



DESIGN AND FABRICATION OF TRAINER GO-KART



A Project Report

Submitted by

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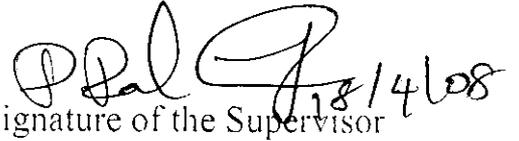
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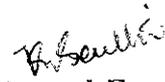
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ABSTRACT

This project work titled "**Trainer Go-Kart**" has been conceived studying various safety features and problems present in the current Race training scenario.

Our study in regard to the various "Race training institutes", revealed the fact that some crude methods were adopted in training the young drivers for the Racing championships.

The project has been concentrated on building a "Race Go-kart" for young trainees in order to equip them with practical and realistic skills. The contemporary "Race Training institutes" mainly depend on Computer Aided Simulations, which are very costly and moreover do not endow its students with the much needed practical skills required for racing.

We have developed a "**Trainer Go-Kart**" which overcomes all the above mentioned intricacies.

The design part of it was done in a step by step process. The basic rough design was done with the help of modeling software Pro Engineer (WILD FIRE). Then detailed design with dimension was done in Auto CAD (2004). Suitable materials were selected for the parts by considering various options available. The fabrication part of it has been considered with at most care for simplicity and economy, such that it can be accommodated as one of the essential tool in each and every Race training institutes.

ACKNOWLEDGEMENT

We sincerely express our heart full thanks to our guide Dr.P.Palanisamy for his valuable suggestions and encouragement offered to us without which this project would not have come to the successful stage.

We would also like to record our deep sense of gratitude to our Head of Department Dr.C.Sivanandan, for providing us with adequate facilities in the department for completion of this project.

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CHAPTER 1

INTRODUCTION

THE CURRENT TREND:

The most important thing needed to become a race trainee is money. The contemporary "Race Training institutes" mainly depend on Computer Aided Simulations, which are very costly and moreover do not endow its students with the much needed practical skills required for racing.

Training Institutes fee itself is Rs 10,000 and includes a fitness program with isometrics, cardio-vascular training and upto 2 kms of running a day.

THE PROJECT IMPORTANCE

The project has been concentrated building a "Race Go-kart" for young trainees in order to equip them with practical and realistic skills. Our projects aims at providing safe training to children of very young age (6-16yrs) so that they can be molded into good professional racers.

THE SCOPE OF OUR PROJECT

Kart racing is usually used as a low-cost and relatively safe way to introduce drivers to motor racing. Many people associate it with young drivers but adults are also very active in karting. Karting is considered the first step in any serious racer's career. It can prepare the driver for high-speed wheel-to-wheel racing by helping develop quick reflexes, precision car control, and decision-making skills. In addition, it brings an awareness of the various parameters that can be altered to try to improve the competitiveness of the kart (examples being tire

pressure, gearing, seat position, chassis stiffness) that also exist in other forms of motor racing.

All current as well as many former Formula One racers grew up racing karts, most prominent among them Michael Schumacher, Ayrton Senna, Alain Prost, Fernando Alonso, Kimi Räikkönen or Lewis Hamilton. Many NASCAR drivers also got their start in racing from karts, such as Darrell Waltrip, Lake Speed, Ricky Rudd, Juan Pablo Montoya, Tony Stewart, and Jeff Gordon.

CHAPTER 2

LITERATURE SURVEY

NatSKA is a budget karting association set up for schools and youth groups in the UK, with 13 classes.

In the United States, the biggest proportion of racers are in the dirt oval classes which often use Briggs & Stratton industrial engines.

In Australia, classes include Midget, Rookie, Junior and Senior.

Many people race worldwide in Spec series such as Rotax Max (a Touch-and-Go class) or those using the Yamaha KT100 engine.

Concession Karts

As well as "serious" competitive kart racing, many commercial enterprises offer casual hire of karts known as "Concession" karts. Such karts are usually powered by small, detuned four-stroke engines and are far slower than the fully-fledged competitive versions. These karts are built and set to be drivable by anyone.

TYPES OF GO-KARTS

As with most types of vehicles, there are many types of Go-Karts. Although most Go-Karts look very similar to one another, there are actually some subtle variations between them that differentiate them.

Electric Go-Karts When we think of the average Go-Kart, we tend to think of the traditional petrol-powered Go-Kart, but they can also be powered by electricity too.

Electric Go-Karts are best suited to those who already have some experience of Go-Karting, as they can accelerate very quickly. On the plus side, they are quick

and easy to handle, as well as being lower maintenance than their petrol-run counterparts, and cost less to insure. You can buy an electric Go-Kart for less than £200.

They aren't particularly competitive, but they suit anyone who wants to have their own Go-Kart, but isn't bothered about having a top-of-the-range model. The battery packs also make it harder for the Go-Karts to flip over, as the added weight usually makes them too heavy. This makes electric Go-Karts safer to drive, as long as they are driven on flat ground.

Unlike petrol-powered Go-Karts, they can be used in both indoor and outdoor Go-Karting. Go-Karts that are run on petrol can't be used indoors because of the toxic fumes that they produce. As electric Go-Karts only use electricity to power them, they are also environmentally friendly.

Most of the time, the type of Go-Kart that you choose will be influenced by the type of Go-Karting that you take part in.

Speedway races mostly require Go-Karts that are specially modified, as there are only left turns on a Speedway circuit. To counter this, Speedway Go-Karts are designed so that the rear isn't fully in line with the front, creating an asymmetrical look.

The 125 cc shifter Go-Kart is one of the most popular types of Go-Kart, mostly because it is probably the closest that a Go-Kart can get to a Formula 1 car. For this reason, it is not included in the junior Go-Karting classes as it is designed to be driven by the more experienced Go-Karters who are looking for a Go-Kart

that has maximum performance. With a top speed of around 125 mph, it is usually driven at circuits that offer sprint and endurance races.

Shifter Go-Karts allow you to keep the engine at a constant RPM (Revs per Minute) if you know how to change gears. This allows shifter Go-Karts to go faster than most non-shifter Go-Karts that have the same kind of engine. They are more difficult to drive though, mostly because of the gear changes.

Non-shifter Go-Karts mostly come in two forms: direct drive and clutch. With the clutch type, the engine doesn't drive the rear axel chain until the engine reaches a certain RPM (the stall speed), whereas this happens automatically with the direct drive type. Direct drive types need to be push started though, while clutch types need a separate starter.

Most Go-Karts may look similar on the outside, but underneath, they are not the same vehicles. Certain forms of Go-Kart racing require different types of Go-Karts, so you will need to do your homework before you choose which type of Go-Kart to race in.

CHAPTER 3

MATERIAL SELECTION

TYPICAL USES OF CARBON STEELS

Steel Designation	Typical uses
C07, C10	Used for cold forming and deep drawing. Rimming quality used for Automobile bodies, cold heading wires and rivets. Killed quality used for forging and heat treating applications.
C10 and C14	Case hardening steels used for making camshafts, cams, light duty gears, worms, gudgeon pins, selector forks, spindles, pawls, ratchets, chain wheels, tappets, etc.
C15	Used for lightly stressed parts. The material, although easily machinable is not designed specifically for rapid cutting, but is suitable where cold work, such as bending and riveting may be necessary.
C15Mn <u>75</u> , C20, C25 and C25Mn <u>75</u>	General purpose steels for low stressed components.
C30	Used for cold formed levers - Hardened and tempered tie rods, cables, sprockets, hubs and bushes - steel tubes.
C35	Steel for low stressed parts, automobile tubes and fasteners.
C35Mn <u>75</u>	Steel for making low stressed parts in machine structures, cycle and motorcycle frame tubes, fish plates for rails and fasteners.
C40	Steel for crankshafts, shafts, spindles, automobile axle beams, push rods, connecting rods, studs, bolts, lightly stressed gears, etc.
C45	Steel for spindles of machine tools, bigger gears, bolts and shafts.
C50	Steel for making keys, shafts, cylinders, machine components requiring moderate wear resistance. In surface hardened condition it is also suitable for large-pitch worms and gears.
C50Mn1	Rail steel. Also used for making spike bolts, gear shafts, rocking levers and cylinder liners.
C55 and C55Mn <u>75</u>	Steels used for making gears, cylinders, cams, keys, crank shafts, sprockets and machine parts requiring moderate wear resistance for which toughness is not of primary importance.
C60	Steel for making spindles for machine tools, hardened screws and nuts, couplings, crank shafts, axles and pinions.
C65	High tensile structural steel for making locomotive carriage and wagon tyres. Typical uses of this steel in the spring industry include engine valve springs, small washers and thin stamped parts.

CARBON STEEL : PROPERTIES (Contd.)

Designation	Condition	tensile strength N/mm ²	yield strength N/mm ²	Izod impact Nm
C 35 Mn 75	bars & forgings			
	hardened & tempered	600—750	400	55
	tubes, cold drawn & annealed	440	280	
	,, & tempered	620	500	
C 40	bars, cold drawn			
	upto 20 diam	680		
	20—40 ,,	640		
	40—63 ,,	600		
	Over 63 ,,	580		
	bars & forgings, hardened and tempered	600—750	380	41
C 45	bars & forgings, hardened & tempered	600—750	380	41
	tubes, cold drawn & annealed	520	340	
	,, & tempered	700	600	
C 50	bars, cold drawn			
	upto 20 dia.	680		
	20—40 ,,	640		
	40—63 ,,	600		
	Over 63 ,,	660		
		bars & forgings, hardened & tempered	700—850	460
	tubes, cold drawn & annealed	520	340	
	,, & tempered	700	600	
C 55 Mn 75	bars, cold drawn	720—780		
	bars & forgings, hardened & tempered	700—850	460	—
C 55 Cr 75	Wear resisting, hardened & tempered	900—1050	660	35 (BHN 255 — 311)

TENSILE STRENGTH OF STRUCTURAL STEELS : N/mm²

grade	St 30	St 32	St 34	St 37	St 39	St 42	St 44	St 47	St 50	St 52	St 55	St 58	St 63	St 88
tensile strength	300	320	340	370	390	420	440	470	500	520	550	580	630	880
	to													
	380	440	460	490	510	540	540	570	600	620	650	680	710	1000

CARBON STEELS : PROPERTIES

Designation	condition	tensile strength N/mm ²	yield strength N/mm ²	Izod Impact value, Nm
C 07	sheets, cold rolled and annealed	300—380		
C 10	—do—	320—400		
	Case hardened—refined & quenched	500		55
	bars, cold drawn upto 20 diam	500		
	20—40 „	460		
	40—63 „	420		
	over 63 „	340		
C 14	Case hardened—refined & quenched	500		55
	tubes, cold drawn and annealed;	340	190	
	cold drawn and tempered;	440	380	
C 15	tubes cold drawn and annealed	340	190	
	Cold drawn & tempered	440	380	
	sheets, cold rolled & annealed	320—440		
C 15 Mn 75	bars, cold drawn			
	upto 20 dia	520		
	20—40 „	480		
	40—63 „	440		
	Over 63 „	420		
	tubes, cold drawn & annealed	340	190	
	„ & tempered	440	380	
C 20	bars, cold drawn			
	upto 20 diam	560		
	20—40 „	540		
	40—63 „	480		
	Over 63 „	440		
	sheets, cold rolled & annealed	390—510		
	tubes, cold drawn & annealed	370	220	
	cold drawn & tempered	520	420	
C 25	tubes, cold drawn & annealed	390		250
	cold drawn & tempered	560		460
C 25 Mn 75	tubes, cold drawn & annealed	390		250
	„ & tempered	560		460
C 30	bars & forgings:			
	hardened & tempered	600—750	400	55
	bars: upto 20 diam	620		
	20—40 „	580		
	40—63 „	540		
	Over 63 „	500		
C 35	tubes, cold drawn & annealed	440	280	
	„ & tempered	620	500	

SELECTION OF MATERIALS

MILD STEEL

The mild steel is selected for the fabrication of various parts because of its ability to increase hardness and strength of steel. Since this material is ductile, it can withstand tensile stresses produced during drilling. Also its availability and easy machinability has made it the most suited material for our Go-kart.

CAST IRON

Cast iron is also used for its strength and hardness. Its also very cheap and can be cut and joined easily.

CHAPTER 4

SELECTION OF ENGINE

INTRODUCTION

The internal combustion engine is an engine in which the combustion of fuel and an oxidizer (typically air) occurs in a confined space called a combustion chamber. This exothermic reaction creates gases at high temperature and pressure, which are permitted to expand. The defining feature of an internal combustion engine is that useful work is performed by the expanding hot gases acting directly to cause movement of solid parts of the engine, by acting on pistons, rotors, or even by pressing on and moving the entire engine itself.

This contrasts with external combustion engines, such as steam engines and Stirling engines, which use an external combustion chamber to heat a separate working fluid, which then in turn does work, for example by moving a piston or a turbine.

The term *Internal Combustion Engine* (ICE) is almost always used to refer specifically to reciprocating piston engines, Wankel engines and similar designs in which combustion is intermittent. However, continuous combustion engines, such as jet engines, most rockets and many gas turbines are also internal combustion engines.

TYPES OF ENGINES

Two-stroke

Engines based on the two-stroke cycle use two strokes (one up, one down) for every power stroke. Since there are no dedicated intake or exhaust strokes, alternative methods must be used to scavenge the cylinders. The most

common method in spark-ignition two-strokes is to use the downward motion of the piston to pressurize fresh charge in the crankcase, which is then blown through the cylinder through ports in the cylinder walls.

Spark-ignition two-strokes are small and light for their power output and mechanically very simple; however, they are also generally less efficient and more polluting than their four-stroke counterparts. However, in single-cylinder small motor applications, cc for cc, (cc meaning cubic centimeter), a two-stroke engine produces much more power than equivalent 4 strokes, due to the enormous advantage of having 1 power stroke for every 360 degrees of crankshaft rotation (compared to 720 degrees in a 4 stroke motor).

Small displacement, crankcase-scavenged two-stroke engines have been less fuel-efficient than other types of engines when the fuel is mixed with the air prior to scavenging, allowing some of it to escape out of the exhaust port.

Modern designs (Sarich and Paggio) use air-assisted fuel injection, which avoids this loss, and are more efficient than comparably sized four-stroke engines.

Fuel injection is essential for a modern two-stroke engine in order to meet ever more stringent emission standards.

Research continues into improving many aspects of two-stroke motors, including direct fuel injection, amongst other things. Initial results have produced motors that are much cleaner burning than their traditional counterparts.

Two-stroke engines are widely used in snowmobiles, lawnmowers, weed-whackers, chain saws, jet skis, mopeds, outboard motors, and many motorcycles.

The largest compression-ignition engines are two-strokes and are used in some locomotives and large ships. These engines use forced induction to scavenge the cylinders. An example of this type of motor is the Wartsila-Sulzer turbocharged 2 stroke diesel as used in large container ships. It is the most efficient and powerful engine in the world, with over 50% thermal efficiency. For comparison, the most efficient small 4-stroke motors are around 43% thermal efficiency (SAE 900648), and size is an advantage for efficiency due to the increase in the ratio of volume to area.

Four-stroke

Engines based on the four-stroke or Otto cycle have one power stroke for every four strokes (up-down-up-down) and are used in cars, larger boats, some motorcycles, and many light aircraft. They are generally quieter, more efficient, and larger than their two-stroke counterparts. There are a number of variations of these cycles, most notably the Atkinson and Miller cycles. Most truck and automotive diesel engines use a four-stroke cycle, but with a compression heating ignition system. This variation is called the diesel cycle. The steps involved here are:

1. Intake stroke: Air and vaporized fuel are drawn in.
2. Compression stroke: Fuel vapor and air are compressed and ignited.
3. Combustion stroke: Fuel combusts and piston is pushed downwards.
4. Exhaust stroke: Exhaust is driven out. During the 1st, 2nd, and 4th, stroke the piston is relying on power and momentum generated by the other pistons. In that case a four cylinder engine would be less powerful than a six or eight cylinder engine.

Five-stroke

Engines based on the five-stroke cycle are a variant of the four-stroke cycle. Normally the four cycles are intake, compression, combustion, and exhaust. The fifth cycle added by Delautour^[3] is refrigeration. Engines running on a five-stroke cycle are claimed to be up to 30 percent more efficient than equivalent four-stroke engines.

Six-stroke

The six stroke engine captures the wasted heat from the 4-stroke Otto cycle and creates steam, which simultaneously cools the engine while providing a free power stroke. This removes the need for a cooling system, making the engine lighter while giving 40% increased efficiency over the Otto Cycle.

Beare Head Technology combines a four-stroke engine bottom end with a ported cylinder, which closely resembles that of a two-stroke: thus, $4+2 = \text{six-stroke}$. It has an opposing piston that acts in unison with auxiliary low pressure reed and rotary valves, allowing variable compression and a range of tuning options.

Bourke engine

In this engine, two opposed cylinders are linked to the crank by a Scotch yoke. The Scotch yoke mechanism prevents side thrust, preventing any piston slap, allowing operation as a detonation or "explosion" engine. This also greatly reduces friction between pistons and cylinder walls. The Bourke engine uses fewer moving parts and has to overcome less friction than conventional crank and slider engines with poppet valves. However no independent testing of this engine has ever borne out any of these claims.

Controlled Combustion Engine

These are also cylinder-based engines, which may be one or two-stroke but use, instead of a crankshaft and piston rods, two gear-connected, counterrotating concentric cams to convert reciprocating motion into rotary movement. These cams practically cancel out sideward forces that would otherwise be exerted on the cylinders by the pistons, greatly improving mechanical efficiency. The number of lobes of the cams (always an odd number not less than 3) determines the piston travel versus the torque delivered. In this engine, there are two cylinders that are 180 degrees apart for each pair of counterrotating cams. For single-stroke versions, there are as many cycles per cylinder pair as there are lobes on each cam, and twice as many for two-stroke engines.

Wankel

The Wankel engine (rotary engine) does not have piston strokes, so is more properly called a four-phase, rather than a four-stroke, engine. It operates with the same separation of phases as the four-stroke engine, with the phases taking place in separate locations in the engine. This engine provides three power 'strokes' per revolution per rotor (while it is true that 3 power strokes occur per ROTOR revolution, due to the 3/1 revolution ratio of the rotor to the eccentric shaft, only 1 power stroke per shaft revolution actually occurs), typically giving it a greater power-to-weight ratio than piston engines. This type of engine is most notably used in the current Mazda RX-8, the earlier RX-7, and other models.

Gas turbine

Gas turbines cycles (notably jet engines) do not use the same system to both compress and then expand the gases; instead, separate compression and expansion turbines are employed, giving continuous power. Essentially, the intake gas (normally air) is compressed and then combusted with a fuel, which greatly raises the temperature and volume. The larger volume of hot gas from the combustion chamber is then fed through the gas turbine, which is then able to power the compressor. The exhaust gas may be used to provide thrust, supplying only sufficient power to the turbine to compress incoming air (jet engine); or as much energy as possible can be supplied to the shaft (gas turbine proper).



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CHAPTER 5
DESCRIPTION OF PARTS

CHASSIS

The chassis are made of steel tube. There is no suspension therefore chassis have to be flexible enough to work as a suspension and stiff enough not to break or give way on a turn. Kart chassis are classified in the USA as 'Open', 'Caged', 'Straight' or 'Offset'. All CIK-FIA approved chassis are 'Straight' and 'Open'.

Open karts have no roll cage. In Straight chassis the driver sits in the center. Straight chassis are used for sprint racing. In Offset chassis the driver sits on the left side. Offset chassis are used for left-turn-only speedway racing.

The stiffness of the chassis enables different handling characteristics for different circumstances. Typically, for dry conditions a stiffer chassis is preferable, while in wet or other poor traction conditions, a more flexible chassis may work better. Best chassis allow for stiffening bars at the rear, front and side to be added or removed according to race conditions. Braking is achieved by a disc brake mounted on the rear axle. Front disc brakes are increasingly popular; however, certain classes do not allow them.

Professionally raced karts typically weigh 165 to 175 lb (75 to 80 kg), complete without driver.

FRAME

A sturdy, well-built frame is the key to manoeuvring well on the track, especially when turning. The most important criteria for an excellent frame is to negotiate turns well. Frames are directly responsible for how well go-karts turn left and right. Weaker go-karts with cheap components are known to slide and drift along turns – in some instances, flipping to its side entirely with

careless driving. "Side bite" is referred to keeping a go-kart planted to the track without sliding. Without the proper frame, go-karts will manoeuvre out of control, even shutting off in some cases due to over pressure to the engine.

The design of the go-kart chassis has everything to do with how well it moves on turns and maintaining side bite. If the width of the rear rails (go-kart frames constitute front rails and rear rails) is narrow, with measurements ranging from 24" to 25" - from "kingpin" to "kingpin", the ends of the rail – it will have less side bite. Wider rails barely ever exceed 30" on standard go-karts.

Choosing the right frame for your go-kart can largely depend on the surface you are riding on. Whether it is asphalt, concrete, or dirt – different types of frames behave differently according to surface. For example, dirt track frames should consist of a short front rail and a longer back rail. Dirt tracks place a lot of stress and challenge on the front rail and stiff back rails zipping through dirt can cut power to the engine while cutting a turn. The best frame for riding dirt tracks are ones with narrow fronts and longer backs, vice versa to asphalt and concrete.

ENGINE

2-stroke engine was originally taken from moped. This can develop from about 4 hp to 7 hp for a single-cylinder 50 cc unit. There were several available engine models that were suitable for this particular kart. We opted for a 5-horsepower engine, capable of powering the kart at speeds up to about 30 mph. This engine comes with a clutch already installed.

The engine rests on the engine mounting plate, and is bolted in position through four slotted mounting holes in the plate. The holes are slotted so that the engine position can be shifted forward or backward to adjust the tension on the chain, which will be installed in a later step.

The engine is secured to the mount using the provided mounting bolts and nylon lock-nuts. The bolts extend up through the bottom of the plate and engine. When installing the nuts, make certain that the nylon side of the nut is facing away from the threads of the bolt (figure B). Install all four bolts and nuts, but don't tighten the nuts down yet. The engine will need to slide forward and backward for chain adjustment.

COOLING SYSTEM

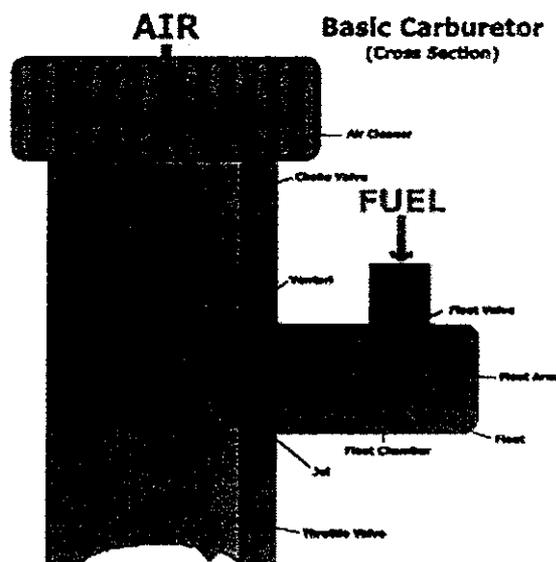
Most modern internal combustion engines are cooled by a closed circuit carrying liquid coolant through channels in the engine block, where the coolant absorbs heat, to a heat exchanger or radiator where the coolant releases heat into the air, and so on, ad infinitum. Thus, while they are *ultimately* cooled by air, because of the liquid-coolant circuit they are known as *water-cooled*. In contrast, heat generated by an air-cooled engine is released directly into the air. Typically this is facilitated with metal fins covering the outside of the cylinders which increase the surface area that air can act on. It is worth noting that in all combustion engines, a great percentage of the heat generated (around 44%) escapes through the exhaust, not through either a liquid cooling system nor through the metal fins of an air-cooled engine (12%). About 8% of

the heat energy finds its way into the oil, which although primarily meant for lubrication, also plays a role in heat dissipation via a cooler.

CARBURETOR

The carburetor works on Bernoulli's principle: the faster air moves, the lower its static pressure, and the higher its dynamic pressure. The throttle (accelerator) linkage does not directly control the flow of liquid fuel. Instead, it actuates carburetor mechanisms which meter the flow of air being pulled into the engine. The speed of this flow, and therefore its pressure, determines the amount of fuel drawn into the airstream.

Basics



A carburetor basically consists of an open pipe, a "throat" or "barrel" through which the air passes into the inlet manifold of the engine. The pipe is in the form of a venturi: it narrows in section and then widens again, causing the airflow to increase in speed in the narrowest part. Below the venturi is a butterfly valve called the throttle valve — a rotating disc that can be turned

end-on to the airflow, so as to hardly restrict the flow at all, or can be rotated so that it (almost) completely blocks the flow of air. This valve controls the flow of air through the carburetor throat and thus the quantity of air/fuel mixture the system will deliver, thereby regulating engine power and speed. The throttle is connected, usually through a cable or a mechanical linkage of rods and joints or rarely by pneumatic link, to the accelerator pedal on a car or the equivalent control on other vehicles or equipment.

Fuel is introduced into the air stream through small holes at the narrowest part of the venturi. Fuel flow in response to a particular pressure drop in the venturi is adjusted by means of precisely-calibrated orifices, referred to as jets, in the fuel path.

Off-idle circuit

As the throttle is opened up slightly from the fully closed position, the throttle plate uncovers additional fuel delivery holes behind the throttle plate where there is a low pressure area created by the throttle plate blocking air flow; these allow more fuel to flow as well as compensating for the reduced vacuum that occurs when the throttle is opened, thus smoothing the transition to metering fuel flow through the regular open throttle circuit.

Main open-throttle circuit

As the throttle is progressively opened, the manifold vacuum is lessened since there is less restriction on the airflow, reducing the flow through the idle and off-idle circuits. This is where the venturi shape of the carburetor throat comes into play, due to Bernoulli's principle (i.e., as the velocity increases, pressure falls). The venturi raises the air velocity, and this high speed and thus low pressure sucks fuel into the airstream through a nozzle or nozzles located in

the center of the venturi. Sometimes one or more additional booster venturis are placed coaxially within the primary venturi to increase the effect.

As the throttle is closed, the airflow through the venturi drops until the lowered pressure is insufficient to maintain this fuel flow, and the idle circuit takes over again, as described above.

Bernoulli's principle, which is caused by the momentum of the fluid, is a dominant effect for large openings and large flow rates, but since fluid flow at small scales and low speeds (low Reynolds number) is dominated by viscosity, Bernoulli's principle is ineffective at idle or slow running and in the very small carburetors of the smallest model engines. Small model engines have flow restrictions ahead of the jets to reduce the pressure enough to suck the fuel into the air flow. Similarly the idle and slow running jets of large carburetors are placed after the throttle valve where the pressure is reduced partly by viscous drag, rather than by Bernoulli's principle. The most common rich mixture device for starting cold engines was the choke, which works on the same principle.

IGNITION SYSTEM

Mechanically timed ignition

Most four-stroke engines have used a mechanically timed electrical ignition system. The heart of the system is the distributor. The distributor contains a rotating cam running off the engine's drive, a set of breaker points, a condenser, a rotor and a distributor cap. External to the distributor is the ignition coil, the spark plugs, and wires linking the spark plugs and ignition coil to the distributor. The system is powered by a lead-acid battery, which is

charged by the car's electrical system using a dynamo or alternator. The engine operates contact breaker points, which interrupt the current to an induction coil (known as the ignition coil).

The ignition coil consists of two transformer windings sharing a common magnetic core -- the primary and secondary windings. An alternating current in the primary induces alternating magnetic field in the coil's core. Because the ignition coil's secondary has far more windings than the primary, the coil is a step-up transformer which induces a much higher voltage across the secondary windings. For an ignition coil, one end of windings of both the primary and secondary are connected together. This common point is connected to the battery (usually through a current-limiting resistor). The other end of the primary is connected to the points within the distributor. The other end of the secondary is connected, via the distributor cap and rotor, to the spark plugs.

The ignition firing sequence begins with the points (or contact breaker) closed. A steady charge flows from the battery, through the current-limiting resistor, through the coil primary, across the closed breaker points and finally back to the battery. This steady current produces a magnetic field within the coil's core. This magnetic field forms the energy reservoir that will be used to drive the ignition spark.

As the engine turns, so does the cam inside the distributor. The points ride on the cam so that as the engine turns and reaches the top of the engine's compression cycle, a high point in the cam causes the breaker points to open. This breaks the primary winding's circuit and abruptly stops the current through the breaker points. Without the steady current through the points, the magnetic field generated in the coil immediately begins to quickly collapse.

This rapid decay of the magnetic field induces a high voltage in the coil's secondary windings.

At the same time, current exits the coil's primary winding and begins to charge up the capacitor ("condenser") that lies across the now-open breaker points.

This capacitor and the coil's primary windings form an oscillating LC circuit.

This LC circuit produces a damped, oscillating current which bounces energy between the capacitor's electric field and the ignition coil's magnetic field. The oscillating current in the coil's primary, which produces an oscillating magnetic field in the coil, extends the high voltage pulse at the output of the secondary windings. This high voltage thus continues beyond the time of the initial field collapse pulse. The oscillation continues until the circuit's energy is consumed.

The ignition coil's secondary windings are connected to the distributor cap. A turning rotor, located on top of the breaker cam within the distributor cap, sequentially connects the coil's secondary windings to one of the several wires leading to each cylinder's spark plug. The extremely high voltage from the coil's secondary — often higher than 1000 volts -- causes a spark to form across the gap of the spark plug. This, in turn, ignites the compressed air-fuel mixture within the engine. It is the creation of this spark which consumes the energy that was originally stored in the ignition coil's magnetic field.

TRANSMISSION

Our go-kart does not contain any external clutch. It has an auto-engaging clutch which controls the transmission. Power is transmitted from the engine to the rear axle by way of a chain. Both engine and axle sprockets are removable, their ratio has to be adapted according to track configuration in order to get the most of the engine

PROPELLER SHAFT

Axles are an integral structural component of a wheeled vehicle. The axles maintain the position of the wheels relative to each other and to the vehicle body. Since for most vehicles the wheels are the only part touching the ground, the axles must bear the weight of the vehicle plus any cargo, as well as acceleration and braking forces. In addition to the structural purpose, axles may serve one or more of the following purposes depending on the design of the vehicle. Karts do not have a differential. The lack of a differential means that one rear tire must slide while cornering; this is achieved by designing the chassis so that the inside rear tire lifts up slightly when the kart turns the corner. This allows the tire to lose some of its grip and slide or lift off the ground completely.

WHEELS

Wheels and tires are much smaller than those used on a normal car. Wheels are made of magnesium alloy or aluminum. Similar to other motorsports, kart tires have different types for use appropriate to track conditions. Kart tires come in many different compounds, from very soft to very hard. Intermediates for damp or low traction conditions. Sometimes worn rain tires are used. Special, such as spiked tire for icy conditions, or cuts for high grip dirt/clay speedways. Cuts are modified slicks using a lathe to optimize handling while spiked tyres are slicks with screws through them. Tires are sometimes prepared with special solvents to soften them and increase grip, however this is banned by many racing organizations. These solvents typically affect the behavior of the tire temporarily and are most often destructive to the rubber. The tires can support cornering forces in excess of 2 G (20 m/s^2), depending on chassis, engine, and motor setup.

BRAKING SYSTEM

Rear drum brakes are typically of a leading design, the shoes being moved by a single double-acting hydraulic cylinder and hinged at the same point. In this design, one of the brake shoes will always experience the self-applying effect, irrespective of whether the vehicle is moving forwards or backwards. This is particularly useful on the rear brakes, where the footbrake must exert enough force to stop the vehicle from travelling backwards and hold it on a slope. Provided the contact area of the brake shoes is large enough, which isn't always the case, the self-applying effect can securely hold a vehicle when the weight is transferred to the rear brakes due to the incline of a slope or the reverse direction of motion.

Front drum brakes may be of either design in practice, but the twin leading design is more effective. This design uses two actuating cylinders arranged so that both shoes will utilize the self-applying characteristic when the vehicle is moving forwards. The brake shoes pivot at opposite points to each other. This gives the maximum possible braking when moving forwards, but is not so effective when the vehicle is travelling in reverse

Advantages

Drum brakes are still used in modern cars. There can be engineering and cost advantages. Drum brakes allow simple incorporation of a parking brake. They are often applied to the rear wheels since most of the stopping happens in the front of the vehicle and therefore the heat generated in the rear is significantly

less. Drum brakes are also occasionally fitted as the parking (and emergency) brake even when the rear wheels use disk brakes as the main brakes. In this situation, a small drum is usually fitted within or as part of the brake disk.

Disadvantages

Drum brakes are designed to convert kinetic energy into heat energy via the process of friction. This heat is intended to be further transferred to atmosphere, but can just as easily transfer into other components of the braking system.

But brake drums have to be substantial pieces of steel or cast-iron to cope with the forces that are involved. They can therefore retain a lot of heat. Whilst heat transfer to atmosphere can be aided by incorporating fins into the design of the drum, when excessive heating occurs due to heavy or repeated braking it can cause the drum to distort, leading to vibration under braking.

The other consequence of overheating is brake fade. This is due to one of several processes or more usually an accumulation of all of them.

1. When the drums are heated by hard braking, the diameter of the drum increases slightly due to thermal expansion of the material, this means the brakes shoes have to move further and the brake pedal has to be depressed more.

CHAPTER 6

FABRICATION

SHEARING

It's the process of cutting the metal by applying shear force. In this process the tool hits the work, and due to the shear forces the metal shears. The angles used in the frame, base are cut using shearing operations as per the dimensions

ARC WELDING

Arc welding uses a welding power supply to create an electric arc between an electrode and the base material to melt the metals at the welding point. They can use either direct (DC) or alternating (AC) current, and consumable or non-consumable electrodes. The welding region is sometimes protected by some type of inert or semi-inert gas, known as a shielding gas, and/or an evaporating filler material. The process of arc welding is widely used because of its low capital and running costs

CASTING

Casting is a process whereby the molten material is poured into a mould of the required shape and then allowed to solidify. Molding is similar process used to form plastic materials. The mould should be so shaped so that molten material flows to all parts of the mould

TURNING

In this process, the work is held in two rotating spindles and makes contact with the cutting edge removing material from the surface of the workpiece. By moving the cutting tool along the length of the work piece, circular section components are rapidly produced. The tool can be held at the varying distance from the work piece to create components of varying diameter.

DRILLING

Under normal usage, swarf is carried up and away from the tip of the drill bit by the fluting. The continued production of chips from the cutting edges produces more chips which continue the movement of the chips outwards from the hole. This continues until the chips pack too tightly, either because of deeper than normal holes or insufficient backing off (removing the drill slightly or totally from the hole while drilling). Lubricants and coolants (i.e. cutting fluid) are sometimes used to ease this problem and to prolong the tools life by cooling and lubricating the tip and chip flow. Coolant is introduced via holes through the drill shank (see gun drill). Straight fluting is used for copper or brass, as this exhibits less tendency to "dig in" or grab the material. If a helical drill (twist drill) is used then the same effect can be achieved by stoning a small flat parallel with the axis of the drill bit. For heavy feeds and comparatively deep holes oil-hole drills can be used, with a lubricant pumped to the drill head through a small hole in the bit and flowing out along the fluting. A conventional drill press arrangement can be used in oil-hole drilling, but it is more commonly seen in automatic drilling machinery in which it is the workpiece that rotates rather than the drill bit.

CHAMFERING

Chamfering is used after a hole has been drilled and a small chamfer is desired on the edge of the hole. Chamfers are a must when the hole is going to be tapped or reamed. The chamfer provides a start for the next tool, as well as eliminates tool impact shock to the reamer or tap.

ASSEMBLY

Dimensions

- Length 2,000mm
 - Wheel Base 1,500mm
 - Tred 1,000mm (Front & Rear)
-

Accommodation

1 person (only the driver, no passenger).

Vehicle Frame, Suspension Arms, & Steering Linkages, etc.

All are designed and built by steel plates and metal sheets. Original frame of TVS 50 is supposed to cut into piece as an engine mounting structure.

Drive shafts and steering linkages are also to be built on own as well as the complete frame work.

Bearings standardly offered in the market and rod ends will have to be purchased.

SPROCKETS:

Driven sprockets designed for TVS50 (aftermarket parts) having 41 teeth for chain in size of 428.

This particular sprocket was chosen because;

- (1) The drive sprocket of TVS50R produced in 1987 was in the size of 428.
- (2) Due to the use of 10-inch rear wheels for my buggy, I thought smaller final gear ratio would be preferable to achieve good drivability.

In thinking about combination of chain size 428 with smaller number of teeth, this was the only choice available.

Size of a drive chain to be chosen is 428 with length of 130mm.

These are non-sealed type that is applicable up to 125cc. The chain can be cut into length later.

A silencer of TVS 50 that is to be installed as well...

BRAKING:

A brake caliper that we bought were of TVS 50.

The pads for TVS could be used in combination with the caliper. We calculated that the base plate of the pad must be cut by 2mm at both ends to get it installed. Material of the calipers is steel, instead of plastic used for XLR ones.

Wheels:

Initially we were going to build wheels, having chosen some old 16inch Cessna casings. This will prove to be a lot of work which needs a large metalworking lathe. We decided to mold plastic hubs with 16x4 tires and come with no bearings. The bearings have a 12mm internal diameter, to fit 12mm stainless steel bolts as axles. The front axle is a piece of 12mm stainless threaded at each end to take standard nuts. Since the bearing faces are less than 100mm apart, we used 100mm bolts and fitted a spacer.

CHAPTER 7

BILL OF MATERIAL

BILL OF MATERIALS

SNO	NAME OF THE COMPONENTS	MATERIAL	WORKS PERFORMED IN THE COMPONENT	NO OF PARTS
1	MOTOR	CAST IRON	RUNNING	1
2	RODS	CAST IRON	FOR BALANCING PURPOSE	2
3	WHEELS	RUBBER & ALUMINIUM	FOR RUNNING PURPOSES	3
4	STEERING	STEEL	FOR DIRECTION PURPOSES	1
5	SPROCKETS	IRON	JOINING PURPOSES	2
6	CHAINS	IRON	FOR CONNECTING PURPOSES	1
7	BEARINGS	IRON	JOINING PURPOSES	2
8	NUTS & BOLTS	IRON	CONNECTION PURPOSES	8
9	WELDING RODS	IRON	WELDING PURPOSES	3
10	BASE	IRON	SUPPORTING PURPOSES	1

COST OF PURCHASED MATERIAL

SNO	NAME OF THE PARTS	COST /PIECE	NO OF PARTS PURCHASED	TOTAL COST
1	MOTOR	1100	1	1500
2	WHEELS	300	3	900
3	STEERING	250	1	250
4	WELDING RODS	75	4	300
5	CHAINS	50	1	50
6	NUTS & BOLTS	10	8	80
7	BEARINGS	75	2	150
8	SPROCKETS	100	1	100
9	BASE	250	1	250
10	RODS	100	4	400
11	CHAINS	90	1	90
12	BELT	75	1	75

Silencer replacement

We have used a silencer from TVS 50, 1-cylinder motorcycle, and the acceleration in a certain range of engine revolution goes less powerful possibly due to uncongeniality of the silencer with the engine.

Repair of broken front axles & Offset change of front wheels

Tires at right side are always stressed higher than for left, however the failure must be solved otherwise the buggy will never be able to come back on the ground.

One suspected root cause is that the moment applied on the axle might be higher than the limit of the material.

The surface of inner bearing stays almost in the surface of side wall of the tire. Bending moment applied on the axle should become less if the surface of the inner bearing comes toward inboard.

CONCLUSION

The machine build by us is running successfully. The project has lead to providing greater training aid to the development of motor racing skills in the trainees. A number of photographs and drawings have been provided for better understanding the units of our project.

Knuckle arm extension

Since the heavy operation force of steering and the angle less than 90 degrees for lock to lock, we have to extend the length of knuckle arms for slower steering and restricted the operation angle of steering.

We put some pieces of materials by welding, painted, and the extension has become completed.

Front fender add-on

A lot of stones and sand are rolled up by the front tires turning.

Also the stones and sand are stuck up on the seat until the end of run.

We can make a pair of fenders for the front tires at the opportunity of taking the knuckle arms off from the buggy.

The material we chose was a front fender which can be found at a shop of used motorcycle parts. We cut it into two pieces, made the corners rounded, and a pair of fenders becomes completed.

We can purchase a used kick pedal for motorcycle and welded it onto the rod we originally put in place.

As a replacement of an automotive jack, we made a foldable supporting structure in "A" shape and put onto the frame of the buggy.

The material was from a leg of a beach bed being disposed, thus the cost was zero.

Difficulty to make it complete was that the thickness is only 1.2mm therefore it was a hard job not to get it melted due to excess heat coming from DC battery welder.

We can get it painted, and made a few small components for completion.

An "A" shape structure and the kick pedal itself are designed to be folded and tied up onto the frame of the buggy when it is in driving.

Heat Shield Plate in front of Exhaust Pipe

The heat comes from exhaust pipes coming close to the seat heats it up.

A shielding place is needed to block the heat.

Exhaust pipes coming closer to the seat (approx. 40mm in between).

The material we chose was a steel plate originally used an air conditioner

The thickness can be less than 1mm thus easy to work, and also it is pre-plated with zinc that I can expect sufficient anti-rust performance.

Further Modifications and Improvements

Followings are the points of modifications and improvements.

1. Kick pedal re-design
2. Heat shield plate in front of exhaust pipes
3. Knuckle arm extension
4. Front fender add-on
5. Silencer replacement
6. Reinforcement around ball joints of front-lower suspension arms
7. Repair of bent drive shafts
8. Repair of broken front axles & Offset change of front wheels
9. Replacement of ignition coil, spark plug wire & the cap
10. Repair of broken front axles (Vol. 2)
11. Steering angle adjustment of inner & outer wheels
12. Fuel filter relocation

Kick pedal re-design

Pull-up lever has been the method to start the engine, a steel rod with a kick pedal at the end, supported by a automotive jack.

It redundantly takes time to put on and off every time of starting engine, furthermore, every time engine stops somewhere far away from the base we have to push it back to the place or to come back just to take the pedal for re-start.

Direct Drive Braking

The drive from the engine is directly given to the axle without the use of bearings. Thus as soon as the acceleration is reduced, the vehicle automatically slows down without the need of braking.

LIMITATIONS

The limitations in our project are listed below

- Due to smaller engine high speeds are difficult to attain.
- The absence of multiple gears restricts varying of speeds
- There is a loss of grip due to having only three wheels

Stronger Chassis

Most of the Go-Karts made now-a-days are very light and hence very weak. These Go-Karts can attain very high speeds but will fail in the case of an accident. Hence we decided to build our vehicle on Cast Iron in order to improve the safety for our Young racers.

Three Wheels

In order to increase maneuverability and to reduce the drag on the vehicle we decided to have three wheel system. The three wheel system also doesn't require a differential drive, thereby delivering maximum power of the engine to the wheels.

No Suspensions

At higher speeds the vehicles will usually experience 'pitching' and 'rolling'. This is very difficult to control for the inexperienced drivers. Hence we avoided suspension but compensated it by adding a broad and heavy chassis.

Free Flow Exhaust

The major feature added to the engine in order to increase the power developed by the vehicle is the free flow exhaust. The obstructions in the exhaust like the muffler are removed in order to increase the air intake by the engine.

ADVANTAGES

Wheel Base

For a greater stability of the Go-kart we had designed a broader wheel base. Our base of dimensions 1000mm X 1700mm offers greater control and stability while negotiating sharp curves. Hence the basic structure of our Go-kart itself acts as a shock absorber while turning.

Two Stroke Engine

As already mentioned we have designed our Go-Kart for children. Hence we designed it with a 50cc engine. To compensate this we used a 2-stroke Engine which provides very high torque and accelerations. Hence our vehicle provides higher torque and pick-up under safe speeds.

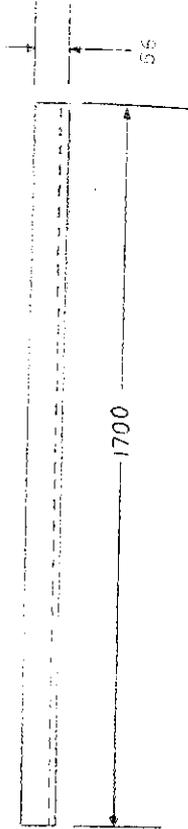
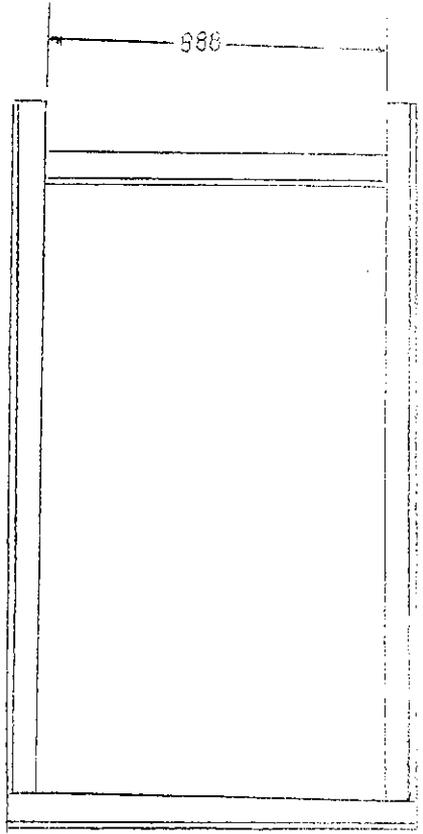
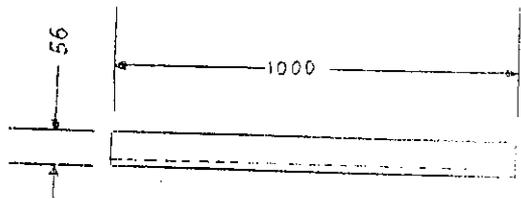
Steering

The toughest part in driving is maneuvering. Most of the steering systems provided in four wheeled vehicles are often complicated to understand. Also the varying gear ratio in the steering systems of different vehicles causes confusion while turning. Hence we found that a single handle steering is best suited for training. Our Go-Kart offer this.

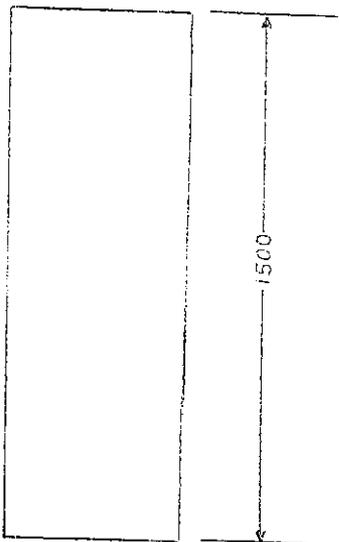
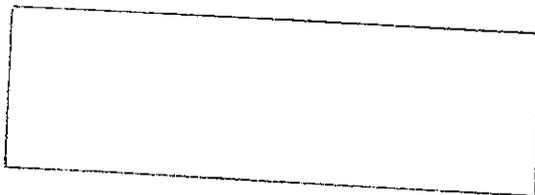
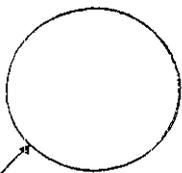
CHAPTER 9

CONCLUSION

DRAWINGS

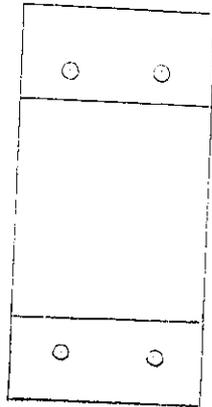
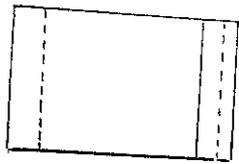
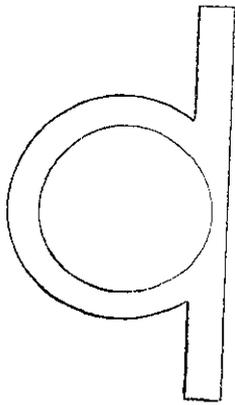


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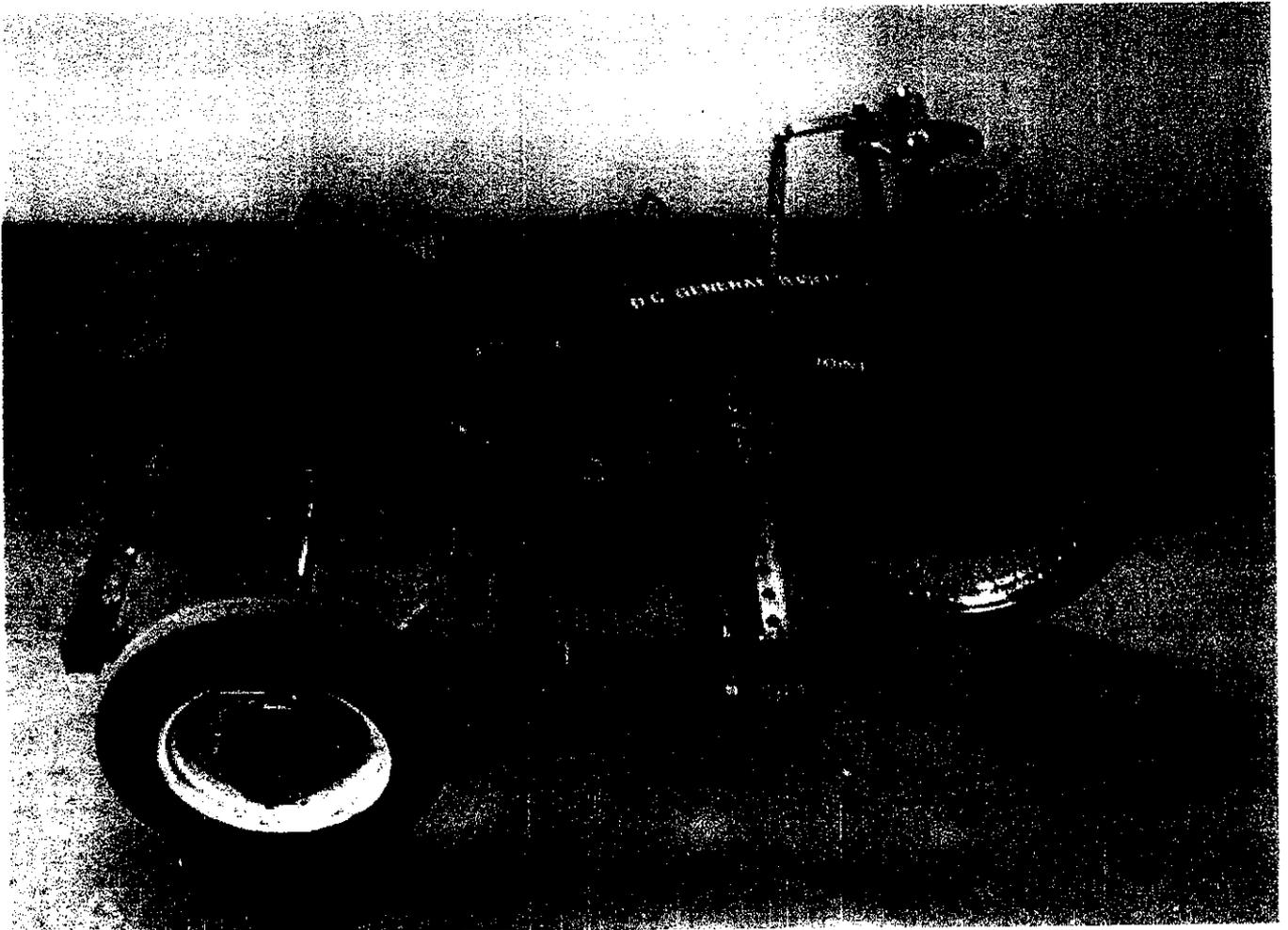
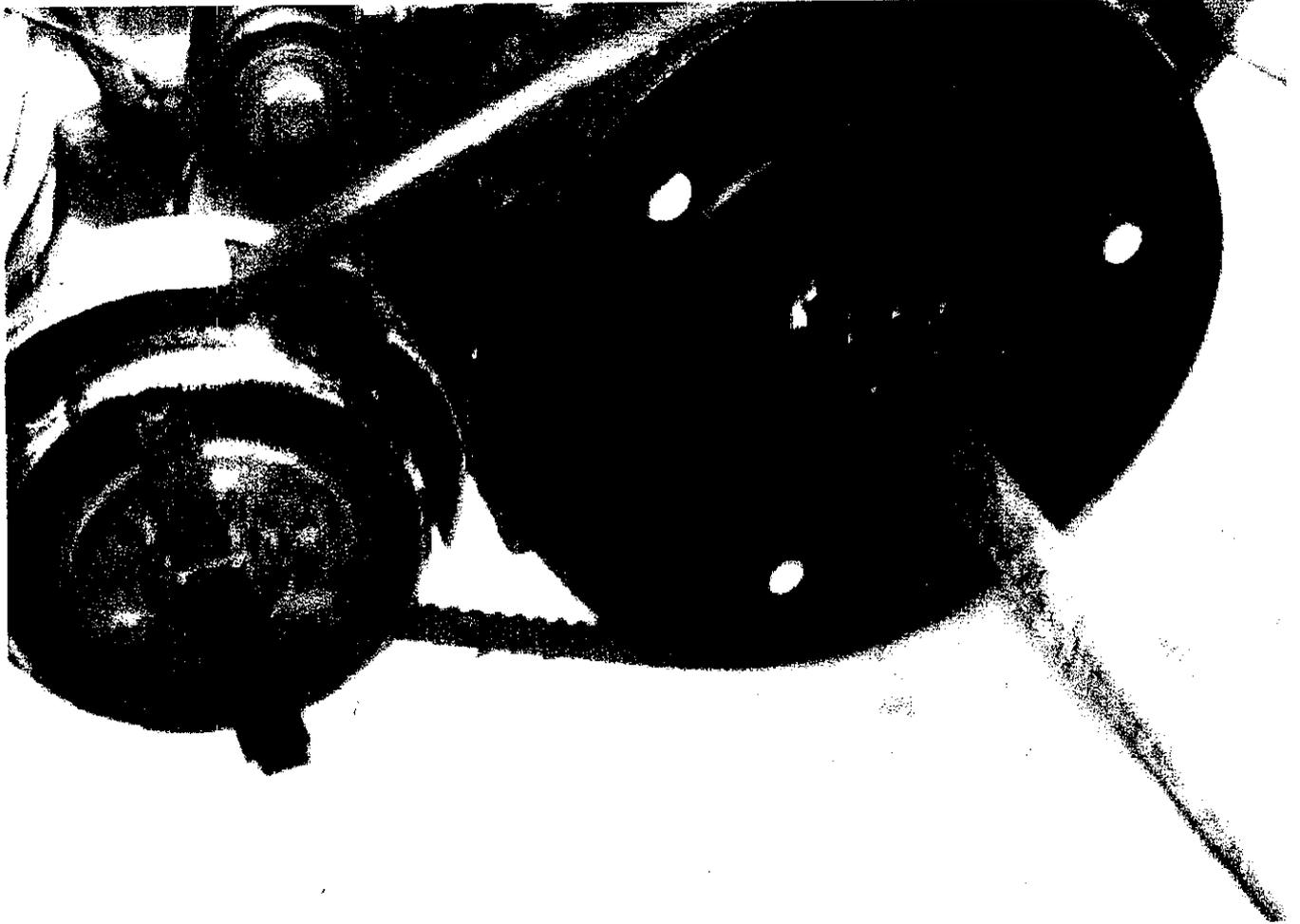
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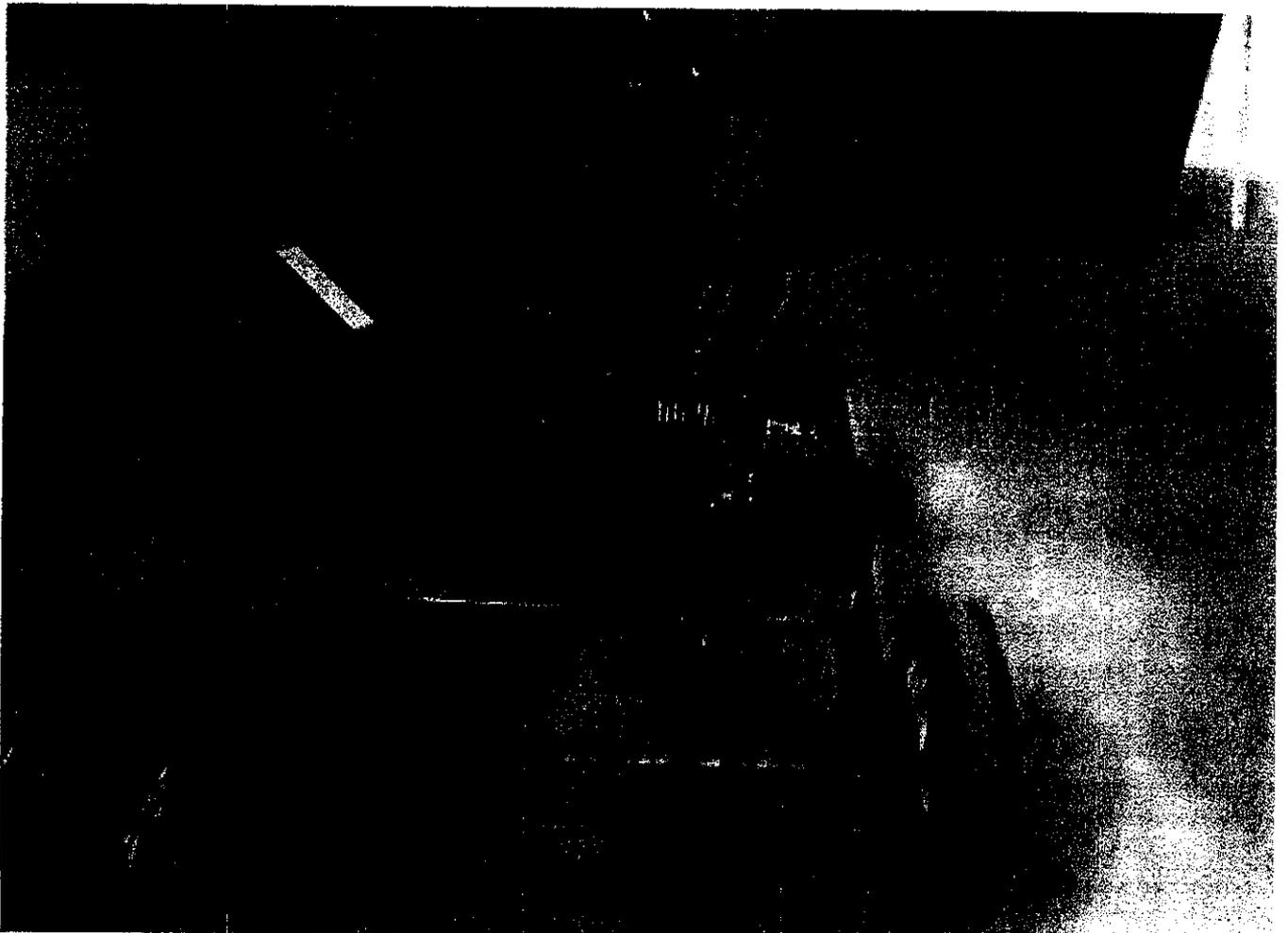
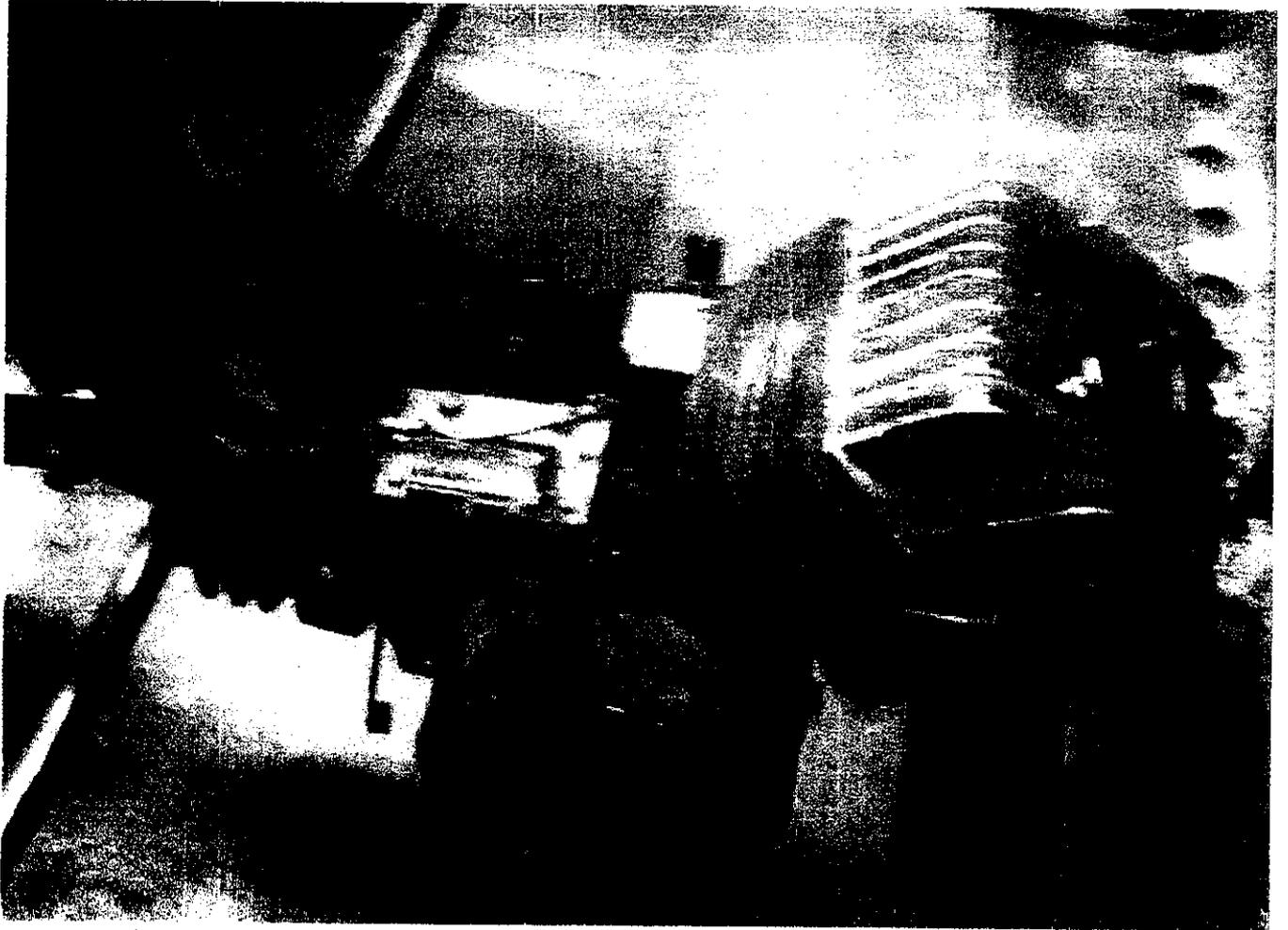
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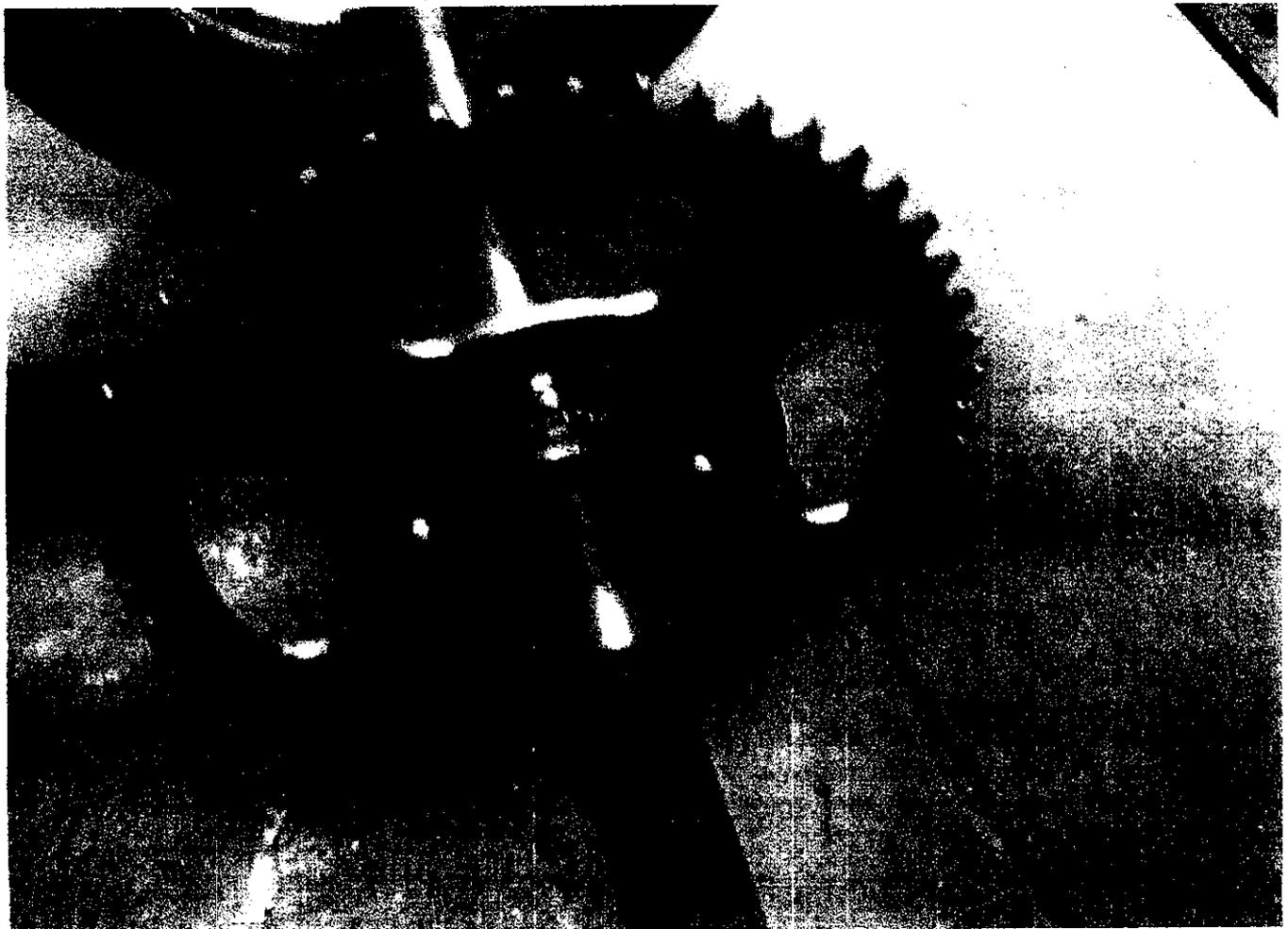
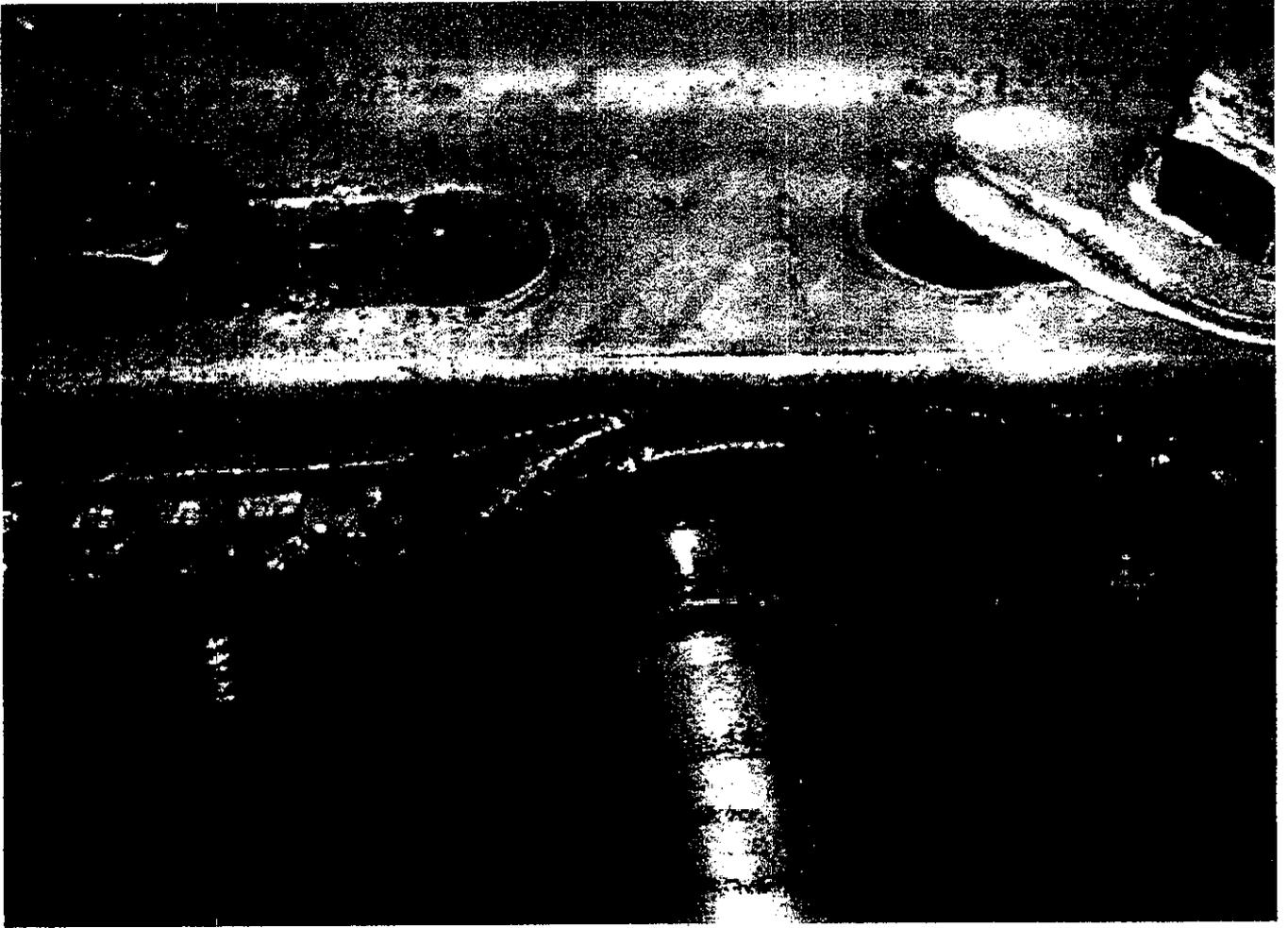


BEARING

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