California Vocational Agriculture Curriculum Guidelines Instructional Unit

CLUTCH, BRAKE & TRACK MAINTENANCE

TABLE OF CONTENTS

CLUTCH, BRAKE & TRACK MAINTENANCE

Unit Goals:

To assist the student in gaining knowledge and skills to recognize the need for as well as make power train adjustments.

Unit Performance Objectives:

The student will:

1. Differentiate between properly and improperly adjusted clutches and brakes.
2. Be able to refer to the operator's manual and make simple brake and clutch adjustments.
3. Be able to adjust track tension in accordance with the operator's manual.
4. Be able to determine the extent of wear on tracks and their component parts.
5. Be able to specify the repairs necessary for a set of tracks.

Teaching Outline

I. Power Train Adjustments

A. Clutches

1. Check operator's manual for specifications and adjustments

2. Manual clutch should engage smoothly (no chattering or jerks) usually at mid-point of control travel

   a. Hold (not slip) under power
   b. Hand clutch should snap over center without excessive pressure required to engage or disengage

B. Brakes

1. Check operator's manual for adjustment and specifications

2. Brakes should apply evenly so that equal pedal height applies equal braking force to each wheel

3. Operate smoothly (without grabbing) and firmly so that wheel motion can be stopped without excessive pressure at mid-point of pedal travel

C. Tracks

1. General facts about tracks

   a. Track and undercarriage equal 20% of the purchase price of a crawler
   b. Track and undercarriage will equal 50% of the service cost of the tractor
   c. Tracks are designed to take rough and abusive use but they must have proper maintenance
   d. The tracks work like a roller chain. As the chain moves around the sprockets, it continually lays down the pads, thus providing itself with a road bed to float on the pads and also provides cleats for traction

2. Parts of the system (TM -1)(Use drawing of a given track system)

   a. Tracks - endless chain made up of links, bushings, pins, and shoes (TM - 2)
   b. Shoes - these are bolted to the links.
      1) They provide the flotation which prevents the tractor from sinking
      2) The pressure on the soil per inch is far less than the pressure created on the soil by a wheel tractor.
      3) The grousers are attached to the shoes.
   c. Types of grousers - cleat type attachments that provide traction
      1) Standard - designed for work in clay, silt, loam and gravel
      2) Open-center - provides openings for mud to squeeze out and prevent build-up
      3) All-purpose - have small self-cleaning openings; work well on hard, smooth surfaces; normally used on loader units
      4) Rubber shoes - used on floors or smooth surfaces where you do not want to tear up the surface

      NOTE: The shoes should never be wider than needed for good floatation and traction.

	Suggested Learning Activities	Suggested Resource Materials
I.A	1. Demonstrate proper and improper clutch and brake adjustment.	1. School equipment or local dealer
	2. Have students adjust simple manual clutch to specifications.	2. Operator's manual.
I.B.	3. Have students adjust simple tractor brake system to specifications	3. Operator's manual.

I. C. 2. d. Drive sprocket - is driven by the tractor final drive which in turn drives the track by engaging the teeth of the sprocket with bushing of the track (TM - 3)

e. Rollers
   1) Carrier roller - supports weight of upper part of the track and prevents the track from sagging; not all tractors will have these
   2) Track rollers - they provide even pressure on the track as it revolves and contacts the ground; the weight of the tractor is distributed evenly over the entire bottom of the track giving the tractor great traction and flotation.

f. Front idler
   1) Supports the track as it revolves
   2) May have tension springs attached to it to tighten up the tracks

g. Roller guards
   1) Protects the rollers
   2) Prevents dirt and rocks from entering the chain
   3) Guides the tracks and prevents twisting and buckling

h. Frame - supports and holds the track components in place

3. Adjusting Tracks

a. Track tension (TM - 4)
   1) Always follow the operator's manual for exact method for each brand of tractor
   2) Measure the slack on the top side of the tracks (normal is 1 inch of slack)
   3) <u>There are two methods of tightening the tracks</u>:
      a) By inserting grease into a hydraulic cylinder to extend the idler
      b) By the use of an adjusting nut to lengthen the idler distance from the sprocket drive
   4) Explain why track must have the right tension

b. Track alignment
   1) Purpose of alignment - the sprocket, rollers, idler and frame must be all properly aligned to prevent excessive wear (TM - 5, by John Deere and publications to show examples)
   2) Use the operator's manual or the instructions given John Deere Publication for proper alignment procedures.

4. Track repair

a. Diagnosis of track wear (TM - 6,7)
   1) Drive sprocket wear
   2) Pin and bushing wear
   3) Grouser wear

b. Track repair
   1) Turning the pins
   2) Replacing the pins and bushings
   3) Weld build up of the rails
   4) Weld build up or replacement of the rollers
   5) Weld build up of the idlers
   6) Weld build up of the sprocket

c. Removal of tracks from frame
   1) Master pin
   2) Proper removal of tracks
      a) By hoist
      b) By driving tractor off track

d. Tear down of tracks - by use of press

e. Installing of tracks on tractor frame

	Suggested Learning Activities	Suggested Resource Materials
I.C.	1. Find one old roller. Tear down and then show the construction of the bearings, seals and show importance of proper lubrication. If possible, rebuild the roller.	1. Tires and Tracks-Fundamentals of Service; John Deere service publications.
	2. Watch tractor in the field. Show how the weight is evenly distributed over the soil. Drive the tractor up a log or small hill and show the importance of the rollers. Test compaction. Compare to wheel tractor on same soil.	2. Preventive Maintenance-Fundamentals of Machine Operation; John Deere service publications.
	3. Show on tractor the roller guards and why they prevent rocks from getting into the track and rollers. Identify components.	3. Slides produced by John Deere service publications.
	4. Have each student lubricate one crawler track and perform preventive maintenance check.	4. Operator's manual.
	5. Check alignment and track tension on one track. Adjust according to specifications given by the operator's manual.	5. Operator's manual.
	6. Repair and build up one set of tracks or follow one set being built up in industry.	6. Worn tracks or parts from local dealer.

II. Tips for Crawler Operators

A. Avoid reckless operation over rough, rocky ground

B. Do not spin the tracks - apply loads gradually

C. Slow down - remember that track layers are not designed for high speed travel

D. Avoid high speed operation in reverse

E. Stay off concrete and other hard surfaces when possible

F. Keep roller guards in place

G. Clean out packed mud after operating in muddy conditions

H. Check track tension often

I. Do not park on side of a hill as this puts a strain on the roller seals

J. Do not pump too much grease into the rollers, you can damage the seals

K. In freezing weather, park on a hard surface to avoid freezing the tracks to the ground

L. Check the tightness of all bolts regularly

	Suggested Learning Activities	Suggested Resource Materials
II.	1. Develop check sheet for crawler operators.	1. Use the teaching outline.

Student Evaluation

1. Why does a track layer have the ability not to sink in soft dirt?

2. Why does a track layer have better traction than a wheel tractor?

3. Explain the hunting tooth design of a drive sprocket.

4. Why should the grease fitting on the track tension adjustor never be lubricated?

5. What is the normal sag of track?

6. What happens to the length of the track as the pins and bushings wear?

7. How is the master pin different than the rest of the pins?

8. List some of the things that may happen when the tracks are too loose.

9. What may happen when the tracks are too tight?

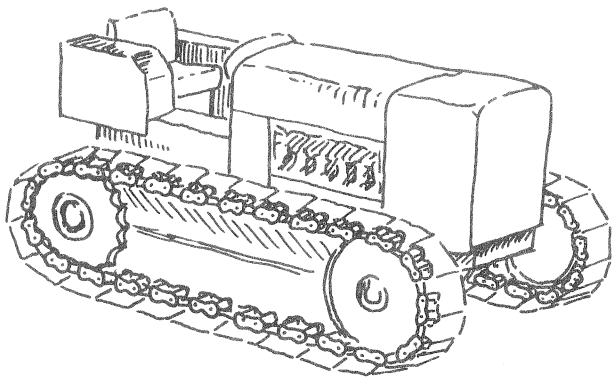
10. Why should grease never be applied to the tracks?

Student Evaluation Answers:

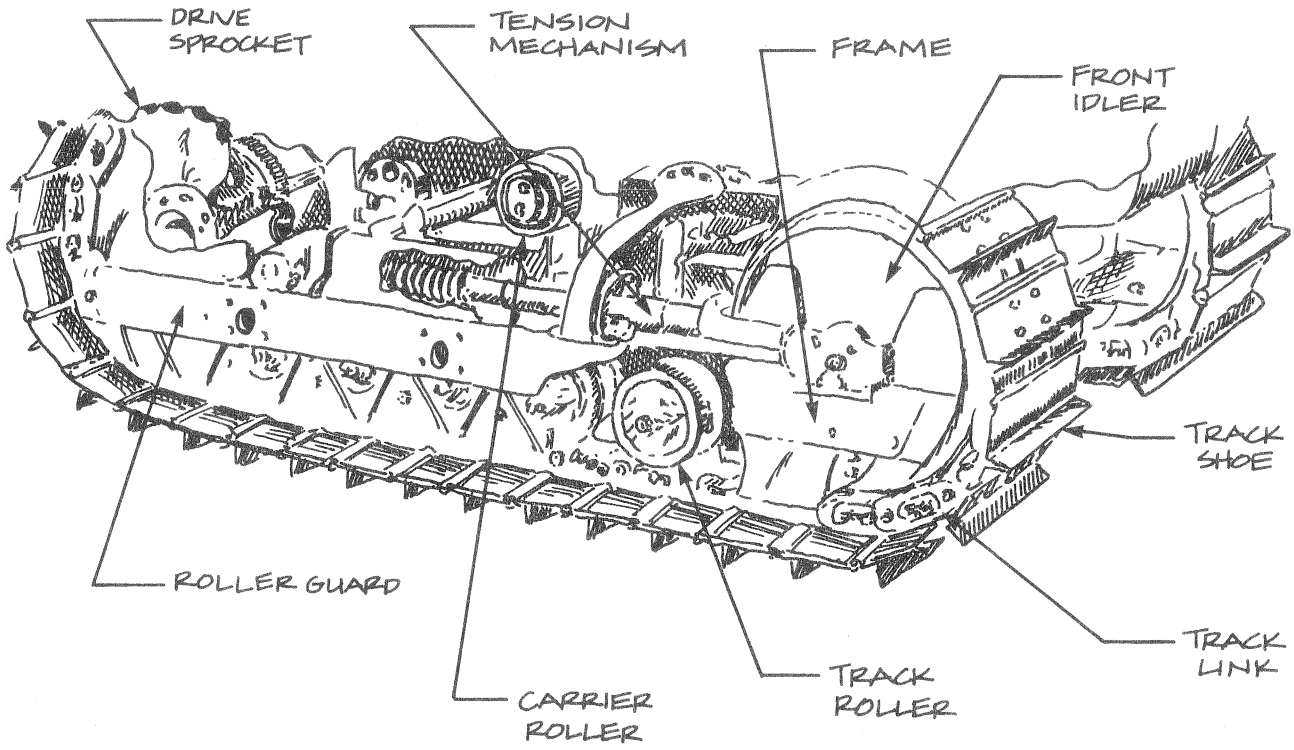
1. Weight is distributed over a large area.
2. More surface area in contact with soil.
3. The number of teeth on the drive sprocket is not an even multiple to the spaces between bushings so that the teeth will not contact the same bushing each revolution of the tracks.
4. The grease fitting is not for lubrication but a hydraulic fitting for track tension adjustment.
5. 1"
6. It becomes greater.
7. Smaller diameter - some held in with retainers
8. Jump track, etc.
9. Excessive wear
10. Would form a grinding compound causing excessive wear

CRAWLER TRACTOR

TM-1

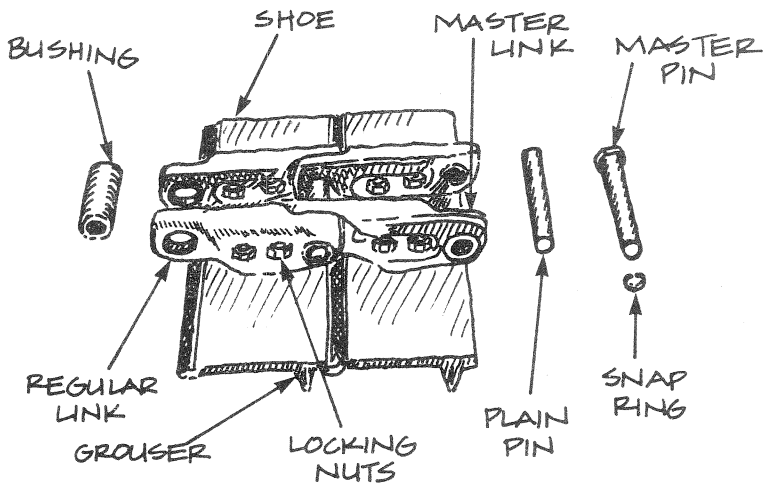


TRACTORS ARE LIKE ROLLER CHAINS WITH SHOES

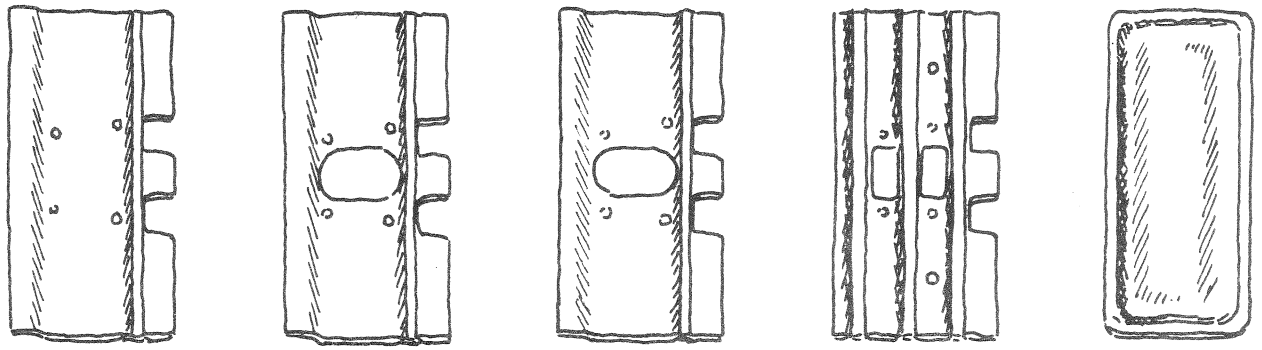


CRAWLER TRACTOR TRACK

TRACKS

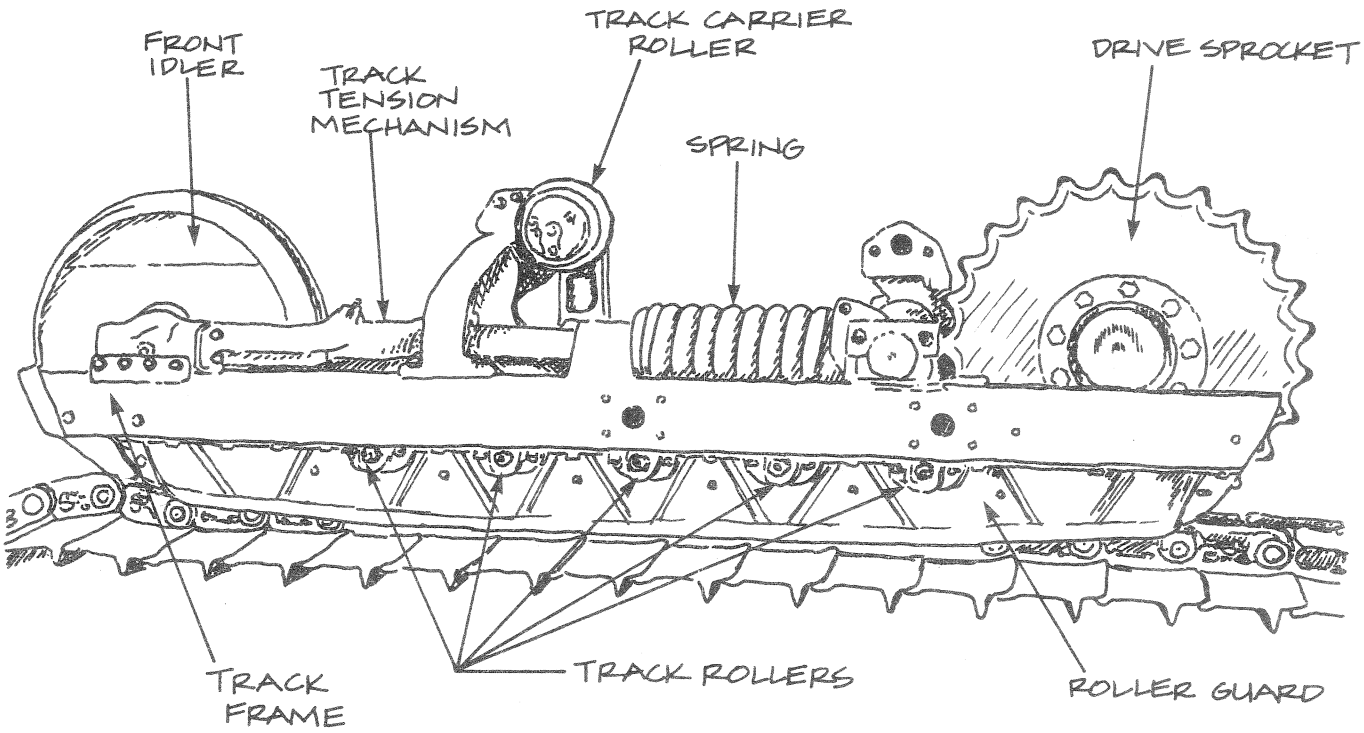


TRACK LINKS AND SHOES



COMMON TRACK SHOES

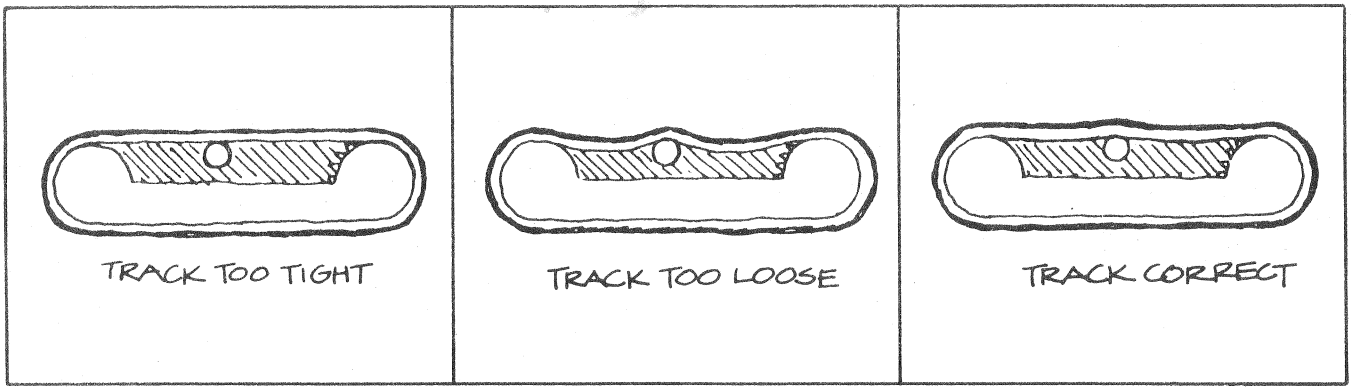
TRACK MECHANISM

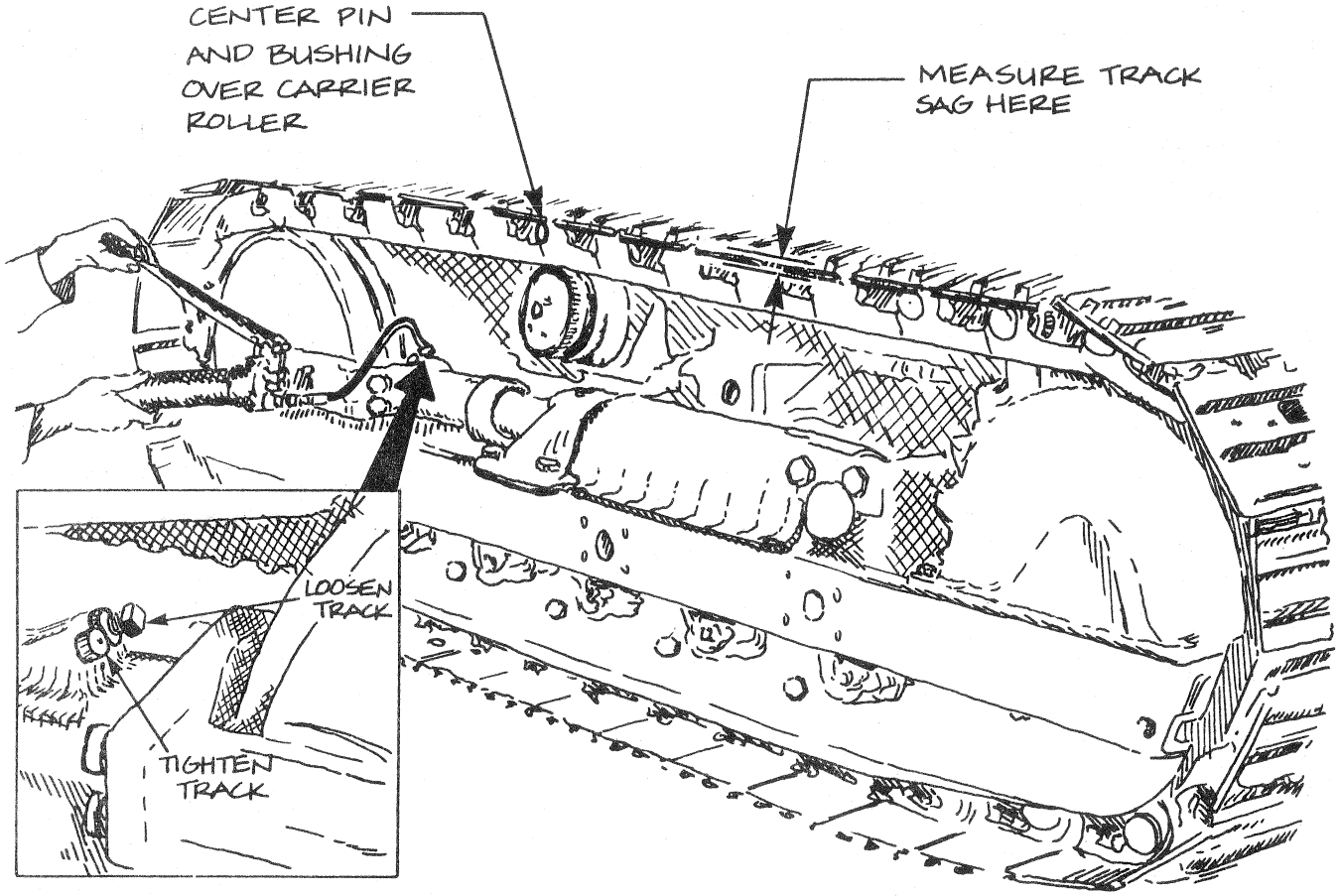


CRAWLER TRACTOR TRACK AND UNDERCARRIAGE

TRACK TENSION ADJUSTMENT

TM-4





Results of Improper Track Adjustment

TM-4A

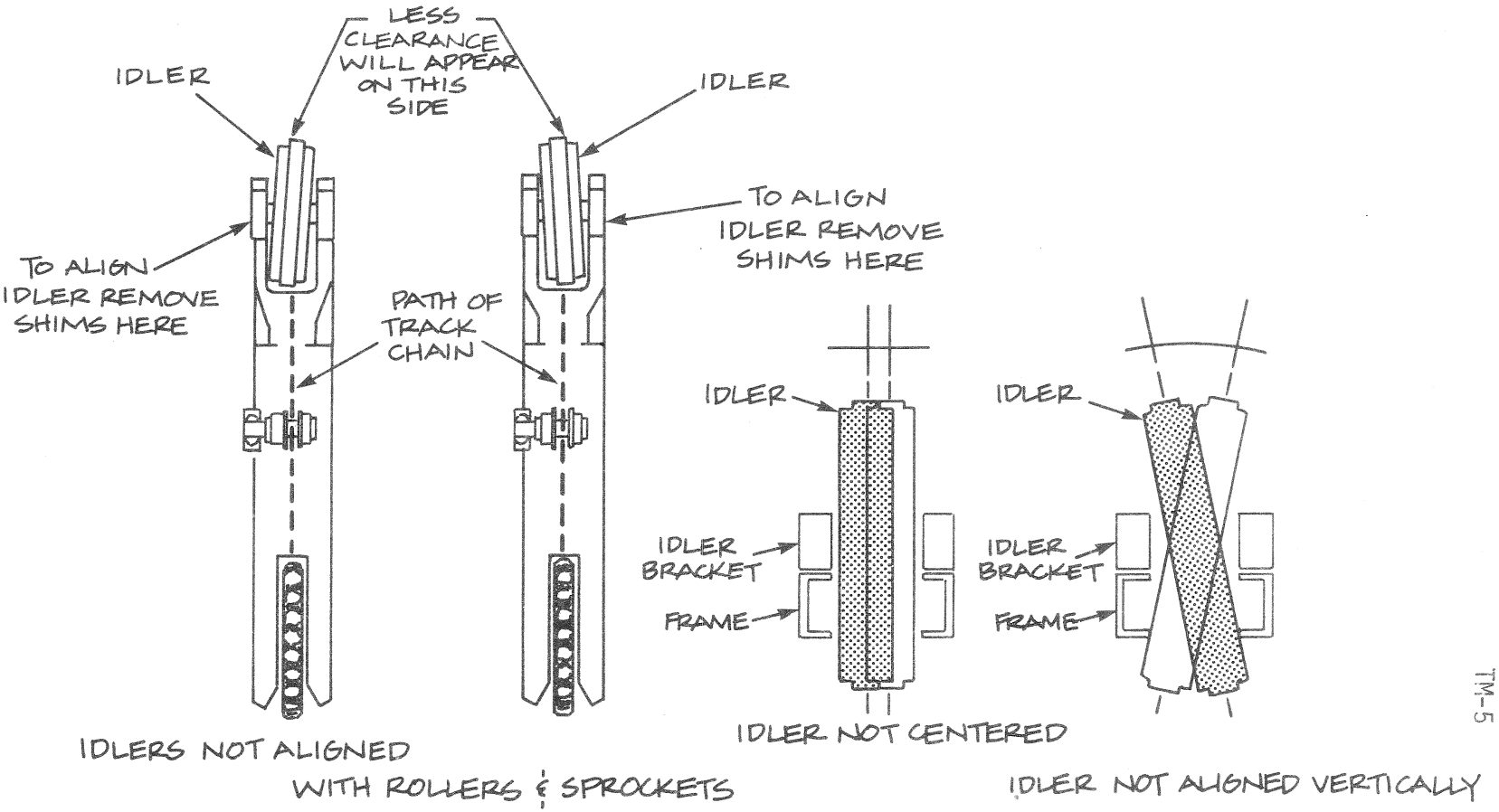
Track Too Loose

1. Extremely fast wear on pins, bushings, and track links.
2. Unnecessary and rapid wear on sides of drive sprocket, teeth and idler wheel flanges
3. Possible damaged or broken drive sprocket, idler and idler bracket, side frames, and rollers.
4. Track may jump sprocket in both forward and rearward operation. Track may be thrown off when tractor is turned.
5. Noisy track.
6. Frequent accumulation of trash in track.

Track Too Tight

1. Extreme loss of drawbar power and ground speed. Tractor will not handle rated working load.
2. Drifting of tractor to right or left, depending on which track is tighter.
3. Fast wear on pins, bushings, and track links.
4. Excessive and rapid wear on drive sprockets and idler wheels. Extra strain on entire track system because flexibility is lost.
5. Unnecessary wear on final drive bearings and oil seals.
6. Abnormal steering clutch wear.

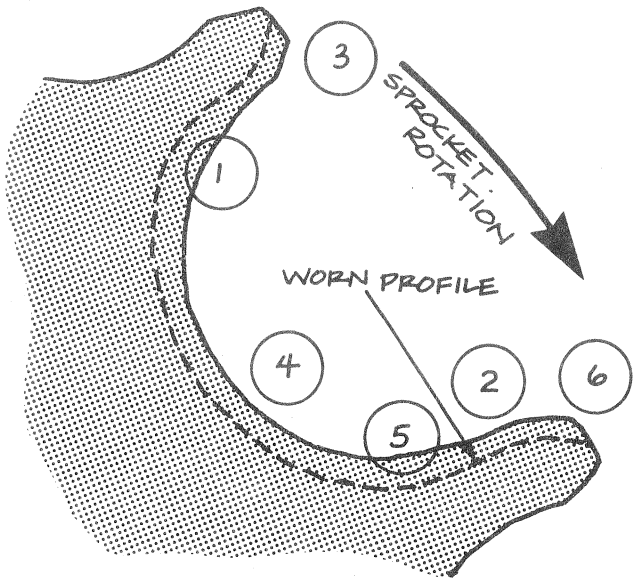
IDLER ALIGNMENT



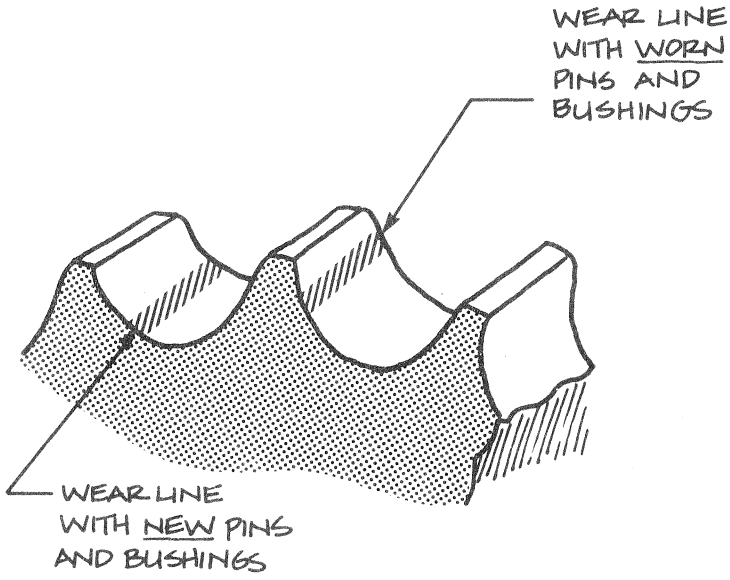
IDLER MISALIGNED - 3 EXAMPLES

SPROCKET WEAR

TM-6



1. DRIVE SIDE WEAR – WHEN OPERATING FORWARD.
2. REVERSE DRIVE SIDE WEAR – WHEN OPERATING IN REVERSE
3. CLIMBING WEAR – RESULT OF INCREASED TRACK PITCH.
4. ROOT WEAR – WHEN BUSHING SLIDES FROM SIDE TO SIDE.
5. ROTATING WEAR – WHEN BUSHING ROTATES AS IT LEAVES (FORWARD) OR ENTERS (REVERSE) THE SPROCKET.
6. REVERSE DRIVE SIDE TIP WEAR – WHEN SPROCKET PITCH IS GREATER THAN TRACK PITCH.



TROUBLE SHOOTING CHART FOR TRACKS

Refer to this guide for possible causes of track problems.

Fast wear on pins, bushings, and track links.	1. Track too loose. 2. Track too tight. 3. Track misaligned. 4. Sprocket badly worn. 5. High-speed operation.
Rapid wear on sides of sprocket teeth, idler, and rollers.	1. Track misaligned. 2. Sprocket or idler misaligned. 3. Track too loose.
Track whips and damages other components.	1. Track too loose. 2. Idler frozen in back position.
Track jumps sprocket or is thrown off.	1. Track too loose.
Noisy track.	1. Track too loose.
Frequent accumulation of trash in track.	1. Track too loose.
Loss of drawbar power.	1. Track too tight.
Drifting to right or left.	1. One track tighter than the other. 2. Track misaligned.
Abnormal wear on final drive bearings and oil seals.	1. Track too tight. 2. Track misaligned.
Abnormal wear on steering clutch and brake.	1. Track too tight. 2. Track misaligned.

General References

Preventive Maintenance-Fundamentals of Machine Operation. John Deere Service Publications.

Tires and Tracks-Fundamentals of Service. John Deere Service Publications.

Slides produced by John Deere Service Publications.

"Facts about Tracks" Caterpillars