

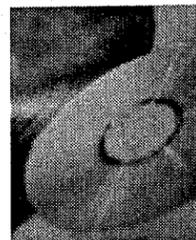
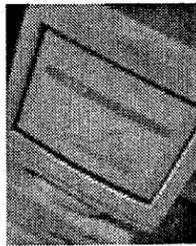
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TECHNICAL REPORT NO. 74-26

ENGINEER TEST AND USER EVALUATION OF UNA-TRACK KIT

by

Joseph T. Gurganious  
Mobility Branch

May 1974

Final Report

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U. S. ARMY LAND WARFARE LABORATORY

Aberdeen Proving Ground, Maryland 21005

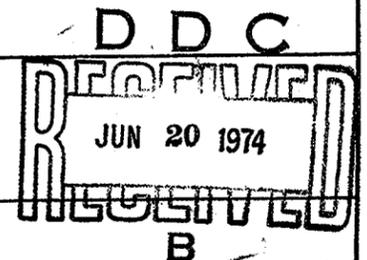
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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER TECHNICAL REPORT NO. 74-26	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) ENGINEER TEST AND USER EVALUATION OF UNA-TRACK KIT		5. TYPE OF REPORT & PERIOD COVERED Final Report
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Joseph T. Gurganious Mobility Branch		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Land Warfare Laboratory Aberdeen Proving Ground, MD 21005		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS LWL Task No. 08-M-73
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE May 1974
		13. NUMBER OF PAGES 36
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report)  Approved for public release; distribution unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) UNA-Track Tracks for replacement of wheels Vehicle for all-terrain mobility Vehicle for all-year mobility Track Conversion Kit for 4-wheel drive vehicles		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The UNA-Track Kit consists of four independent track assemblies which mount directly to the hubs of existing 4-wheel drive vehicles. The tracks replace the wheels on a one-for-one basis; no vehicle modifications are required. UNA-Track Kits were mounted on the 1/4-ton M151 and 1 1/4-ton M715/725 trucks and tested to determine the mobility in an arctic environment, and to determine what modifications would be required. Engineer Design Tests were conducted at Aberdeen Proving Ground, MD and service type tests were (CON'T)		



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## 20. ABSTRACT CON'T

conducted at Fort Greely, Alaska. The UNA-Track did significantly improve the mobility of the 1/4-ton M151, but power steering and other steering system modifications would be required for acceptable operation. The mobility of the 1 1/4-ton M715/725 was also significantly improved, but power steering and other steering system modifications would also be required. In addition, the weight of the 1 1/4-ton vehicle resulted in early failures of the UNA-Tracks. The report concludes that the UNA-Track Kits significantly improve the mobility in winter and summer arctic terrains. A recommendation is made that the UNA-Track Kits be redesigned to correct deficiencies and evaluated for use on military/commercial type 4-wheel drive vehicles which are organic to most Army Transportation Motor Pools.

## PREFACE

The US Army Land Warfare Laboratory evaluated the UNA-Track Kit System in response to a request from HQ, US Army, Alaska.

Technical feasibility tests were conducted for LWL at Aberdeen Proving Ground, MD on a 1/4-ton, 4 x 4, M151 truck and a 1 1/4-ton, 4 x 4, M715 truck by The Materiel Test Directorate, USATECOM. Operational feasibility tests were conducted at Fort Greely, Alaska by the Vehicle Test Branch, US Army Arctic Test Center. Tests were conducted under USATECOM Project Numbers 1-VG-687-UNA 001 & 002.

Toward the end of the tests in Alaska, the UNA-Track manufacturer made design changes and up-dated his commercial inventory of UNA-Track items to correct the deficiencies found in these tests. In early 1974, the Canadian Army R & D Headquarters procured and began evaluating a set of the up-dated UNA-Tracks on a commercial "Dodge Power Wagon" (a 3/4-ton pick-up truck with 4-wheel drive and power steering). The Canadian user evaluation is continuing. To date, no significant problems have occurred, and the Canadian evaluators are well pleased with performance and durability of the Dodge Power Wagon application. A contact for further information is: Defense Headquarters, 200 Elgin Street, ATTN: DLMSEM 3-2-2, Ottawa, Ontario K1A 0K2 (Telephone 613-992-9624).

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INTRODUCTION

During the winter months in the northern hemisphere, ground vehicle operation is frequently made difficult by heavy snow fall. During other seasons in the arctic and subarctic regions the terrain becomes difficult to negotiate due to boggy muskey areas. Limited road networks add to the limitations on vehicle travel. The mobility of the Army's wheeled vehicles must be improved if the Army is to achieve year-round mobility in those areas. The UNA-Track Kit (the test item) is a commercial innovation which appears to offer an approach toward fulfilling the Army's need for arctic and subarctic transportation. Figure 1 illustrates a test application of the UNA-Track to the 1/4-ton M151 truck.

The USALWL procured a number of the UNA-Track Kits for technical assessment and operational evaluation on 1/4-ton M151 trucks, a 1 1/4-ton M715 truck and a 1 1/4-ton M725 ambulance. Technical tests were conducted at Aberdeen Proving Ground, Maryland and operational feasibility tests were conducted at Fort Greely, Alaska. The tests were conducted for the USALWL by the US Army Test and Evaluation Command (TECOM).

The plan of this report is to describe the UNA-Track Kit system, to summarize the test results, and to describe the modifications which are required to make the UNA-Track Kit suitable for further consideration by the Army. In describing the UNA-Track items and the installation/operation procedures, references are made to the "Manufacturer's Suggested Operator Instructions," which is included in this report as the Appendix.

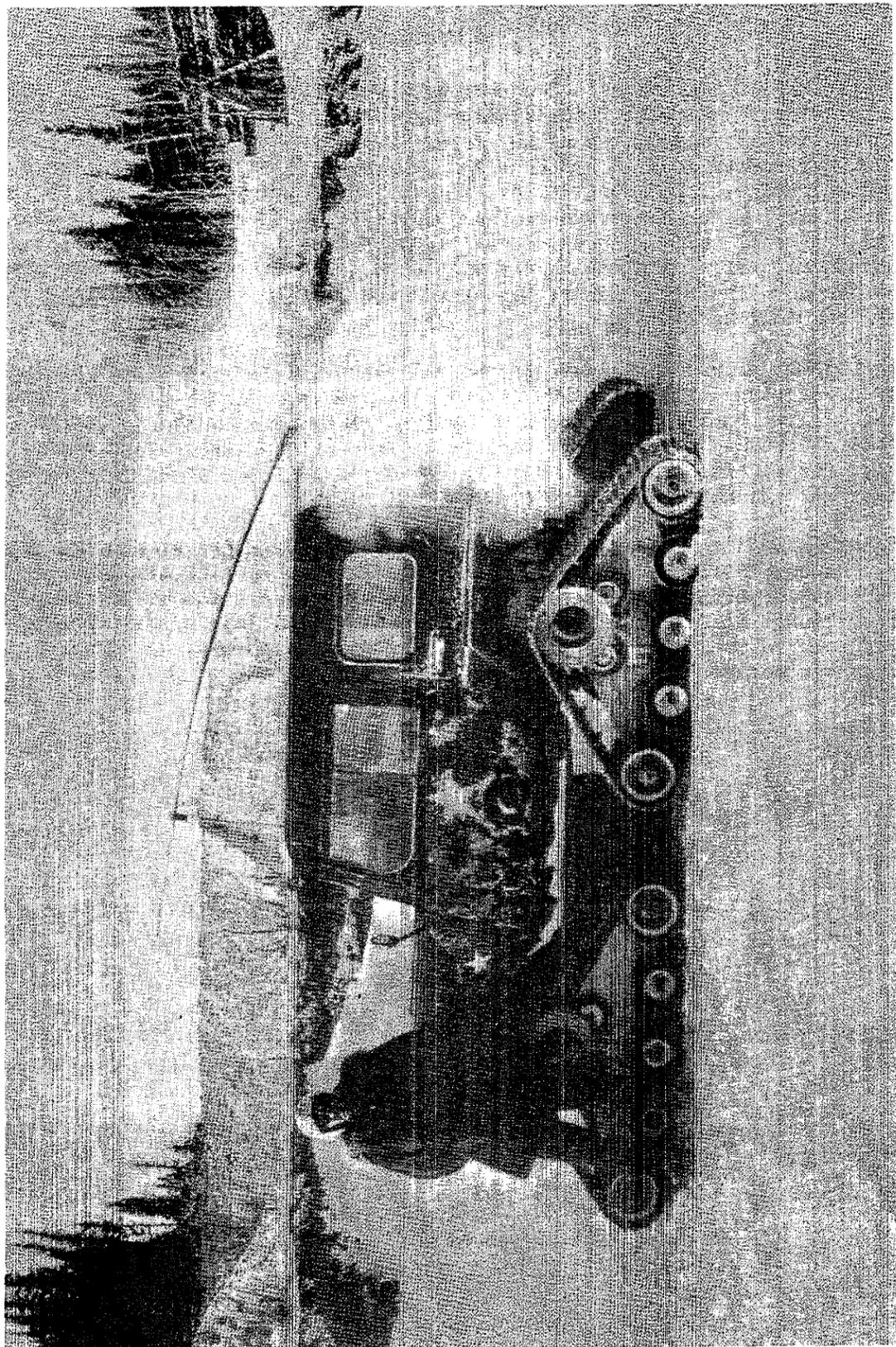


Figure 1. The UNA-Track Kit on the 1/4-Ton M151 Truck Undergoing Feasibility Test in Alaska.

#### DESCRIPTION OF EQUIPMENT

The UNA-Track Kit (test track system) consists of four independent track assemblies which mount, without modification, onto the hubs of 4-wheel drive vehicles. Each track assembly is 68 inches long, 18 inches wide, 32 inches high, and weighs 278 pounds. Each assembly has six major components: body, idler, bogie and drive support wheels, drive sprocket, and track section. The M715/725 vehicles require the addition of a hub adaptor flange to accommodate their six lug bolt configuration. Metal portions of the assemblies are made of aluminum. The track section is 156 inches long and consists of 26 each 6 x 18 inch segments. The track is made of Du Pont Hytrel Polyester Elastomer, used commonly on snowmobiles.

Two types of commercially available track segments, a standard type and a "Special Arctic Blend" type were tested. The standard type track is intended for use in weather temperatures down to approximately thirty degrees below zero (-30°F). The Special Arctic Blend type tracks are for use in extreme cold temperatures of fifteen degrees below zero and lower (-15°F to -65°F). The only difference in physical appearance between the two types of track is that the standard type is black and the Special Arctic Blend is orange in color.

The manufacturer's suggested operating instructions are given in the Appendix. The Appendix gives a detailed description of the assembly, operation, and maintenance of the UNA-Track. It also includes a component identification and parts list.

## TECHNICAL FEASIBILITY TEST

### Test Objective

The principal objective of the technical phase of the test was to determine the structural adequacy and operational capability of the UNA-Track system when applied to the 1/4-ton M151 and 1 1/4-ton M715 trucks. A secondary objective was to determine what design changes, if any, should be made to the UNA-Track in order to make it effective, and rugged enough for troop evaluation.

### Test Procedures

The two vehicles were equipped with UNA-Track Kits as shown in Figures 2 and 3. Then they were inspected and weighed. The weight/load distributions for the two UNA-Track equipped vehicles are given in Table 1.

The vehicles were first operated over the gravel course a total of 25 miles, running at speeds up to 20 miles per hour. Next, they were operated over the obstacle courses, including the wave course, the ditch profile, the 18" vertical wall obstacle, the sand course, and the marsh course. (The obstacle courses are described in Reference 1.) Then, by operating on paved surfaces, the operational characteristics were determined, including turning radius, maximum side slope, maximum longitudinal slope, minimum stopping distance, maximum speed, and maximum draw-bar pull.

TABLE 1

#### Load Distribution

<u>Wheel Position</u>	<u>Curb Wt. Lb.</u>	<u>W/Cross-Country Payload-Lb.*</u>
<u>M151A2 Vehicle</u>		
Left Front	850	900
Right Front	850	900
Left Rear	700	1000
Right Rear	<u>700</u>	<u>1000</u>
Total	3100	3800

\*Cross-country payload is 800 lbs for the M151A2 and 2500 lbs for the M715.

<sup>1</sup>"Final Letter Report on Feasibility Test of the UNA-Track Kit on Trucks M151 and M715," TECOM Project No. 1-VG-687-UNA-001, Report No. APG-MT-4359, STEAP-MT-U, dated 17 October 1973.

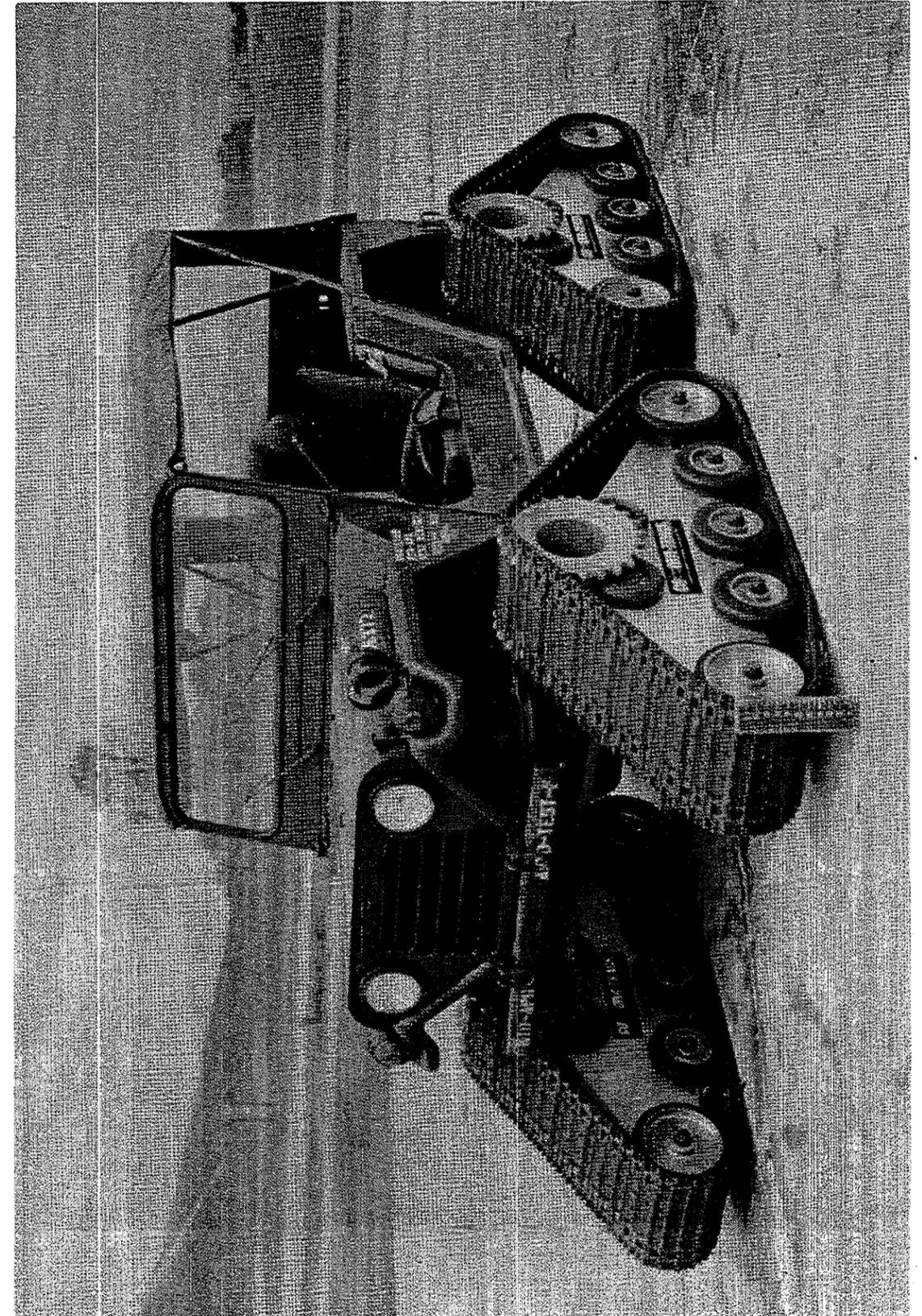


Figure 2. The UNA-Track Kit Applied to the 1/4-Ton M151 Truck.

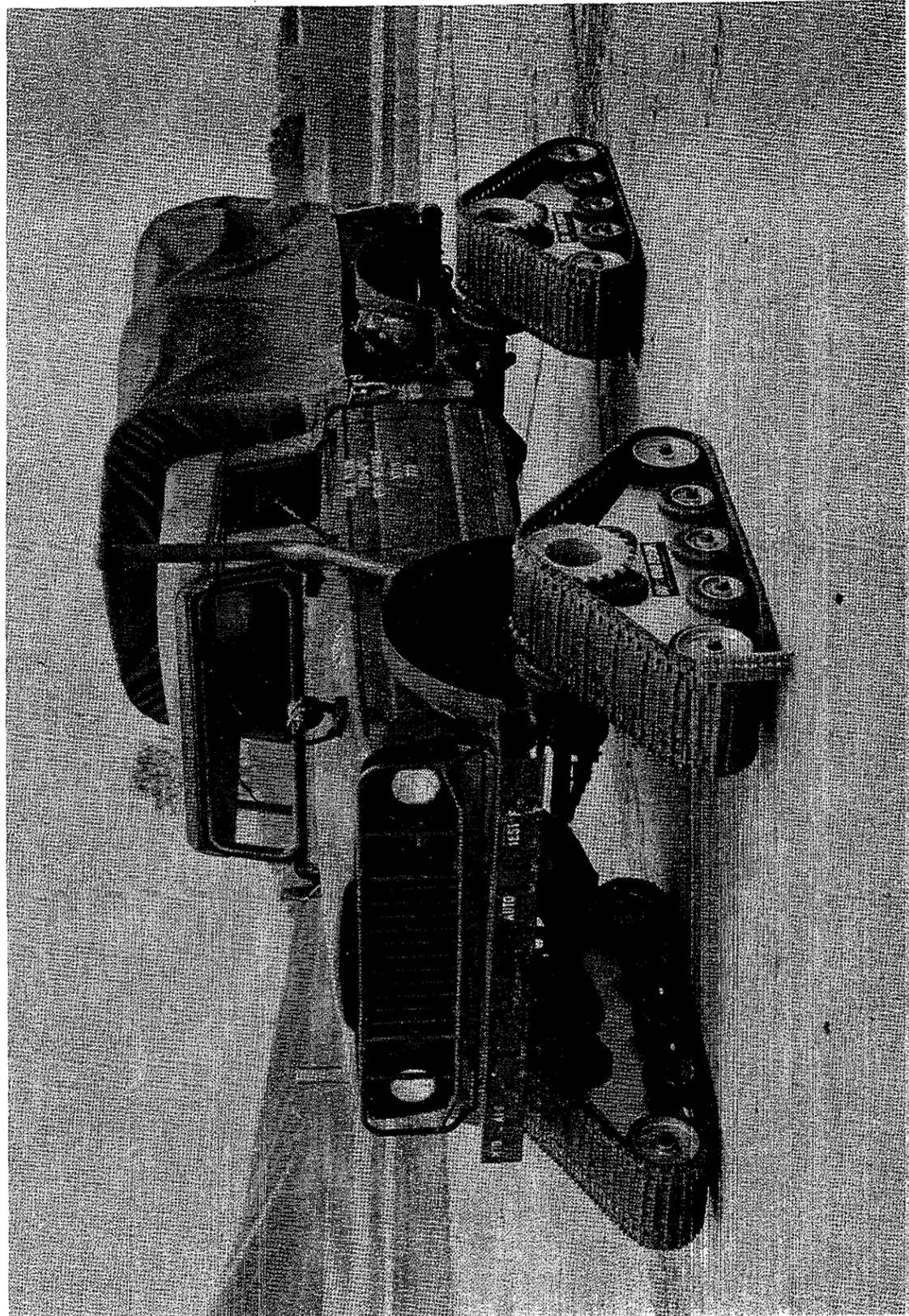


Figure 3. The UNA-Track Kit Applied to the 1 1/4-Ton M715 Truck.

TABLE 1 (Con't)

<u>Wheel Position</u>	<u>Curb Wt. Lb.</u>	<u>W/Cross-Country Payload-Lb.*</u>
<u>M715 Vehicle</u>		
Left Front	1550	1700
Right Front	1500	1600
Left Rear	1450	2500
Right Rear	<u>1450</u>	<u>2500</u>
Total	5950	8300

\*Cross-country payload is 800 lbs for the M151A2 and 2500 lbs for the M715.

Test Results

Durability:

1. During the initial operation over the gravel course, the drive sprocket support roller wheels and the sprocket drum wear plates (Parts No. 66-4 and 66-31 on page 15 of the Appendix) became overheated and excessively worn due to induction of sand and grit. Sand creates an abrasive action that is harmful to the UNA-Track components.
2. During the braking test on the 1 1/4-ton vehicle, when making a panic stop from maximum speed, one track segment failed on each of the two rear tracks.
3. Though no other track failures occurred, the track segments showed evidence of excessive wear. This was attributed to the fact that most of the test operations were conducted on pavement and hard-packed gravel surfaces.

Vehicle Characteristics:

1. Turning Radius: The minimum turning radius for the M151 application was 23 feet to the left and 22 feet to the right. For the M715 application it was 39.5 feet to the left and 34.2 feet to the right.
2. Maximum Side Slope. Both the M151 and M715 UNA-Track applications were found to be capable of operation along side slopes up to and including 30%.
3. Maximum Longitudinal Slope. The M151 application was capable of operating over longitudinal slopes up to 50% grade before losing traction. For the M715, the maximum was 40%.

4. Stopping Distance. The minimum stopping distance from a speed of 15 miles per hour was 23 feet for the M151 application and 27 feet for the M715. (As noted previously, a track segment failed during the braking test on the M715 application.)

5. Maximum Speed. The maximum forward ground speed for both vehicles was found to be 25 miles per hour, though the manufacturer's recommended maximum speed is 20 miles per hour.

6. Maximum Draw-Bar Pull. The maximum draw-bar pull for the M151 UNA-Track application was 1900 lbs, recorded during operation in 1st gear at 4 miles per hour. The maximum for the M715 was 3875 lbs in low range, 1st gear at 3 miles per hour.

#### Operational Capability:

1. Over Obstacles. Both vehicles failed to negotiate the wave course and the 18-inch vertical wall.

2. Across Ditches. Both vehicles negotiated the ditch profile although on the M151, the track assemblies made contact with the vehicle body, doing minor damage to the body panels.

3. Sand Course. Both vehicles traversed the sand course without incident. As noted previously, however, sand creates an abrasive action that is harmful to the UNA-Track components.

4. Marsh. The M151 application traversed the marsh course without incident. The M715 vehicle application did not successfully traverse the marsh course. The M715, having a higher ground pressure, broke through the vegetation mat and became immobilized.

## OPERATIONAL FEASIBILITY TESTS

### Test Objectives

The objectives of the test were to determine the degree to which the UNA-Track system can provide a safe, practical, and significant extension to the Army's all-year vehicle mobility in the Arctic; and to determine the changes necessary to make the UNA-Track system rugged and durable enough for military use.

### Test Procedures

The test was planned and conducted to evaluate the performance of the UNA-Track Kits when used on 1/4-ton M151 series and 1 1/4-ton M725 series vehicles, under both summer and winter arctic conditions. A goal of 750 miles was established for each vehicle (250 miles of summer operation and 500 miles of winter operation). Summer testing took place over secondary roads and trails and over muskeg up to 34 inches in depth. Winter testing was conducted over snow packed roads/trails and frozen tundra in snow depths up to 44 inches. Snow conditions varied from windblown drifts to new dry powder. Temperatures encountered ranged from 55°F to -55°F.

The M725 UNA-Track test vehicle, Figure 4, was operated with 2000 lbs. payload and the M151, Figure 5, with 800 lbs. payload. Crew level maintenance included installation/removal, inspection, lubrication, and part replacement. These activities were conducted under field conditions as well as indoors. The same tools and procedures were used regardless of location.

For a complete description of the test procedures and results, refer to the test reports which were prepared by the US Army Arctic Test Center, References 2 and 3.

### Test Results for the 1 1/4-Ton M725 UNA-Track Test Vehicle

#### Durability of the UNA-Track on the M725:

Testing of the M725, Figure 4, consisted of 25 miles of summer operation and 85 miles of winter operation. Consistent and continuing UNA-Track parts failures dictated that the test of the 1 1/4-ton M725 UNA-Track application be terminated after 110 miles of operation. Most of the failures were directly attributable to an overload condition imposed on the UNA-Track assemblies by the 1 1/4-ton vehicle. The test item as presently designed was, therefore, found to be deficient in terms of reliability/durability (strength and structural adequacy) when used on the 1 1/4-ton M725 vehicle. Redesign of the

<sup>2</sup>Final Letter Report on the M725 Portion of the Feasibility Test of the UNA-Track Kit on Trucks M151 Series and M725," STEAC-MT-VB, dated 11 February 1974.

<sup>3</sup>Final Letter Report on the M151 Portion of the Feasibility Test of the UNA-Track Kit on Trucks M151 Series and M725," STEAC-MT-VB, dated April 1974.

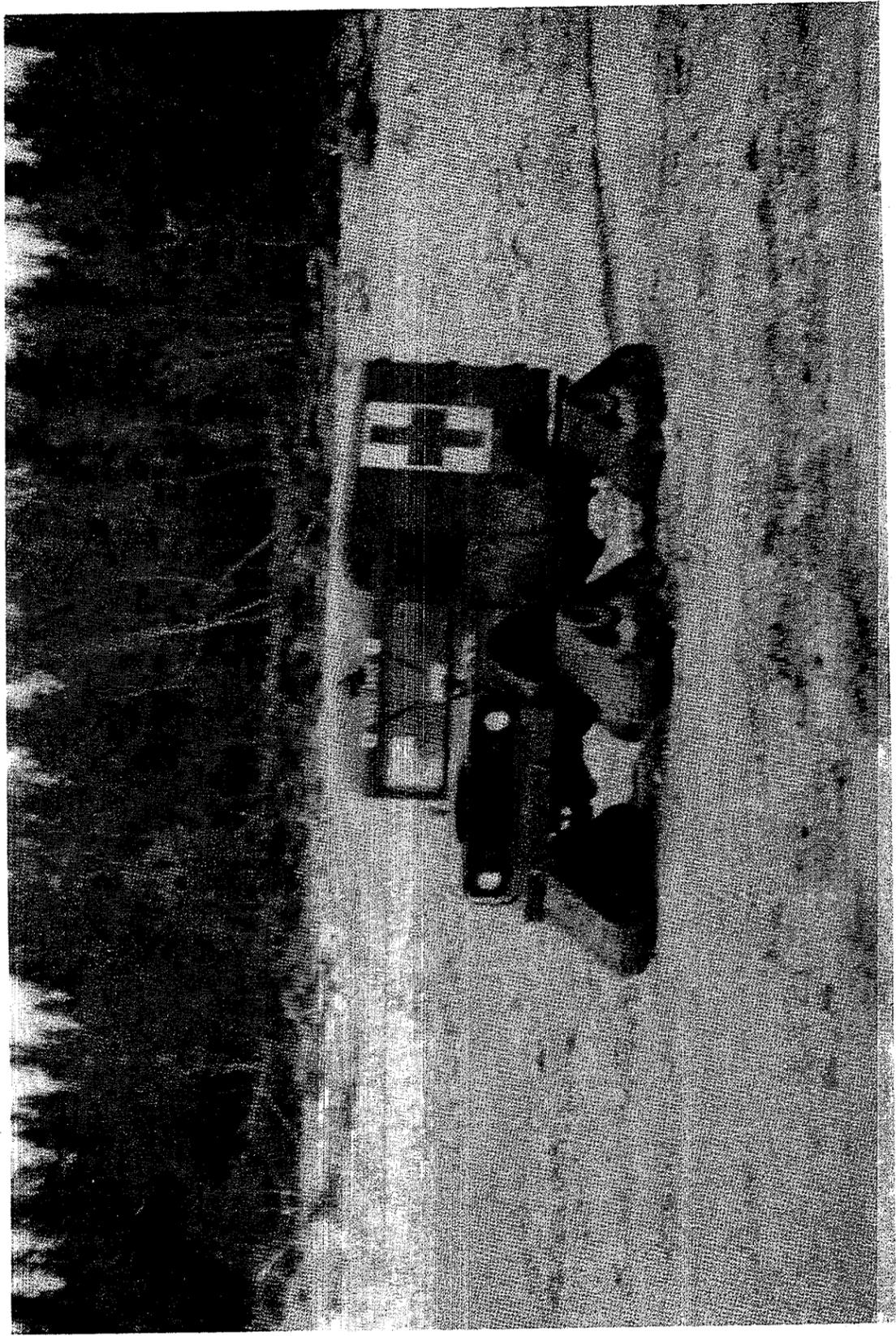


Figure 4. The M725 Ambulance Vehicle Equipped with the UNA-Track Kit Undergoing Feasibility Test in Alaska.

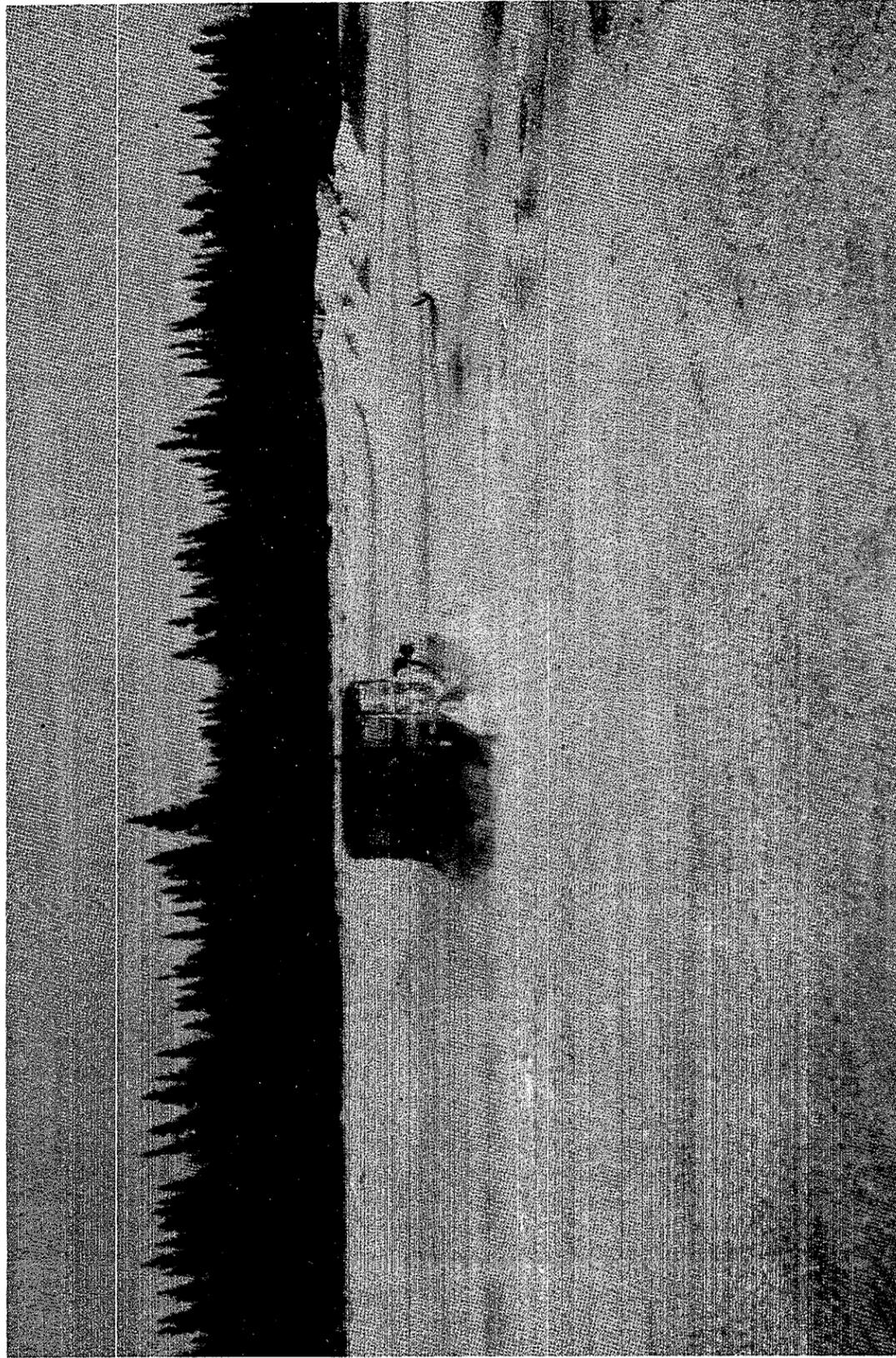


Figure 5. The 1/4-Ton M151 Truck Equipped with the UNA-Track Kit Undergoing Feasibility Test in Alaska.

UNA-Track would be required to provide strengthened bogie wheel axles, sprocket drive support roller wheels, and track connecting pins.

#### Compatibility with the M725:

All drivers complained about the difficult steering. Much greater effort was required to turn the vehicle with the test track system than with the standard wheels. Turning from a standing start on a hard surface was much more difficult than making a stationary turn on snow. Straight line control was relatively easy; however, bumps caused the vehicle to change direction unexpectedly, which required that the driver maintain an unusually firm grip on the steering wheel. This requirement resulted in unacceptable driver fatigue.

These excessive steering forces were another factor in the determination that the UNA-Track as designed, is incompatible with the M725 vehicle. In addition to the operator fatigue problem, the strength of the steering gear assembly is inadequate. The steering gear box failed and had to be replaced with a new one. Finally, it was found that contact with the UNA-Track assemblies when traveling over obstacles caused damage to the M725 body paneling at the wheel wells.

#### Mobility:

Though the M725 never became totally immobilized during the 110 miles of operation, early termination of the test prevented a meaningful evaluation of the degree to which the UNA-Track application increases the mobility of the M725.

#### Test Results for the 1/4-Ton M151 UNA-Track Test Vehicle

#### Durability of the UNA-Track on the M151:

Testing of the 1/4-ton M151 UNA-Track application, Figure 5, consisted of 230 miles of summer operation, and approximately 570 miles of winter operation. Though there were numerous failures, the only significant deficiency in the durability of the UNA-Track was the excessive failure rate of the 1/4" diameter by 18" long steel rods which connect the track segments. The rods broke from fatigue failure, each rod demonstrating a life of only 50 to 100 miles of track operation. (Note: The manufacturer has, based upon these test results, redesigned the track connector into a two piece rod, which will be described later in this report under the heading of Proposed Modifications.)

The standard track performed without significant failure until the operating temperature became as low as -30°F. Then occasional track segment failures occurred due to cold induced embrittlement. The Special Arctic Blend Tracks were installed and thereafter no significant temperature related problems were experienced. Operating temperatures with the Special Arctic Blend Tracks ranged between -6°F and -55°F.

#### Compatibility with the M151:

To a lesser degree, and to an extent which could be taken care of without

unreasonable maintenance and repair, the 1/4-ton M151 experienced the same type of difficult steering and weak steering assembly problems as encountered by the 1 1/4-ton M725 vehicle. The flange and insulator assembly on the M151 steering column required replacement on two occasions during the 803 miles of operation. At the post-winter phase inspection, after completion of the Feasibility Test, the worm gear in the M151 steering gear box was found to be excessively worn. The entire steering gear box was replaced. This steering gear box failure was caused by the same extreme steering force that caused the two steering column flange and insulator assembly failures. The body framework at the gear box mounting location also required repair and reinforcement.

The M151 body paneling at the wheel wells became damaged from contact with the UNA-Track assemblies when traveling over obstacles. This was similar to the compatibility problem encountered with the M725 application.

The fuel consumption with the UNA-Track equipped M151 was approximately two times greater than with the standard wheeled operation. It should be noted, however, that the standard wheeled vehicle could not traverse the terrain on the test course.

#### Mobility:

The mobility of the M151 with the UNA-Track was significantly greater than any conventional wheeled vehicle. The vehicle was mobile over both summer and winter arctic terrain. The vehicle became immobilized in only one terrain condition, a 42-inch depth of snow with a heavy crust on the top. Also, a problem occurred occasionally when the leading track edge encountered a positive change in slope of the snow drifts, which resulted in the track assembly "nosing" under the snow surface. This drags the vehicle into the snow depth and brings it to an abrupt halt. After each such occasion, however, the vehicle was able to back out of the immobilized position under its own power and continue the operation. Figure 6 illustrates this condition. As is discussed later in this report, this problem can, to a degree, be alleviated by modifying the tracks to provide them with an increased "angle of attack."

Another minor problem is impairment of visibility when operating in powdery snow. This situation is illustrated in Figures 7 and 8, which show the snow cloud created by the UNA-Track operation.

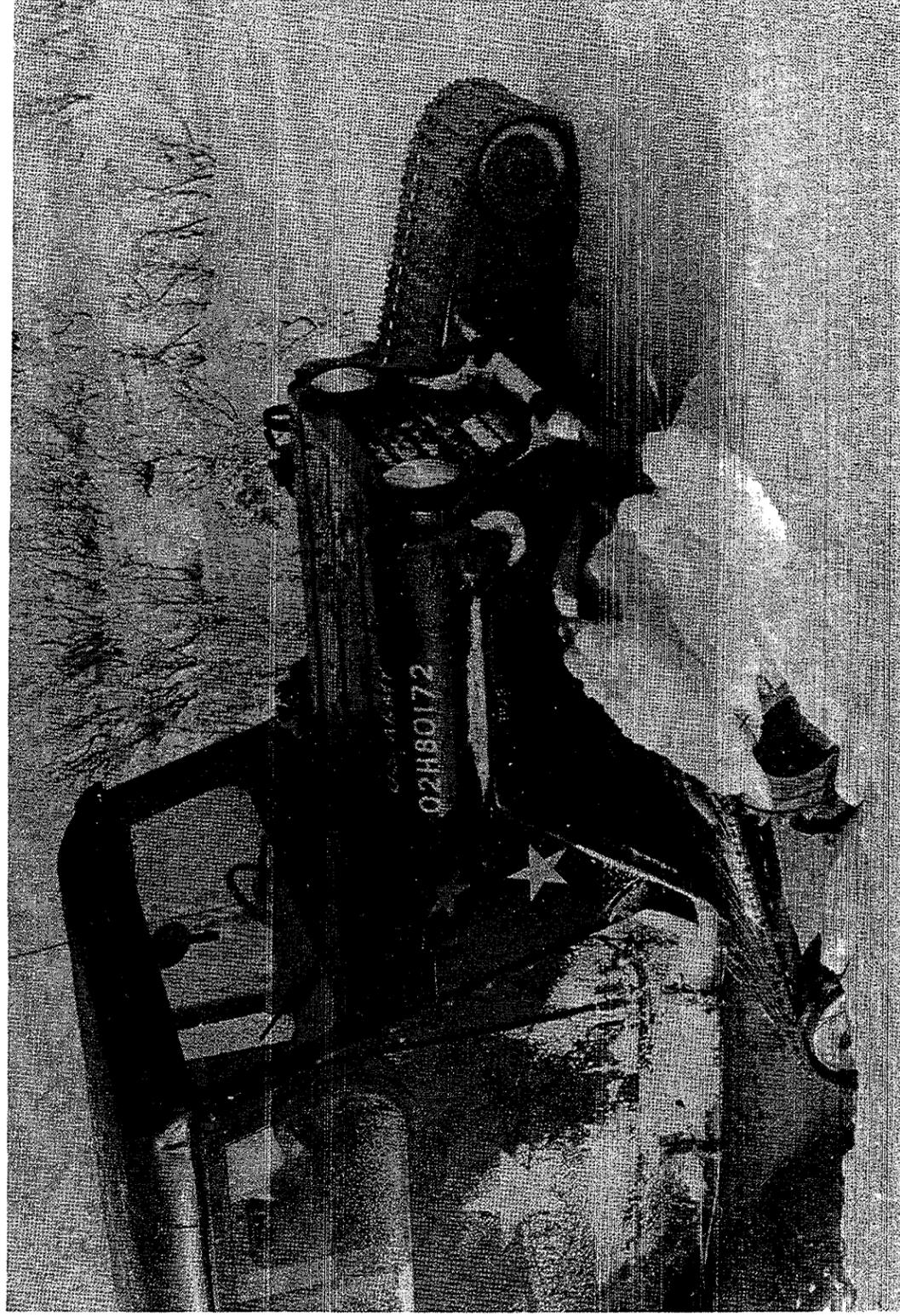


Figure 6. M151 Truck with UNA-Track Temporarily Immobilized Due to "Nosed Down" Condition of One UNA-Track Assembly. The Vehicle Was Able to Back Up and Proceed with Forward Travel.

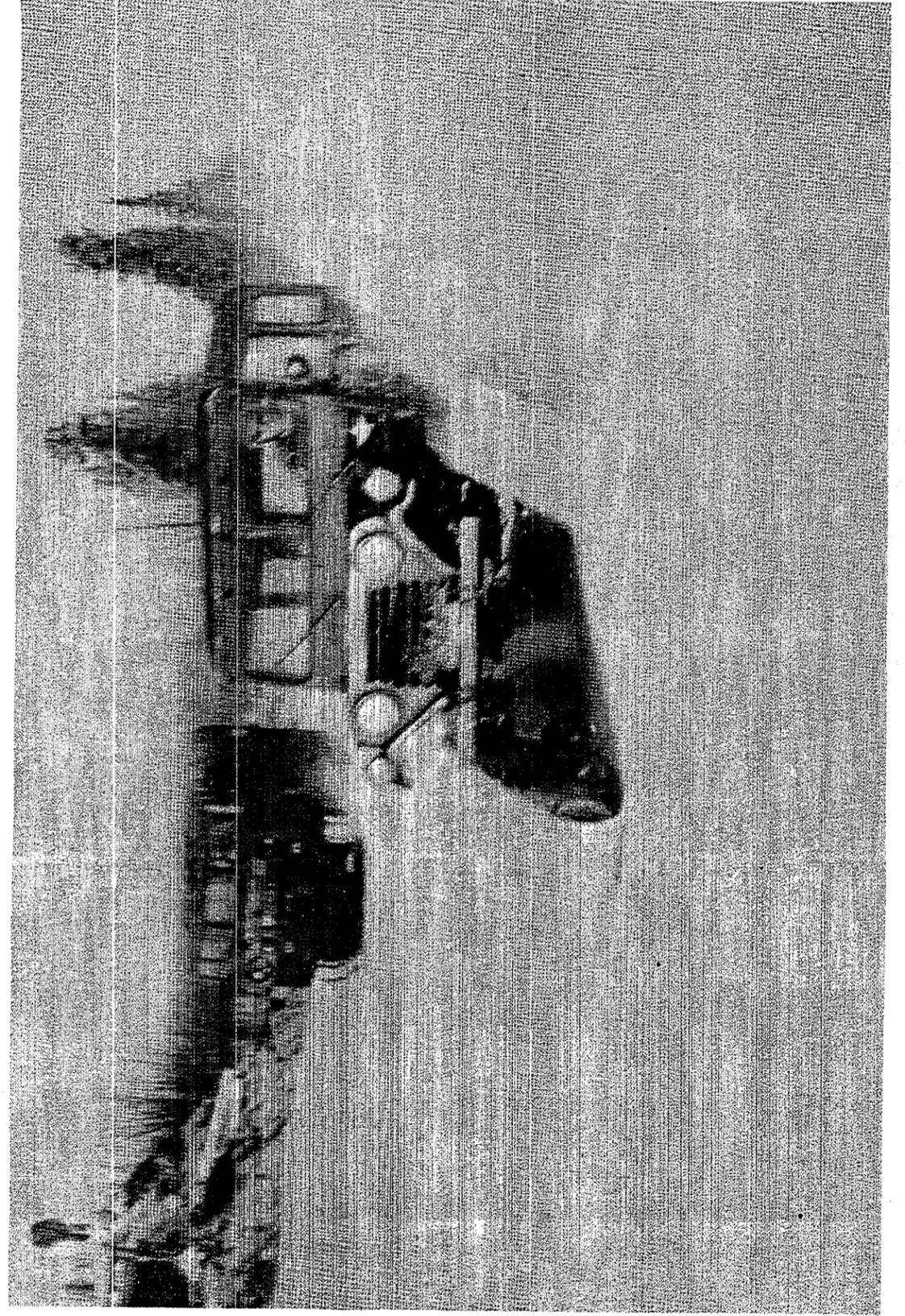


Figure 7. 1/4-Ton M151 Truck Equipped with the UNA-Track Kit Showing a "Snow Cloud" Problem when Operating in Powdery Snow.

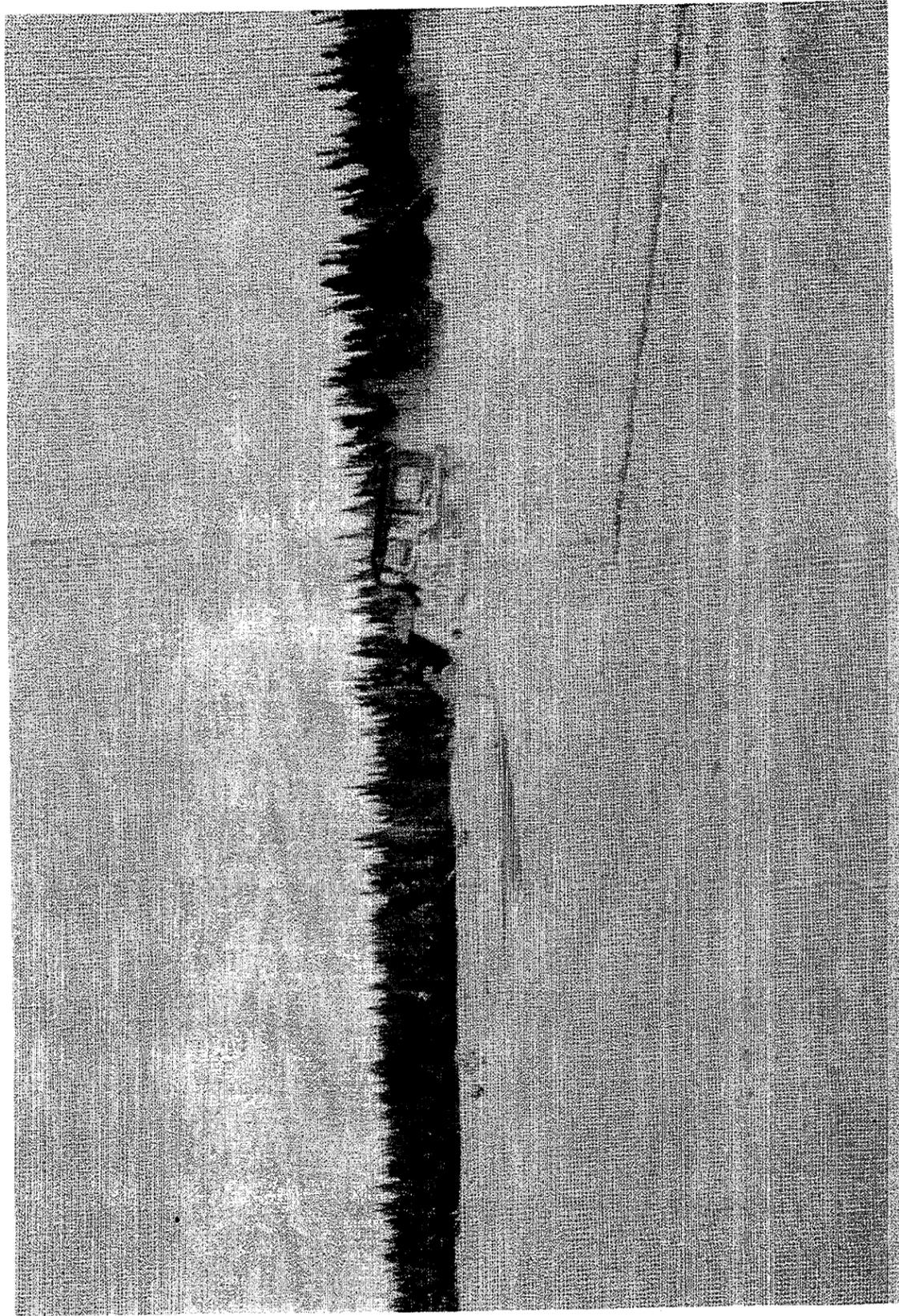


Figure 8. 1/4-Ton M151 Truck Equipped with the UNA-Track Kit Operating Over Powdery Snow.

## MODIFICATIONS REQUIRED

### Selection of Vehicle with Power Steering

Application of the UNA-Track Kit on any vehicle will require that the vehicle be equipped with power steering. Application of the UNA-Track Kit to the 1/4-ton M151 does significantly improve this tactical vehicle's mobile capability, but the M151 would require modification to provide power steering. It would not be practical, however, to significantly modify the tactical vehicle for the specific purpose of adapting an "occasional use" kit.

Most Army transportation motor pools do have military/commercial 4-wheel drive vehicles, e.g., the Dodge 3/4-ton A-200 Pick-up Truck (Dodge Power Wagon). These vehicles are equipped with power steering as an available option, and are designed and currently used for rugged applications. By applying the UNA-Track Kit to these vehicles, they could be made to perform temporary "tactical" missions on difficult arctic terrains. This appears to be a practical and feasible way to achieve a significant increase in mobility with available vehicles.

### Modifications to UNA-Track

The test operations in Alaska identified some deficiencies and shortcomings in the UNA-Track design. Based on this experience, the UNA-Track manufacturer has modified the design. The modified UNA-Track Kit is shown in Figure 9. These design changes appear to provide correction to most of the deficiencies found during the tests in Alaska, but they have not been tested.

#### Track Modifications:

The track-segment connecting rods have been changed from the one-piece, 1/4" diameter by 18" long rod to a two-piece, 1/4" diameter by 8 1/2" long rod connection. The track segments were modified as necessary to receive the 2-piece rod connector. This modification is shown in Figure 10. The track segments were also modified to provide lengthened and reinforced guide lugs. To further improve the track-guide arrangement, a track-guide skirt was welded to the underside of the UNA-Track frame. These modifications are shown in Figure 11.

#### Frame Modifications:

The frame was modified to provide an "angle of attack" for the track, a necessary change to give the UNA-Track a resistance to "nosing" into the snow. The modification was accomplished by raising the idler wheel end of the frame and by using smaller idler wheels, as shown in Figures 12 and 13. The beneficial effect of this modification, for operation in snow, is shown in Figure 14. The frame was also modified to strengthen it as shown in Figures 12 and 15.



Figure 9. The Modified UNA-Track Kit (Installed on Chevrolet Blazer). Note the Improved "Angle of Attack" of the Tracks and the Smaller Idler (End) Wheels.

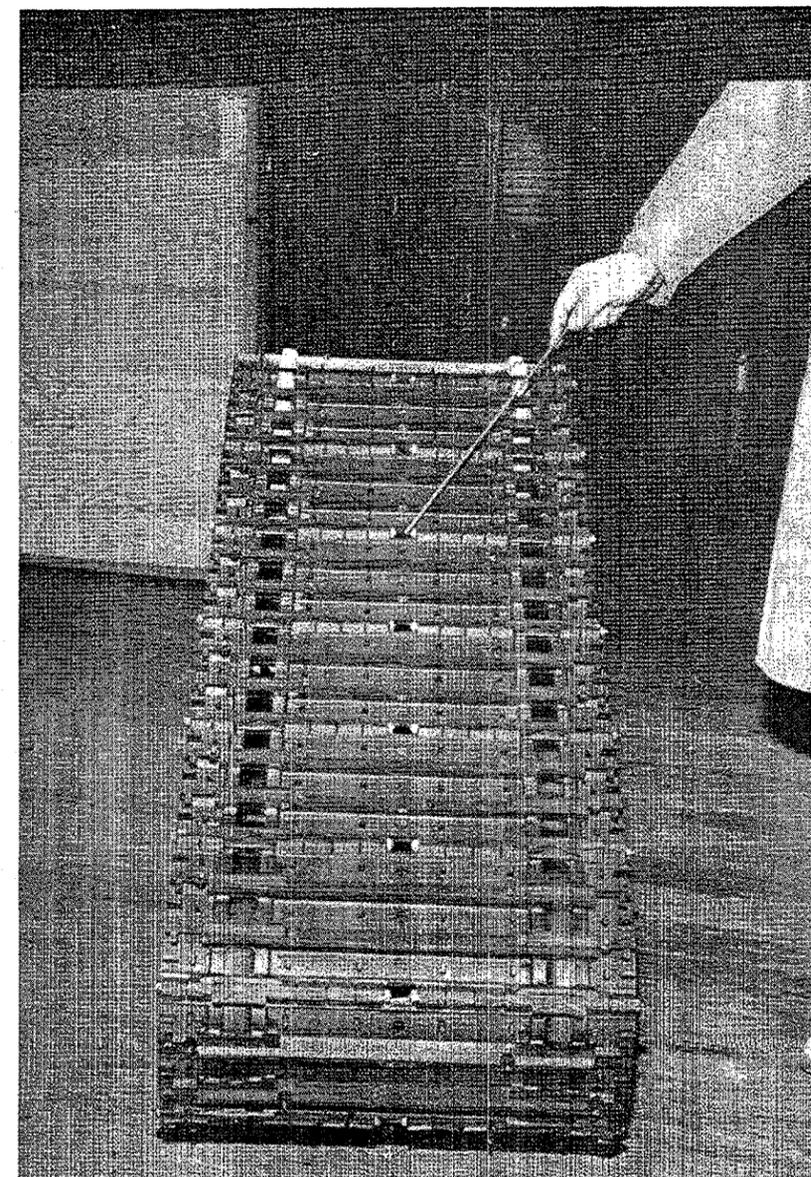


Figure 10. Modification to the Track Assembly of the UNA-Track to Provide a Two-Piece Track Segment Connector Rod as Tested.

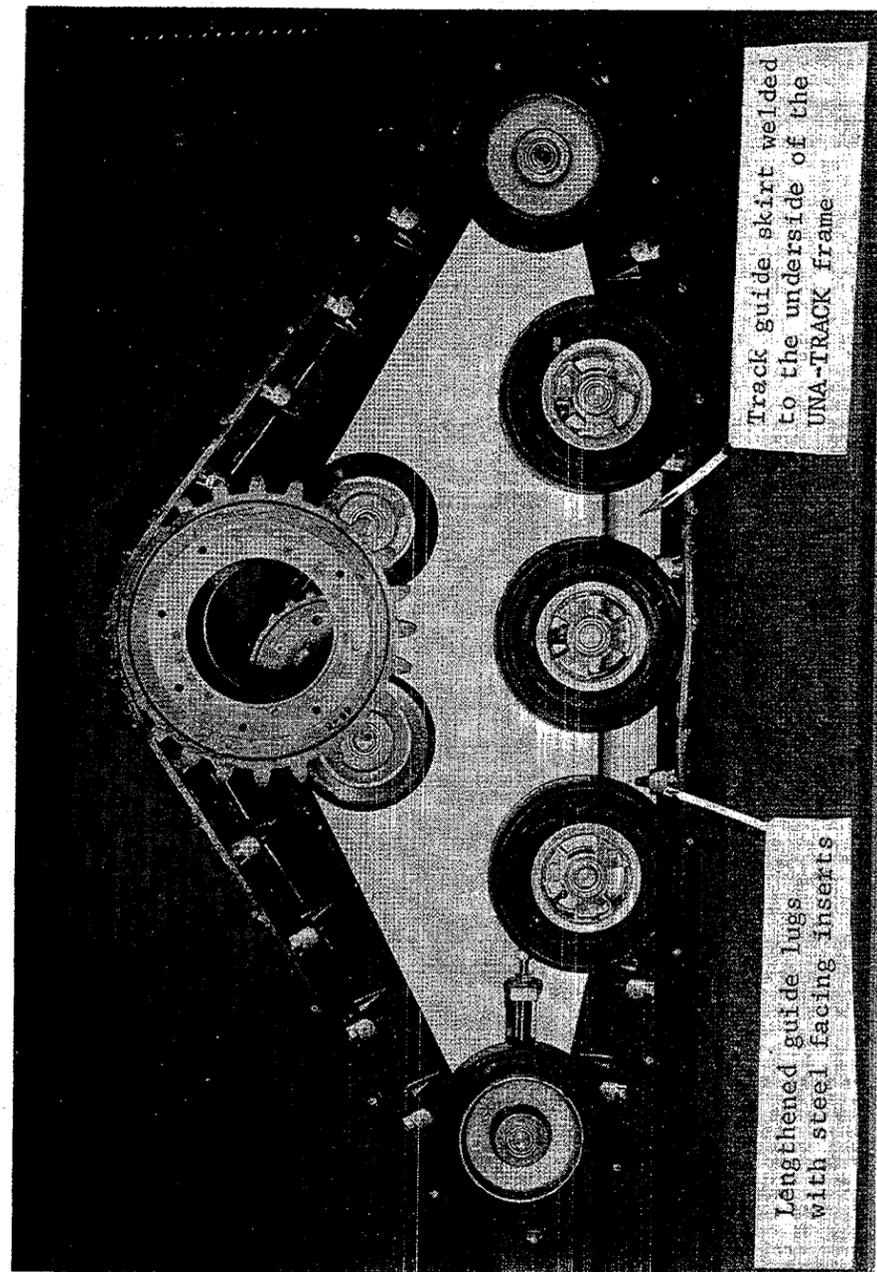


Figure 11. An Illustration Showing Modifications to Lengthen and Strengthen the Track Guide Lugs and to Provide Track Guide Skirts.

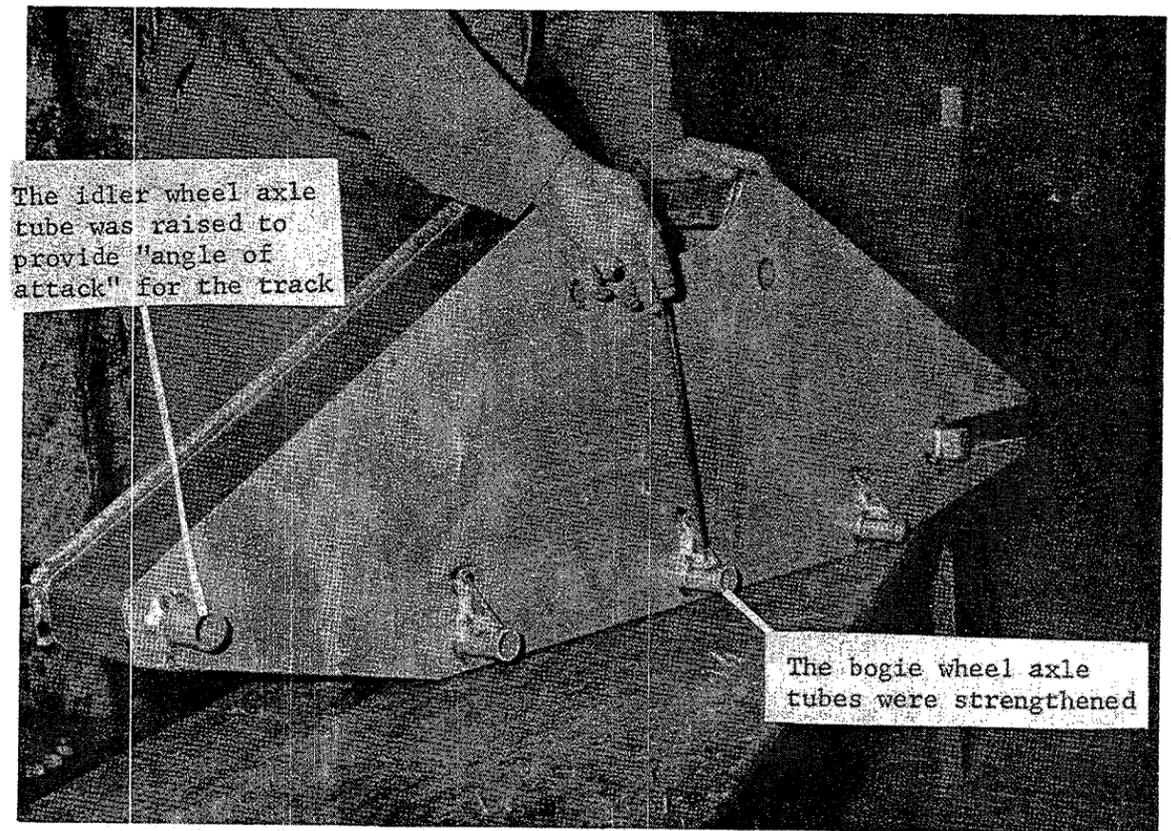


Figure 12. Modification to the UNA-Track Frame as Necessary to Provide a Greater "Angle of Attack" and also to Strengthen the Bogie Wheel Axle Tubes.

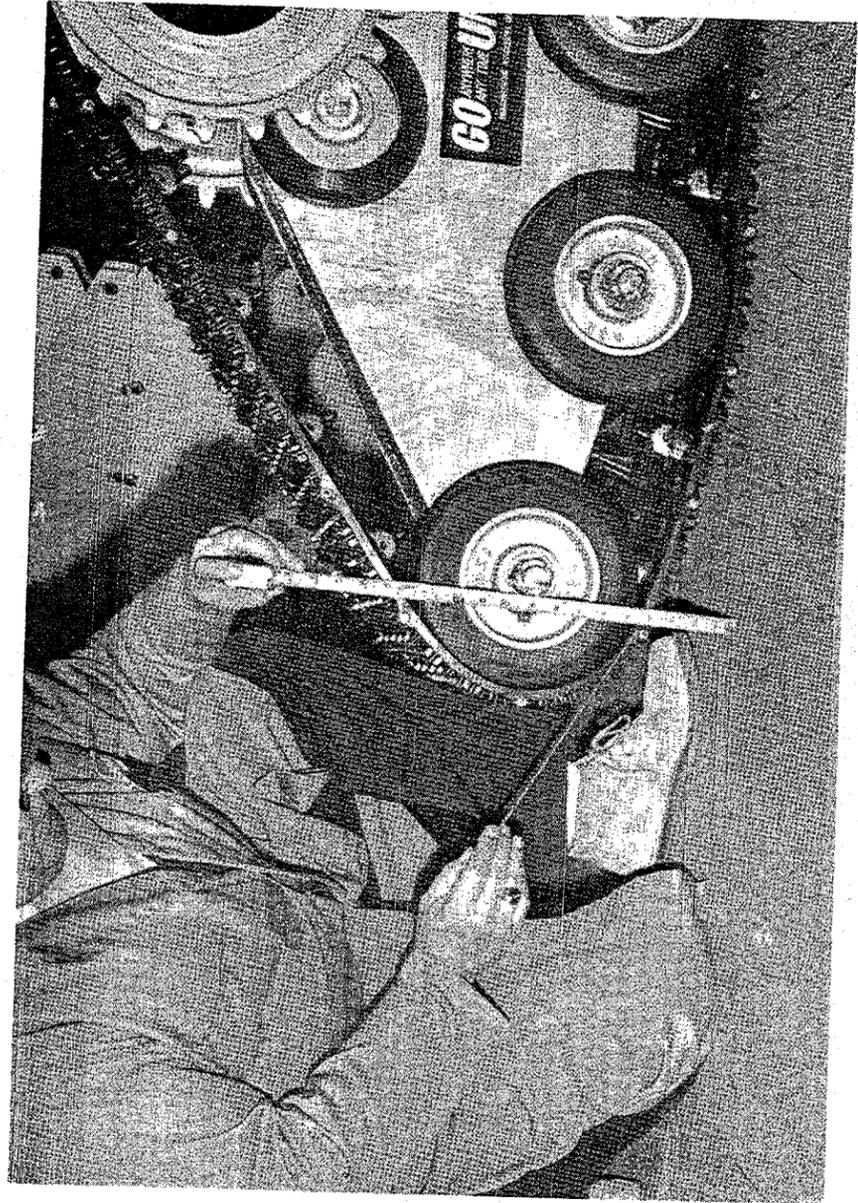


Figure 13. Modification of the UNA-Track to Provide an "Angle of Attack" for the Track. Note the Small Front and Rear Idler Wheels Are Raised 4 1/2" Off the Ground Providing Greater Climbing Characteristics. Refer also to Figure 14.

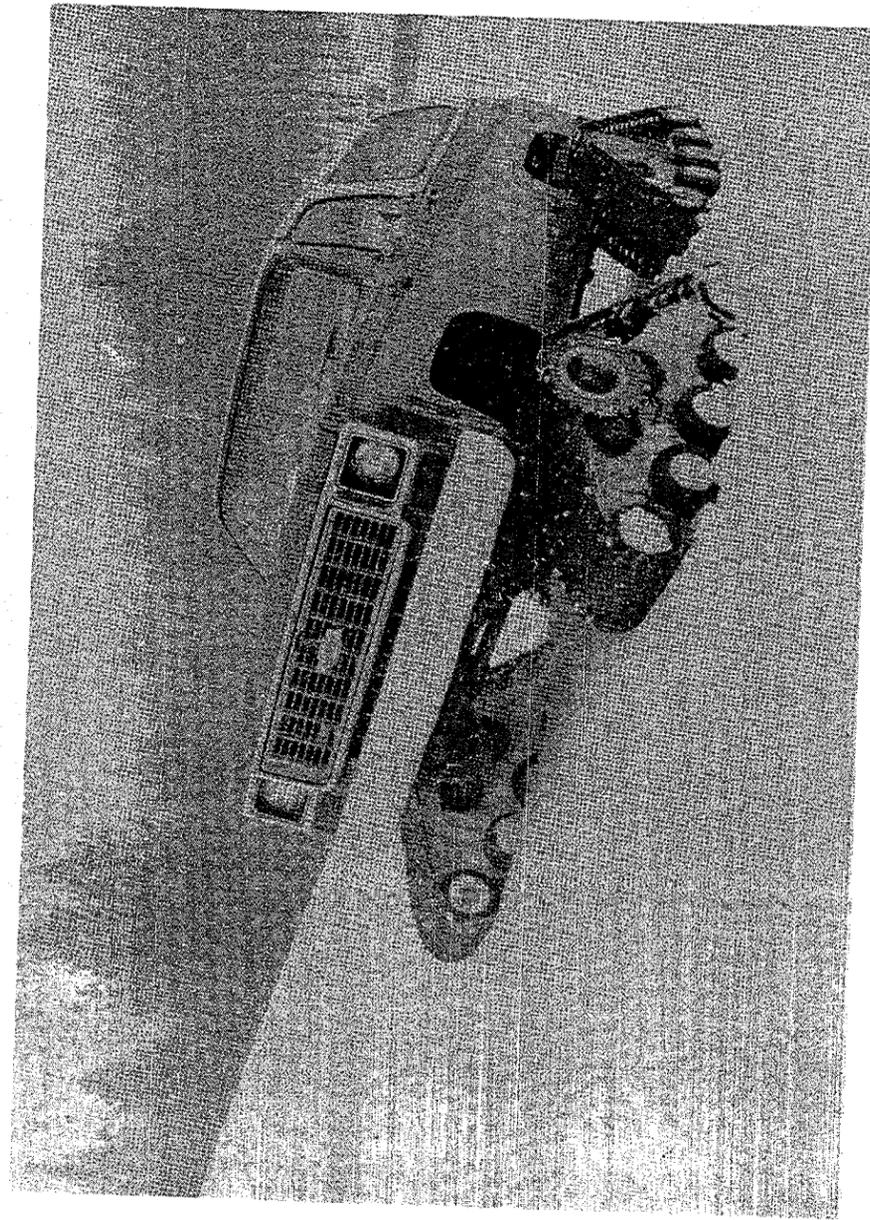


Figure 14. The Modified UNA-Track System Showing How the Raised Idler Wheels Provide Better Climbing Capability.

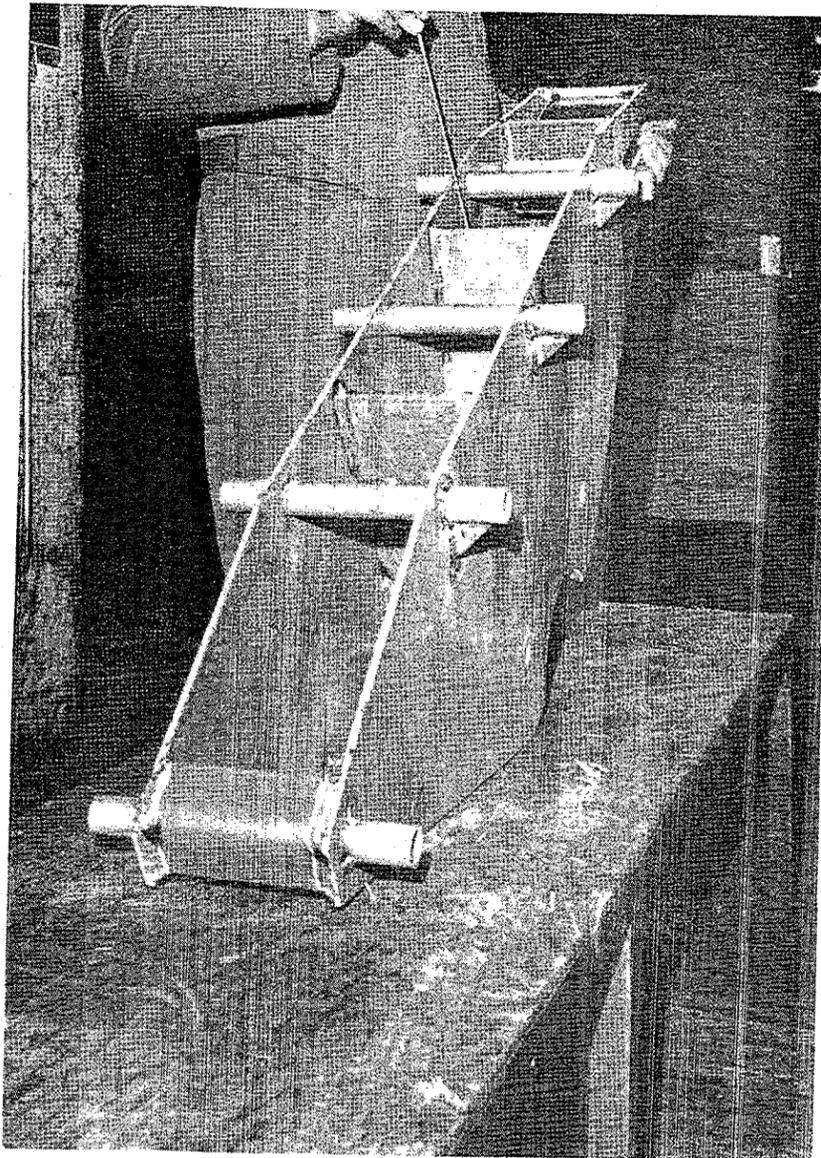


Figure 15. Two Vertical Members Were Welded Inside the Body Panels to Provide Greater Strength.

Changes to the Drive Sprocket and Support Roller Wheels:

The drive sprockets were changed to aluminum alloy 356, and then heat treated to T6 hardness, to improve durability. The drive sprocket support roller wheels were redesigned to provide heavy duty hubs with larger axles and double sealed ball bearings. This modification is shown in Figure 16.

Track Adjustment Take-Up Assembly Modifications:

The track tension adjustment and take-up mechanism was redesigned to make it stronger and more tightly restrained. The modified mechanism is shown in Figure 17.

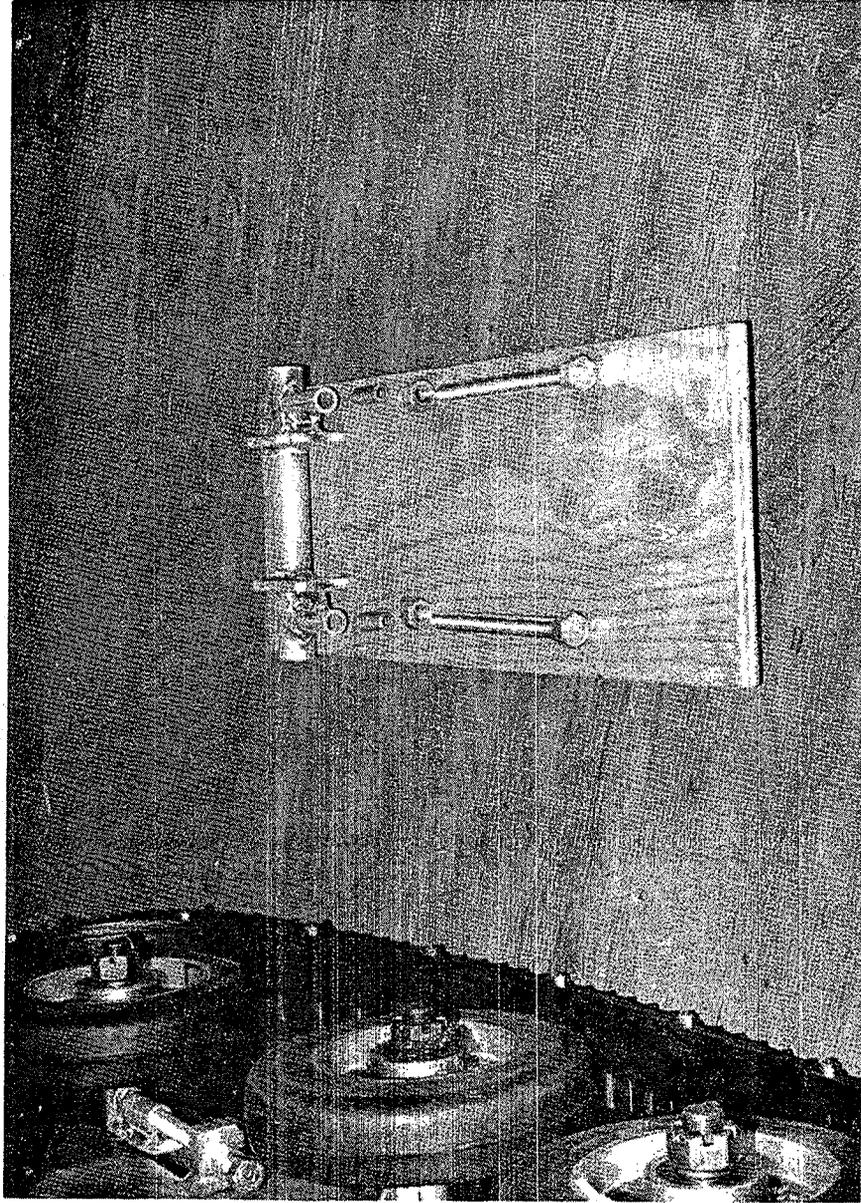


Figure 17. Illustration of the Modified Track Tensioning Adjustment Component.  
It Was Strengthened and Improved in Function.

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusions

The UNA-Track Kit provides all-year and all-terrain mobility of both the 1/4-ton M151 truck and the 1 1/4-ton M715/725 vehicles.

The UNA-Track Kits as tested were not sufficiently durable. Design modifications subsequently made by the manufacturer (but not adequately tested) appear to correct the durability deficiencies. (See "Modifications Required.")

With the Kit installed, the steering effort on both vehicles caused unacceptable operator fatigue.

Failures of steering gear components occurred on both vehicles. Vehicle modifications to overcome these problems are not considered practical (cost effective) for adaptation of a special purpose kit.

UNA-Track Kit, with design modifications to correct durability deficiencies, offers potential for significantly increasing the all-terrain mobility of 1/4-ton to 1 1/4-ton military/commercial type 4-wheel drive vehicles (with power steering) which are organic to most Army Transportation Motor Pools.

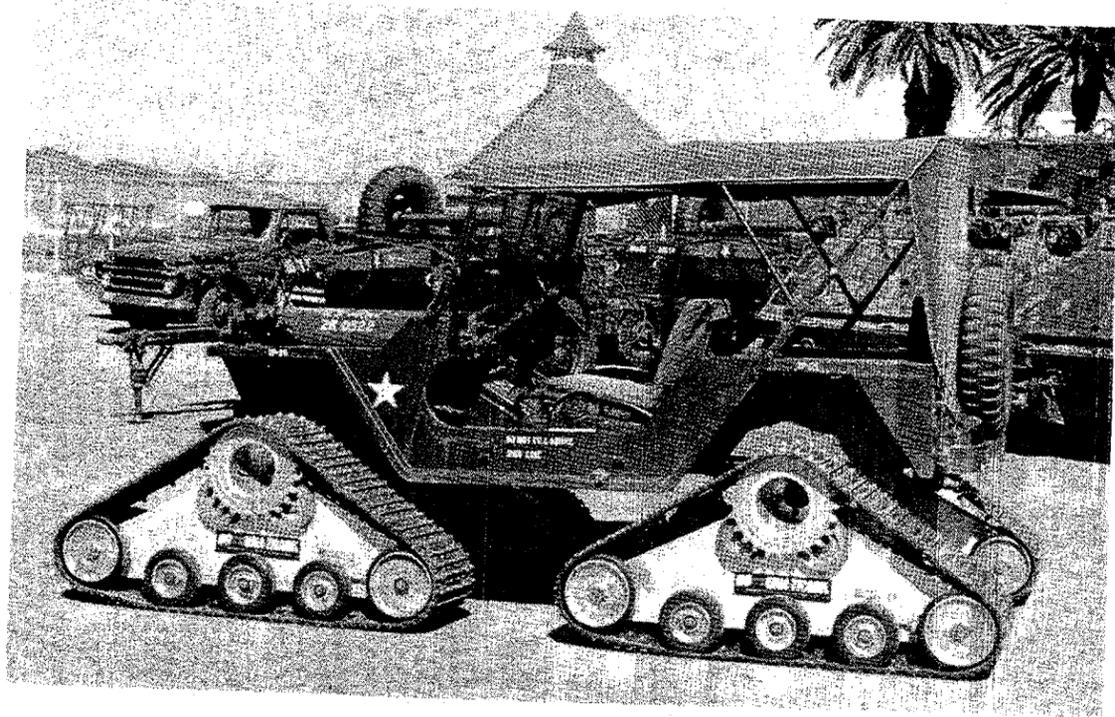
### Recommendations

It is recommended that the Army procure and evaluate an updated UNA-Track Kit for military use on the military/commercial 4-wheel drive vehicles which are organic to most Army Transportation Motor Pools, particularly the 3/4-ton Dodge A-200 (Dodge Power Wagon). It is further recommended that the evaluation be made in arctic and subarctic regions.

## APPENDIX

### MANUFACTURER'S SUGGESTED OPERATOR INSTRUCTIONS

July 1973



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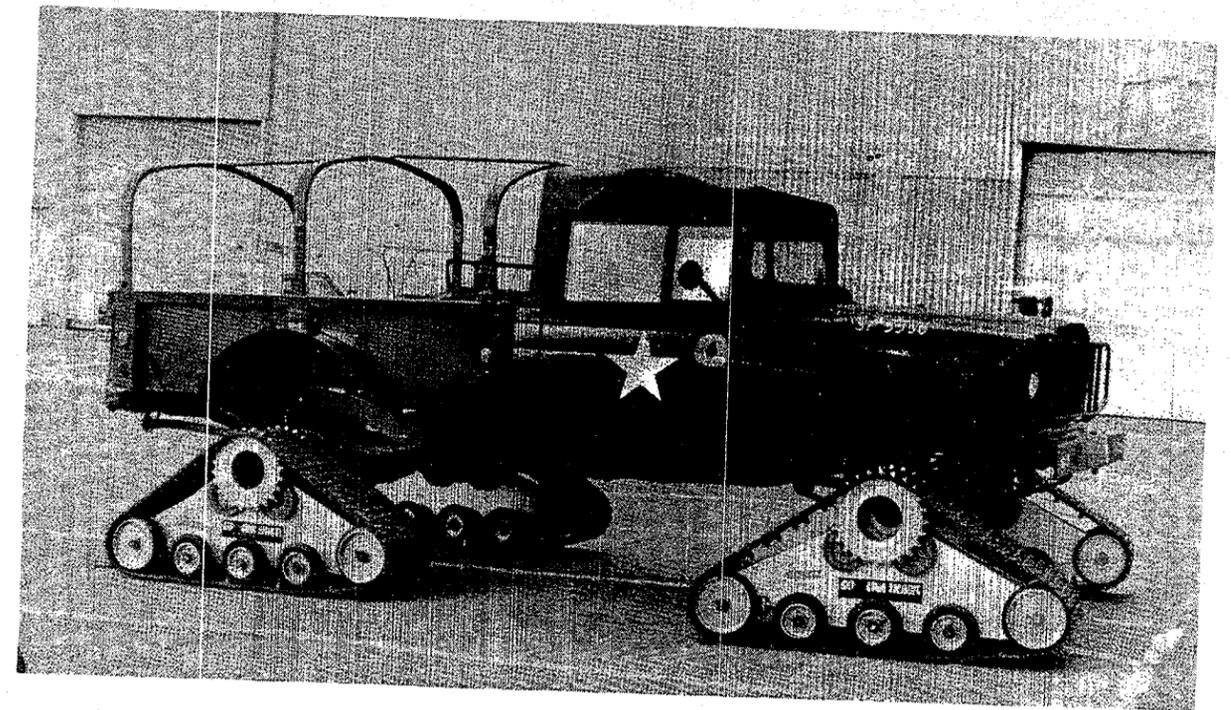


FIGURE NO. 1

## OPERATING INSTRUCTIONS

Congratulations on your purchase of UNA-TRACK! You will find that it is a well engineered and heavily constructed piece of equipment that will give you many years of pleasure and service.

Your new combination of 4-wheel drive vehicle and UNA-TRACK will take you safely into areas where you have never before been able to go. It lets you take advantage of modern communications - you can always be in touch with home base with two-way radio - a great personal safety factor.

For your own safety be sure someone at home base knows when you leave, where you're going, and when you expect to return. See the "Checklist" on page 15 - we recommend that you tape it to your dashboard where you can refer to it before every trip. This will also keep your warranty handy since it is printed right on the back.

Be sure you are in 4-wheel drive at all times when traveling on UNA-TRACK. The rear units will wear excessively if you run in 2-wheel drive.

UNA-TRACK is not intended for speed. We consider any speed over a 40 mph speedometer reading as excessive. Your speedometer will read approximately twice your actual ground speed so you will be travelling about 20 mph. The reason for this is the Track moves 48 inches with every Sprocket revolution while a tire moves about 96 inches - UNA-TRACK doubles your engine power and gives you better hill-climbing ability.

Always use good judgment when travelling over deep snow or where big obstacles could be hiding. Bumping into a hidden rock or tree trunk, even at 20 mph could cause serious damage to the UNA-TRACK or to your vehicle.

## ASSEMBLING UNA-TRACK

Your set of four UNA-TRACKs came to you either assembled or unassembled. If you bought them from a Dealer they probably came to you completely assembled and ready to mount on your vehicle. In any case, we recommend that you read the first part of this section and keep the information in mind. It will be valuable in case you ever have to make field repairs.

"Unassembled" simply means the UNA-TRACK is shipped in three pieces for easier handling:

1. UNA-TRACK Body.
2. Fastrac cleated Track Belt.
3. Set of four Adapter Plates (not shown in this picture).

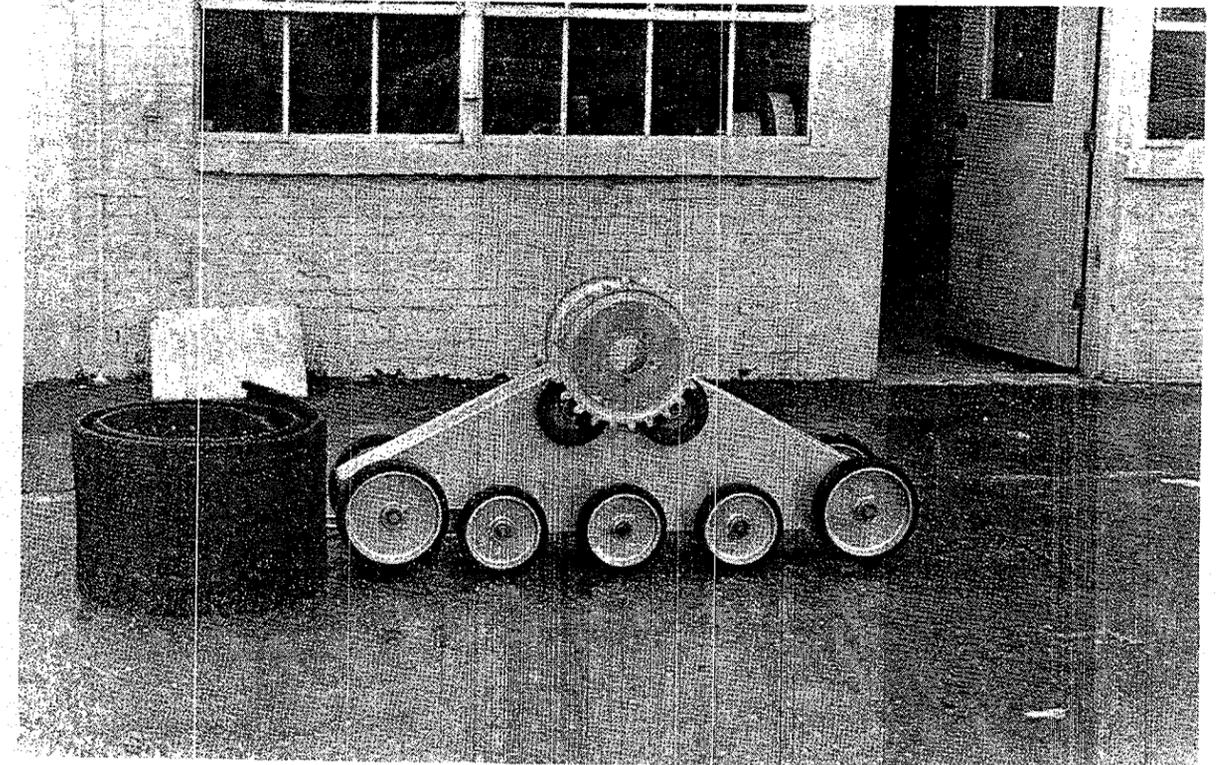


FIGURE NO. 2

Assembly is quick and easy if you follow these simple directions.

First, check the Adapter Plates to make sure the lug holes and the diameter of the center hole matches your spare wheel. If not, you have the wrong Adapter Plates and they will not work. Your dealer will exchange them.

Adapter Plates come with 32 flat head Allen screws, wrench, & Locktite. Place Adapter Plate in the recessed Sprocket Hub and register the holes with the tapped holes in the Sprocket. It will fit snugly. Draw it tight against the Sprocket Hub.

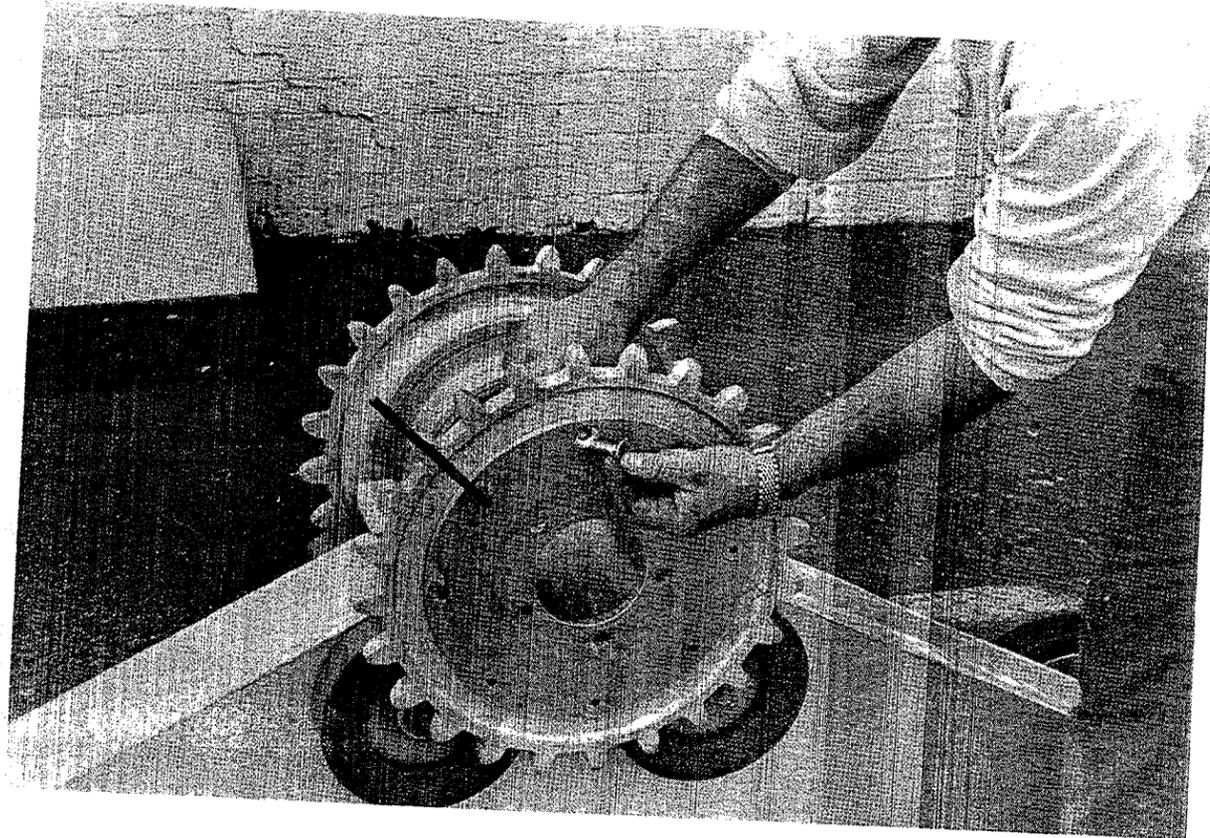


FIGURE NO. 3

The Screw heads are designed to fit tight in the Adapter Plates. This helps to prevent them from working loose. We recommend a drop of "Locktite" on each screw to further secure them in place.

Use the Allen wrench to set the screws securely with a few firm hammer blows to the long end of the wrench. The same hammer-blow treatment in the opposite direction will remove the screws. Bear in mind that the screws are steel and the Sprocket threads are aluminum. It is possible to tear out the threads with excess pressure.

#### TO INSTALL TRACK

Back out Take-Up Bolt all the way to allow joining of Track belt. As you turn the Take-Up the Idler Wheel will move toward the Bogie Wheel to the point of almost touching.

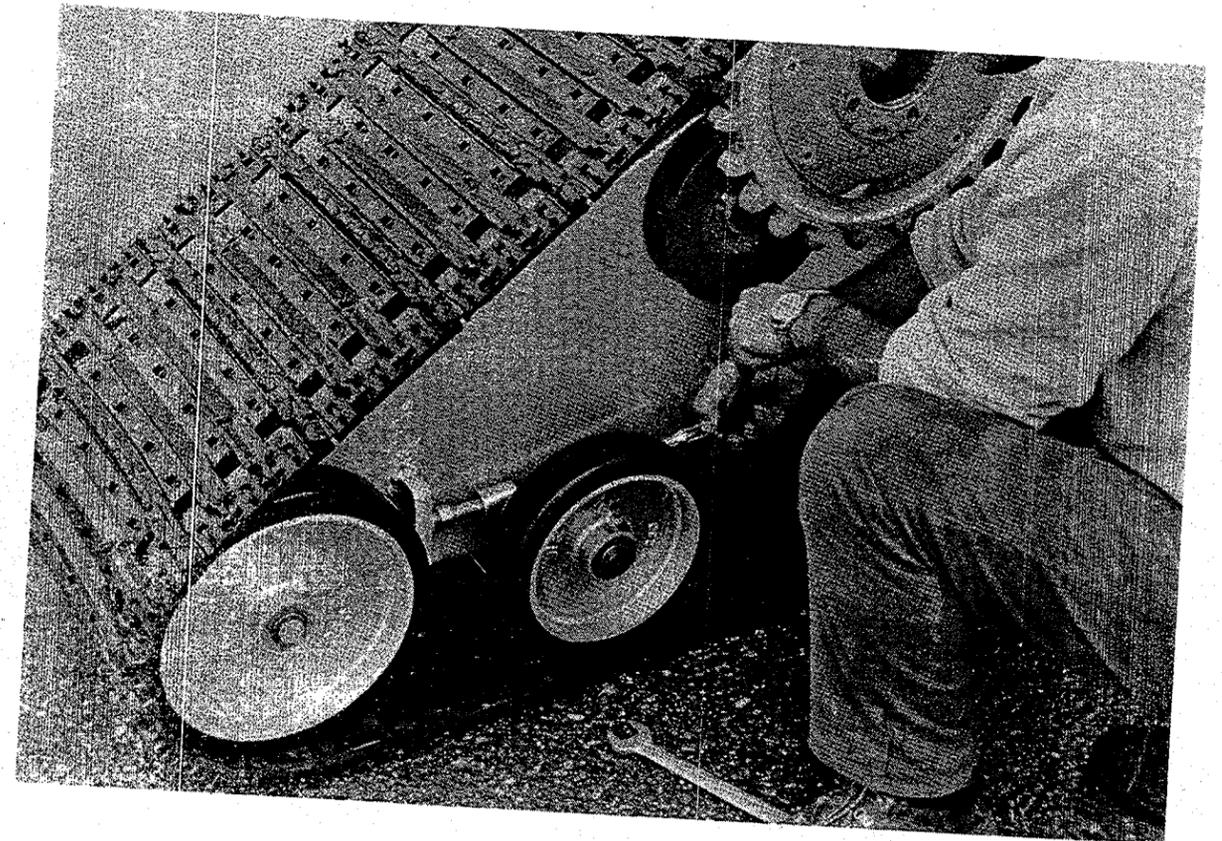


FIGURE NO. 4

Lay the Track out on any flat surface. Roll the UNA-TRACK Body right into place on the Track between the Guide Lugs on the Track. Center the Body in the length of the Track.



FIGURE NO. 5

Be certain the arrows on the Track are pointed forward, the drive attachment holes are on the inside, and the Take-Up Bolts are in the rear. Feed the Track over the Idlers and Sprockets.

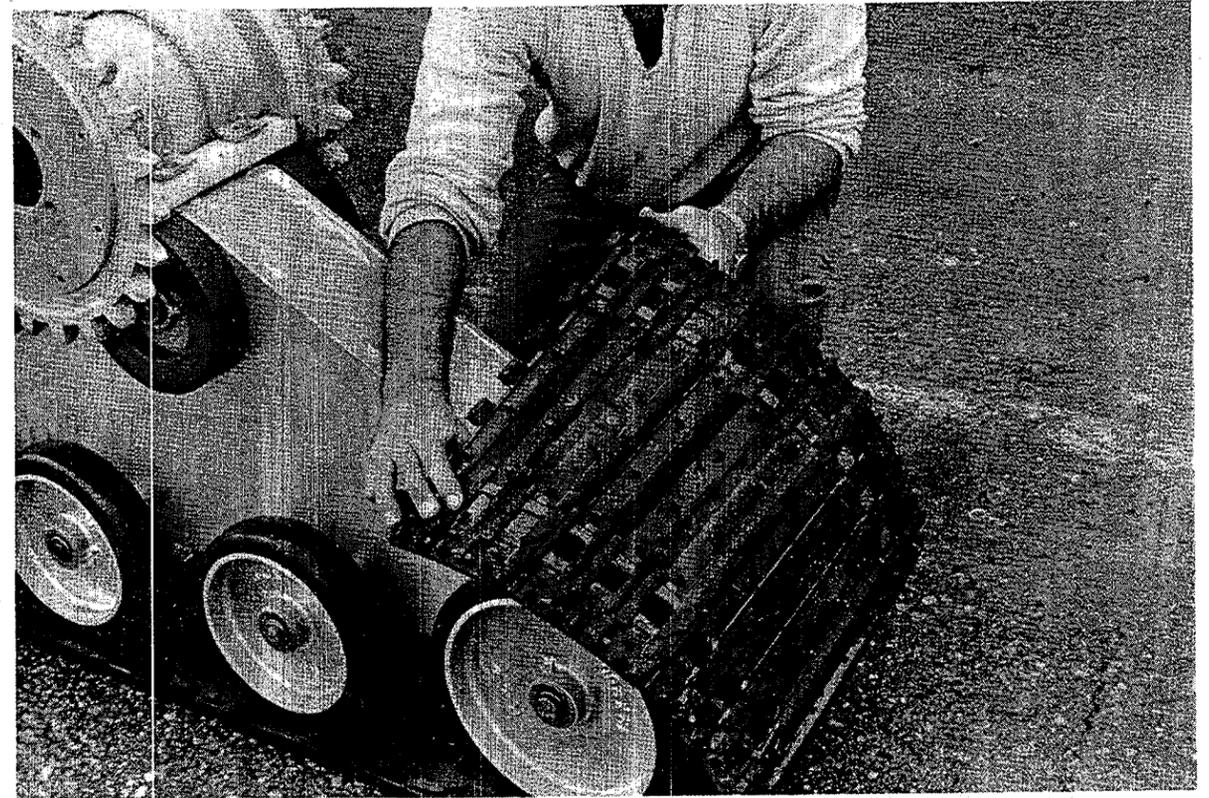


FIGURE NO. 6

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Temporarily join the ends of the Track in the middle of the Drive Sprocket by inserting the 3/16" Rod. Next, grease the 1/4" Rod and insert it into the side of the Track with the larger hole. Drive\* it into place while driving out the 3/16" Rod at the same time. Use a punch or a large nail to recess the Rod into the hole. (Note the use of Vise Grip Pliers for this job.)

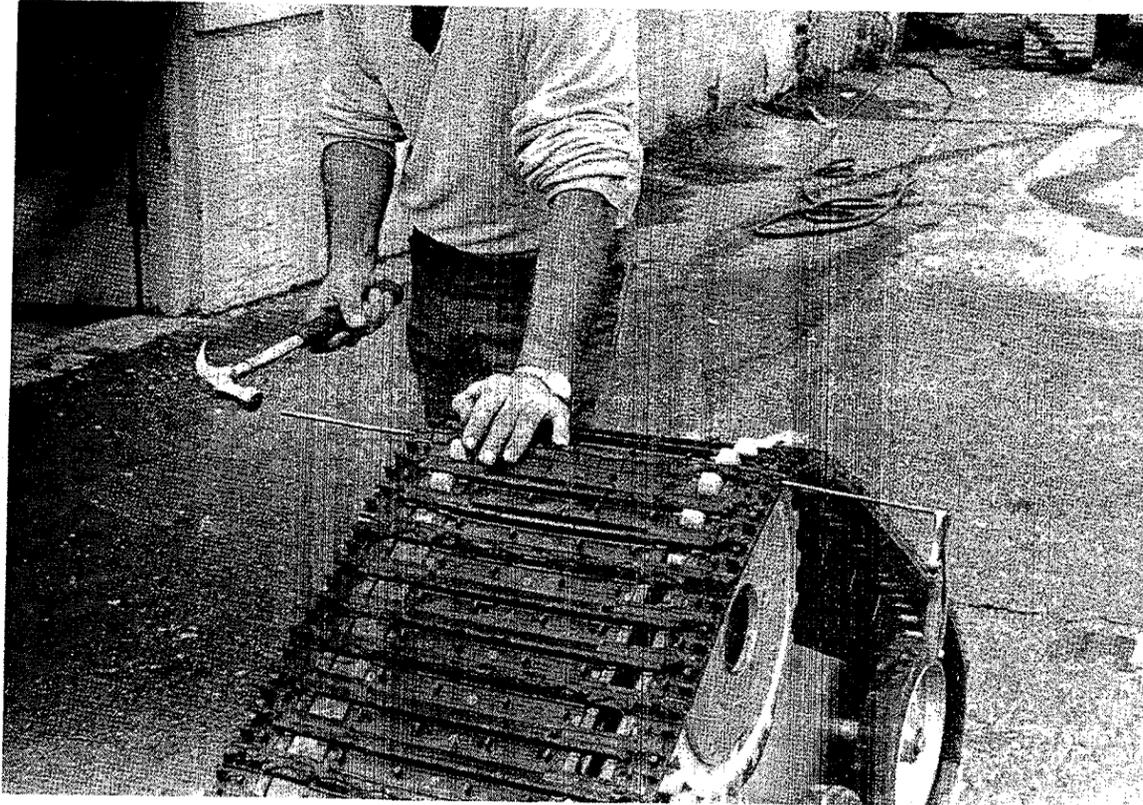


FIGURE NO. 7

\*We recommend using our special Driver Rod for this to prevent splaying the end of the 1/4" Rod.

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A steel Retaining Ring is used to lock and hold the 1/4" Rod in place. (BE SURE Retaining Rings are in before running.) Set the steel Retaining Ring into the 1/4" diameter hole.

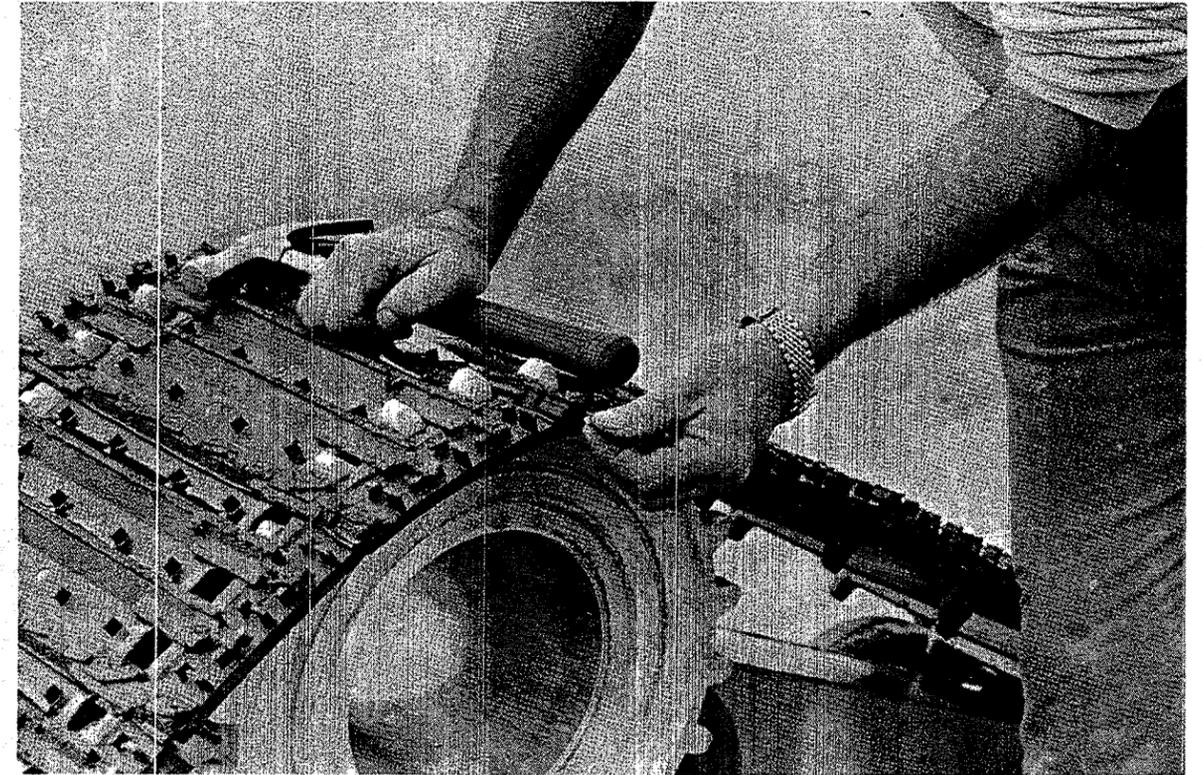


FIGURE NO. 8

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Use a 1/4" dia. punch and hammer to firmly set Retaining Ring in place. The Track is shipped assembled except for splicing the ends together. You will find two Retaining Rings taped to the Track. (One is extra - so don't lose it!)

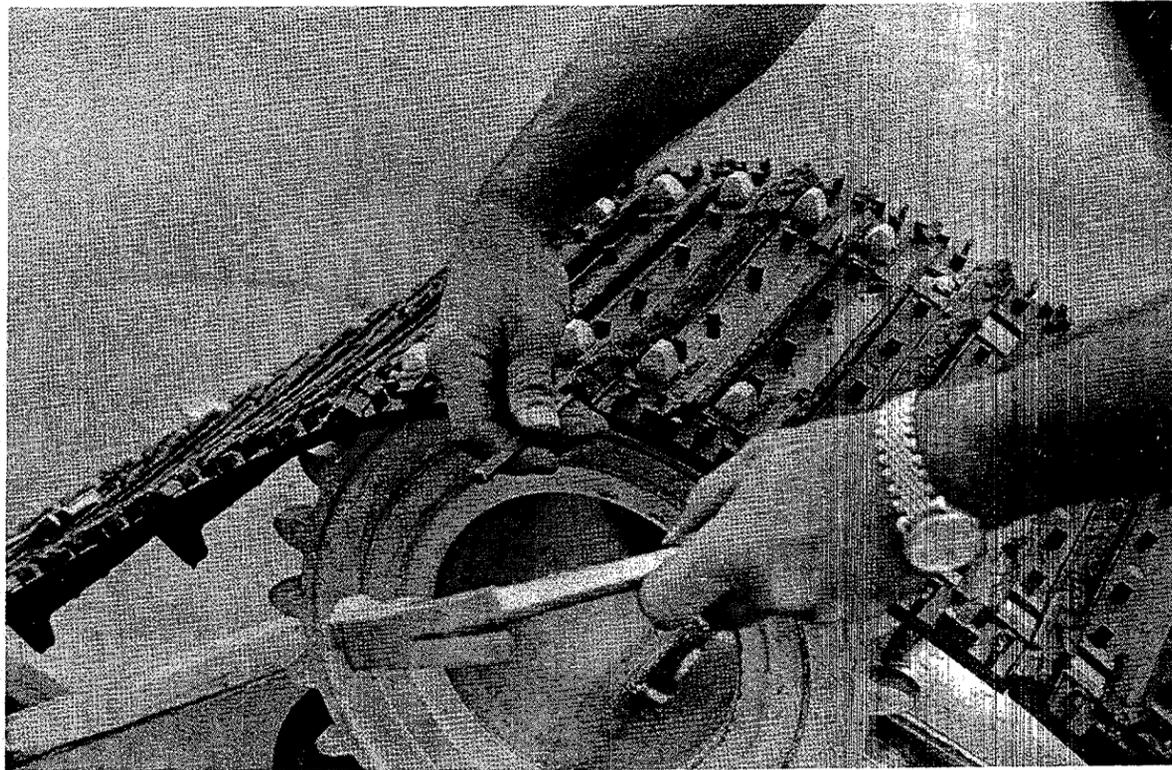


FIGURE NO. 9

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## ADJUSTING TRACK

Be sure UNA-TRACK is resting on a flat surface. Turn Take-Up Bolts so that "droop" in Track between the Idler Wheels and Sprockets is not any more than 1/2". Be sure that tension is equal on both sides. The center distance between the front and rear Idler Wheels must be the same on both sides. Picture shows the Lock Nuts being tightened to secure the position of the Take-Up Bolts on both sides.

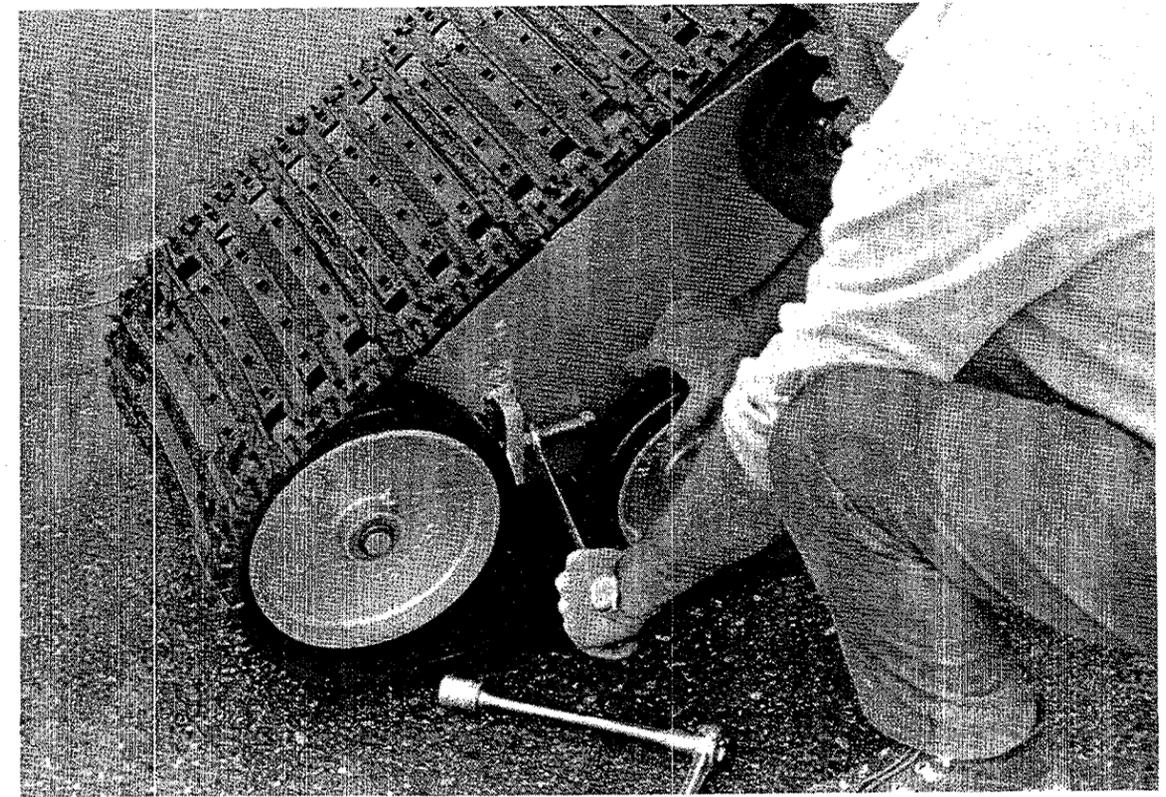


FIGURE NO. 10

**NOTE:** A Track that is too loose will ride up or slip on the Drive Sprocket. If the Track slips or jumps off the Drive Sprocket during operation it will "feel" like the engine is skipping. After Track tension is adjusted check alignment before running.

### TO CHECK TRACK ALIGNMENT

Raise the vehicle on a grease rack or raise one Track at a time so it is clear of the ground. Run slowly to see if Idler Wheels center in the Track. If the Track runs to the left, tighten the left Take-Up Bolt. If it runs to the right, tighten the right Take-Up Bolt.

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TO REMOVE TRACK

There is one 3/16" Rod furnished with each Track. You will have four left after you finish assembling your four UNA-TRACK units. They can be used as drive rods to remove the 1/4" Connecting Rods. We suggest you cut one of the Rods into 6" and 12" pieces, as these will be much easier to handle. Back off the Take-Up Bolts until the Track belt is as slack as possible. Drive the Rod out of the smaller 3/16" hole at the joint on the top of the Drive Sprocket.

LUBRICATION

UNA-TRACKs are lubricated at the factory with special grease to withstand temperatures from 150° to minus 40° Fahrenheit.

All grease fittings should be lubricated as often as needed, usually about every 40 hours of driving time. When injecting grease use caution that you do not blow the seals.

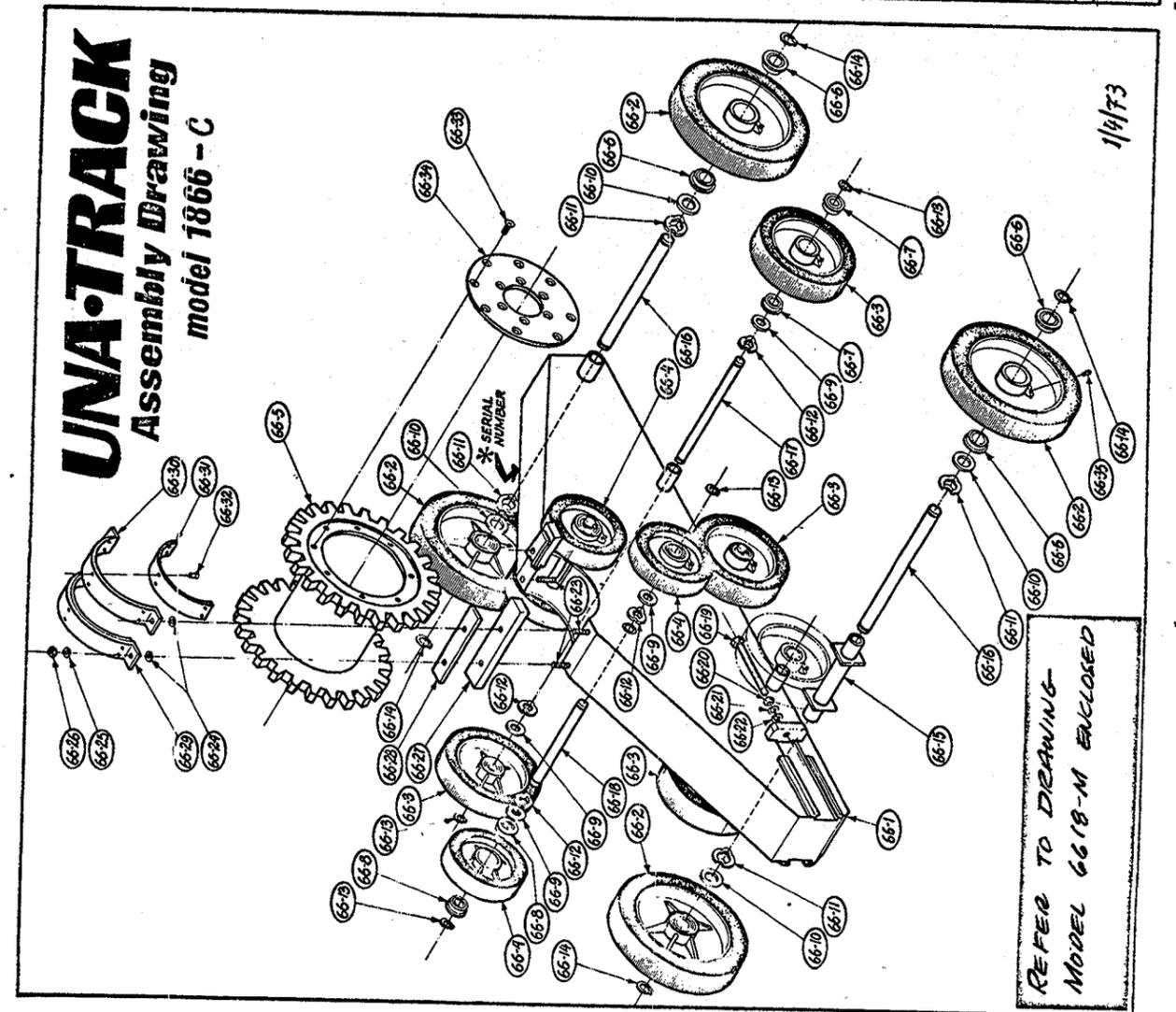
Be sure to use the proper grease for the climate of your area. Your Dealer or your local service station will be able to advise you regarding the proper lubricant. The main purpose of any supplementary lubrication is to prevent intrusion of moisture or foreign abrasive material. Pump grease into the zerk fitting slowly until all the air is expelled and the lubricant is visible at the shaft or at the seals on either side. DO NOT FORCE! Extra care will prevent damage.

MOUNTING YOUR UNA-TRACKS

Putting your UNA-TRACKs on is just as quick and easy as changing a wheel.

Parts List

Part No.*	Description	Quan.
66-1	Body Assembly	1
66-2	Wheel, Idler, 12"	4
66-3	Wheel, Bogie, 10"	4
66-4	Wheel, Drive Support, 8"	4
66-5	Drive Sprocket Assembly	1
66-6	Bearing, Idler Wheel, 1" bore	8
66-7	Bearing, Bogie Wheel, 3/4" bore	12
66-8	Bearing, Support Wheel, 3/4" bore	12
66-9	Washer, Shim, 3/4"x1/8"	10
66-10	Washer, Shim, 1"x1/8"	10
66-11	Washer, Wave Spring, 3/4"	4
66-12	Washer, Wave Spring, 3/4"	10
66-13	Snap Ring, 1"	10
66-14	Snap Ring, 1"	10
66-15	Take-Up Pipe Shaft Assembly	4
66-16	Shaft, Idler, 1"x15-1/2"	2
66-17	Shaft, Bogie, 3/4"x15-3/4"	2
66-18	Shaft, Drive, 3/4"x15-1/2"	2
66-19	Take-Up Bolt, 5/8"x10" NC	2
66-20	Washer, Flat, 5/8", Take-Up Bolt	2
66-21	Washer, Flat, 5/8", Take-Up Bolt	2
66-22	Washer, Flat, 5/8", Take-Up Bolt	2
66-23	Washer, Flat, 5/8", Take-Up Bolt	2
66-24	Washer, SAE, 3/8"	2
66-25	Washer, Lock, 3/8"	4
66-26	Nut, Hex, 3/8" NC	4
66-27	Scraper, UHMW Plastic, 1"x1-3/4"x10"	2
66-28	Hold Down Plate, 1/4"x1-1/2"x1"	2
66-29	Hold Down Assembly	2
66-30	Hold Down Band	2
66-31	Rivets, UHMW Plastic	2
66-32	Screws, Socket Cap, 1/2"x1-1/4" NC	8
66-33	Washer, Flat (Specify wheel config)	1
66-34	Grease Fittings, Zerk	14
66-35	Grease Fittings, Zerk	14
NOT SHOWN ON THIS DRAWING		
104-40	Track Segment, 6"x18"	26
104-40B	Barbed Retaining Rings	27
104-40C	Dowel, Steel, 3/16"	1
104-40R	Connecting Rod, 1/4"	26
104-40T	Track, FASTRAC Assembly	1
66-106	Wrench, Allen "L", 5/16"	1
SPARE PARTS KIT		
66-KT-3	Spare Parts Kit - Incl. the following:	
66-6	Bearing, Idler Wheel, 1" bore	2
66-7	Bearing, Bogie Wheel, 3/4" bore	2
66-8	Bearing, Support Wheel, 3/4" bore	2
66-9	Washer, Shim, 3/4"x1/8"	2
66-10	Washer, Shim, 1"x1/8"	2
66-13	Snap Ring, 1"	2
66-14	Driver Bearing	2
66-101	Track Segment w/Connecting Rod	1
66-102	Dowel, & Barbed Retaining Ring	2
OPTIONAL EQUIPMENT (not shown on this drawing)		
66-101	Driver Bearing	
66-104	Driver, Connecting Rod	
66-105	Jack, High-Lift, 48"	
66-106	Wrench, Allen "L", 5/16"	



You will need a 16" extension for your socket wrench of the proper size to fit your particular bolt or nut. A standard lug wrench will usually not be long enough. A 16" extension for your socket wrench is available from almost any auto parts or hardware store.

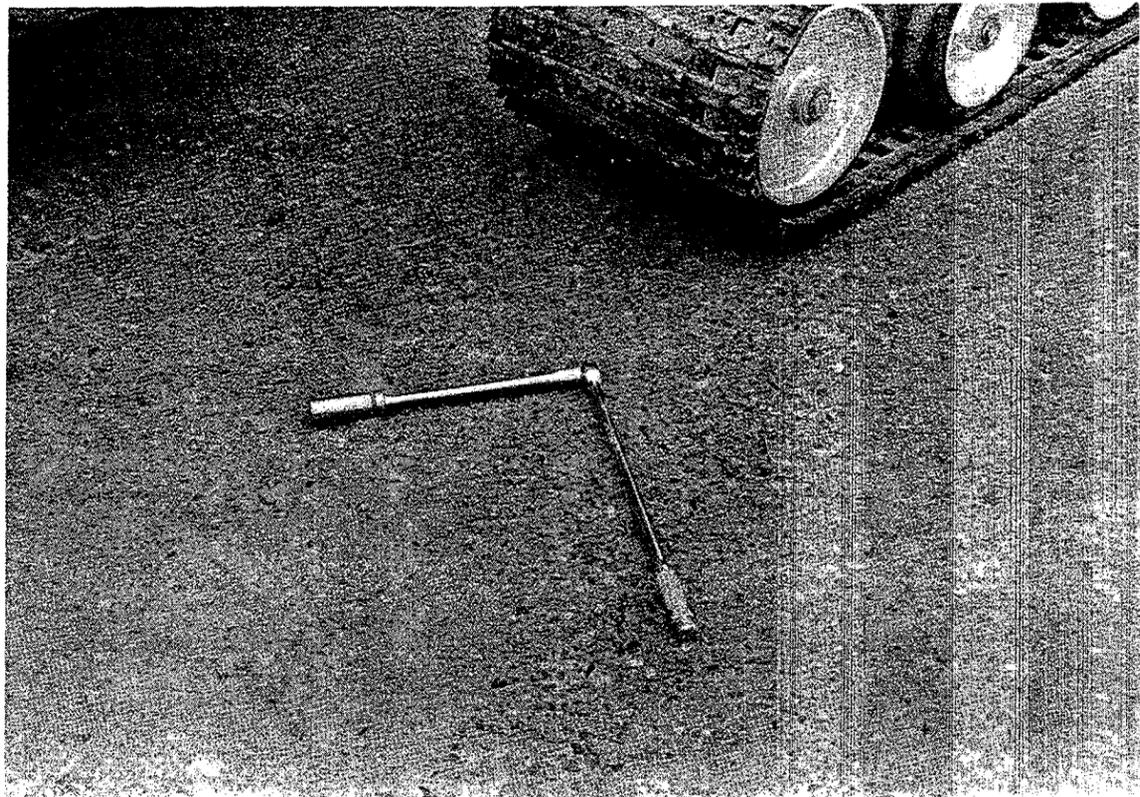


FIGURE NO. 11

The very easiest way to mount your UNA-TRACKs is to run your vehicle to your friendly service station and hoist it up on the rack. After they are mounted this would be a good time to check the alignment of each track.

If a grease rack is not available, the next best thing is a fork lift truck. Set your brake and engage the four wheel drive. Shift into lowest gear (or lock your transmission if your drive is automatic). Lift either end of the vehicle and mount two units at a time.

If a grease rack or fork lift truck is not available, then you should have a good, heavy-duty high-lift jack (see Accessories, page 9) capable of raising the vehicle at least 12" higher than normal (your vehicle will stand 12" higher with UNA-TRACK). The extra height will make this a "tippy", or a dangerous job, especially if you have to do it on snow or unstable ground. Every precaution should be taken to keep the vehicle well chocked and stable. You should never get under any part of the vehicle where you could be hurt if the jack should slip!



FIGURE NO. 12

A set of two portable ramps is available for about \$50 from Western Auto, Sears and other auto supply companies that make changing a snap. You simply place a ramp at each rear tire, drive the vehicle up the 48" ramp to the top level surface about 10" to 12" off the ground.

With the wheels chocked, a small hydraulic jack under the rear spring will lift the wheel off of the platform enough to match the hubs to the UNA-TRACK. Same for the other side. Do the whole thing again for the front wheel and you're ready to roll - quickly, safely, no sweat.

Remove the wheels and store them or put them in the back of the vehicle to carry along with you for a quick change-over when the UNA-TRACKS are no longer needed. It is presumed by now that you have checked to make sure you have the correct size Adapter Plates, and that they are already properly secured to the UNA-TRACKS, ready for mounting on the vehicle.



FIGURE NO. 13

Fasten the UNA-TRACK securely with your extended socket wrench. Apply the same bolt tightening sequence that you would use for mounting a normal wheel. Then raise the other wheel and install the opposite unit.

Follow the same general procedure for installing the other two units. We recommend mounting the rear units first. Be sure the arrows on the Track are all pointing forward, and that the Take-Up Bolts are at the rear of the unit.

After you have run your UNA-TRACKS for about half an hour, check each for proper alignment, and tighten each again to be sure they are firmly set.

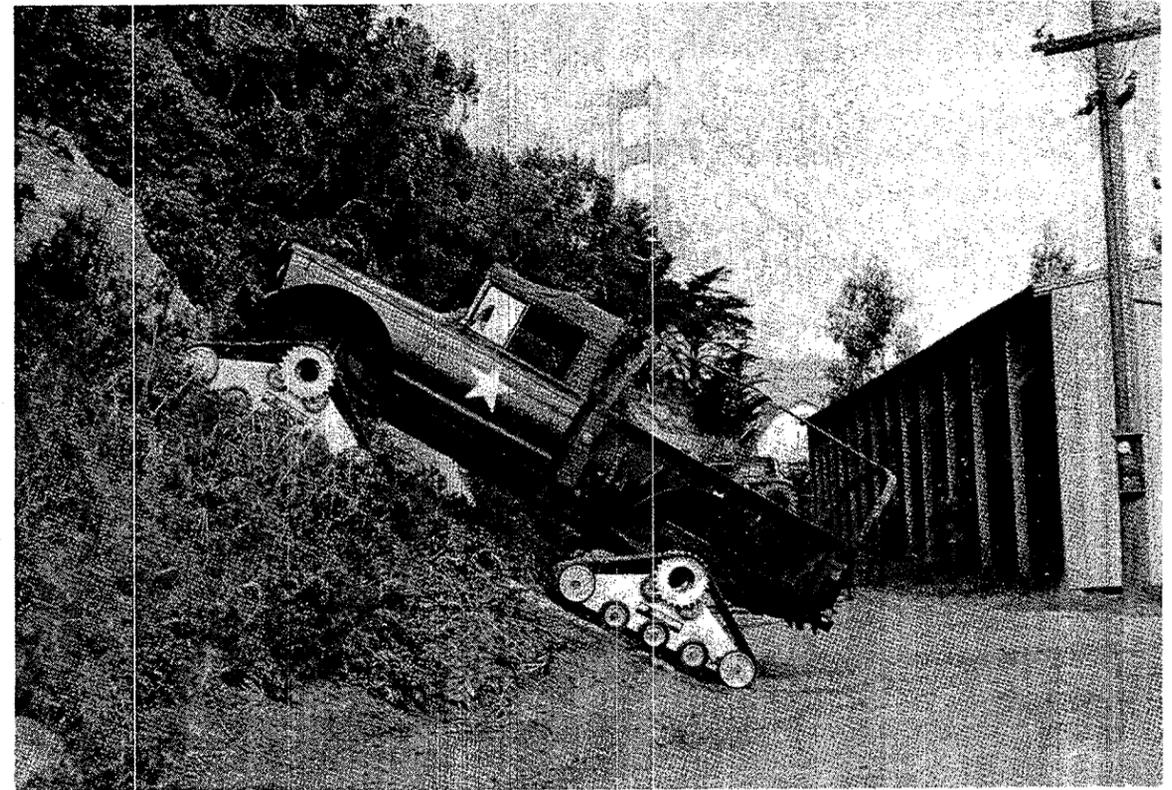


FIGURE NO. 14

#### CARING FOR UNA-TRACK

The better care you take of your equipment, the better service you can expect, and the longer life. With UNA-TRACK even a little bit of care will go a long way.

Rule one is - keep it clean. Wash off any accumulations of mud, sand, stones, and brush and your bearings and Tracks will last much longer.

Inspect all Tracks, Wheels, and Sprockets as often as possible to be especially sure there is no foreign abrasive material in any vital parts.

#### TROUBLE SHOOTING

Squeaking or Rattling Noises: Check your power steering. Be sure the V-belt is under the proper tension so that it does not slip on the power steering pump pulley. With UNA-TRACK your power steering will be working extra hard, so check the fluid level in the pump reservoir. Fill it to capacity, even if it is only slightly low.

**Clicking Noises:** Some vehicles have oversize studs on the wheel attachment. When UNA-TRACK is attached, be sure the Adapter Plate face is tight against the Brake Drum face. If any space exists, take up the difference with standard spacer washers available at any hardware store.

**Excessive Wear on Tracks:** Your Track alignment is off! Check the Take-Up Bolts on both sides of the UNA-TRACK Body to be sure the Lock Nuts are secure. Measure the center distances of the Idler Wheels on both sides -- they should be the same. Be sure the Track is running evenly and smoothly. If this is not the answer, jack up the UNA-TRACK and run it under power to see which side it favors. Adjust the Take-Up Bolts to suit. Lock them securely. Be sure none of the Tracks droop more than 1/2" on the top surfaces. Check the Track for possible cuts or broken segments or Rods.

**Any Strange Noise:** First of all, identify the source of the noise. Is it a bearing? The track alignment? Sticks or brush caught in the tracks? Don't proceed until you've adjusted and corrected the fault. You'll find your Spare Parts Kit will be mighty handy to have in any emergency involving parts.

**Power Loss in Vehicle:** Assuming that the motor sounds okay, your loss of power may be from something binding up on one of your UNA-TRACKs. It could happen! Maybe your Plastic Scraper Blades (part #66-22) are too tight or have overheated. Could you have a frozen wheel bearing? Is something jammed between your Track and Sprocket? Take a look and clear the trouble before it does real damage.



FIGURE NO. 15

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## CHECK LIST

1. Inspect all Lug Bolts for tightness.
2. Inspect each UNA-TRACK for:
  - a. Condition
  - b. Alignment
  - c. Foreign materials
3. Have Aboard:
  - a. High lifting jack
  - b. Spare wheel to use with jack
  - c. Planks, chocks, and shovel
  - d. Spare parts kit, tool kit, first aid kit
  - e. Survival gear including food, water, warm clothing, snow shoes, etc.

## VEHICLE IS NOW READY

Check to be sure you have plenty of gas for the trip and that the power steering pump reservoir is full. Start engine, engage four-wheel drive.

Move vehicle slowly forward and back to check for proper UNA-TRACK action.

Do NOT exceed 40 MPH on your speedometer (this will reflect a "true" 15 to 20 MPH ground speed).

Travel slower over rough terrain or deep snow to avoid damage from hidden objects.

Leave word where you are going and when you expect to return.

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