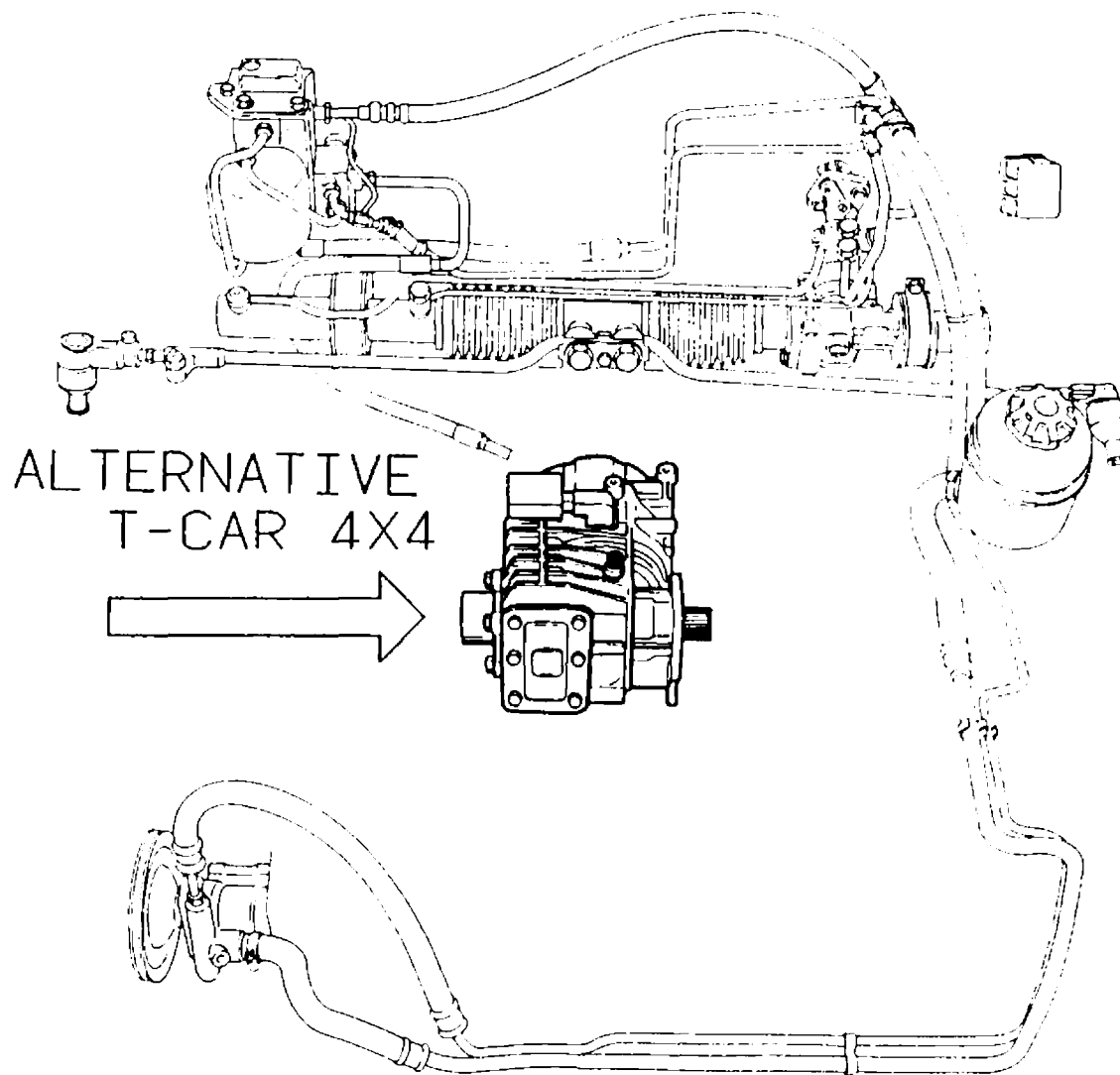
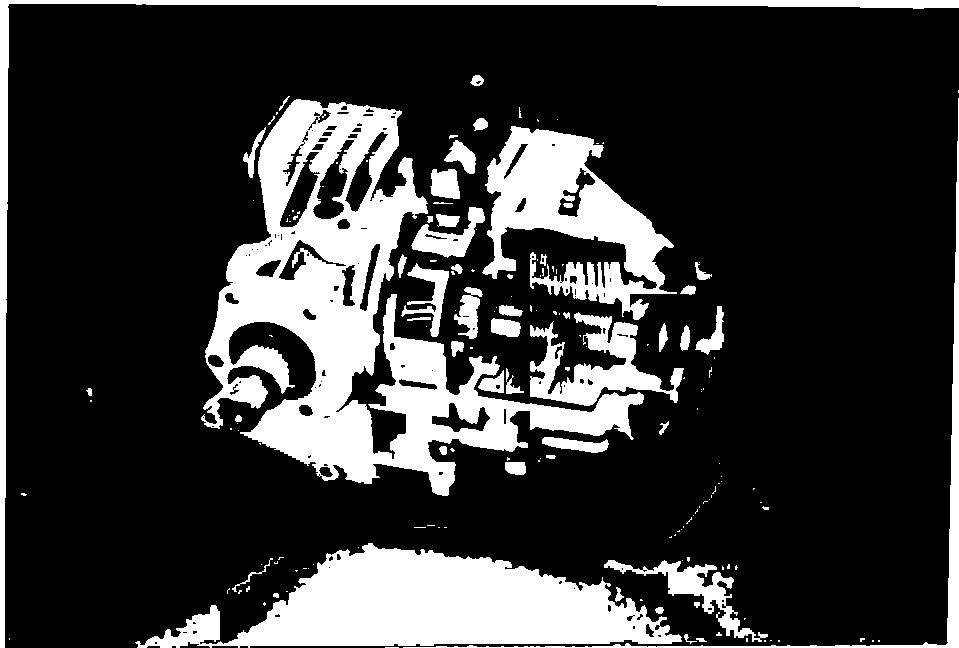


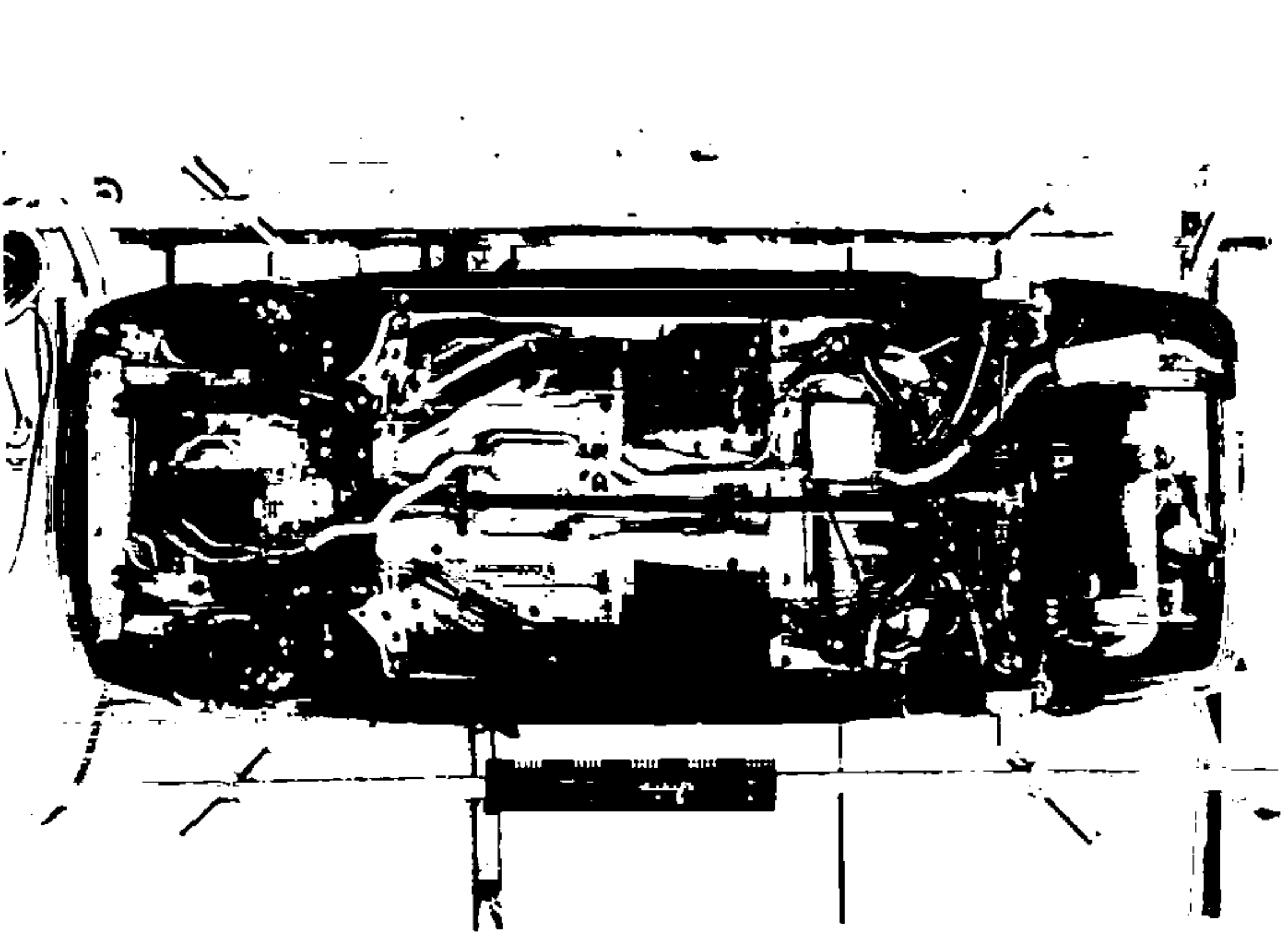


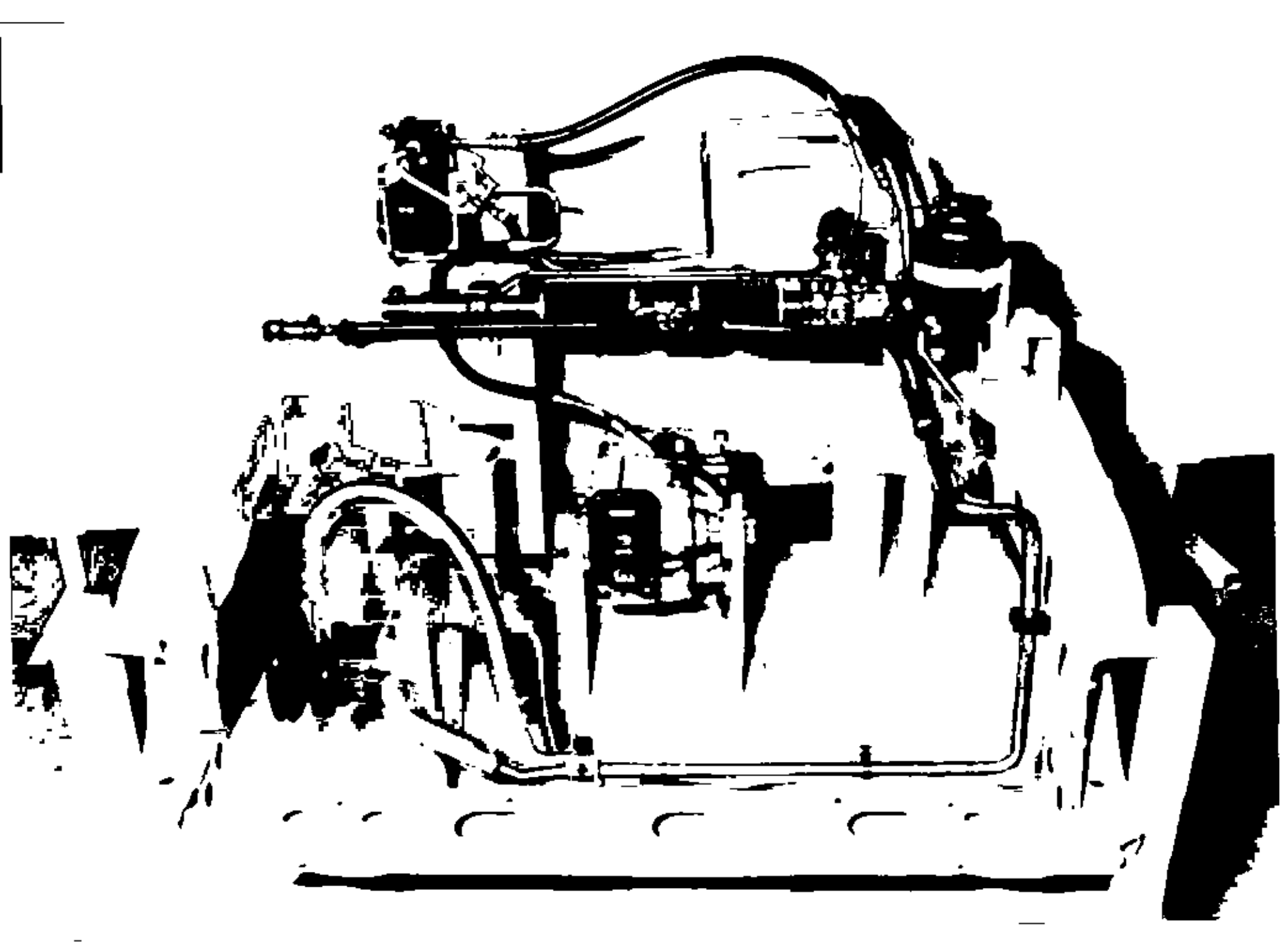
VECTRA 4X4

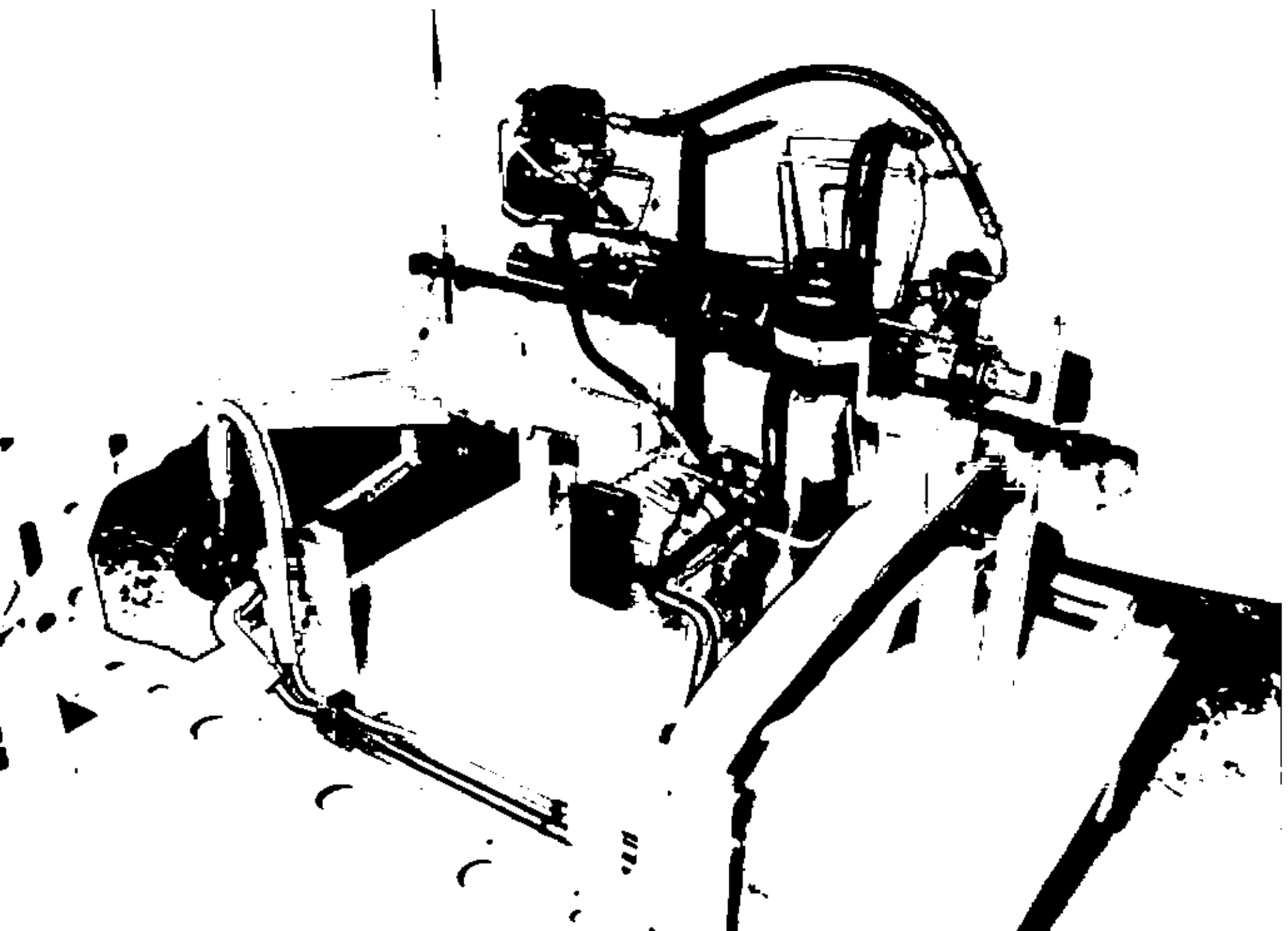
TDC
APS











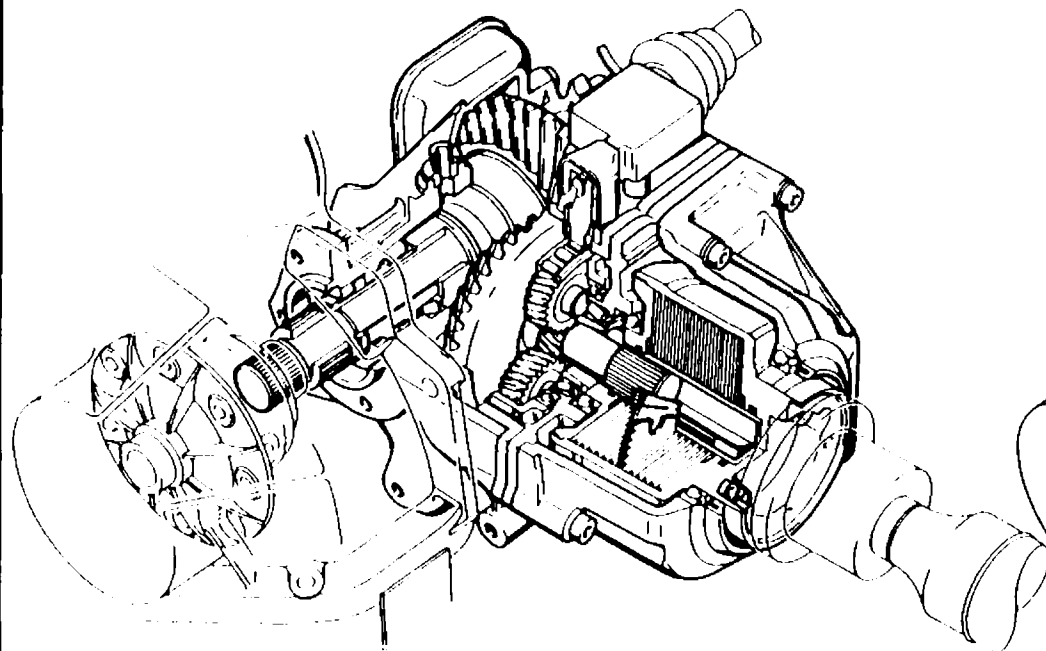




HANG ON TRANSMISSION COMPARISON

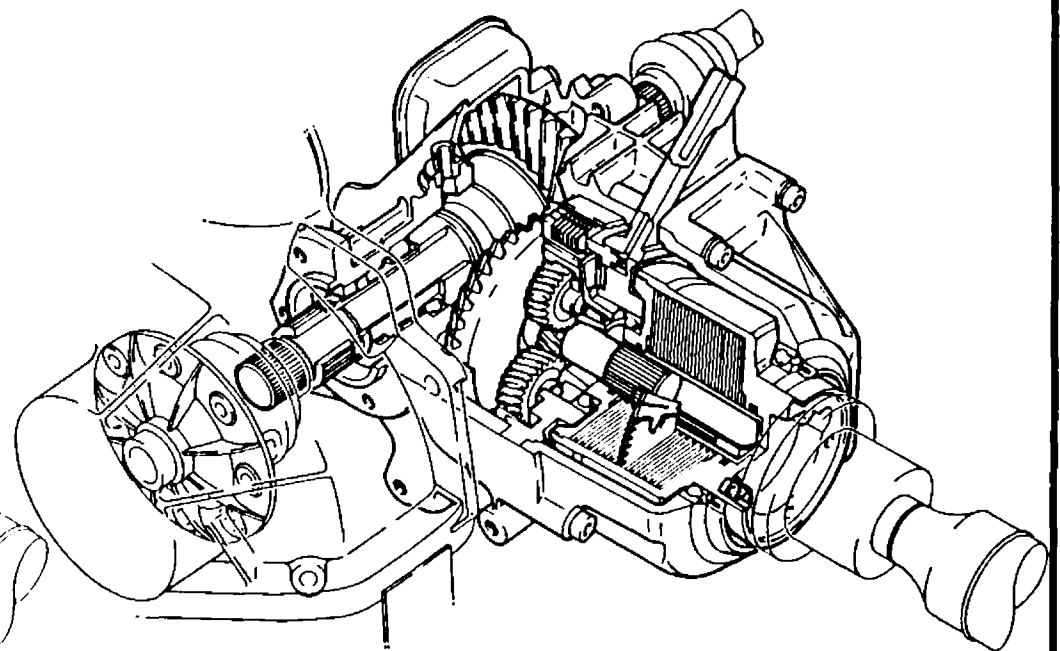
TDC
APS

ALTERNATIVE T 4X4



SHIFTABLE ROLLER CAGE
LESS ELECTRONICS

VECTRA 4X4

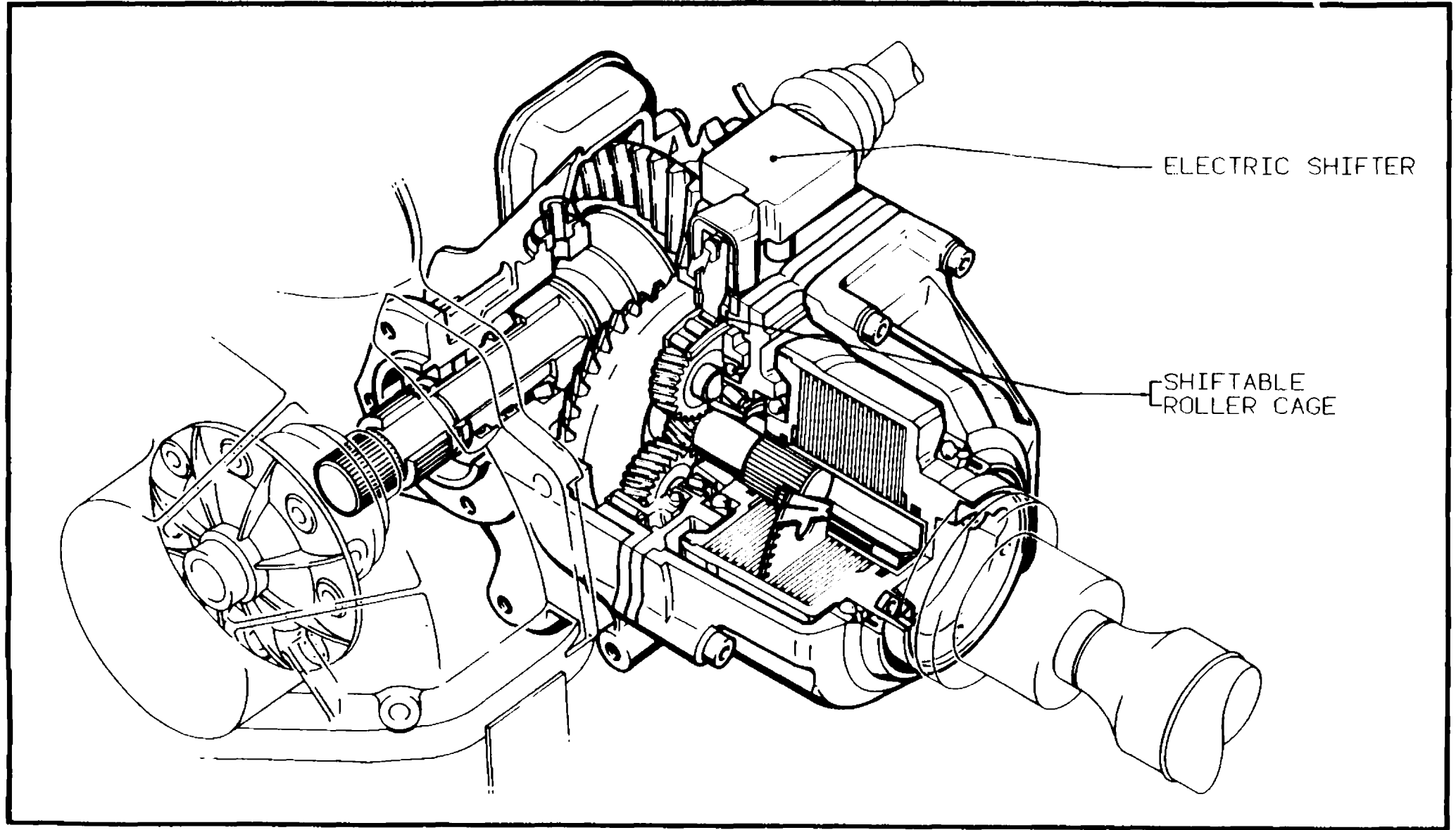


HYDRAULIC MULTI DISC CLUTCH



4X4 HANG ON TRANSMISSION WITH SHIFTABLE ROLLER CAGE

TDC
APS





T 4X4 SYSTEM

TDC
APS

DRIVE TRAIN

CO

PERMANENT 4-WHEEL DRIVE SYSTEM WITH AUTOMATICALLY CONTROLLED VISCO CLUTCH FOR VARIABLE TORQUE SPLIT.

4X4 HANG ON DISTRIBUTION TRANSMISSION

MOD

COMBINED GEARBOX AND DIFFERENTIAL - INSTEAD OF AN ELECTRONICALLY CONTROLLED HYDRAULIC MULTI DISC CLUTCH, A SHIFTABLE ROLLER CAGE IS INSTALLED ON TOP OF THE RING GEAR. AN ELECTRIC SHIFTER IS MOUNTED TO THE TRANSMISSION HOUSING.

4X4 MODE: ACTIVATED WITH IGNITION IN FORWARD DRIVING POSITION. BACKWARDS DRIVING POSITION SHIFTED BY BACK UP LIGHT SIGNAL. SERVICE POSITION (DECOUPLED REAR WHEEL DRIVE).

REAR

3 PIECE TUBULAR SHAFT WITH A RUBBER JOINT AND TWO UNIVERSAL JOINTS - AXLE DRIVE WITH HYPOID GEARS, BEVEL PINION DIFFERENTIAL.

FINAL DRIVE RATIO

HAS TO BE DETERMINED (4,19/3,72)



SHIFTABLE ROLLER CAGE WITH VC

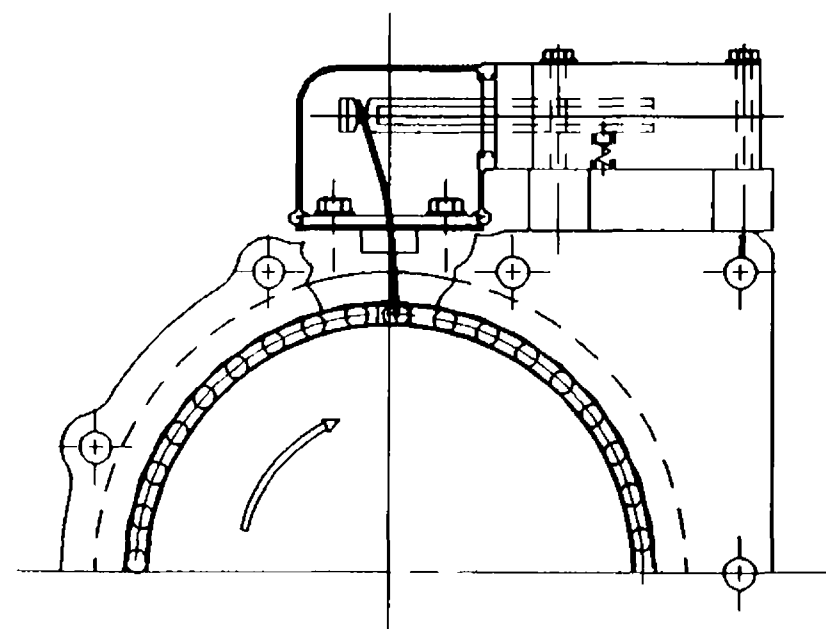
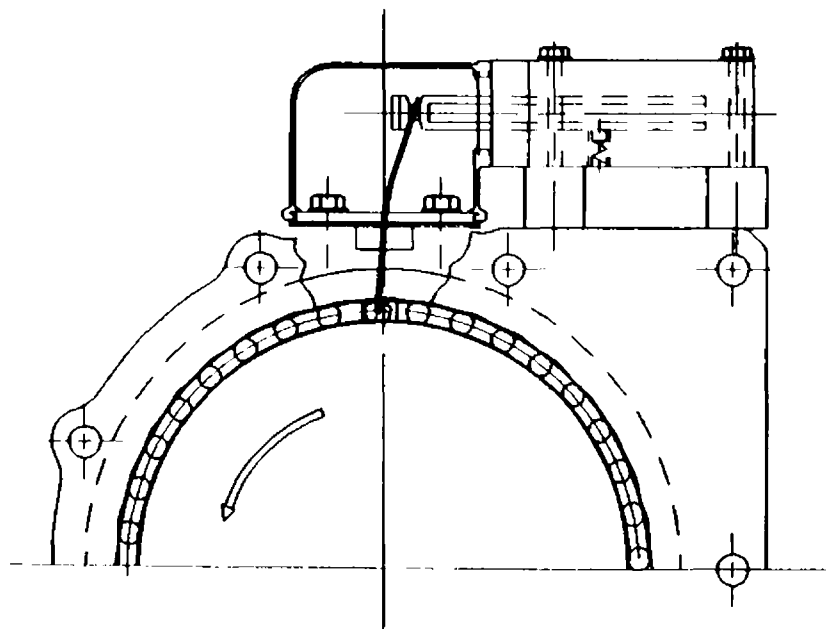
TDC
APS

FUNCTION

DRIVING POSITIONS

4X4 - FORWARDS

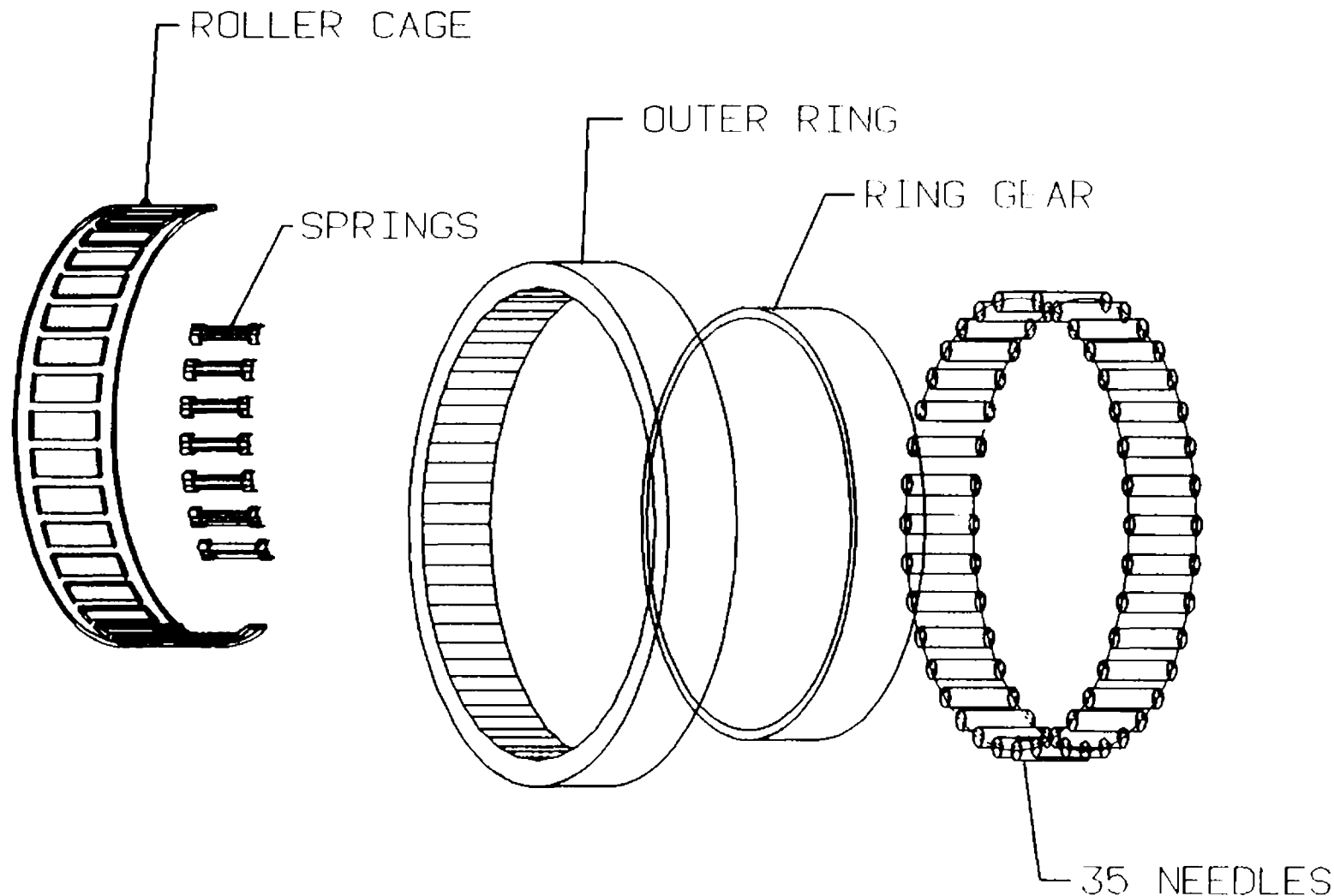
4X4 - BACKWARDS AND
SERVICE - POSITION





SHIFTABLE ROLLER CAGE

TDC
APS



SHIFT TRAVEL:
5 DEGREES

ROLLER CAGE:
Ø 136x44.5

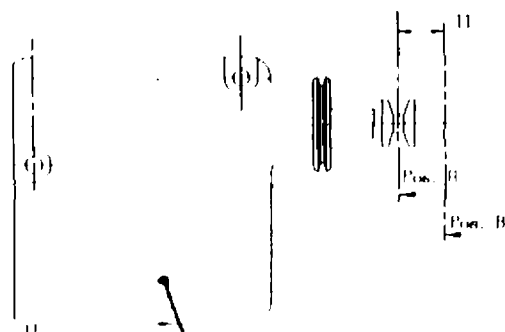
MATERIAL OF
OUTER RING:
100 Cr 6

HARDNESS:
HRC 60+2
MIN. 1 mm DEEP



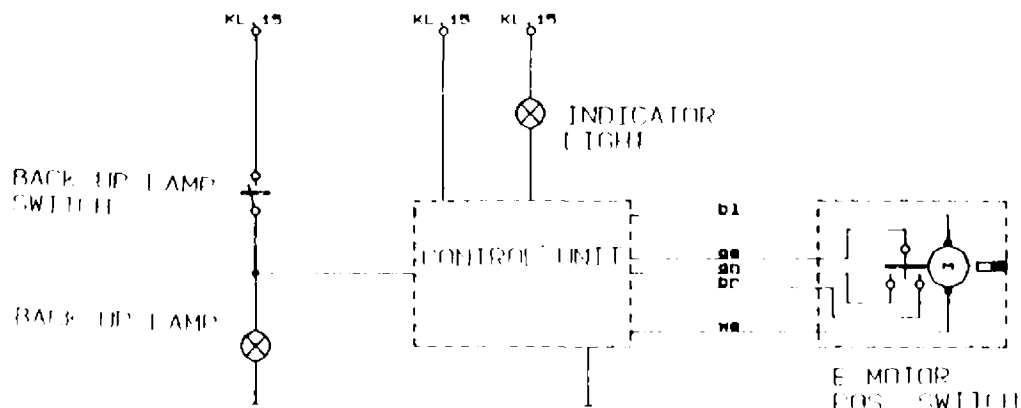
ELECTRIC SHIFTER AND CONTROL UNIT

TDC
APS



ELECTRIC SHIFTER

RATED VOLTAGE:	12 V
SHORT CIRCUIT CURRENT:	3.8 A MAX.
TEMPERATUR RANGE:	-40° BIS 140° C
SHIFTING FORCE:	100 N
STROKE:	11 MM
SHIFTING TIME:	< 0.193 SEK.
DEV. COST:	DM 390.000,-
PROD. COST:	DM 60,-
ENDURANCE:	100 000 CYCLES





SYSTEM COMPARISON

TDC
APS

HANDLING CHARACTERISTIC IN COAST SHIFTABLE ROLLER CAGE COMPARED TO VECTRA 4X4

TEST PROCEDURE	ROAD SURFACE	RESULT
DOWNHILL DRIVE WITH ENGINE BRAKE. GRADE CA. 15-18%	SNOW SURFACE (GALTISPUDA- SWEDEN)	NO DIFFERENCE BETWEEN BOTH SYSTEMS
LANE CHANGE BEHAVIOR MAX. SPEED	ICE $\mu = \text{ca. } < 0.1$	ROLLER CAGE: $V_{\text{max.}} 40 \text{ KM/H}$ VECTRA 4X4: $V_{\text{max.}} 42-43 \text{ KM/H}$
STARTING ENGINE WITH ROLLING CAR (2. GEAR)	ICE $\mu = \text{ca. } < 0.1$ ICE WITH SNOW $\mu = \text{ca. } 0.1-0.2$	ROLLER CAGE: ENGINE DOESN'T ALWAYS START PROD. SYSTEM: ENGINE ALWAYS STARTS ENGINE ALWAYS STARTS WITH BOTH SYSTEMS



COST COMPARISON

TDC
APS

COST OF HANG ON TRANSMISSION

BASED ON VOLUME/YEAR:

HB 11500

WAGON 10000

TOTAL: 21500

	T 4X4 C/O VECTRA 4X4	T 4X4 SHIFTABLE ROLLER CAGE
PRODUCT COST	1472.-	1224.- DM
INVESTMENT	BASIS	+ 5,1 MIO DM
ENGINEERING	BASIS	+ 4,3 MIO DM
PAYBACK		21 MONTH



TIMING CHART

TDC
APS

SHIFTABLE ROLLER CAGE FOR T-4X4 CAR 1992

DESCRIPTION	1988				1989				1990															
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
APS-PATENT APPLICATION				▽																				
CONCEPT STUDY																								
BUILT UP OF FIRST EXP. CAR								▽																
FUNCTION TESTS SUMMER & WINTER																								
BUILD OF SECOND EXP. CAR																								