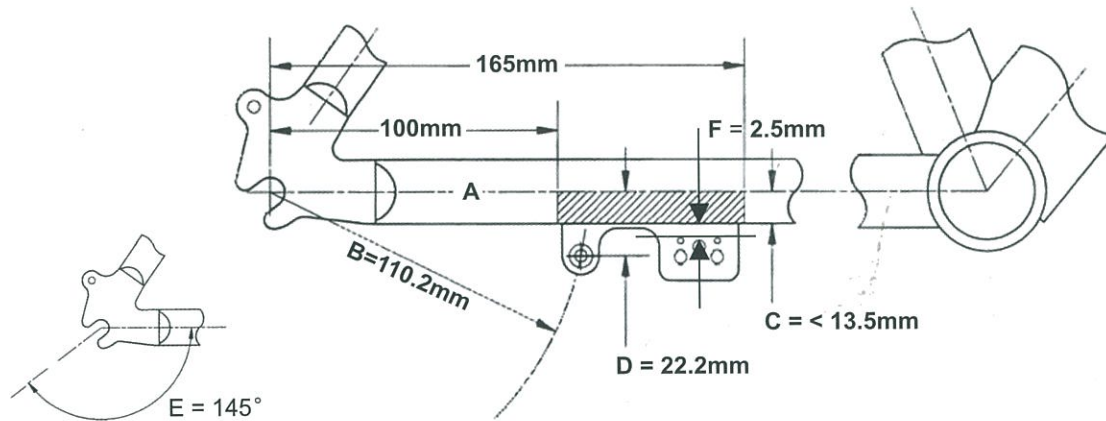


Fig.2-1

Locate the position of the Rear Mount with the Temporary Braze-on Fixture shown in Figs. 2-5 & 2-6.

A = Line between center of Bottom Bracket and center of Rear Axle

B = Radius of center of Rear Axle to center of Rear Mount Hole =  $110.2\text{mm} \pm 0.5$

C = Distance from Centerline A to bottom of Chain Stay = **Less than 13.5mm** (measured within shaded area.)

D = Distance from Centerline A to center of rearmost mount hole =  $22.2\text{mm} \pm 0.3\text{mm}$ .

E = Dropout Slot Angle =  $145^\circ \pm 10^\circ$

**F = Weld or brazing material must not come within 2.5mm of top of Rear Mount guide pin holes.**

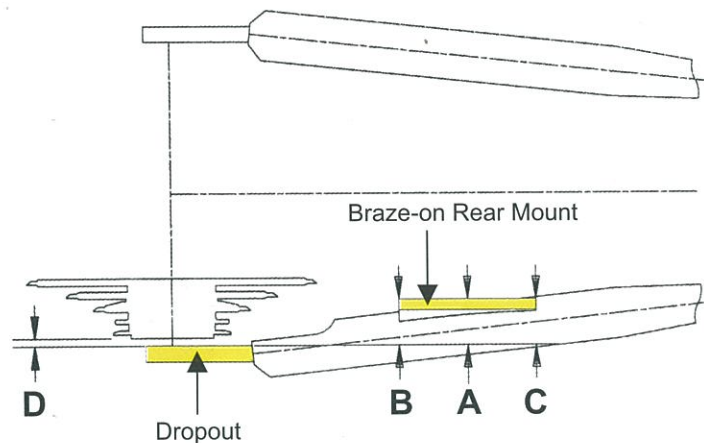


Fig. 2-2

A = Inner face (toward centerline) of Dropout to inner face (toward centerline) of Rear Mount =  $20.3\text{mm} \pm 0.5$

B & C = The measured difference between B and C must be less than 0.4mm

D = Inner face of Dropout to Outboard Chain Guard =  $5.2\text{mm} \pm 0.5$

**Choose Chain Stay dimensions so that distance from Inner Face of Chain Stay to Inner Face of Dropout does not exceed 19.3mm at position A, Fig.2-2.**

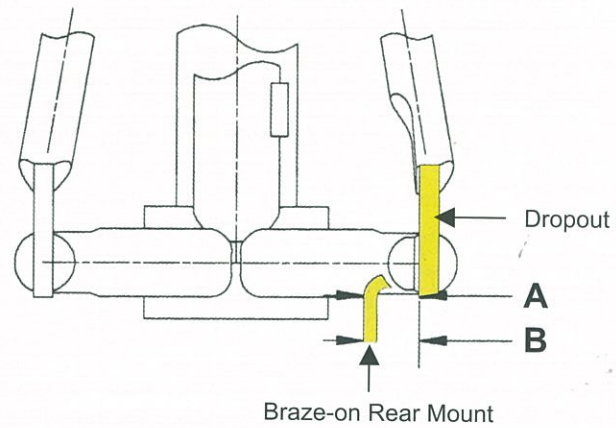


Fig. 2-3

Braze-on Rear Mount must be  $90^\circ$  to Bottom Bracket Centerline.  
 Parallel alignment of inner face of dropout to inner face of Rear Mount Braze-on (**A & B**) must be within 0.4mm.

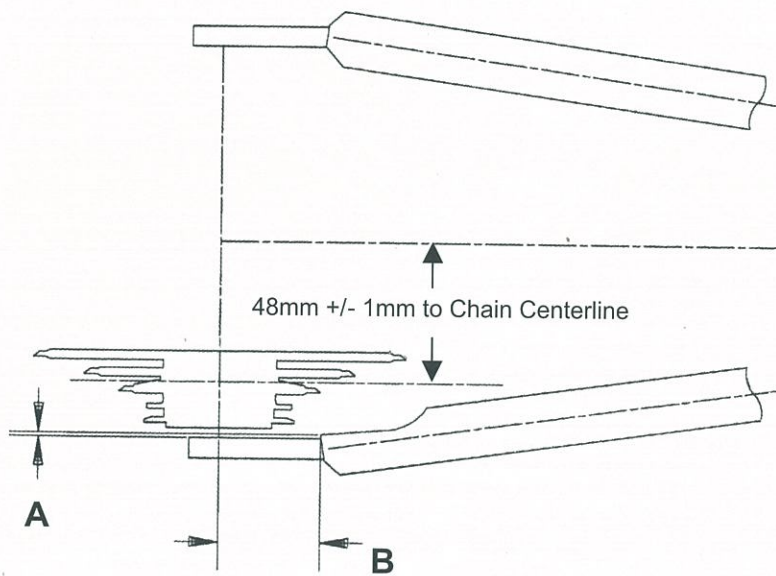


Fig. 2-4

A = Clearance between the Cluster and the inner face of the Dropout within Distance B, must be equal to or greater than 2mm.  
 B = At least 30mm to provide clearance for the outboard chain guard.

## TEMPORARY BRAZE-ON FIXTURE FOR REAR MOUNT

(A drawing for this fixture is available on request from Browning Components)

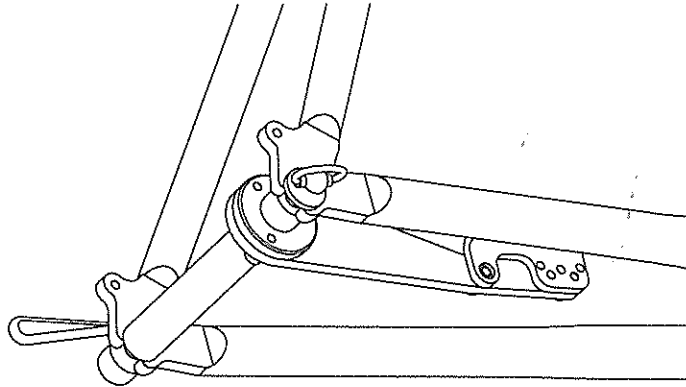


Fig. 2-5

- Fixture shown in position after mitering mount. Miter mount to fit the chainstay tube according to **SECTION II** technical specifications (Figures 1, 2 and 3, Section II).
- Insert Braze-on fixture until it hits the bottom of dropout slot.
- Tighten quick release.

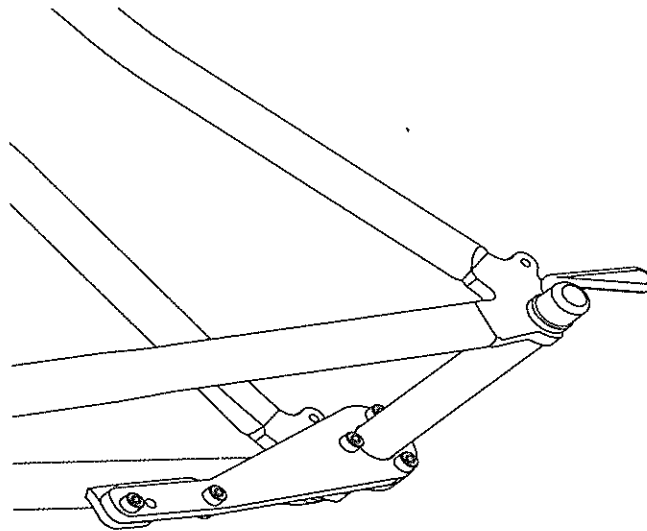


Fig. 2-6

- Inside view of the temporary fixture.

## B. BRAZE-ON CABLE CLIPS AND ECU MOUNTS

Larger scale drawing available.

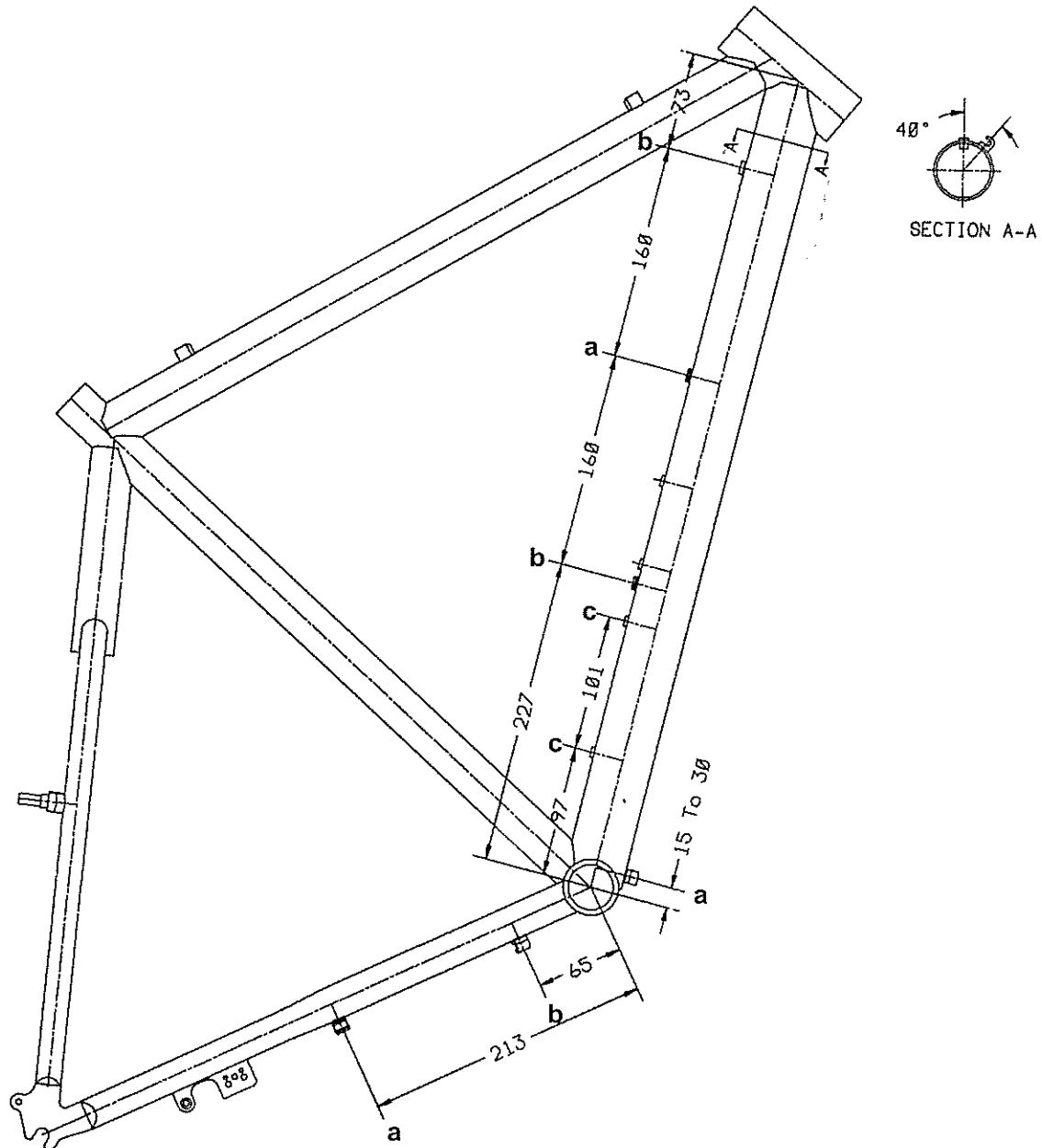
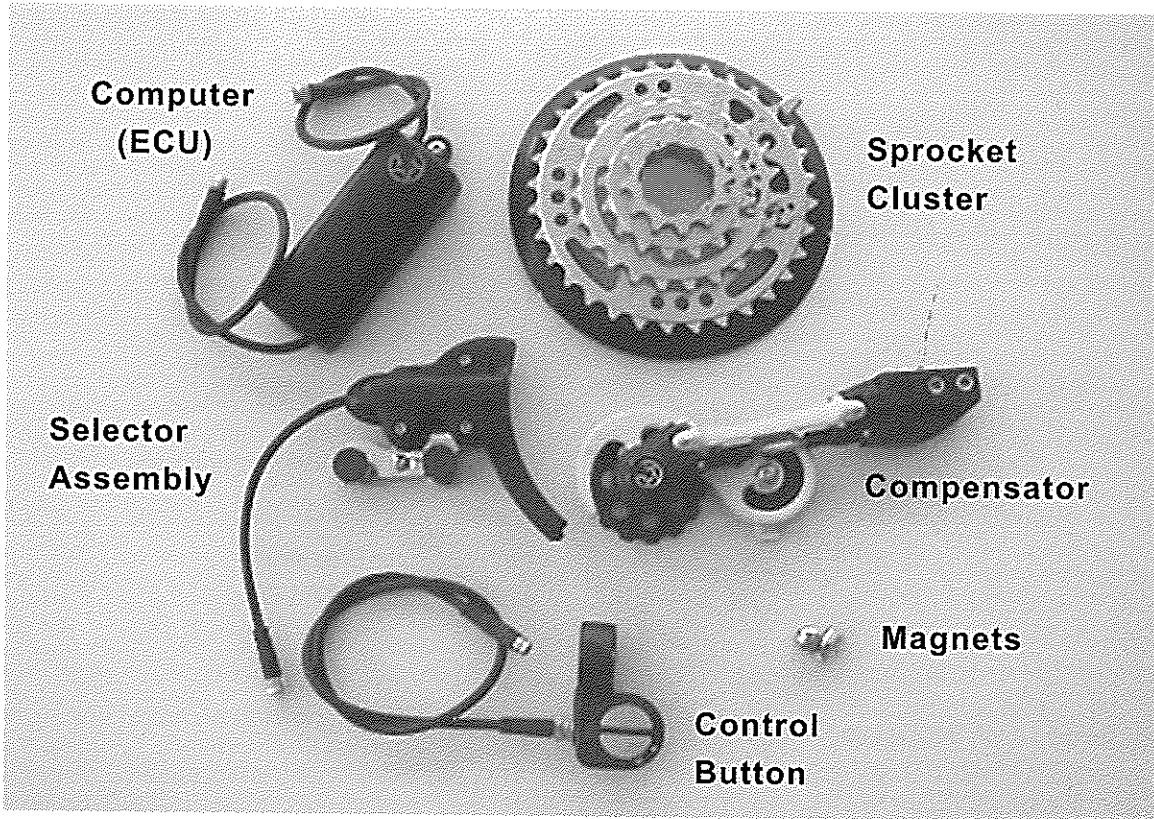


Fig.2-7

All dimensions to be  $\pm 2\text{mm}$ .

- a = 3 Cable Clips with opening to Right (drive side)
- b = 3 Cable Clips with opening to Left (non-drive side)
- c = 2 Threaded ECU Mounts (use standard M5x12 fittings)





## Section 3

### Installation of Components

For the Browning SmartShift 400 Four Speed Transmission

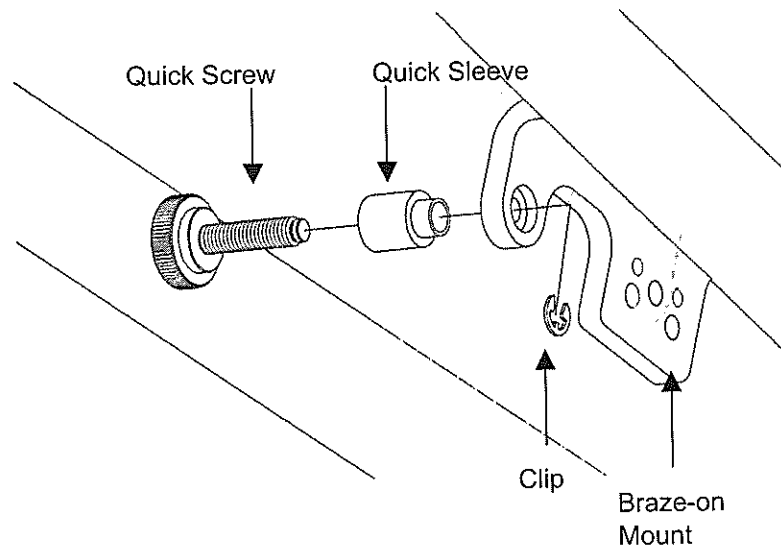


Fig. 3-1

- Insert Quick Screw into Quick Sleeve, and thread into mount. Install Clip.

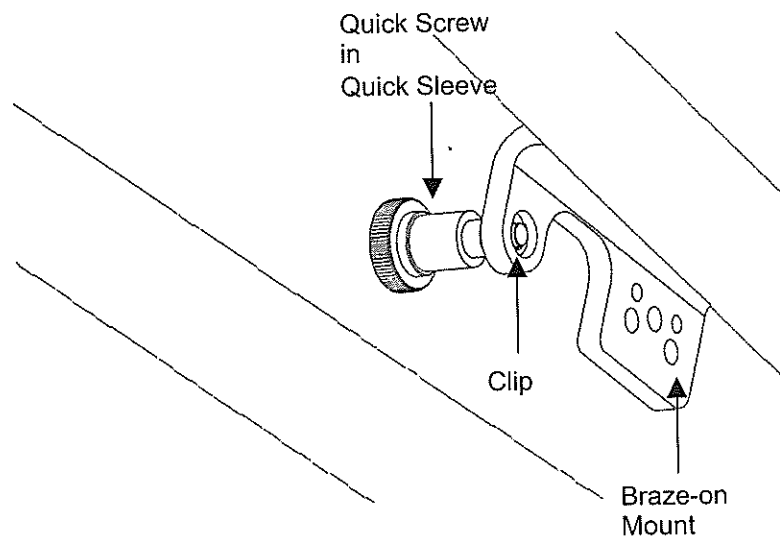


Fig. 3-2

- Loosen quick screw until clip touches mount. The Mount is ready to receive Selector.
- The Quick Screw always stays attached to the bicycle frame.

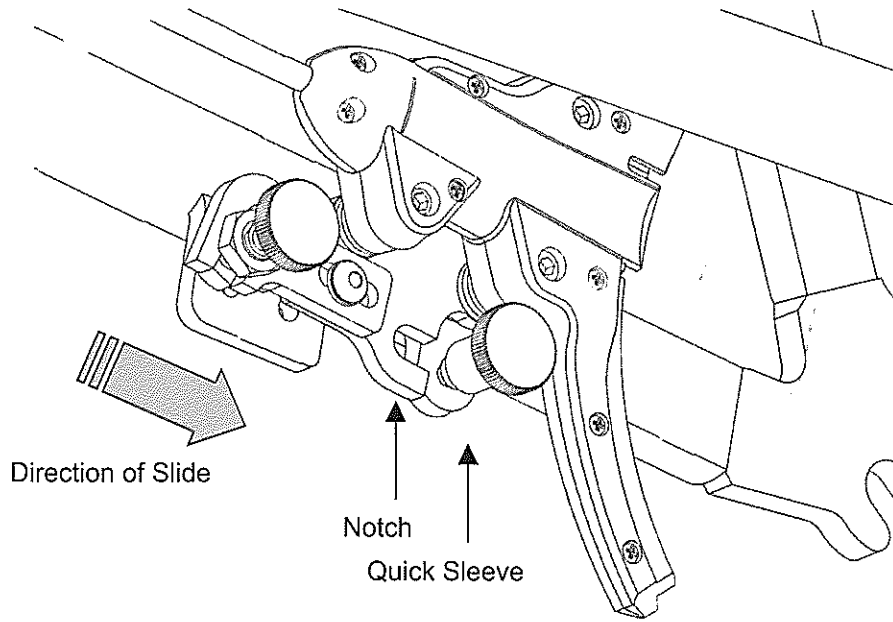


Fig. 3-3

- Slide Notch on Selector Assembly on to the Quick Sleeve.

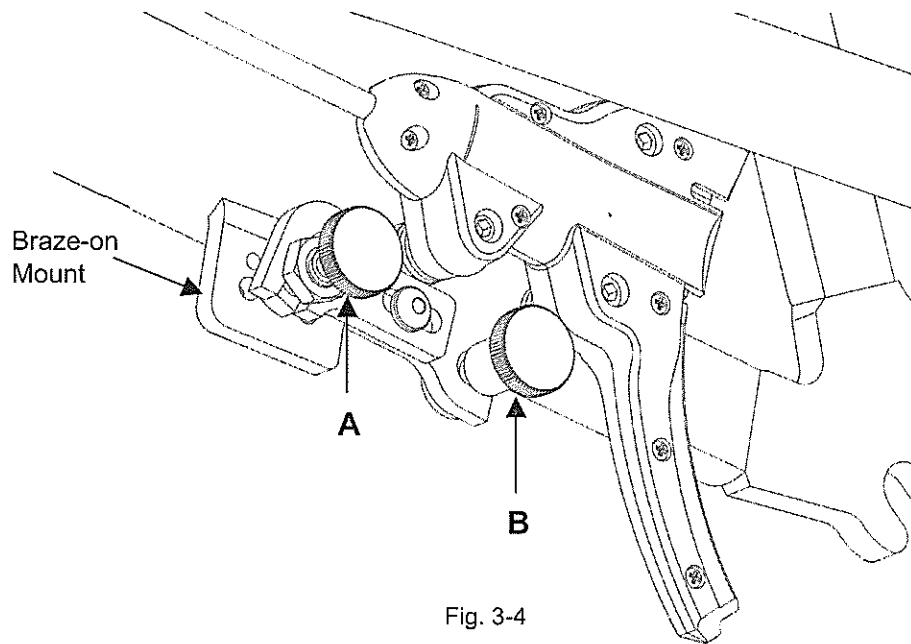


Fig. 3-4

- Thread Thumbscrew "A", which is part of Selector Assembly, in to the braze on mount. Tighten Thumbscrews "A" and "B" finger tight.
- Selector may be removed and replaced (for cleaning, for example) without need of readjustment.



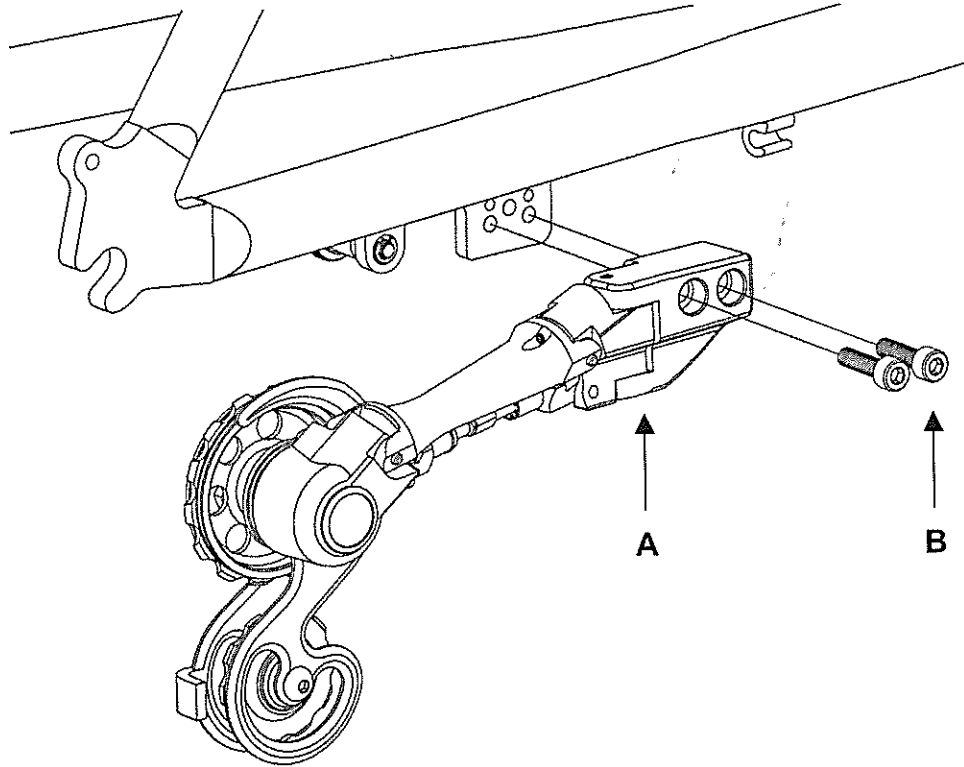


Fig. 3-5

**Do not install Compensator with Chain under tension, as this could shear off the Guide Pins on the back of the Compensator's Swivel Bracket.**

- Insert 5 mm Bolts "B" into Compensator "A".
- Line up Guide Pins on back of Compensator's Swivel Bracket with holes in Braze-on Mount and Bolts with holes on Braze-on Mount.
- Tighten Bolts to 5-7 Nm (44-60 in/lb).

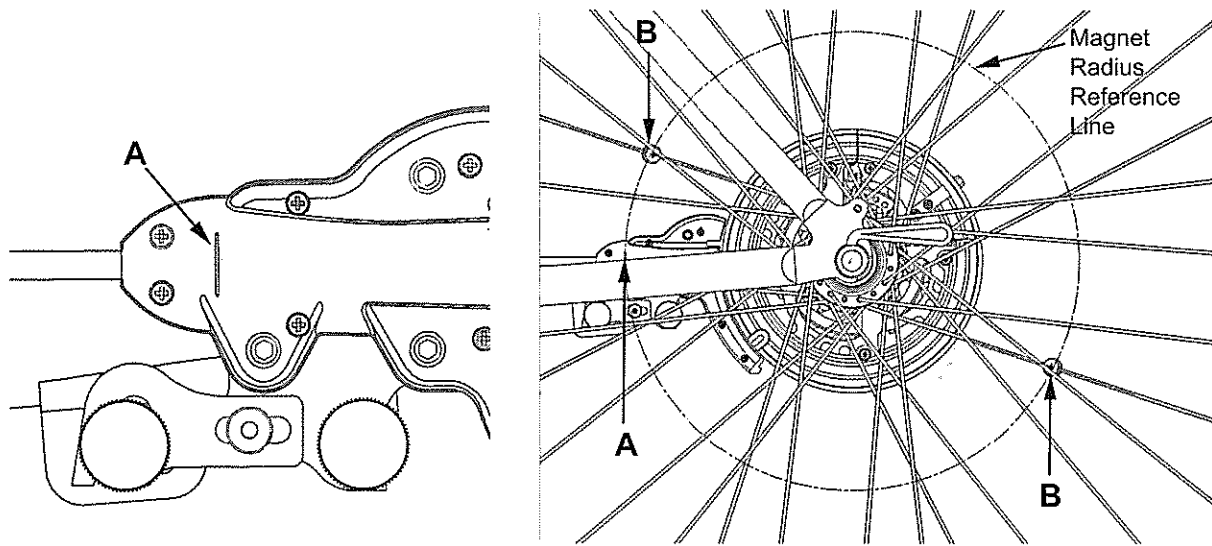


Fig. 3-6

- Place two Magnets, Part "B", 180 degrees apart, on to drive-side spokes, so that faces of Magnets are 3mm or less from Selector, without touching Selector body.
- Line Center of Magnets on mark "A" on Selector. (Visual alignment OK)

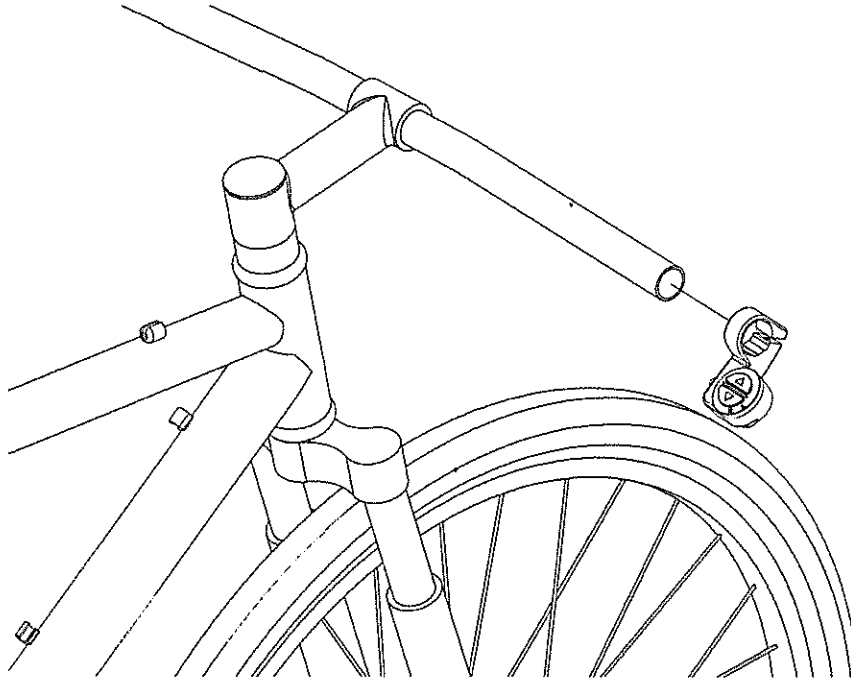


Fig. 3-7

- Before installing Brake Lever, slide Control Button on to right side of handlebar. **Do not bend clamp over handlebar.** Tighten Clamp Bolt to 1.0 Nm (9 in/lb).

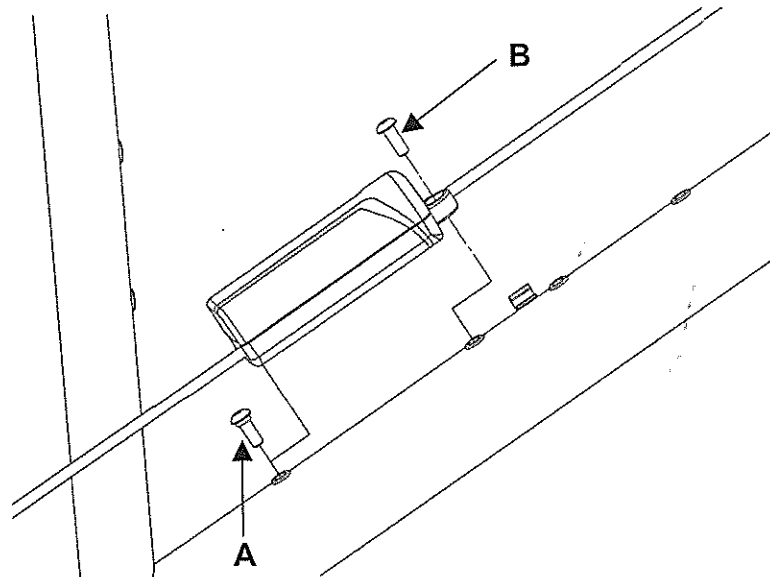


Fig. 3-8

- Thread Shoulder Bolt "A" into bottom ECU frame mount fitting and Bolt "B" into top ECU frame mounting fitting, as shown. Tighten to 3.4 Nm (30 in/lb).

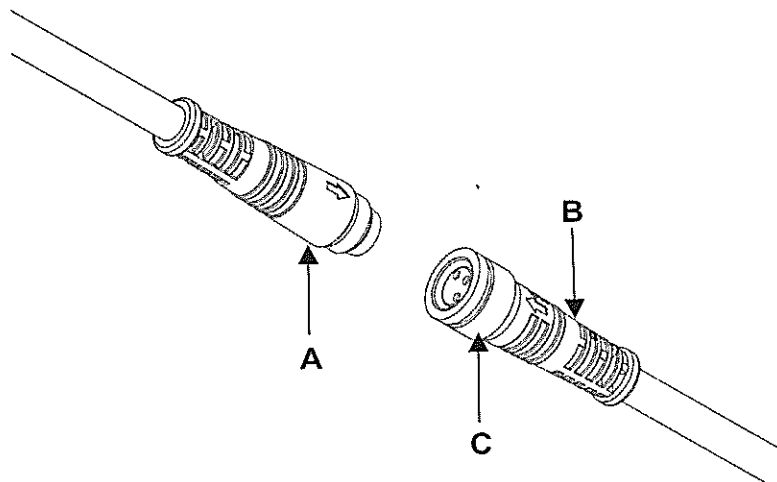


Fig. 3-9

- Connect 4-pin ECU cable to Selector Assembly and 3-pin ECU cable to Control Button. Plug End B (female) aligns with Plug End A (male), with the arrows point to point. The connector is designed to not allow miss-orientation of the plugs. After plugs are connected, screw knurled ring C on to the threads at A, finger tight. Use extension cable between ECU and Control Button.
- Press cables into frame cable clips.

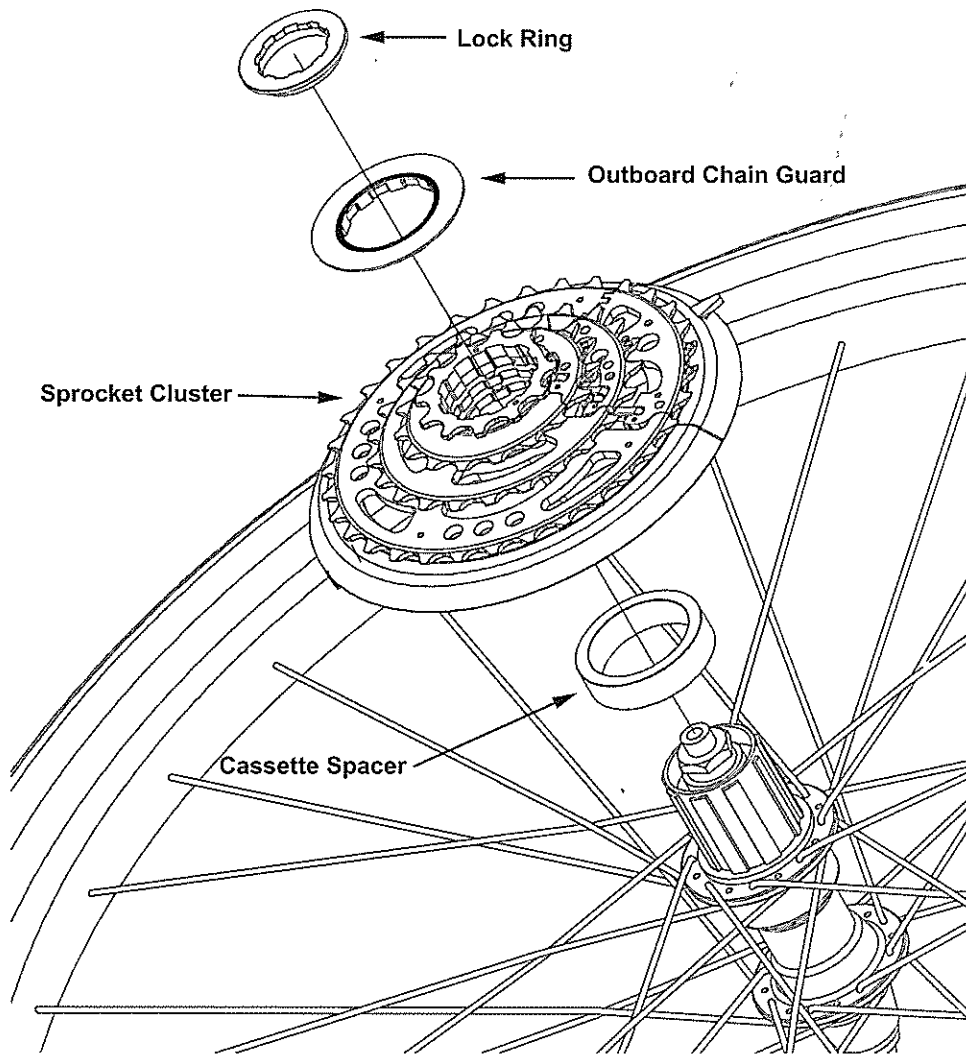


Fig. 3-10

- Install Sprocket Cluster on to Cassette Body as shown.
- Use a standard splined Cassette Tool to tighten Lockring to 30 Nm (260 in/lbs).



## Section 4

### Adjusting

the Browning SmartShift 400 Four Speed Transmission

## Introduction

The SmartShift 400 is adjusted in three steps:

Step 1: Selector to Cluster Adjustment

Step 2: Lateral Selector Adjustment

Step 3: Compensator Adjustment

The following tools are required:

5mm and 11mm open end wrenches

1.5mm and 2mm hex wrenches

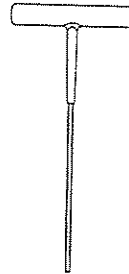
long 2.5mm and 3mm T-handled hex wrenches



5mm & 11mm



1.5mm & 2mm



2.5mm & 3mm

# STEP 1: Selector to Cluster Adjustment

## PARTS IDENTIFICATION

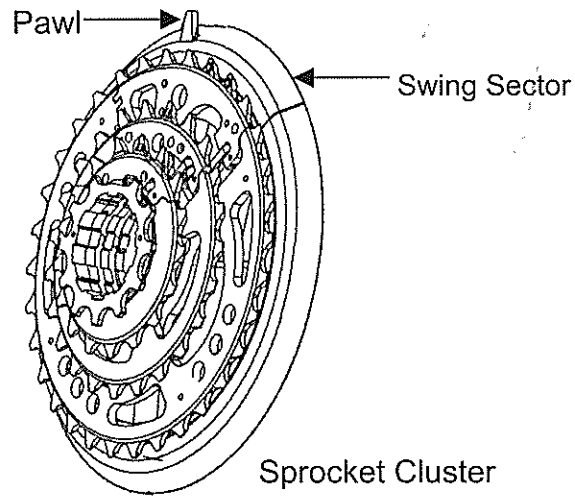


Fig. 4-1

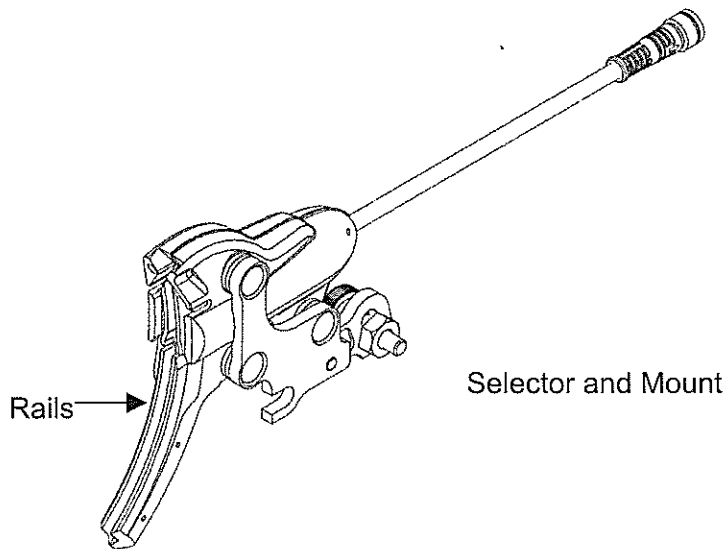


Fig. 4-2

## HOW TO LOOSEN SELECTOR FOR ADJUSTMENT

Important: carefully follow sequence.

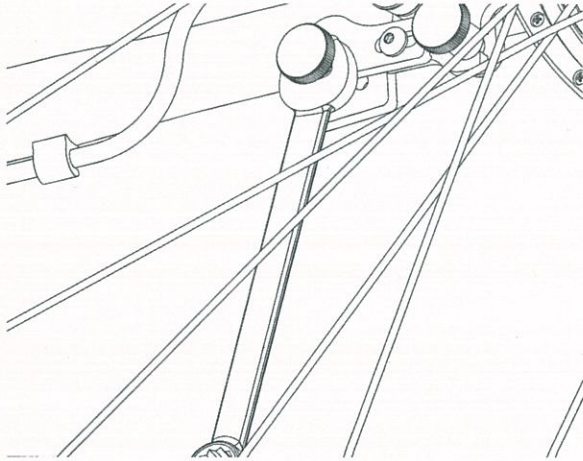


Fig. 4-3  
Loosen 11mm nut. Do not loosen front thumbwheel.

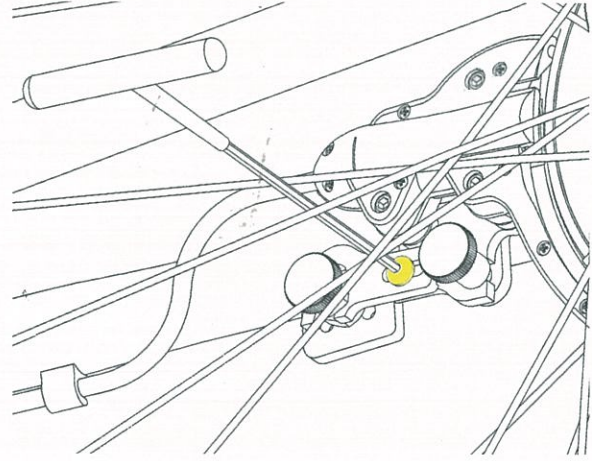


Fig. 4-4  
Loosen 2.5mm button head female hex cap bolt.

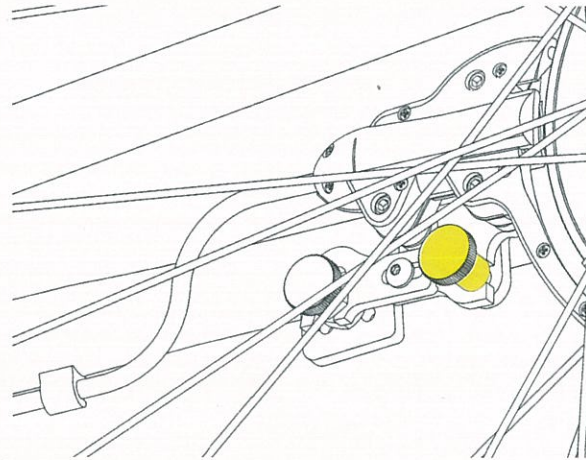


Fig. 4-5  
Loosen rear thumbwheel.



## ADJUSTING

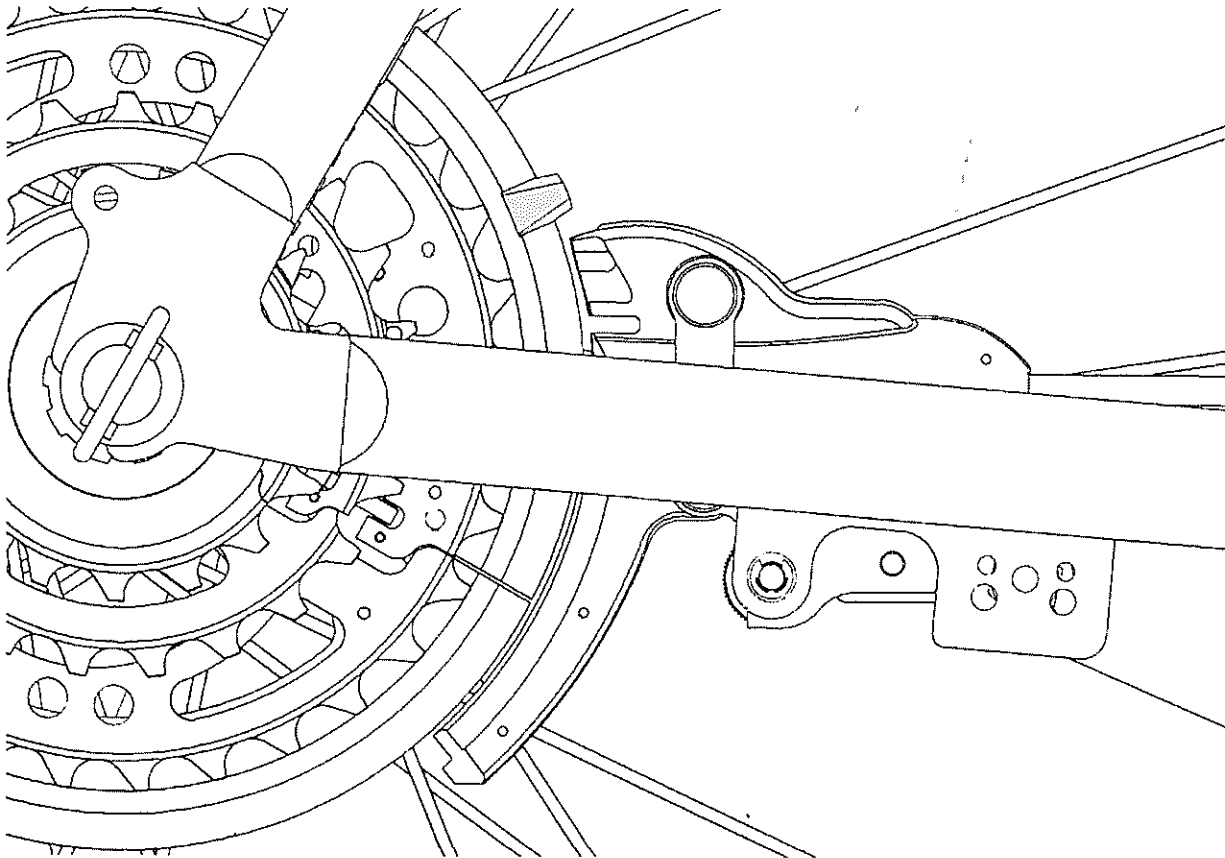


Fig. 4-6

When aligning Selector, position Pawl above the groove and push Cluster Swing Sector to outside of bike. The Selector should be as close to the outboard Chain Guard as possible without touching the Chain Guard.

Adjust by hand. Then, while holding Selector in correct position, tighten Rear Thumbwheel to secure position.

## CORRECTLY ADJUSTED SELECTOR

Pawl entering the Selector.

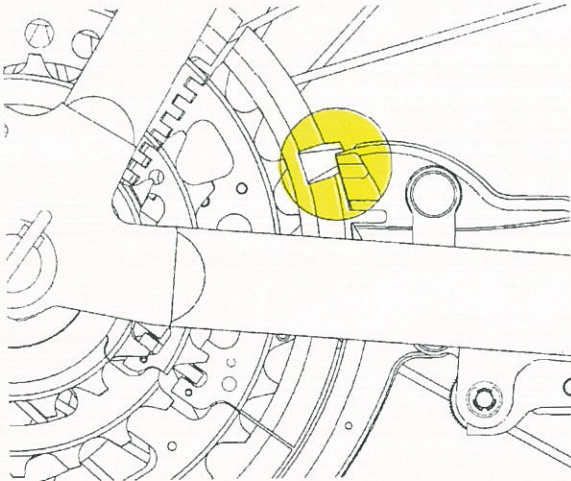


Fig. 4-7

Entering the Selector Rails, the Pawl must penetrate one half the depth of the Selector Rails.

Pawl exiting the Selector.

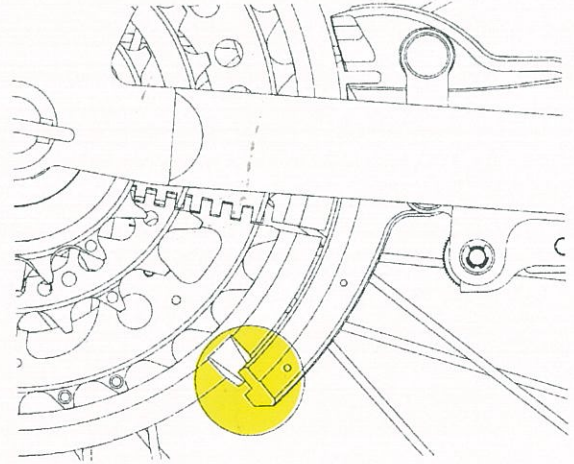


Fig.4-8

Exiting the Selector Rails, the Pawl must penetrate one third the depth of the Selector Rails.

### INCORRECTLY ADJUSTED SELECTOR

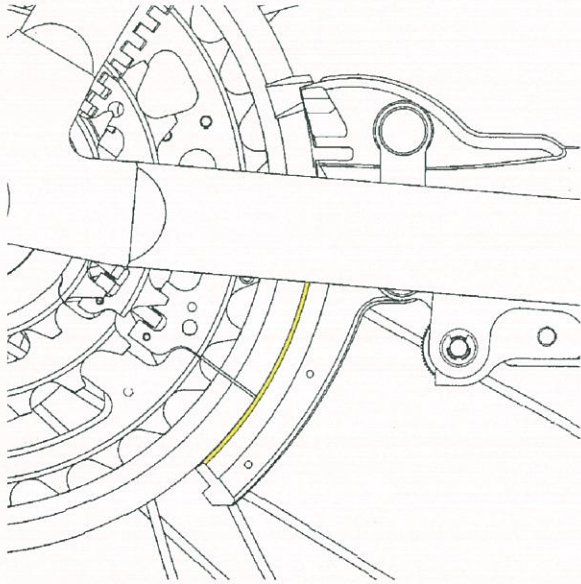


Fig. 4-9  
Selector too close to the Cluster.

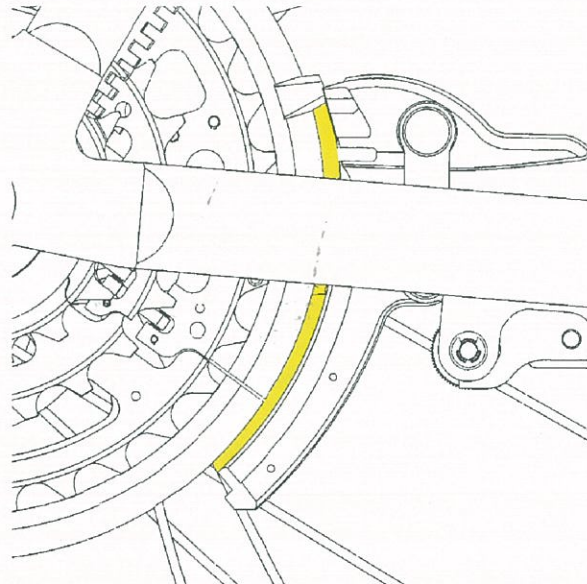


Fig. 4-10  
Selector too far from the Cluster.

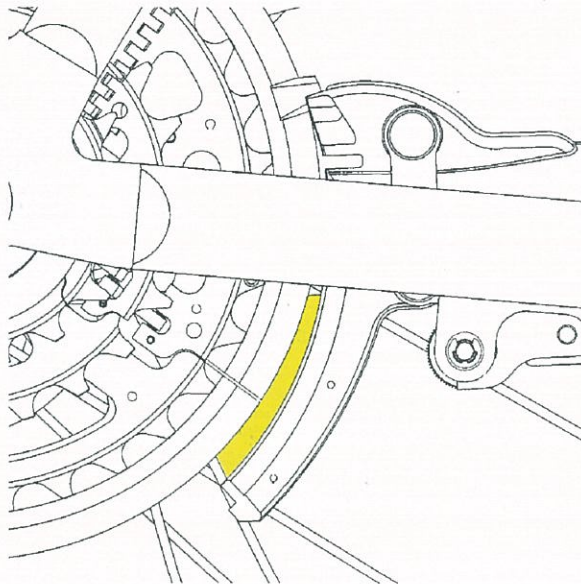


Fig. 4-11  
Bad angle, bottom.

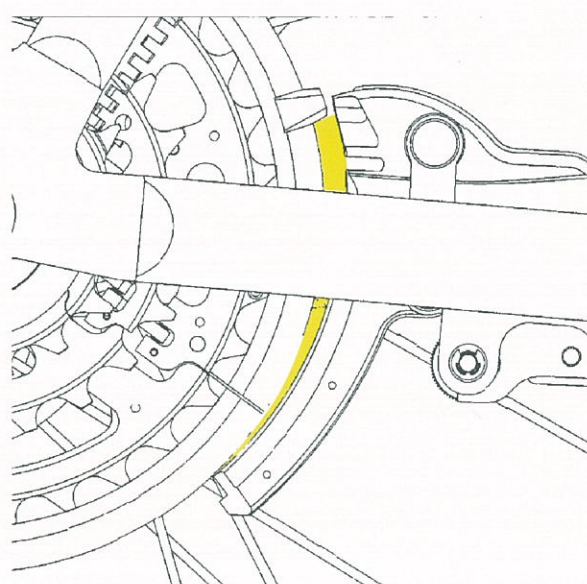


Fig. 4-12  
Bad angle, top.



## RETIGHTEN

**Important: carefully follow sequence.**

NOTE: You can make separate radial or linear adjustments as needed.

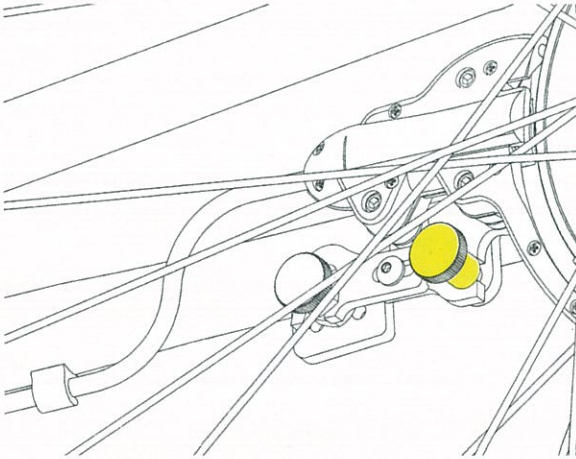


Fig. 4-13  
While continuing to hold Selector in place,  
tighten Rear Thumbwheel.

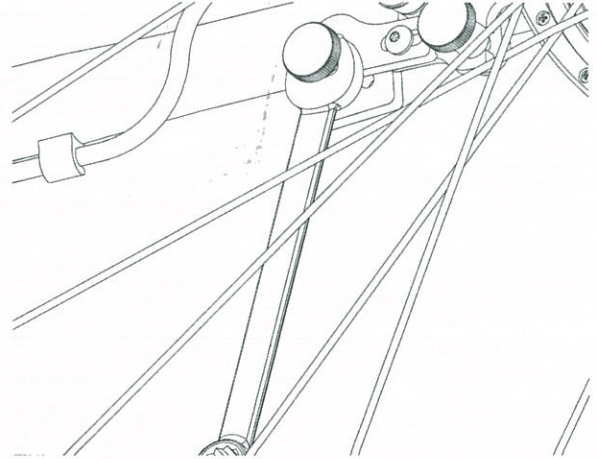


Fig. 4-14  
Tighten the 11mm nut which is directly under the  
Front Thumbwheel.

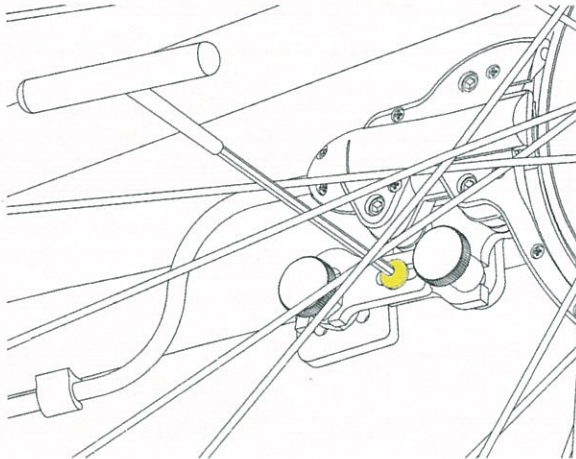


Fig. 4-15  
Tighten 2.5mm button head hex cap bolt.

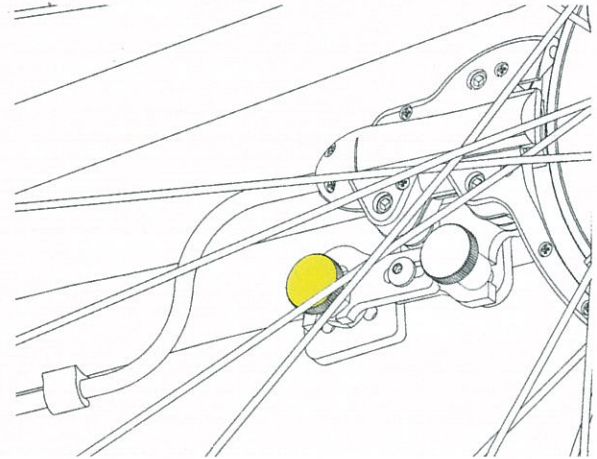


Fig. 4-16  
Check Front Thumbwheel for tightness.

## STEP 2: Lateral Selector Adjustment

### ADJUSTING THE THREE LATERAL ADJUST SCREWS

Using 3mm T-Hex wrench

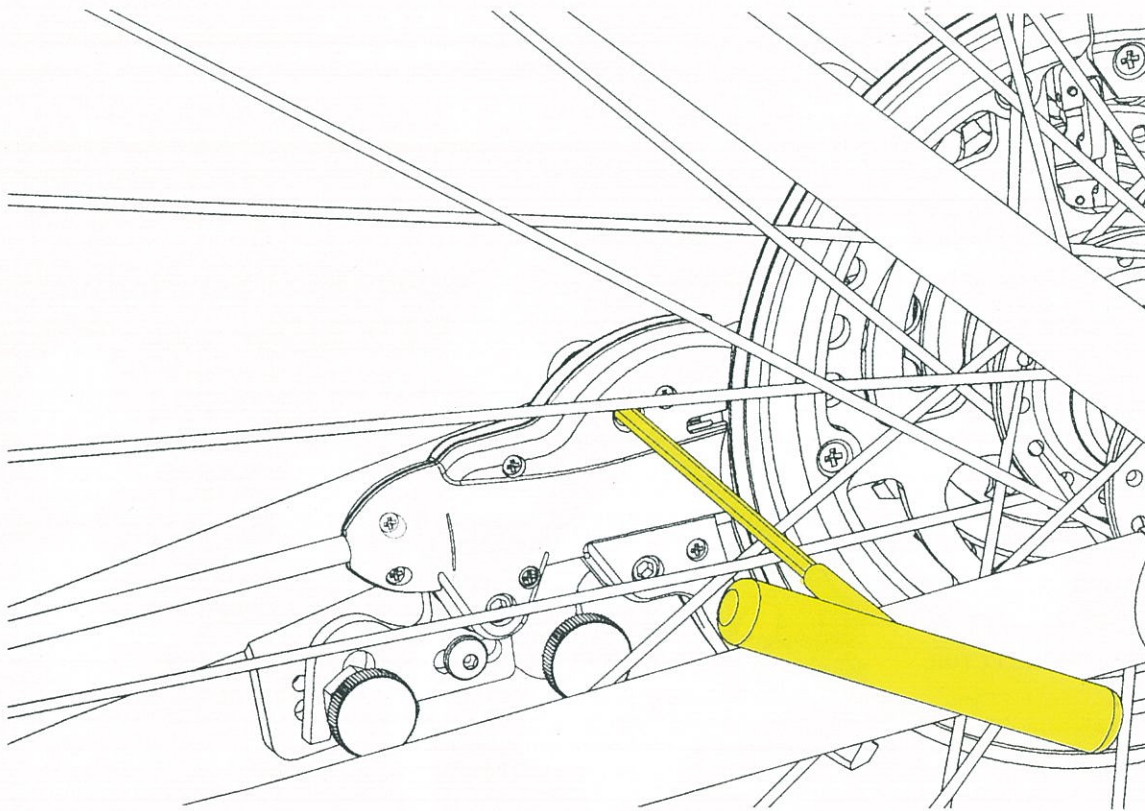


Fig. 4-17

See following page for correct adjustment.



## PAWL AND SELECTOR ALIGNMENT

**Correctly adjusted:** Pawl in center of Rails.

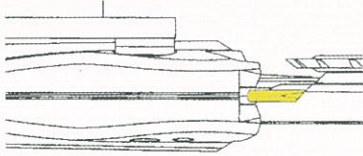


Fig. 4-18  
Correctly adjusted when centered and no contact clicking can be heard.

**Incorrectly adjusted.**

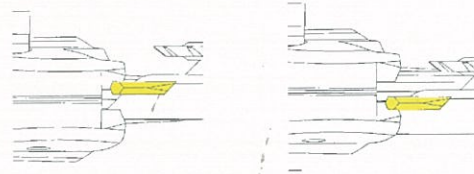
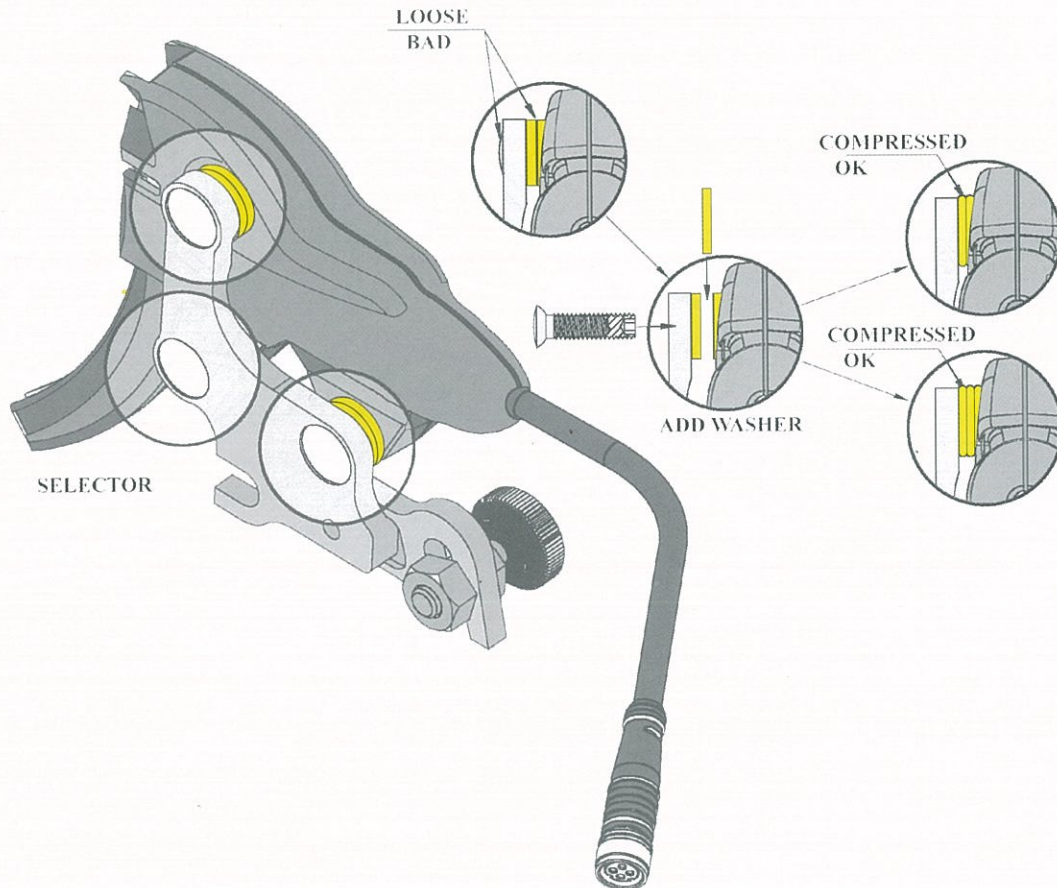


Fig. 4-19 & Fig. 4-20  
When incorrectly adjusted, a clicking sound will be heard from contact between Pawl and Selector.



**Proper compression of rubber washers behind lateral adjust screws.**

Fig. 4-21

## STEP 3: Compensator Adjustment ADJUSTING THE FOUR SPEED COMPENSATOR

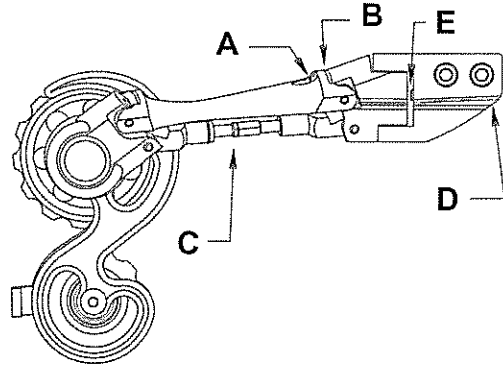


Fig. 4-22

**NOTE:** When the Compensator is adjusted correctly, it will ride on or close to each gear. This is normal. Do not try to compensate by moving the pulley down, as this will compromise shifting.

### Three separate adjustment areas

1. Upper Arm set screw "A" ....1.5mm hex wrench

Measure gap "B" at the screw.....1.5 to 2.0mm

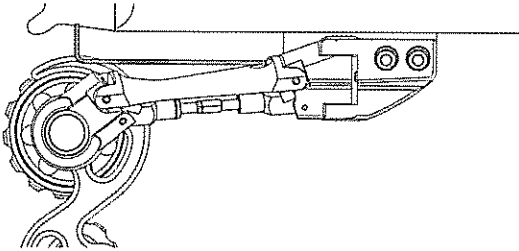


Fig. 4-23

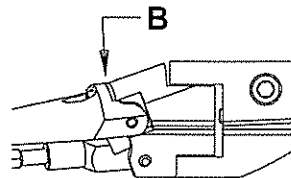


Fig. 4-24

2. Turnbuckle "C" .....5mm open end wrench

Gap "C" measures.....24.0 to 26.0mm

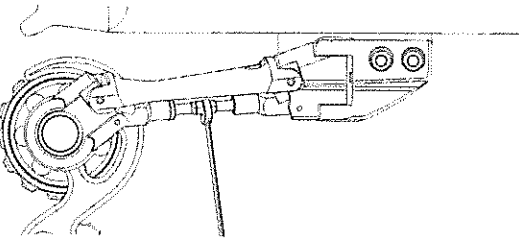


Fig. 4-25

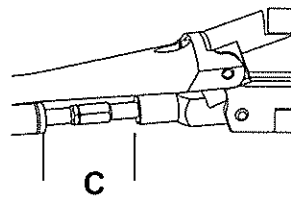


Fig. 4-26

3. Swivel Body set screw "D" ....2mm hex wrench

Measure gap "E" at the screw ... ..2.0mm

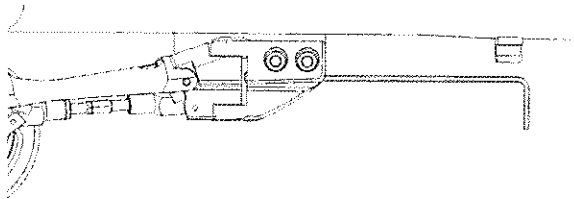


Fig. 4-27

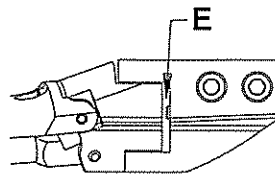


Fig. 4-28

## FINAL CHECK

1. First, check all 3 compensator adjustments, (page 4-11), for correct PRE-SET values.

PRE-SETS: See full details on page 4-11

- B Upper Arm screw set gap.....1.5 - 2.0 mm
- C Turnbuckle gap.....24.0 - 26.0 mm
- E Swivel body set screw.....2.0 mm

### THE TWENTY CYCLE TEST

With the bike on the stand, spin the crank....

- A. If the bike can go through twenty cycles in Automatic Mode without a mis-shift, then it is ready for the road.
- B. A cycle is from 1st to 4th and back to 1st gear.
- C. Each cycle should have different loads and speeds. Use the brake to facilitate this variation.
- D. After every adjustment, run this twenty cycle test.

**IF.....THEN** (Refer to illustrations on page 4-11)

- **UPSHIFT FAILURE 32t to 23t or 23t to 17t:**
  1. Check swivel body set screw. The gap, area "E", should be 2.0mm or less. Regardless of gap dimension, back the set screw "D" out no more than a quarter turn with 2mm wrench.
  2. Shorten turnbuckle gap "C". This turns the forward edge of the 14t Guide Pulley away from the Cluster, which helps the chain off the larger sprockets. Adjust one quarter turn at a time.
- **DOWNSHIFT FAILURE 17t to 23t or 23t to 32t:**
  1. Remove star emblem cap, then check and tighten spring housing bolt.
  2. Lengthen turnbuckle gap "C". This toes in the forward edge of the 14t Guide Pulley. Adjust one quarter turn at a time.
- **DOWNSHIFT FAILURE 12t to 17t:**
  1. Turn upper Compensator arm set screw "A" in, creating a larger gap "B".
  2. Lengthen turnbuckle gap "C". This toes in the forward edge of the 14t Guide Pulley. Adjust one quarter turn at a time.
- **UPSHIFT FAILURE 17t to 12t:**
  1. Remove star emblem cap, then check and tighten spring housing bolt.
  2. Shorten turnbuckle gap "C". This toes out the forward edge of the 14t Guide Pulley. Adjust one quarter turn at a time.



# **Section 5**

## Troubleshooting

The Browning SmartShift 400 Four Speed Transmission

## TROUBLESHOOTING PROCEDURES

<b>Transmission is not shifting at all, in manual or automatic mode.</b>	
<b>Verify</b>	<b>Corrective Procedure</b>
Batteries are good.	If there is doubt concerning condition of the batteries, replace batteries.
Batteries are making proper contact and polarity is correct.	Remove batteries from battery compartment. Check for corrosion or non-conducting interference on battery terminals. Reinstall batteries making sure polarity of batteries is correct according to instructions "Installing the Batteries" in the Operating Guide.
Selector mechanism is free of visible obstructions.	Brush away visible obstructions from Selector. Wash gently with garden hose.
Selector makes a "clicking sound" when button is pushed (Up or Down, Manual or Automatic Mode) and Cam is in turned position after pushing.	<p>If Selector makes "clicking sound" and Cam is in turned position (either Up or Down is OK) after pushing:</p> <ul style="list-style-type: none"> <li>• Check proper assembly of Hub and Wheel to frame.</li> <li>• Check that Pawl on the Sprocket Cluster engages Cam in Selector.</li> </ul> <p>If Selector does not make "clicking sound":</p> <ul style="list-style-type: none"> <li>• Check connector and condition of electric cable between Selector and Computer.</li> <li>• Replace the Selector.</li> <li>• Replace the Computer.</li> </ul>
Selector makes a "clicking sound" (Up or Down, Manual or Automatic Mode) and Cam is NOT in turned position after pushing.	Remove Selector from Chain Stay mount but leave connected to Computer. Push button Up or Down and determine if Cam is being obstructed from turning. If Cam is unobstructed, replace Selector.

<b>Transmission is not shifting in manual mode but does shift in automatic mode.</b>	
<b>Verify</b>	<b>Corrective Procedure</b>
Position of Mode Switch	Turn Mode Switch to Manual mode for manual operation.
Selector does NOT make a "clicking sound" when button is pushed (Up or Down, Manual or Automatic Mode).	<ul style="list-style-type: none"> <li>• Tighten Connector fitting between Button and Computer.</li> <li>• Replace electrical cable between Button and Computer.</li> <li>• Replace Button assembly.</li> <li>• This condition is the default mode when the Button is missing or damaged.</li> </ul>

<b>Transmission is not shifting in automatic mode but does shift in manual mode.</b>	
<b>Verify</b>	<b>Corrective Procedure</b>
Position of Mode Switch	Turn Mode Switch to Automatic mode for automatic operation.
Spoke magnets (2), attached to spokes of rear wheel, are in proper position.	Attach spoke magnets in proper position as shown in Section 3, Fig. 3-6.

<b>Transmission shifting is unreliable and must frequently be corrected with the buttons.</b>	
<b>Verify</b>	<b>Corrective Procedure</b>
Compensator has free vertical movement.	Lubricate Compensator Arm pivots with moly dry film lubricant such as Bike Aid™
Spoke magnets (2), attached to spokes of rear wheel, are in proper position	Attach spoke magnets in proper position as shown in Section 3, Fig. 3-6.
Batteries are good.	Install new batteries