

# MIGHTY MINICYCLES

BY WILLIAM E. BUTTERWORTH



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# ***MIGHTY MINICYCLES***

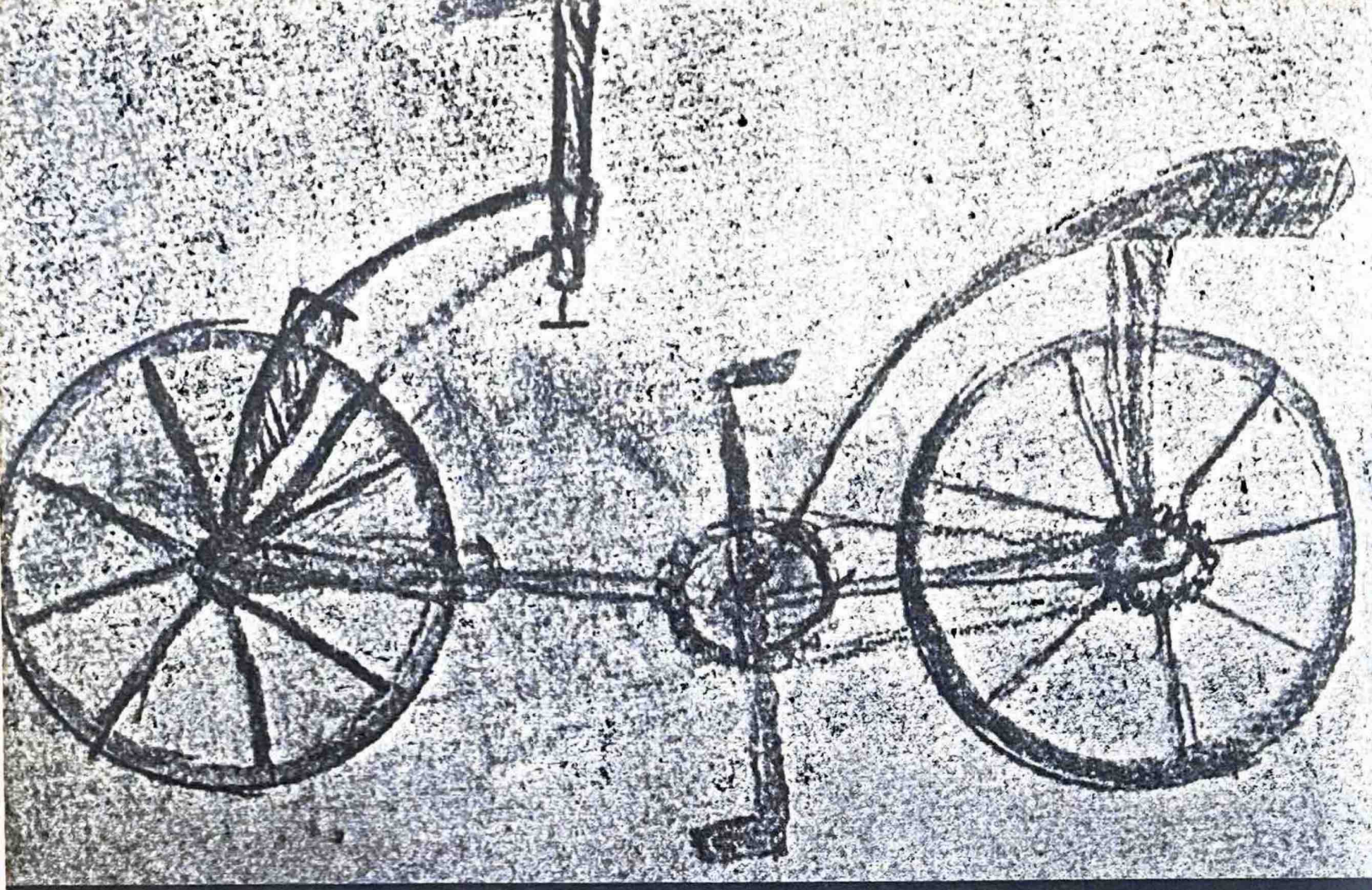
**BY WILLIAM E. BUTTERWORTH**

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**This remarkable 15th-century bicycle design is from the notebooks of Leonardo da Vinci. It shows the great genius' concept of a two-wheeled cycle. From *The Unknown Leonardo*, edited by Ladislao Reti. Copyright 1974. Used with permission of McGraw Hill Book Company.**

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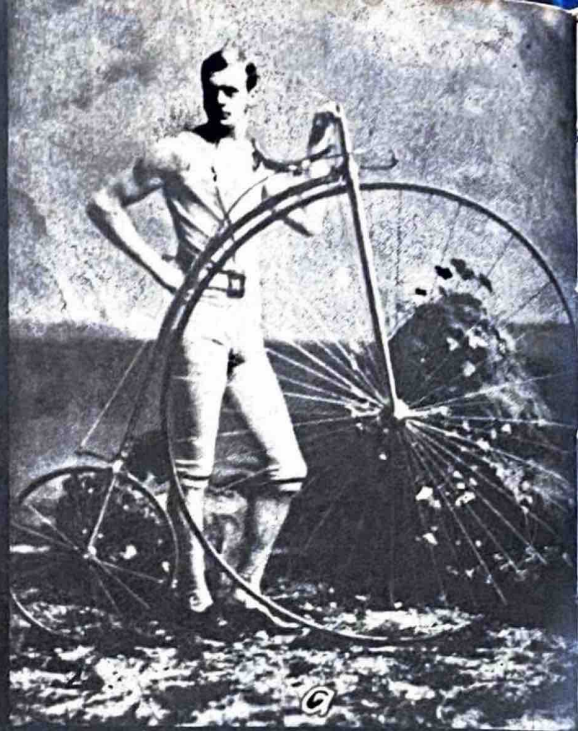
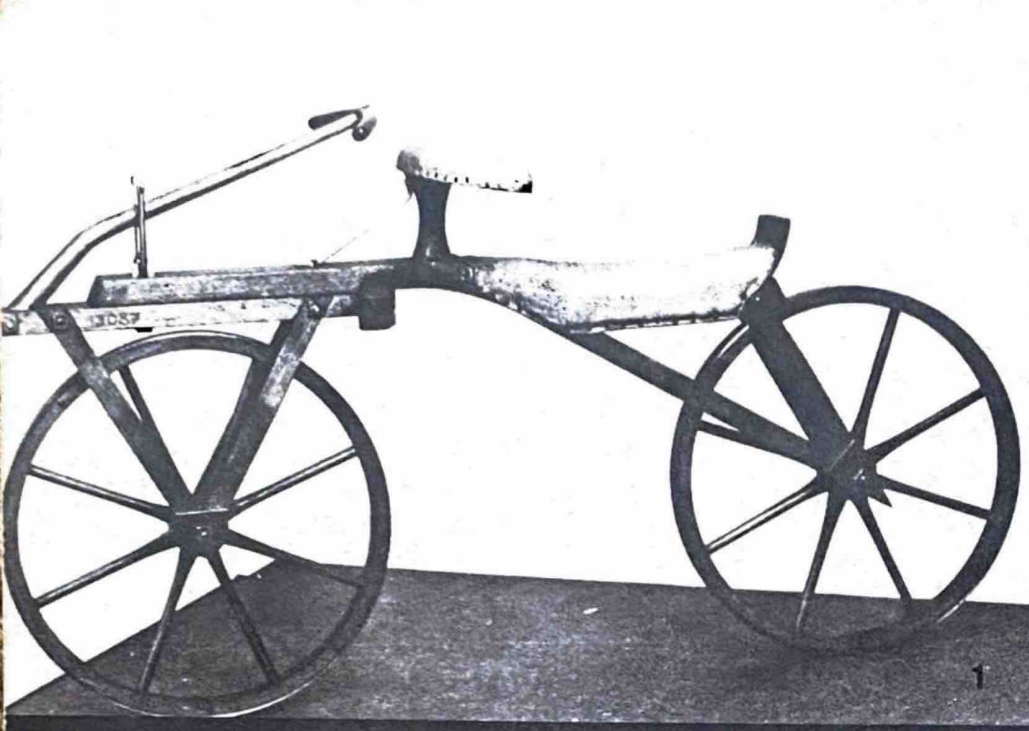
# CHAPTER 1

## A VERY PERSONAL VEHICLE

The idea of a vehicle which would take its owner anywhere he wanted to go with almost no effort on his part goes back a long time. The horse wasn't really the answer to the problem, because horses cost money to buy, and even more money to feed and care for. People began thinking of a self-propelled vehicle a very long time ago. Archeologists have found pictures of two-wheeled, self-propelled vehicles at Babylon and in Egypt. In a church in England, there is a stained-glass window put up in 1580, showing a simple bicycle. The implication seems to be that the only way man was to get a personal vehicle that really worked was to get to heaven.

That isn't really as funny as it sounds. Before the bicycle came along, people had to walk, or use an animal (or other people) to carry them or pull them along. Both George Washington and Thomas Jefferson, for example, had "sedan chairs" which were chairs fastened to long poles and carried by four to eight men.

The first personal vehicle came along in 1791, when the French Count de Civrac connected two buggy wheels with a plank. The rider sat on the plank and pushed himself along with his feet. Twenty-five years later, another Frenchman invented handlebars and a seat. Pedals didn't come along until 1839. They were invented by an Englishman named MacMillan.

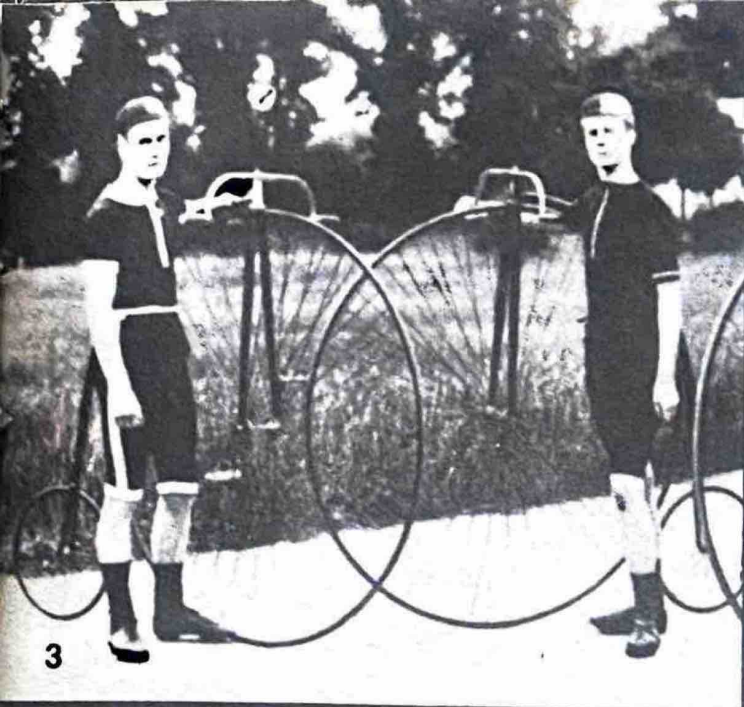


It wasn't until about a century ago (1874) that the bicycle began to look like a present-day bicycle. The last word in personal vehicles a century ago had pedals, two equal-sized wheels, and metal spokes, but it wasn't a toy. It cost far too much for that. It was a perfectly serious, respectable machine, designed to carry adults from one place to another on business.

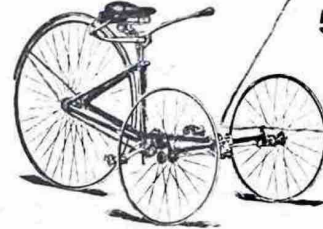
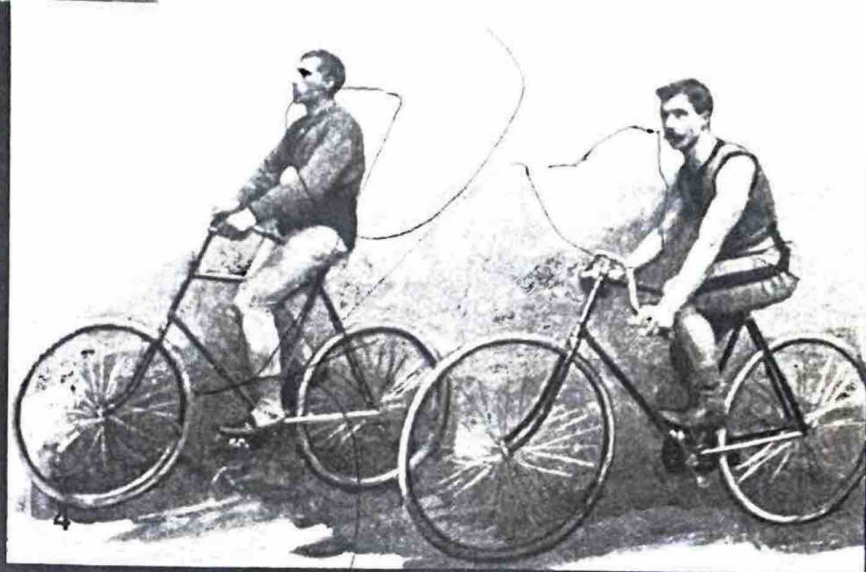
The first bicycle factory in America was started in 1877 by Colonel Albert A. Pope who formed the Pope Manufacturing Company in Boston. His "ordinary" (big front wheel, tiny rear wheel) and "safety" (two equal-sized wheels) bicycles were obviously the ultimate development in personal vehicles, and no reasonable person thought that there was much room for improvement. About the only way they could be improved would be to make them self-propelling, and that was obviously out of the question.

In Germany and in England, however, two wild-eyed dreamers were working on just that. In 1884, Edward Butler built a tricycle in England, and mounted a gasoline engine on it. He could find no banker willing to risk money for further development of such a crazy idea, so Butler's motorcycle never got past the first model.

The next year a respectable German engineer, Gottlieb Daimler, who had made a lot of money building "stationary engines" (huge, one-cylinder gasoline engines which provided power to factories), decided to make a small engine and fit it to a bicycle. The Daimler was the first true motorcycle, and it



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### SURPRISE COLUMBIA TRICYCLE

For Ladies and Gentlemen.

A new departure; unobstructed front; running track adjustable from 30 to 34 inches; folding to 29 inches over all for convenience in handling and storage.



6

1 An early (1813) European bicycle made of wood and iron. National Technical Museum, Prague

2 An English bicycle racer of the 1870's

3 Cycles of the 1880's called "Penny Farthings."

4 Cycle racing in 1894

5 An advertisement for an 1888 Columbia tricycle. Century Magazine, May, 1888

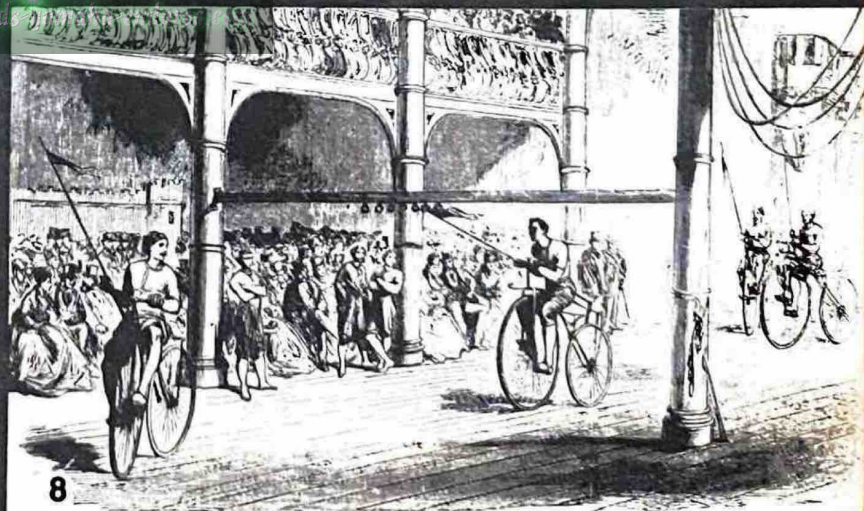
6 An improved American tricycle, 1878

7 An Elliott quadricycle, manufactured in 1892 in the United States

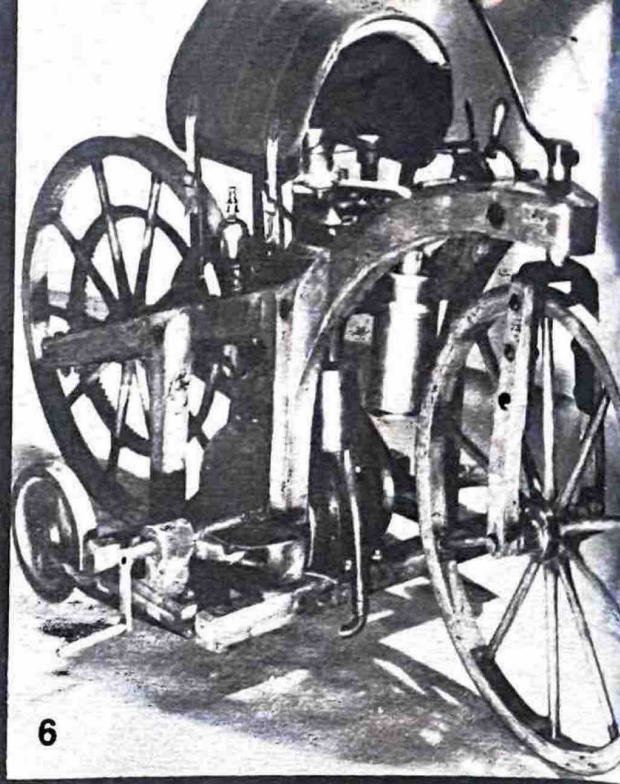
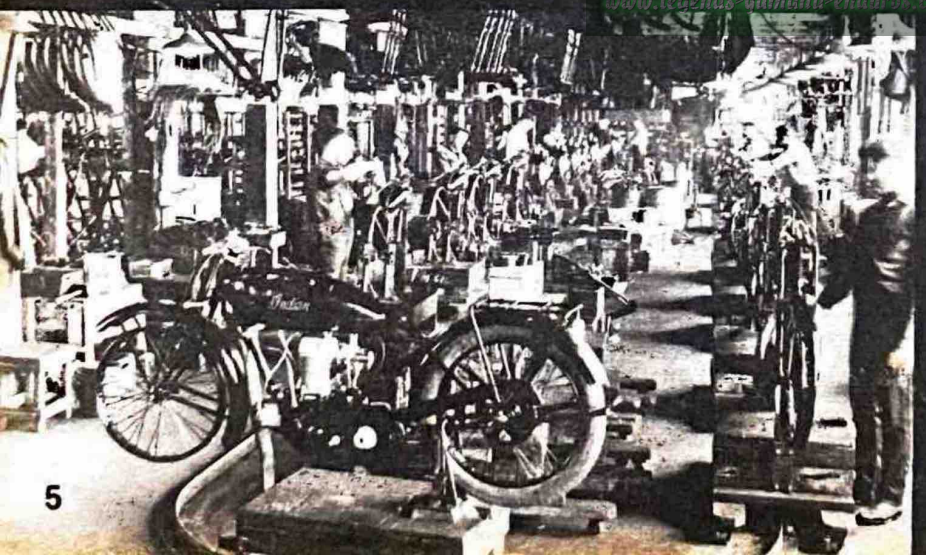
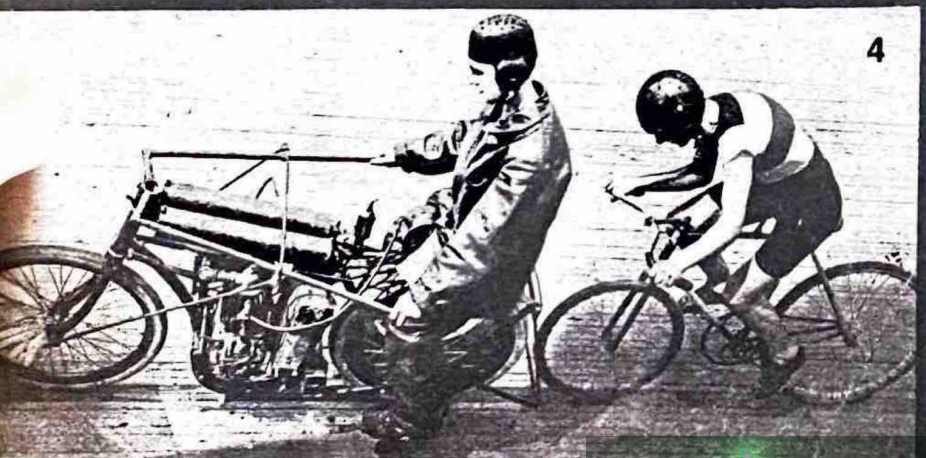
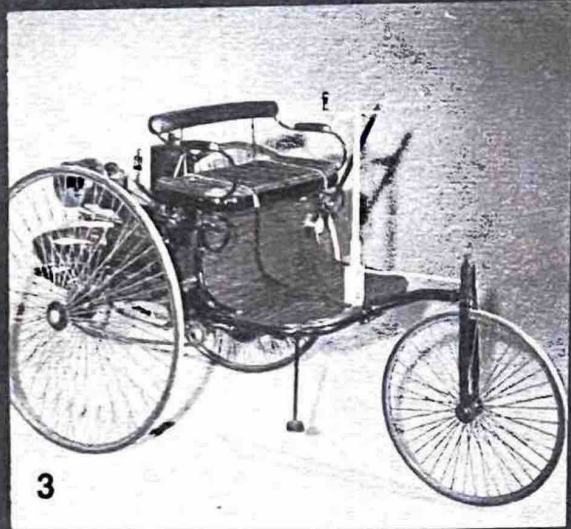
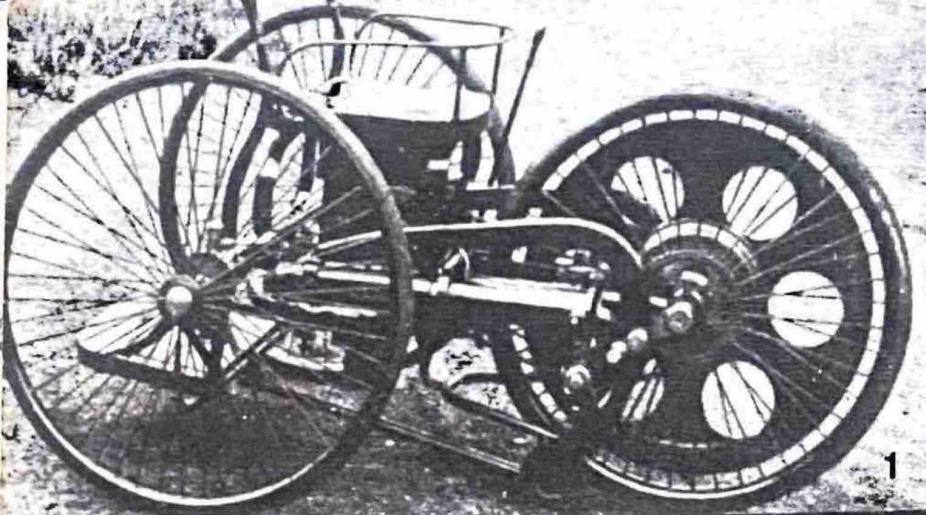
8 A jousting contest on bicycles in England, 1869



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1 An early motorcycle invented in 1885 by Edward Butler. Its maximum speed of 15 mph was 12 mph over the legal limit.

2 Front view of Butler's machine

3 A motor tricycle developed in 1885 by Carl Benz. It reached a speed of 9 mph. Courtesy Mercedes Benz of North America, Inc.

4 Early motorcycle racers wore football helmets.

5 A "loop" assembly line with twenty stations for putting together early Indian motorcycles. Courtesy New York Public Library Picture Collection

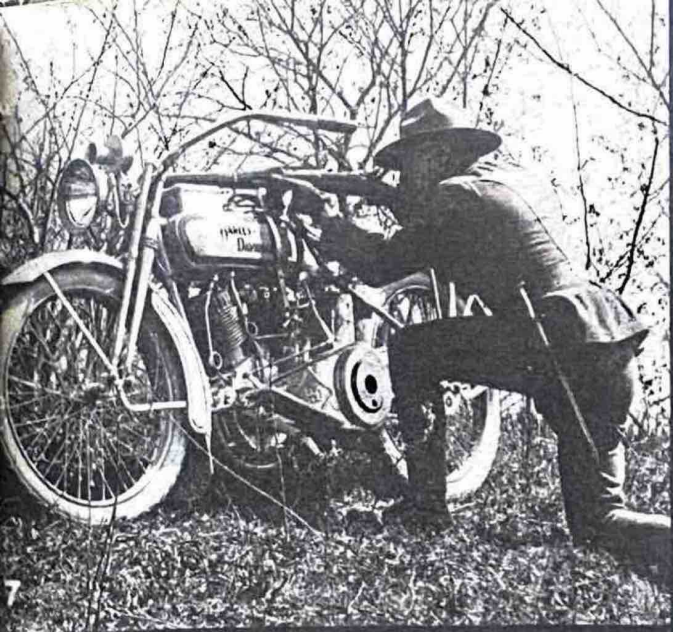
6 Daimler's motor bicycle, 1885. It had a single-cylinder engine. Its two support wheels were retractable. Courtesy Mercedes Benz of North America, Inc.

7 An American soldier of World War I. Courtesy Harley-Davidson Motor Co., Inc.

8 The first Yank and first Harley to enter Germany at close of World War I. Courtesy Harley-Davidson Motor Co., Inc.

9 Motorized infantrymen of World War I. Courtesy Harley-Davidson Motor Co., Inc.

10 Cycles used by the French Army in the 1880's



worked, and people actually bought it. Then Daimler himself had second thoughts about it. What people really needed, he decided, was a four-wheeled, self-propelled vehicle, not a motorcycle. He abandoned the motorcycle and started a company to build automobiles. That company is now known as Mercedes-Benz.

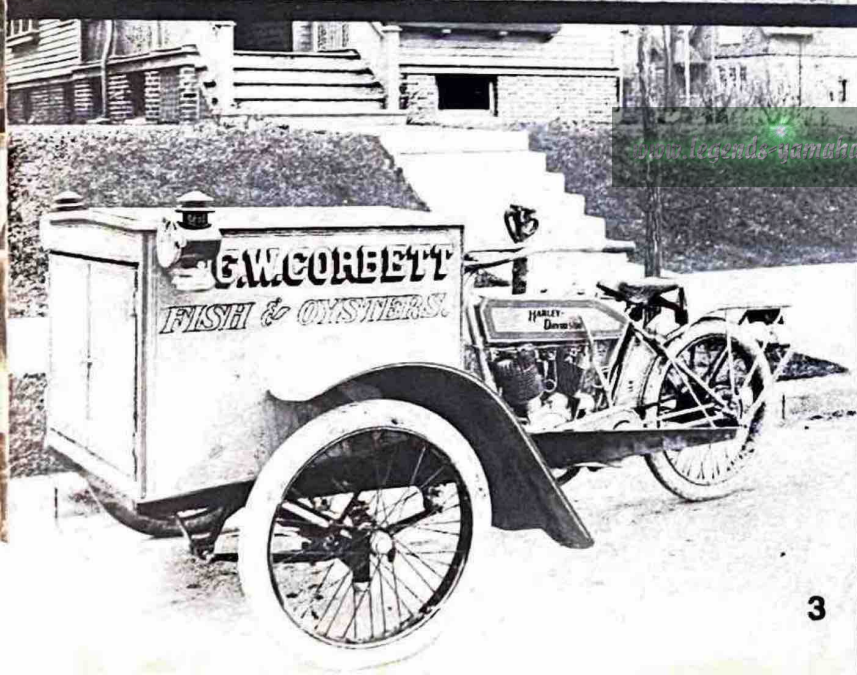
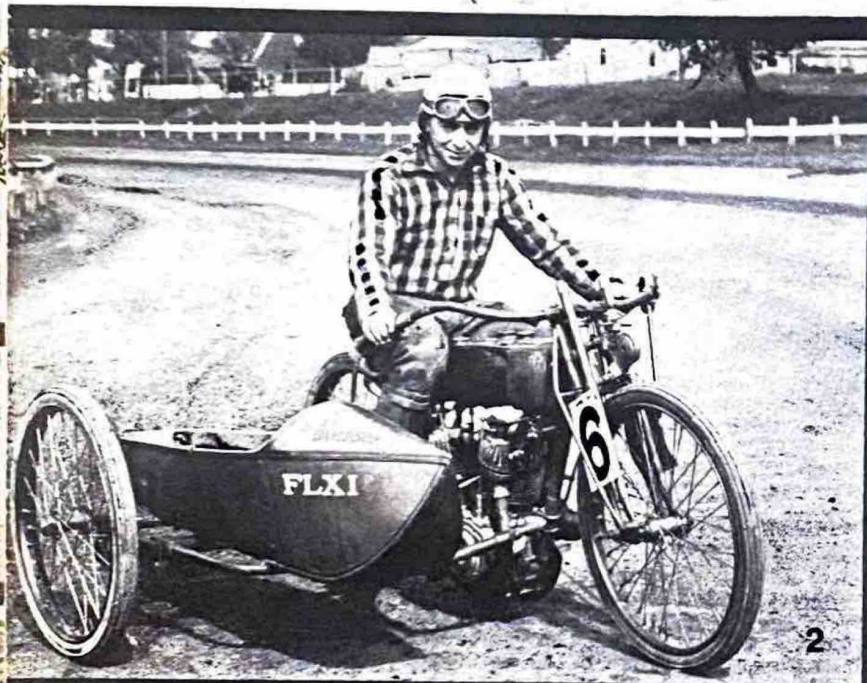
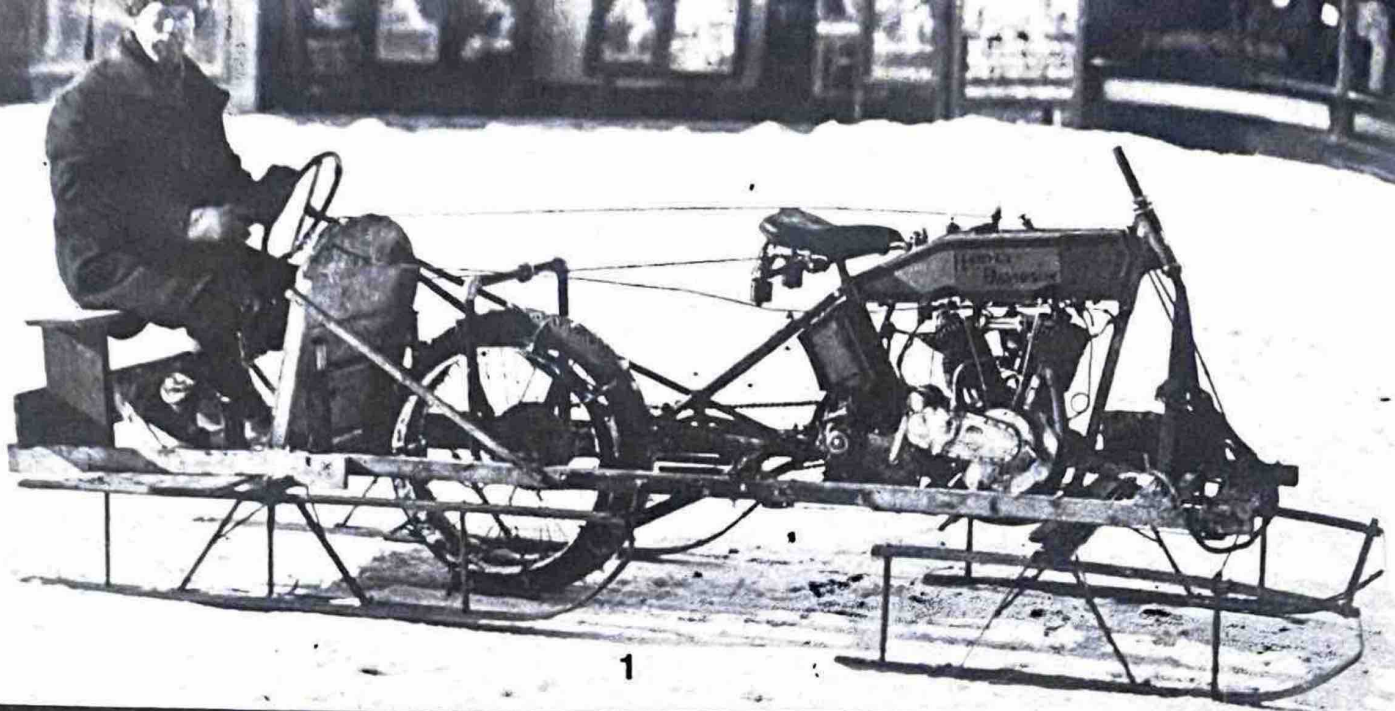
Many other people, however, turned to making what were first called motor-bicycles, and then simply, motorcycles. The motorcycle gradually evolved from a bicycle on which somebody had mounted a motor, into a machine designed specifically to be a motorcycle. All sides during the first World War used motorcycles extensively, especially for dispatch riders. They were faster than horses, and didn't have to be fed.



10







1 1917 Harley converted into a snowmobile

2 A sidecar racer of the 1920's

3 Early delivery van

4 Walter Davidson, Sr. with a 1908 cycle after winning the Federation of American Motorcyclists Endurance Run. He and his brother, Arthur, and William Harley founded Harley-Davidson.

5 Lost on a country road in Wisconsin

All photos these two pages courtesy Harley-Davidson Motor Co., Inc.

Many young men, who otherwise would not have had a chance to ride a motorcycle, got that chance in the Army, or at least got to see the dispatch rider racing past them, splattering them with the mud as they walked. Just as soon as the war was over, the motorcycle business boomed. There were anywhere from 50 to 100 different motorcycle manufacturers in America during the 1920's, and more than 200 different motorcycle manufacturers in England.

In the beginning, manufacturers were nothing more than two or three men working in a garage to assemble motorcycles from parts they bought from others. Some of them grew into large businesses. The American giants were Indian and Harley-Davidson. Norton, Triumph, and BSA, the largest English motorcycle manufacturers, opened branch factories in America.

The boom died out in the 1930's, and most of the smaller manufacturers went broke. In Europe, motorcycles became a standard means of transportation. In America, where just about everybody could afford a used car, motorcycles, with the exception of those used by police and messengers, came to be regarded as sort of expensive and dangerous toys.

Motorcycle gangs sprang up in the United States after World War II and caused respectable motorcyclists all kinds of embarrassment. Compared to



ordinary motorcyclists, there were not — and are not — very many motorcycling hoodlums. The hoodlums, unfortunately, not the motorcycle riding clergymen and bankers and schoolteachers, got their pictures in the newspapers. People began to think that anyone who rode a motorcycle was a hoodlum.

A public relations campaign, led by the American Motorcycle Association, has finally managed to convince the American public that the great majority of motorcycle riders are good citizens. More importantly, it got the idea across that motorcycling is one of the more interesting sports.

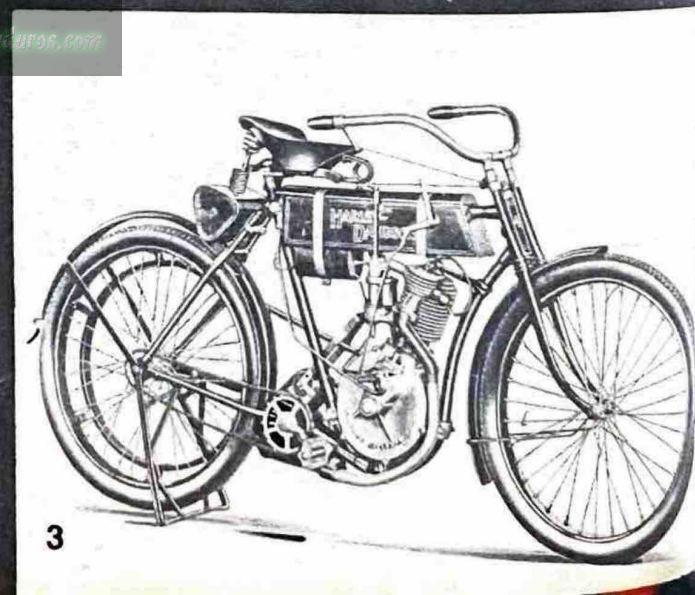
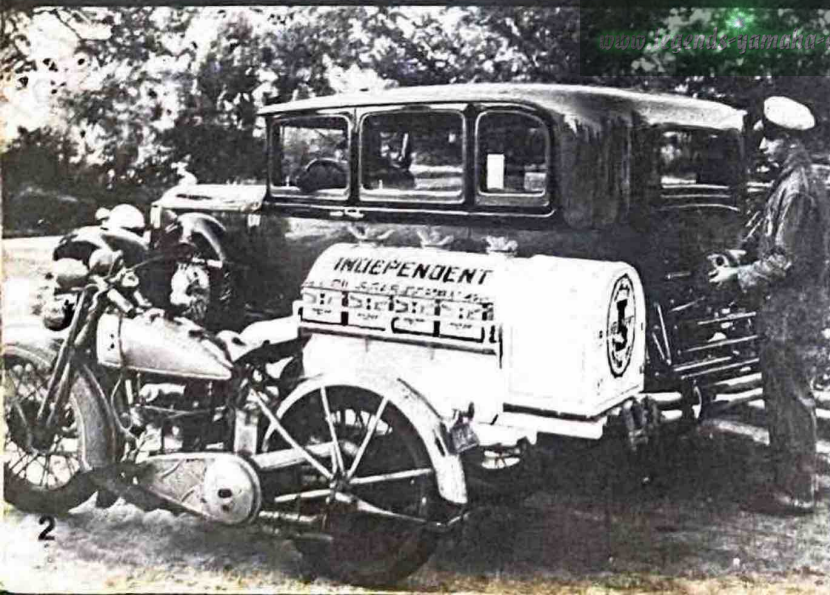
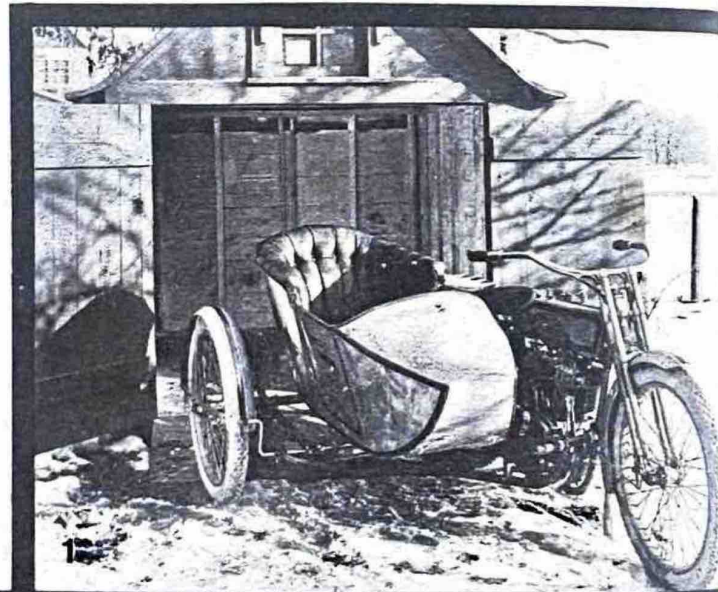
During the period this campaign was being carried on, there was tremendous growth in the motorcycle industry, during which all sorts of special sporting motorcycles were developed. Today, motorcycling, as both a means of transportation and as a sport, is completely respectable and seems to grow more popular by the day.

**1 To devoted cyclists, their vehicles deserved custom-built garages**

**2 Delivering gas by motorcycle to a stranded motorist**

**3 This 1903 Harley was the forerunner of the company's famed "Silent Gray Fellow."**

All photos this page courtesy Harley-Davidson Motor Co., Inc.



## CHAPTER 2

### MOTORCYCLES, MOTORSCOOTERS AND MINICYCLES

Whenever *any* vehicle, from a bicycle to the largest truck, operates on what the government calls "the public highways," it is subject to all the laws governing vehicles. The first law that affects most young people is the law requiring an operator's or driver's license. Generally speaking, it is against the law for anyone to operate a motor vehicle on the road without a license. In most states, you have to be as old to get a license to ride a motorcycle as you do to get a license to drive a car.

The vehicle has to be licensed, too, and that generally means a motorcycle must be equipped with headlights, turn signals, stoplights and other accessories. The laws are different in each state, and the best way to find out what the law is in your state is to contact the police station.

This doesn't mean that young people have to wait until they are old enough to get a driver's license before they can ride a motorcycle. It *does* mean they can't ride a motorcycle *on the road* until both they *and* the motorcycle meet all the licensing requirements.

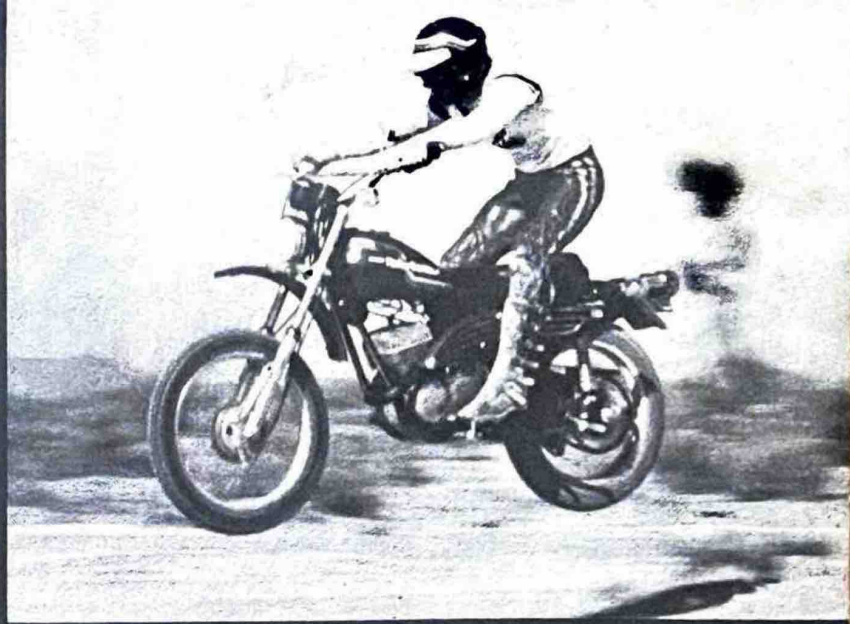
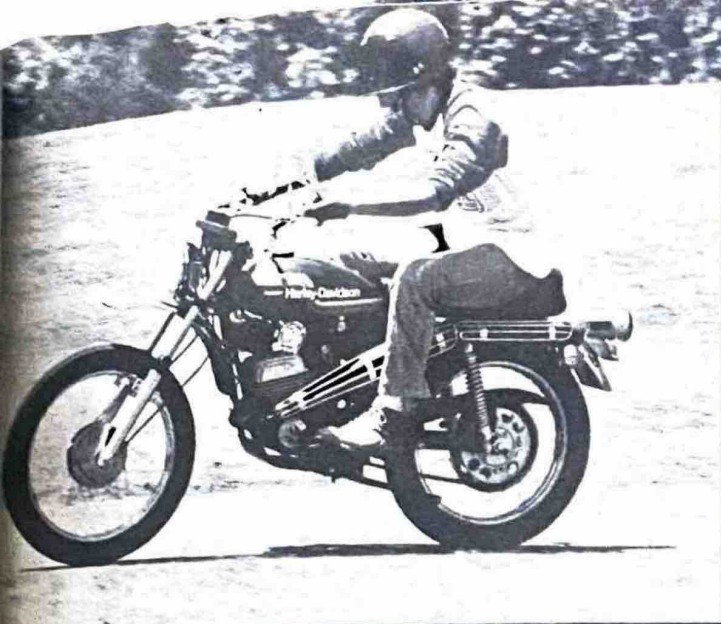
Off the road is another matter. In California and many other places,



**Clockwise from bottom left — motorscooter; Harley-Davidson moped; 50-cc Benelli moped; motorcycles: 125-cc Yamaha; 125-cc Harley-Davidson; 175-cc Harley; 250-cc Benelli; 500-cc Benelli; 750-cc Benelli**

youngsters as young as six and seven regularly ride motorcycles, and even ride them in races, or in motocross, hill climbs, trail races or other forms of competition. They do all their riding on private property, and not on the roads, and this is perfectly legal. It's also very good practice for that happy day when they are old enough to get an operator's license.

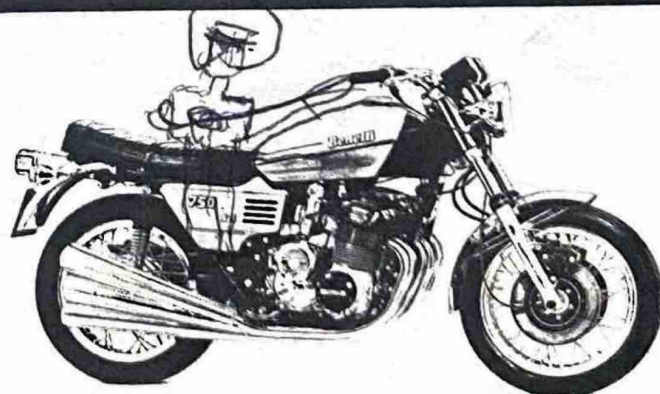
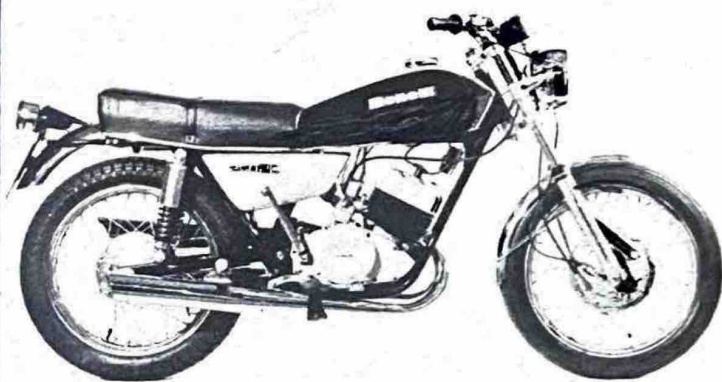
Most motorcycles can, of course, be used for off-road riding, but since the term motorcycle includes motorized vehicles, from the motor-assisted bicycle (sometimes called a Moped, for Motor and Pedals) to the largest three-wheel "all terrain vehicle," it's time to explain the difference:

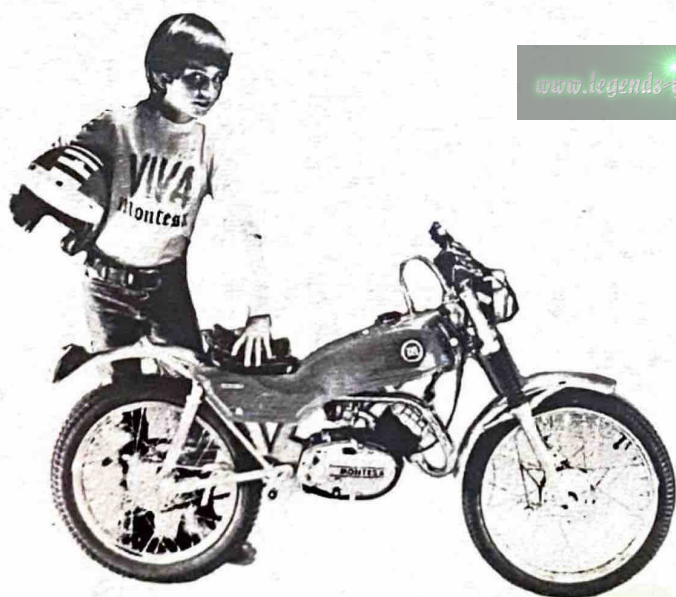


**Moped:** There are several kinds of motor-pedal bicycles. The simplest is just a tiny engine mounted on the frame of a bicycle in front of the handlebars.

The engine, smaller even than a lawn-mower engine, turns a rubber wheel. When the engine is running and lowered into place, the rubber wheel rubs against the bicycle tire and pulls it along.

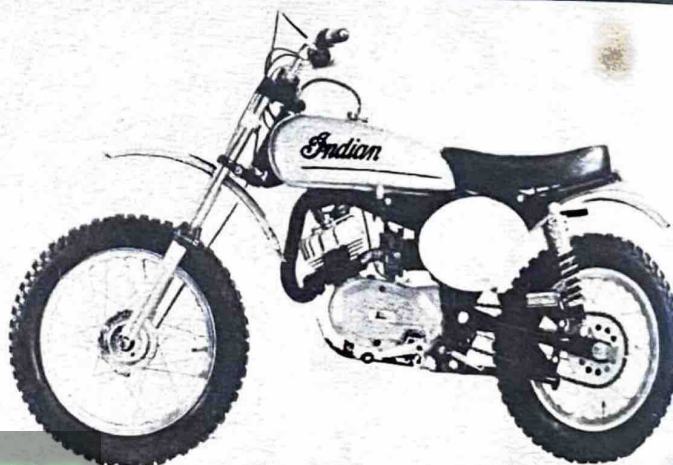
There are mopeds, too, that are specially built. They still look like bicycles, but if you look closely, you can see that the spokes in the wheels are heavier, and the tires larger and stronger, and that the pedals are designed especially to get the machine moving (or to help the engine up hills), rather than for constant use. The engines are sometimes mounted at the rear wheel or in other places.





**Motor Scooters:** Motor scooters generally have engines developing from 3.5 to about 7 horsepower. The engine is mounted over the rear wheels, which are usually no larger than eight or ten inches in diameter. Most often the engine is covered by either sheet metal or fiberglass, and the driver's seat is mounted on top of that. Between the wheels, there is a flat space for the driver's feet. Most motor scooters come equipped with headlights and horns and the other accessories necessary to be licensed for

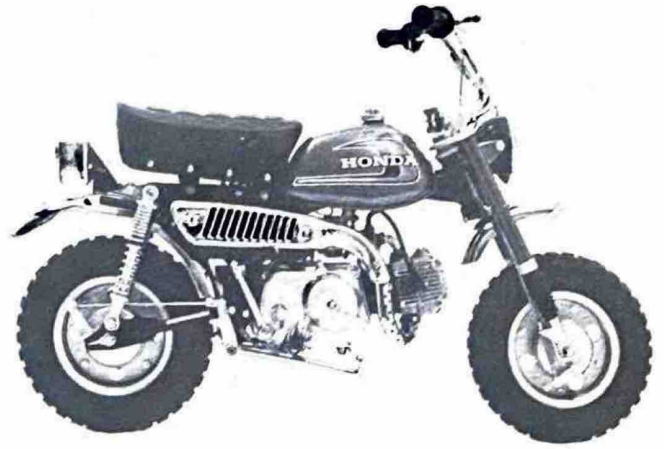
**Top to bottom — Minicycles: Indian MM-5A; Indian JC-5A; Montessa Cota 25; Indian JX-50; Benelli Sprint**



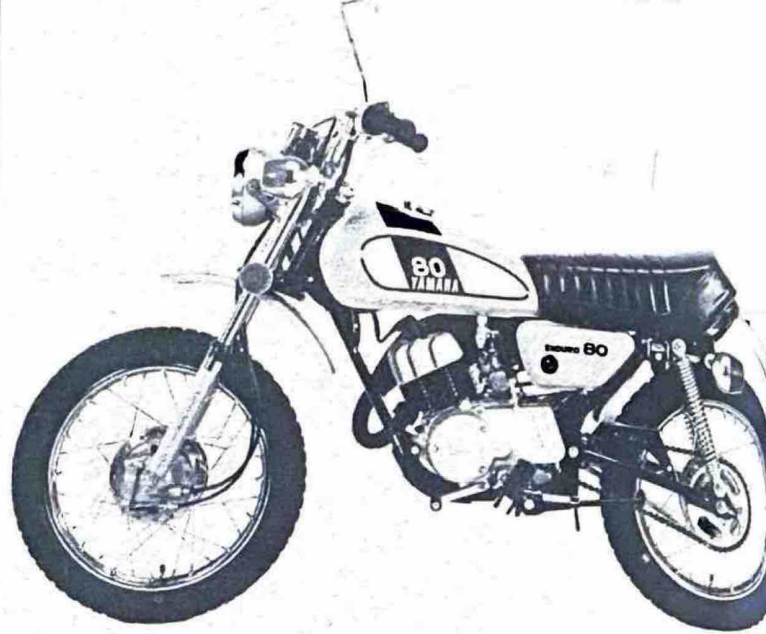
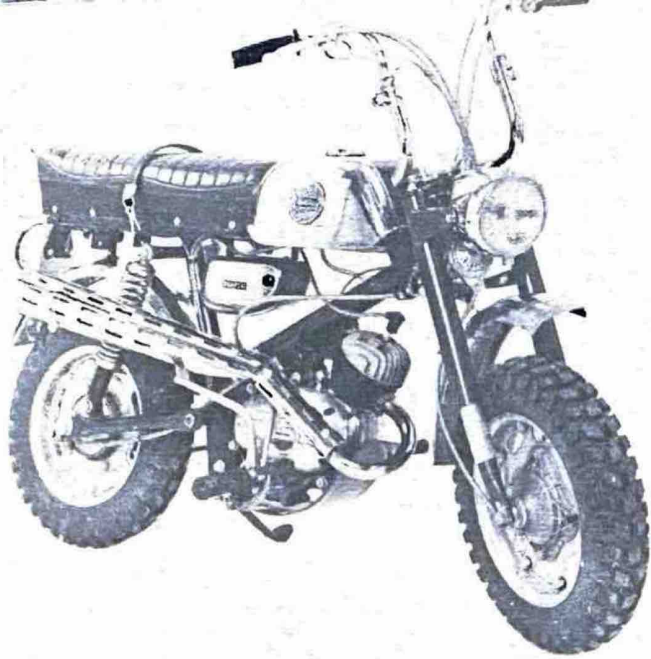
street use. They are used very commonly in Europe by adults, and in America, big-city police departments use them to give patrolmen extra mobility.

**Minibikes:** A minibike is a two-wheeled motor vehicle which is not a moped, or a motor scooter, or a minicycle, or a full-sized motorcycle. The first ones were built in the 1930's by do-it-yourselfers, who welded together a frame, and mounted two wheels and some kind of small gaso-

Down from left — Yamaha RD 60B; Benelli Dynamo Woodsbike. Top to bottom right — Honda Z-50A K6; Honda QA-50 K3; Honda MR-50 K1





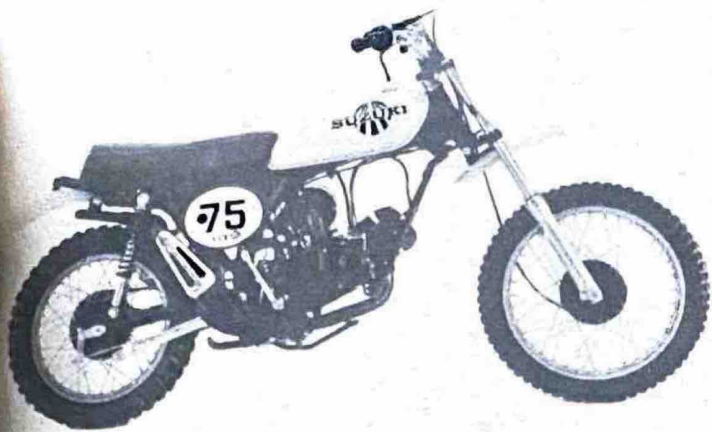


Clockwise from bottom left — Yamaha YZ 80B; Yamaha TY 80B; Benelli Dynamo Trail; Yamaha GT 80B Enduro; Suzuki TM-75 Mini-Cross; Suzuki TS-75 Colt; Indian MX-74; Indian MX-76

line engine on it. Some can often be bought for just over \$100, but that's not the bargain it sounds like, because they're probably the most dangerous, and least useful, of all two-wheeled powered vehicles. They seldom have shock absorbers, which makes them dangerous when a bump is hit, and their brakes and other running parts aren't very reliable.

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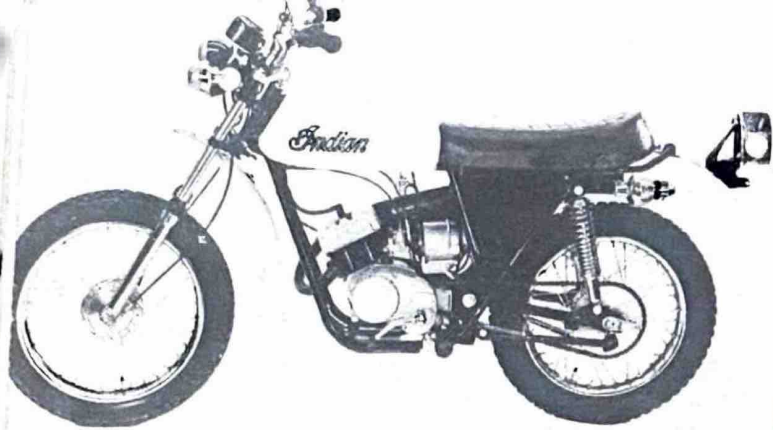
**Motorcycles:** There are three general categories of motorcycles. The lightweights weigh up to 250 pounds; the medium weigh from 250–400 pounds, and the heavyweights from 400 pounds up to about 900 pounds. Some



of the engines on the big, 4-cylinder, 900-pound machines develop as much as 60 horsepower, and some of them (such as the German BMW) have drive shafts, rather than chains, to transmit the power from the engine to the rear wheel.

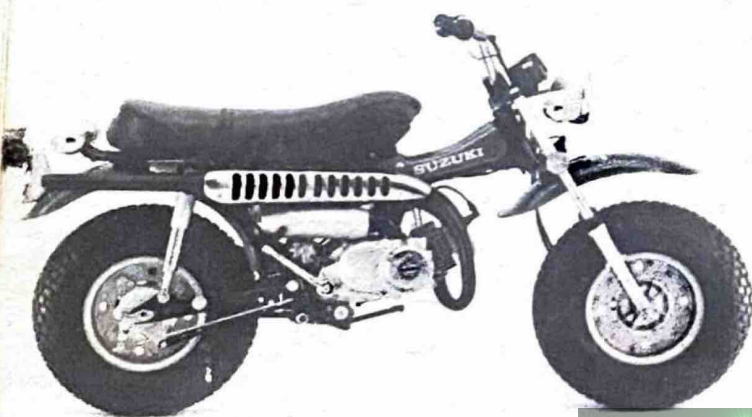
**Three-Wheelers:** There are several kinds of three-wheelers. The most common is the "motor tricycle" (the correct name, although hardly anyone uses it) used by the police and others. It's very much like a regular motorcycle, except that it has two wheels in the back, and a "differential gear" like an automobile. (When turning to the left, for example, the left wheel has to turn slower than the right wheel; a gear to permit this is necessary.) The greatest advantage of the motorcycle



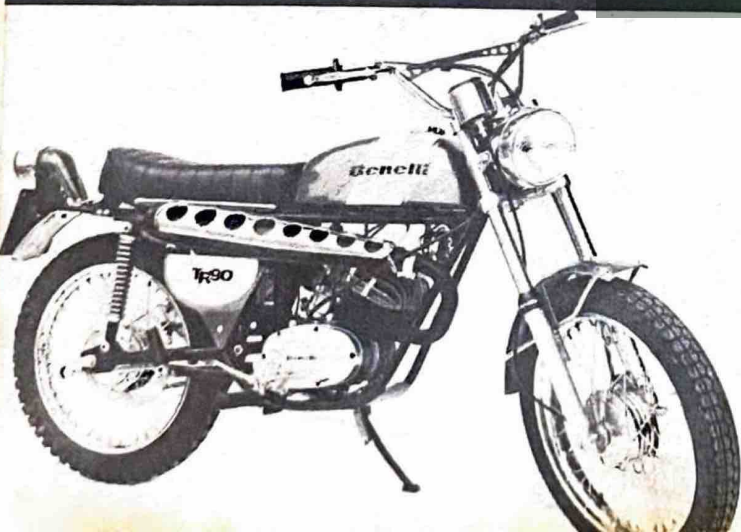


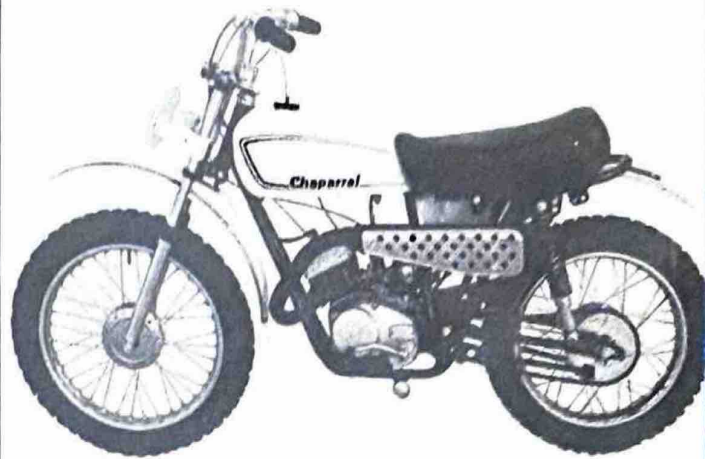
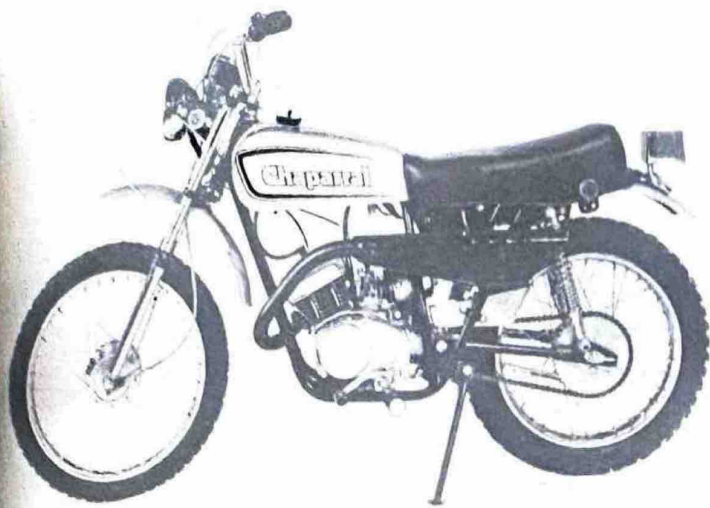
three-wheeler is that it stands up by itself. Large numbers of motor scooter three-wheelers are used in industry, as sort of small trucks.

Motorcycles with sidecars also have three wheels, of course, but only the rear wheel of the motorcycle itself is powered. Motorcycles, or motor scooters, with sidecars have to be ridden like three-wheel motorcycles; they were not designed to be "leaned" going around a corner.



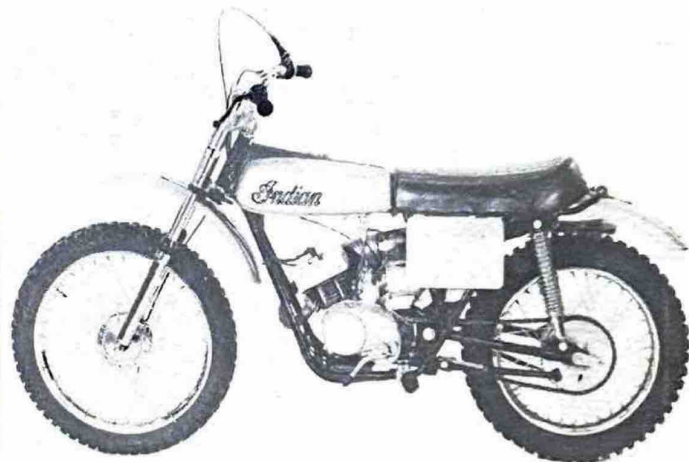
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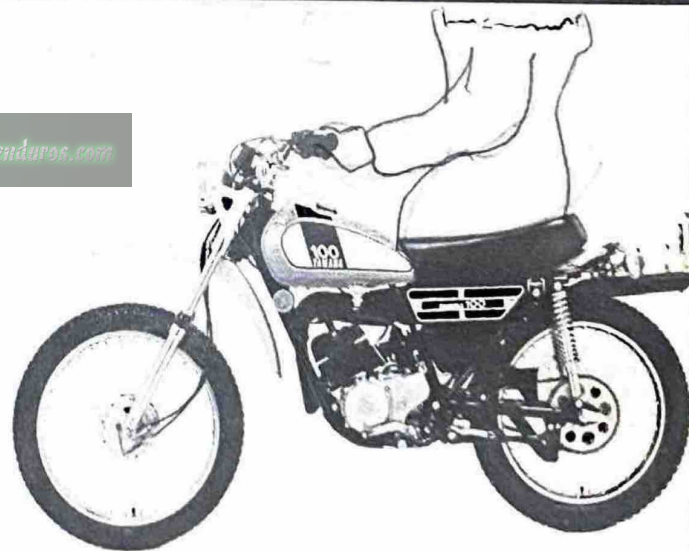


Clockwise from top left (both pages) — Chaparral SX 80; Benelli Banshee; Chaparral ST 100; Indian ML-100; Indian MT-100; Yamaha DT 100B; Yamaha MX 100B; Harley-Davidson Z-90; Benelli Trail 90; Suzuki RV-90 Rover; Chaparral ST-80

One of the latest designs in motorcycles is the three-wheel "all terrain" vehicle. It has very wide tires (the rear tires are 12-18 inches wide) which provide "high flotation." This means they won't sink into sand or marsh, and some of them actually float on



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water. The tires have tread designs like tractors, which help them pull through rough terrain. They don't go very fast, but they can go almost anywhere.

**Minicycles:** A minicycle is a miniature motorcycle. Although adults can, and do, ride them, they're really designed from front to end for young people. They have everything on them that a full-size motorcycle has, and the great majority of them can be licensed for riding on the roads.



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**Bottom to top — Hodaka Road Toad 100; Hodaka Dirt Squirt 100; Yamaha RS 100B; Hodaka Super Rat 100 MX**

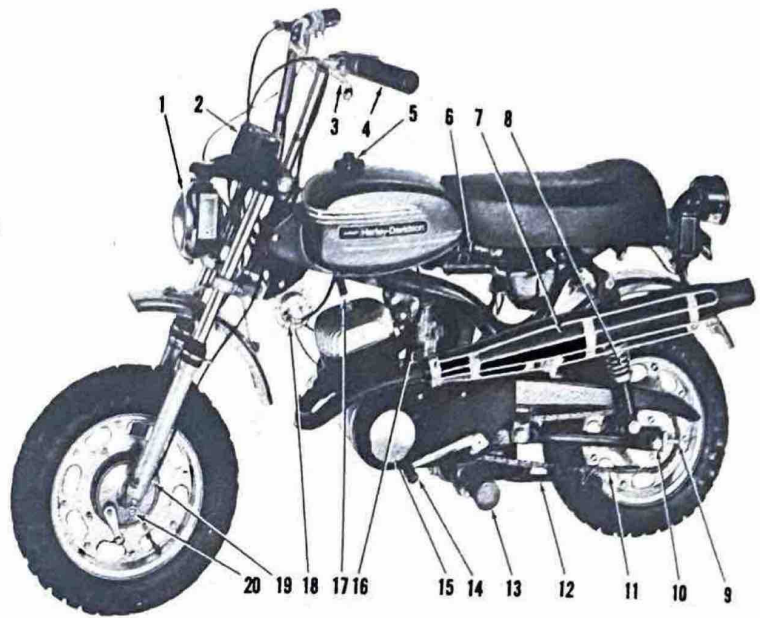
## CHAPTER 3

### HOW THEY WORK

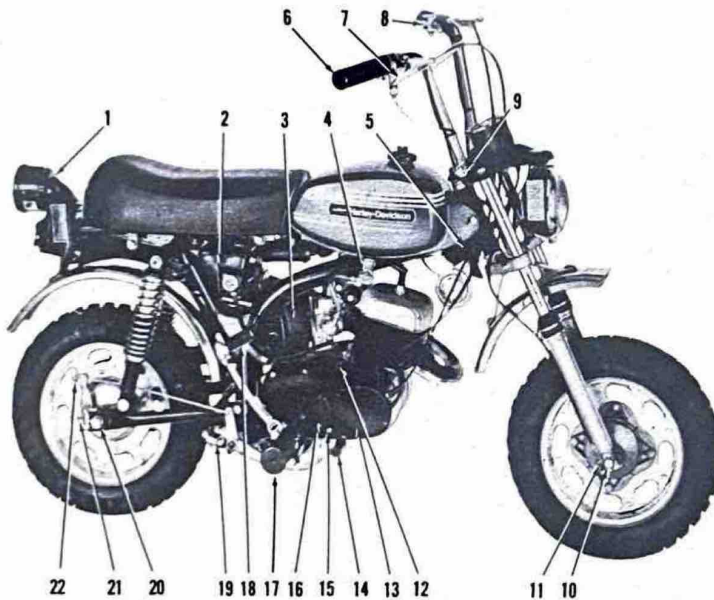
A minicycle is not a toy. It is a motor vehicle. Most people who get hurt on minicycles afterwards express surprise that "it got away from them," or that "it was so powerful" or "so heavy." People who wouldn't think of getting on a horse for the first time and seeing how fast they could make it run (or try to make it stand up on its hind legs) will get on a minicycle, with the power of six horses, or even ten, and do just that.

Operating a minicycle is not only harder than driving a car, but considerably more dangerous. Automobiles made in recent years must be able to sustain the force of running into a brick wall at about the speed of a fast walk. There can be no serious damage to the car, or its driver and passengers after such a collision. Anyone running a minicycle into a wall at that speed can expect both severe damage to the minicycle and injury to himself.

1. Headlamp
2. Speedometer
3. Clutch Hand Lever
4. Left Handlebar Grip
5. Fuel Tank Cap
6. Ignition Coil
7. Muffler
8. Rear Shock Absorber
9. Left Rear Axle Adjusting Stud
10. Rear Wheel Axle Nut
11. Rear Drive Chain
12. Jiffy Stand
13. Left Foot Rest
14. Gear Shift Foot Lever
15. Magneto Generator Cover
16. Carburetor
17. Spark Plug
18. Horn
19. Front Wheel Brake Adjusting Sleeve
20. Front Wheel Axle Nut



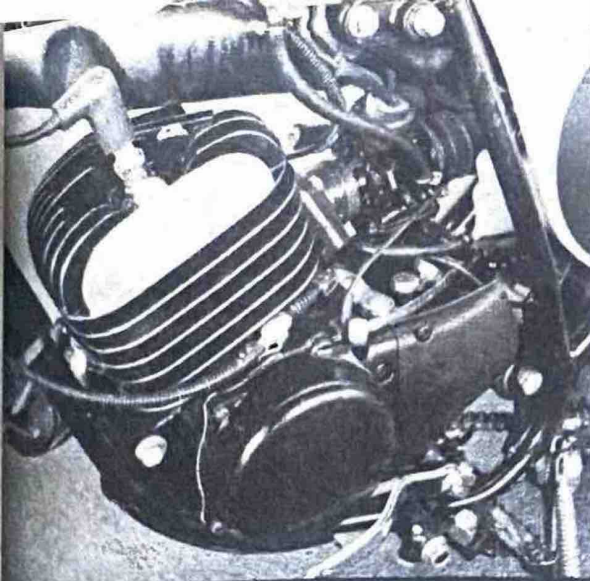
Side views, right and left, of a minicycle



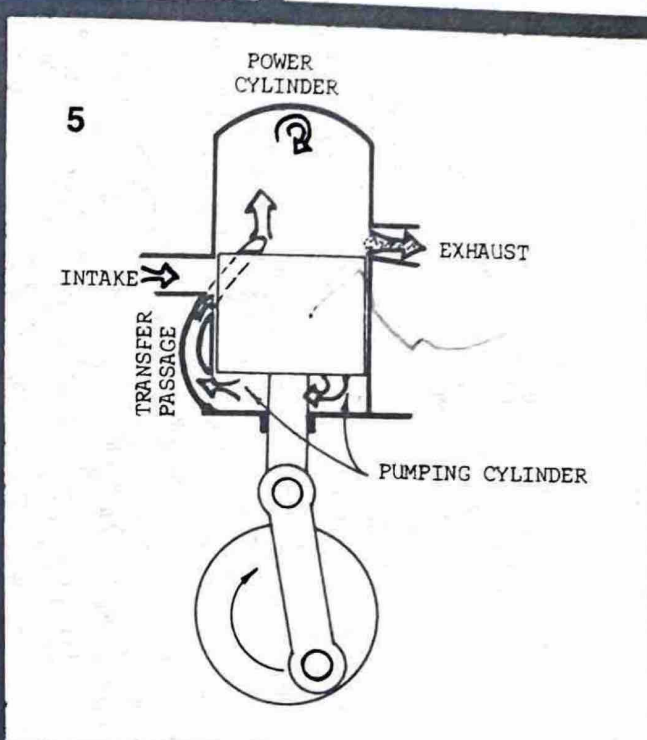
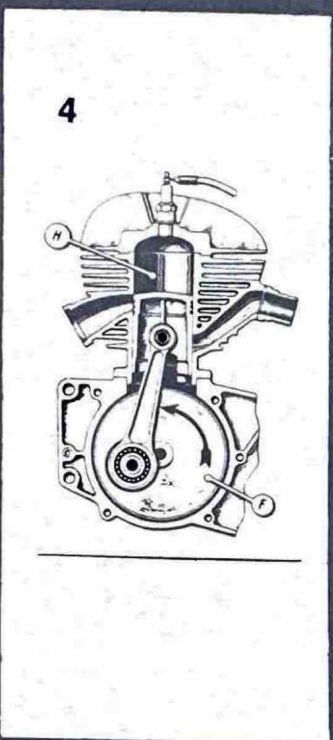
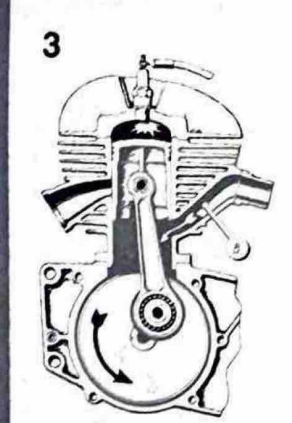
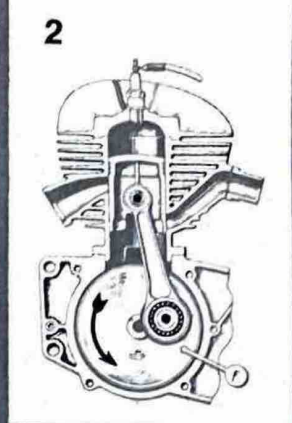
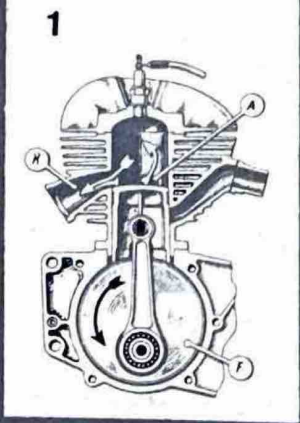
1. Tail Lamp
2. Oil Tank
3. Air Cleaner
4. Fuel Valve
5. Throttle and Oil Pump Control Cable Divider
6. Throttle and Oil Pump Control Grip
7. Front Wheel Brake Hand Lever
8. Light Switch, Beam Switch, Cutout and Horn Buttons
9. Handlebar Locking Lever
10. Front Wheel Axle Nut
11. Speedometer Drive
12. Transmission Filler Plug
13. Oil Pump Cover
14. Rear Wheel Brake Foot Lever
15. Oil Level Plug
16. Clutch Access Cover
17. Right Foot Rest
18. Starter Crank
19. Rear Brake Stoplight Switch
20. Rear Wheel Axle Nut
21. Right Rear Axle Adjusting Stud
22. Rear Brake Adjusting Nut

This doesn't mean that minicycles can't be ridden safely. There are thousands and thousands of motorcyclists who ride thousands of miles annually, year after year, without so much as scratching a fender or a knee. These are the people who know what they're riding, and how to ride it safely.

The first step in learning how to ride safely is to learn and understand the functions of the various parts of the minicycle. This is one of those areas where the old adage "a little knowledge is a dangerous thing" really comes true. Unless the rider knows what every part and control does, and how it does it, he has no right to start the engine.



Top left. Close-up of a minicycle engine



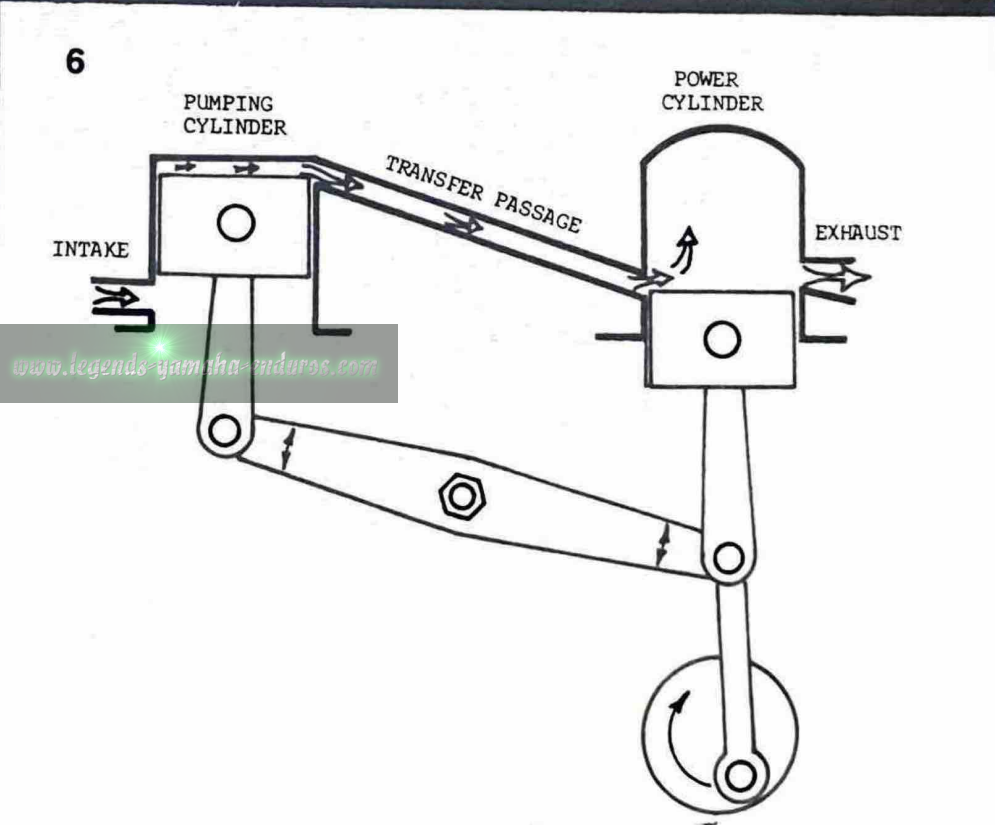
1 to 4 How a 2-stroke cycle works: (1) As the piston opens transfer port (A), compressed fuel mixture moves from crankcase to combustion chamber. Burnt gases from previous stroke go out the exhaust port (K).

2 The piston compresses mixture in combustion chamber on upstroke and draws a fresh charge into crankcase (F) as soon as piston opens inlet port.

3 Inlet port (B) is open and the low pressure in crankcase draws in a new charge. The spark plug has ignited the mixture in the combustion chamber.

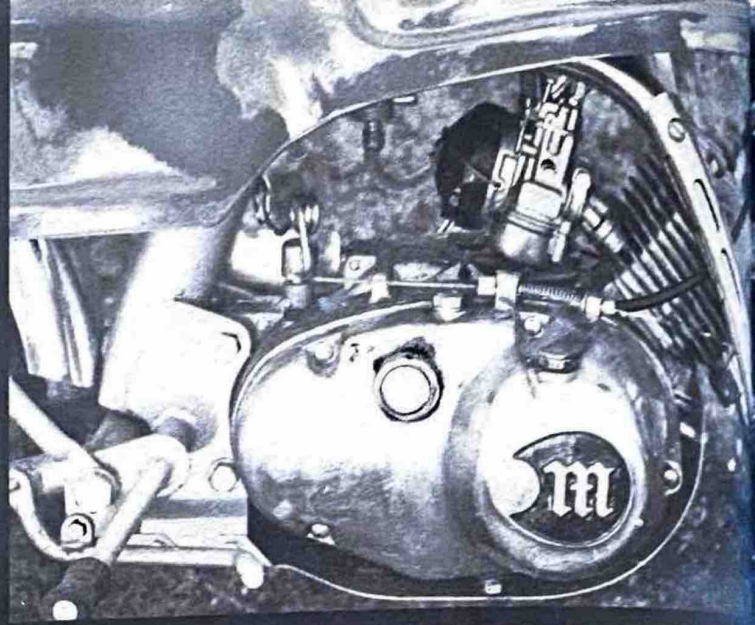
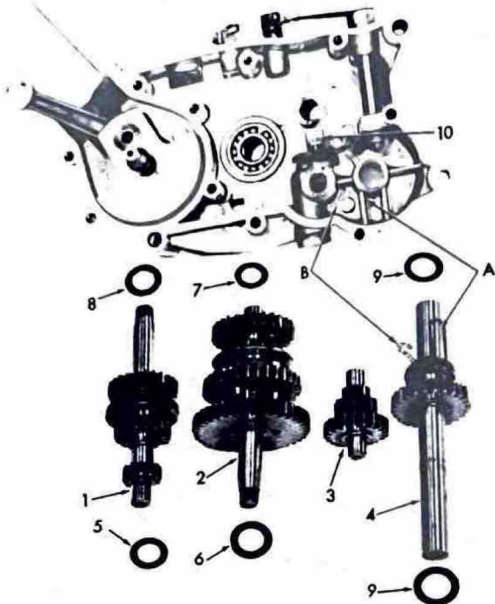
4 As piston moves down it opens exhaust port and compresses a new charge in crankcase, completing cycle in two strokes of the piston.

5 and 6 These two diagrams illustrate how pumping and power cylinders work in 2-stroke engines.





1. Mainshaft
2. Countershaft
3. Transfer shaft
4. Starter shaft
5. Spacer washer
6. Spacer washer
7. Spacer
8. Spacer washer
9. Spacer washer
10. Shifter finger

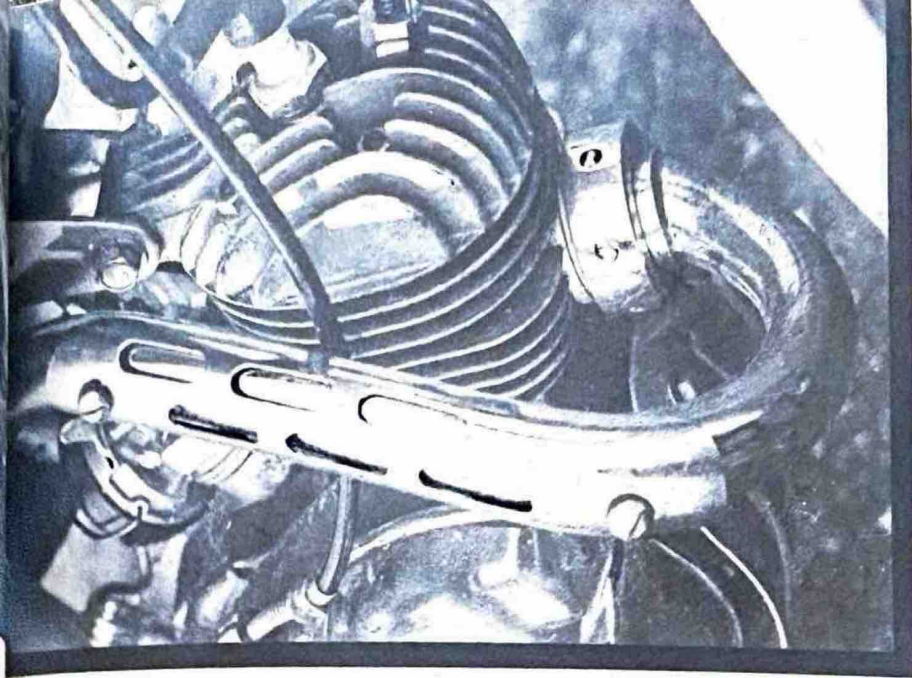


**I The Engine:** Minicycles usually have one-cylinder engines. A few have two cylinders. Some have "two-stroke" and some have "four-stroke" engines. For the rider, the basic difference isn't very important, and the controls are essentially identical.

There are three engine controls. *The ignition switch* closes the electrical circuit, so that the spark plugs can spark and ignite the fuel-air mixture. The ignition switch also usually controls use of the headlights, turn signals and horn. They will work only when the ignition is on. Some well-designed minicycles have another switch built into the circuit called a "kill switch." In case of a spill, for example, or if the throttle should stick, he operates the "kill switch." This cuts off electric power to the engine, stops the engine, and reduces chances of injury or fire.

*The throttle*, generally mounted on the right handlebar grip, controls the amount of gasoline fed from the fuel tank to the engine. By turning the throttle, engine speed can be controlled.

*The Choke:* This lever controls the passage of air into the carburetor, which is the device that mixes air and fuel so that it can be exploded in the engine. Cold engines need a "richer" (more fuel in relation to air) mixture to start and run smoothly until they warm up. The choke chokes off part of the air fed to the carburetor. This control is usually on the side of the engine itself, although sometimes on the handlebars. Running an engine with too rich a mixture results in poor engine performance and often in engine damage.



Left to right. Transmission gears removed from right crankcase.

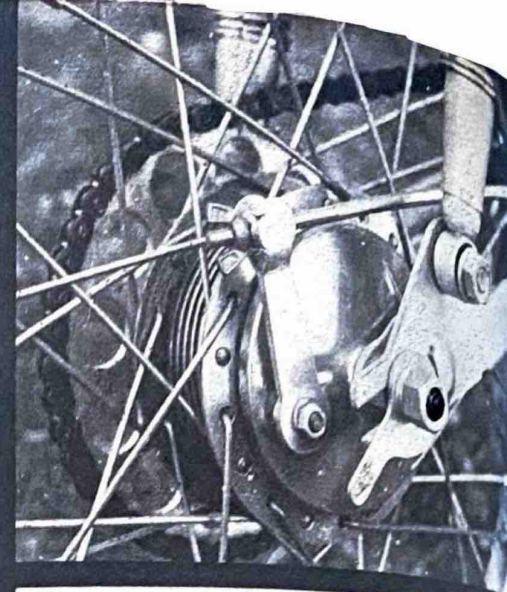
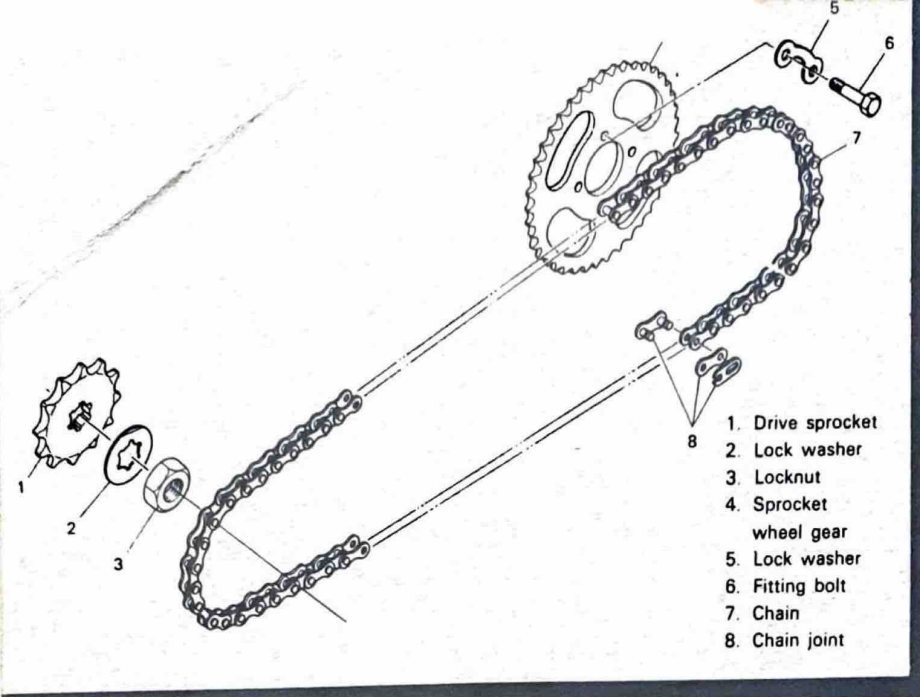
A 50-cc 2-stroke engine showing carburetor, gearbox and exhaust pipe.

Detail of above showing cylinder head, spark plug, exhaust pipe, and compression release.

**II The Power Train:** The power train is all the parts which provide power to move the minicycle, and sometimes the term includes the engine as well.

*The Clutch:* To clutch means to grab, and the clutch on a minicycle grabs, as smoothly as possible, the power from the crankshaft of the engine and feeds it to the transmission. It is probably the most often abused part of any minicycle. Riders who don't know what they're doing put it under great strain by "letting out" the clutch too fast, by "revving" or "racing" the engine at too high a speed for the clutch to handle. The clutch is controlled by a lever, usually mounted on the left side of the handlebar. When the lever is squeezed, the clutch faces are pulled apart, and when the lever is allowed to spring back, the clutch faces are brought together.

*The Transmission:* The transmission (or gear box) takes power from the clutch and feeds it to the rear wheel by a chain. Minicycles usually have three or four forward speeds, which means that the transmission has either three or four gears. The rider selects the gear he wants with a gearshift pedal mounted low on the minicycle and operated with the toe of his left foot. Gear patterns (how the gears are arranged) vary from minicycle to minicycle, but they all work the same way: At the same time the throttle is closed the clutch lever is squeezed. This slows the engine down to "idle" speed and disengages the clutch. The rider then selects the gear he wishes to use by moving the gearshift lever with his left toe. He then releases the clutch lever with his left hand while opening the throttle with his right. A good rider does this



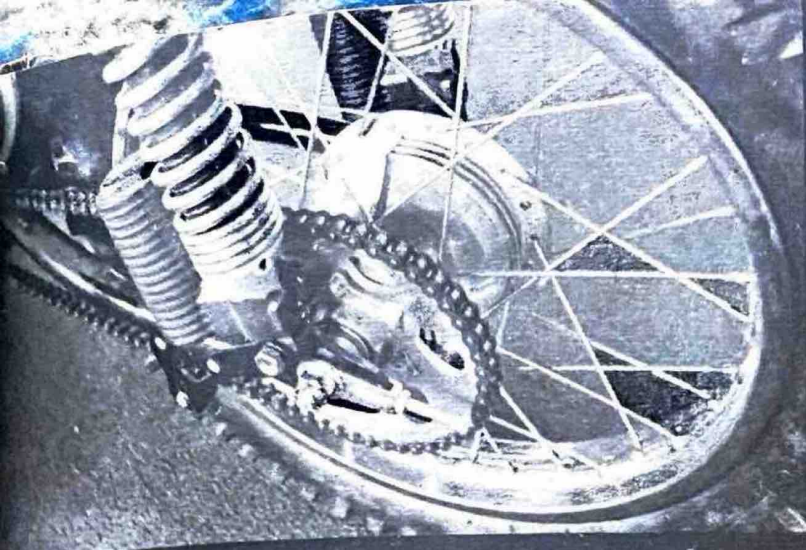
Rear brake with adjustable tension

Detail of the chain and how it works

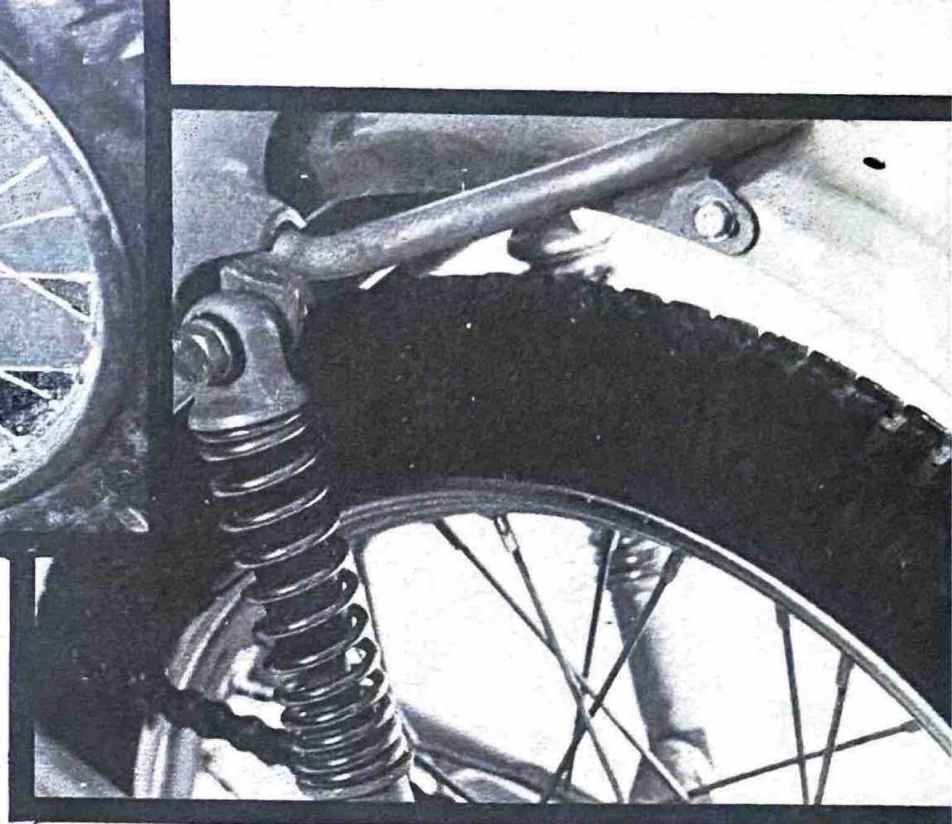
smoothly and quickly, so that the minicycle will start off smoothly, surely, and without undue strain on any of its parts.

*The Chain:* The chain transfers power from the transmission to the sprocket on the rear wheel. It works exactly the way the chain on a bicycle works. The big difference comes in how much work is expected of it. A bicycle chain has a human being pushing down on a pedal to move the chain. A minicycle chain has the power of many horses doing the same thing. Furthermore, the bicycle chain only has to move the weight of the rider, plus the weight of the bicycle, which seldom weighs more than 25 pounds. The minicycle chain has the weight of the rider, plus the weight of the minicycle, rarely less than 200 pounds. The strain on the chain at the moment of starting off on a minicycle is enormous. "Popping the clutch" (just letting go of the clutch lever, instead of easing it off slowly), while harmful to the clutch and the engine and the transmission, really hurts the chain.

**III The Brakes:** Just as getting a minicycle moving requires more power than starting off on a bicycle, stopping or slowing a minicycle is harder and more complex. Newton's Third Law, "A body in motion tends to stay in motion," is just as important to the minicyclist as any law of the State Department of Motor Vehicles.



**Detail of rear sprocket**



**Rear suspension and special tires for dirt riding**

The heavier something is, and the faster it's going, the harder it is to slow down or stop. It's not just a matter of stopping the wheels from turning. About the most dangerous thing a minicyclist can do is "lock the wheels" when his speed is such that the cycle will keep moving anyway.

A minicycle, moreover, is not perfectly balanced, and this means that proper brake application requires far more skill than simply stepping on the power brake pedal in an automobile.

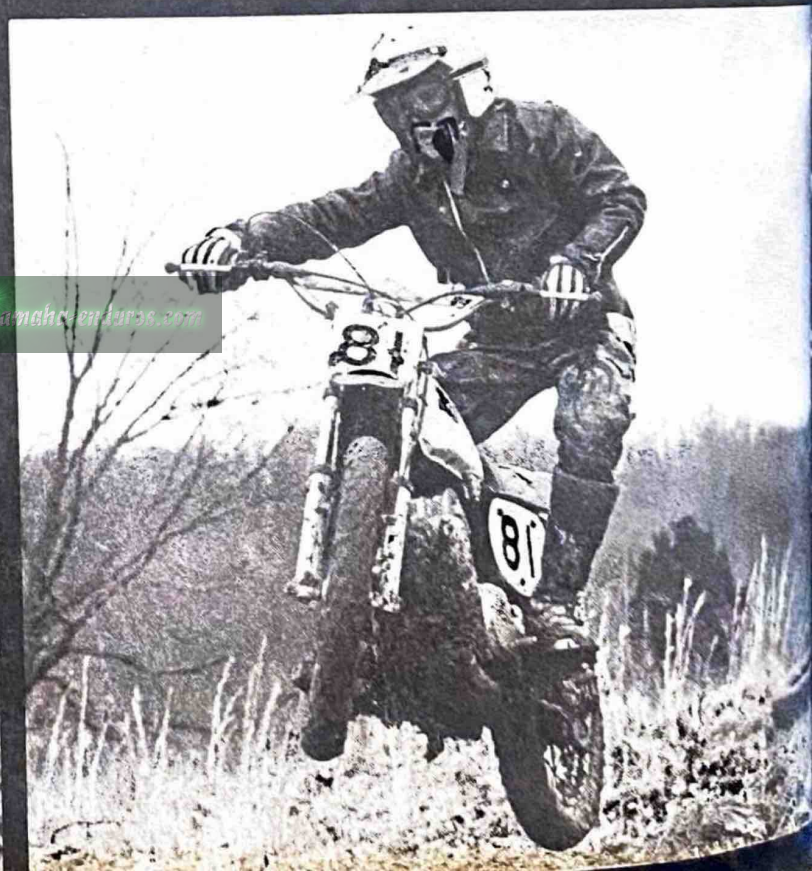
Minicycles have two separate braking systems, one on each wheel, and they have to be used together.

Brakes on the front wheel are controlled by a lever on the right handlebar. Rear wheel brakes are controlled by a foot pedal on the right side of the engine. If too much "front brake" is applied, the rear of the minicycle will try to keep going past the front of the minicycle. If too much "rear brake" is applied, the rear of the minicycle will fishtail — skid. In either case, a nasty spill often results. The only way to acquire the skill necessary for safe braking is by practice. It's an acquired skill, not very much different from learning to ride a bicycle; the more you do it, the more "feel" you have for it, and the better you become.



This page. Racing a minicycle requires practice and good physical coordination. The riders in these photos are competing in a motocross over a hilly course of tight turns, soggy water hazards, and rough straightaways. Their protective clothing minimizes injury in case of a spill.

Facing page, left to right — Rear suspension; Front suspension showing brake and clutch levers, front brake and gas cap.



A great deal of physical coordination is involved in riding a minicycle. The rider who comes to a stop must simultaneously:

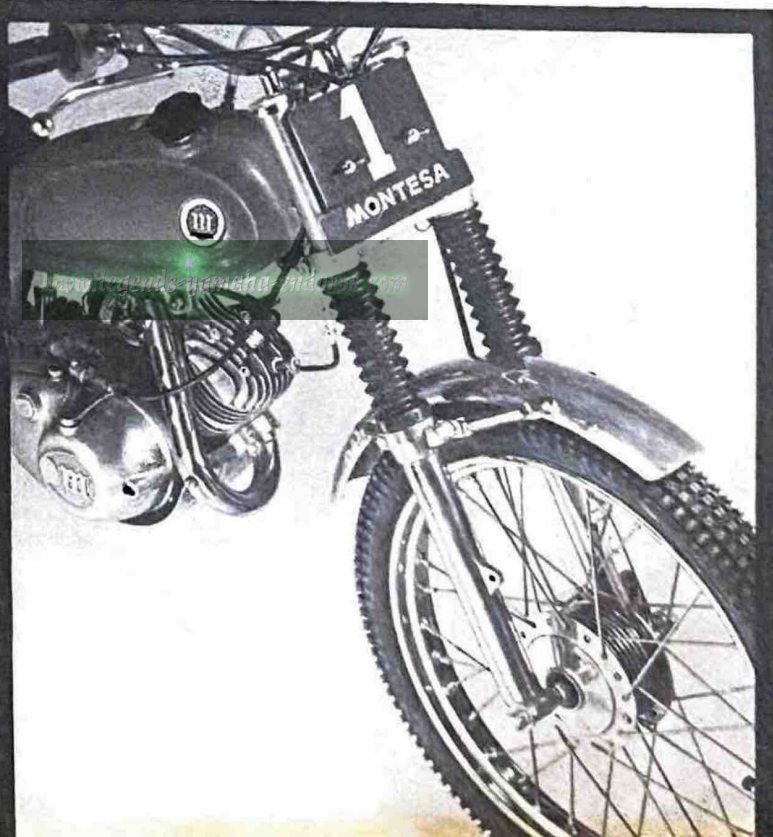
- (a) Slow the engine by manipulating the throttle.
- (b) Use the same hand to grasp the front wheel brake.
- (c) Squeeze the clutch lever with his left hand to disengage the clutch.
- (d) Control the rear wheel brake with his right foot.
- (e) Prepare to support himself and the minicycle with his left foot as he comes to a stop.

To get going again, the rider must:

- (a) Take his right foot from the brake and put it on the ground.
- (b) Shift the transmission into low gear with his left foot.
- (c) Release the front wheel brake and advance the throttle with his right hand.
- (d) Slowly release the clutch with his left hand.

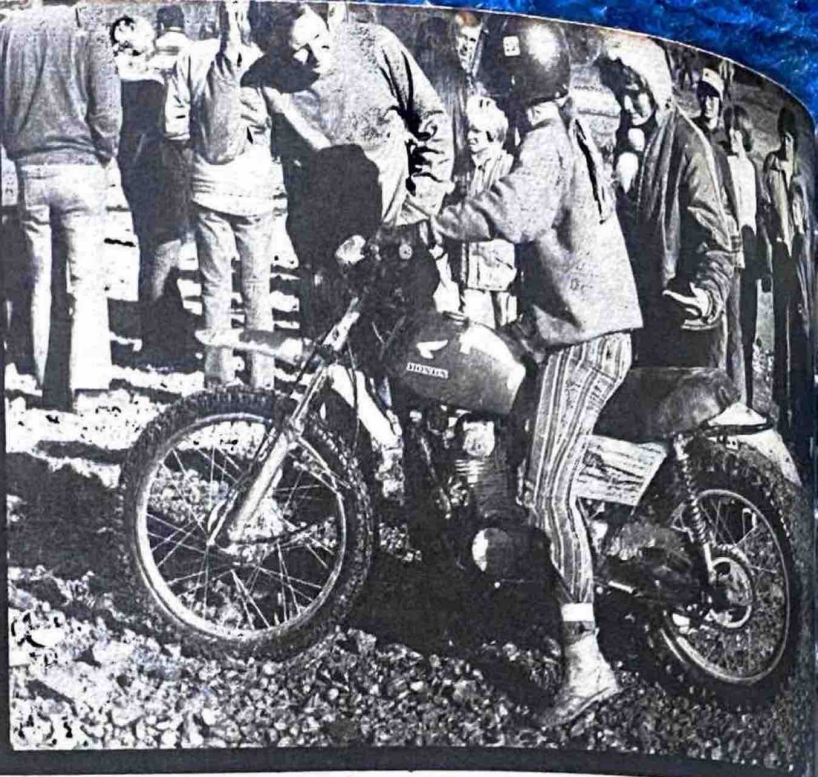
He has to do this automatically, without really thinking about what he's doing with which hand or which foot, or in what sequence, for his basic job is to keep his attention on the road or the path.

**IV The Suspension:** Each of the two wheels on a minicycle has a pair of springs and shock absorbers between it and the frame, called the suspension. One purpose of the suspension is to absorb jolts from bumpy terrain — pot holes, ruts, bumps, etc. Its other and possibly more important purpose is





**A beginner gets instruction on the running gear**



**Pre-race check in mini-enduro**

to maintain, as nearly as possible, constant contact of the wheels with the ground. The more constant the contact, the better the stability of the bike, as well as its handling qualities.

**V The Running Gear:** A minicycle, because it is a real motorcycle, has all the equipment of its big brothers.

*Horn:* The horn button on most minicycles is mounted on the handlebars.

*Head- and Taillights:* There is a large headlight mounted just ahead of the handlebars. It's provided with a "high" beam and a "low" beam, and a switch to select one or the other mounted somewhere on the handlebars. When the headlight is turned on, the taillight, mounted on the rear fender, also goes on. (Some states require that headlights on motorcycles be turned on at all times when the cycle is on the road, day or night.) The taillight contains a second bulb which is turned on whenever the brakes are applied.

*Turn signals:* Still another switch, operated by the hands on the handlebars, controls the turn signals, which are lights mounted in the front and on the back of the minicycle to inform riders (and cars) behind the rider and coming toward him, of his intention to turn, and in which direction. On some



Left to right clockwise

Knowing your bike and how to make minor repairs will save time and money.

Many minicycle models fit into automobile trunks for easy transporting to competitive events.

These high school students in Michigan are on the final lap of a motocross

Minicycles appeal to people of all ages.

Junior racers competing for a motocross championship over a rugged course in southern California.



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minicycles, both rear turn signals light up with the taillight when brakes are applied, as an additional warning.

*Footrests:* These are pedals fixed to the frame of the motorcycle behind the gearshift and rear-brake pedals. They are more than a place to put your feet when you don't have anything for them to do at the moment. Their location has been carefully selected so that the overall stability (or balance) of the cycle is assisted by the way your body will fit onto the machine with your feet on the pedals. Once the best balance point had been determined, the engineers then designed the foot controls so they would be as close to the footrests as possible. A minicycle, no matter how great the temptation, should never be ridden like a bareback horse, with the feet dangling freely, or resting on any part of the minicycle except the pedals.

**VI The Instruments:** The law requires, as an absolute minimum, a speedometer and an odometer. The speedometer, obviously, tells how fast the minicycle is going. The odometer is the correct name for the row of figures which report how far the minicycle has gone in its lifetime.

*The Tachometer:* Many minicycles are also equipped with a tachometer, which is an indicator telling how fast the engine is running, in revolutions per minute (rpm). Most tachometers have a "red-line," a mark on the dial which warns the rider when he is approaching the top *engine* speed he should use. Many tachometers also include a line of numbers which record how many hours the engine has been in use.

*Other Instruments:* Some of the more elaborate minicycles may come equipped with an oil pressure gauge; a gauge which reports cylinder head temperature; a gauge (or a light) showing whether or not the generator (or alternator) is working, and so on. As a good rule to follow, remember that the manufacturer wouldn't have put the instrument on the minicycle unless he thought it was important to either rider safety, or long life for the machine. Find out what the instruments are supposed to tell you by reading the instruction manual, and then keep your eye on them. Form the habit of looking at them whenever you come to a stop.



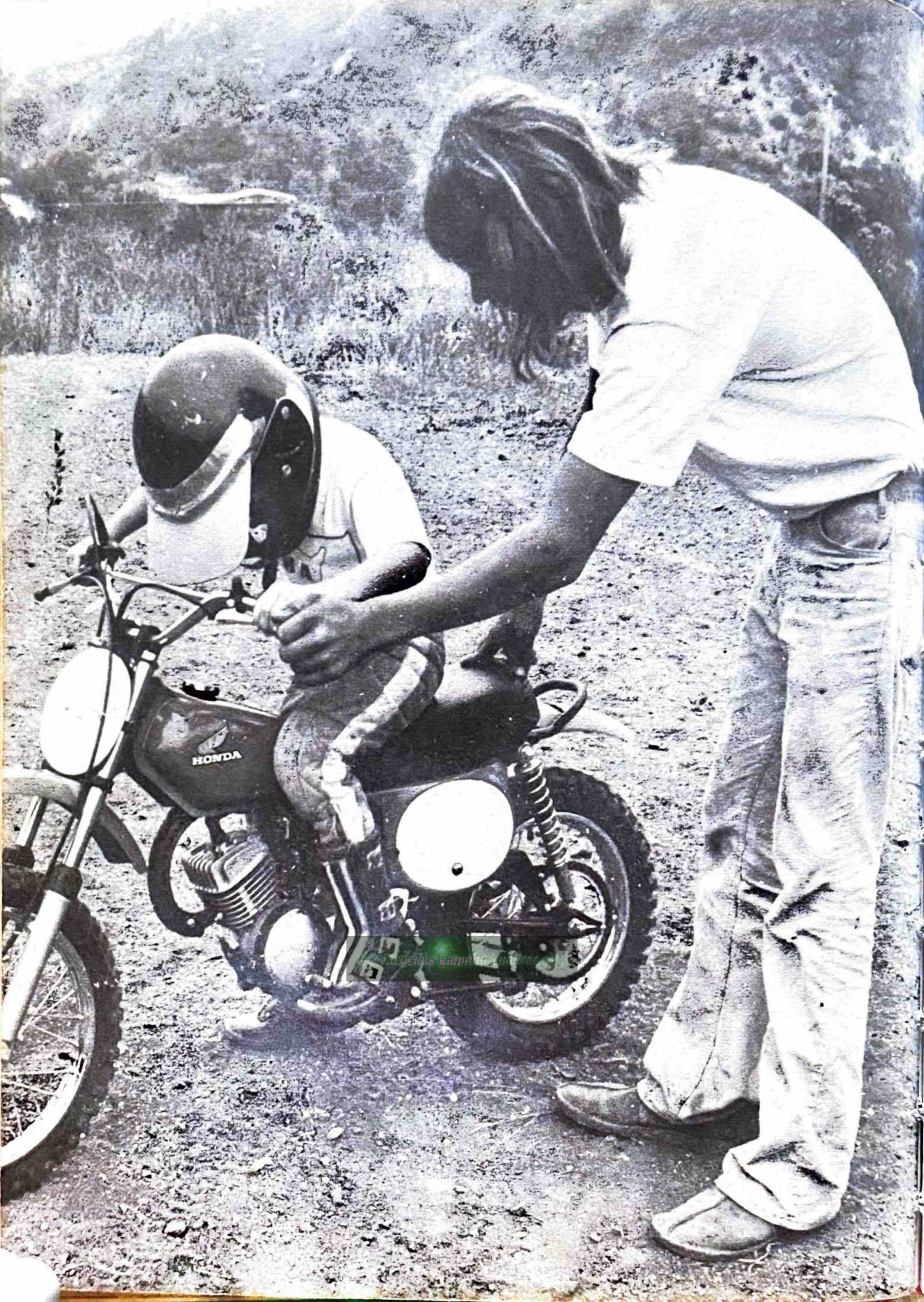
Top to bottom, clockwise —

Some manufacturers of minicycles conduct safety clinics to promote proper care of vehicles and safe driving habits. This maintenance center in Buena Park, California, is operated by Yamaha International.

Even toddlers are eager minicycle enthusiasts.

The girl in the three bottom photographs is a championship motocross racer from Kentucky.





## CHAPTER 4

### LEARNING TO RIDE

The most important part on a minicycle is also the most fragile and is not available as a spare part. For this reason, vast sums of money and thousands of engineering hours have gone into developing a protective covering for this part. The protective covering will permit the most delicate part to perform its function well and at the same time protect it as much as possible. For reasons hard to understand, some minicycle riders discard this protective covering, which is called a helmet, in the strange belief that no matter what happens to other people, *they* are not going to fall off the minicycle on *their* heads.

Sooner or later, minicycle riders who don't wear helmets get to take a fast ride in a long-wheel base, four-wheel vehicle equipped with many flashing lights and called an ambulance.

Helmets can be adapted to face shields of various types and colors, as well as to using them with goggles. Either way, riding a minicycle without a helmet and some device to protect the eyes makes about as much sense as going off the high diving board without knowing how to swim.

Other protective clothing is just about as essential. At the very minimum, minicycle riders should wear a long-sleeved shirt (a turtleneck is fine), a sturdy pair of trousers (blue jeans, for example) and thick-soled boots or



shoes at least ankle (and preferably calf-) high. Gloves are also a fine idea. The alternative to wearing a layer of tough cloth or leather over your skin is scraping a layer of skin off when you take a spill; it's as simple as that.

The next step in learning to ride a minicycle is to find a competent instructor. In some places, schools, motorcycle dealers and the police offer formal courses of instruction. If you can find one of these, this is the best possible solution, because the instructors will not only be first-class riders, but will know how to pass on their skill to you.

(The worst way to learn how to ride is simply to get on one and start off. This is about as foolish as riding without a helmet.)

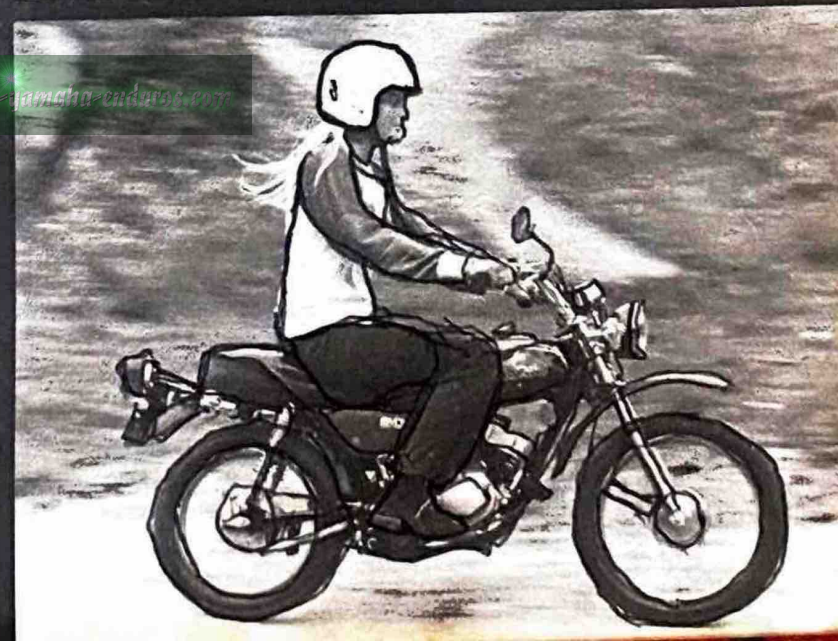
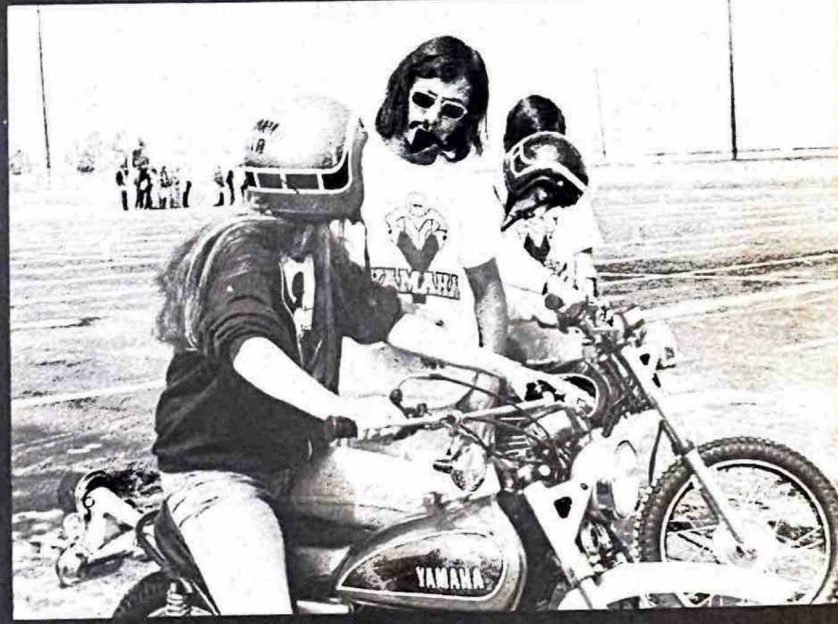
If there is no formal course in riding available to you, find a good rider who is willing to take the time to teach you. This isn't as hard as it sounds. Most motorcyclists are friendly people, willing, even anxious, to help someone get safely started in the sport. One sure way to judge how good a teacher is likely to be is to take a close look at his motorcycle. If it's carefully maintained, and doesn't look as if he's been sliding down the highway on it, this may well mean that he's a skilled and safety-conscious rider.



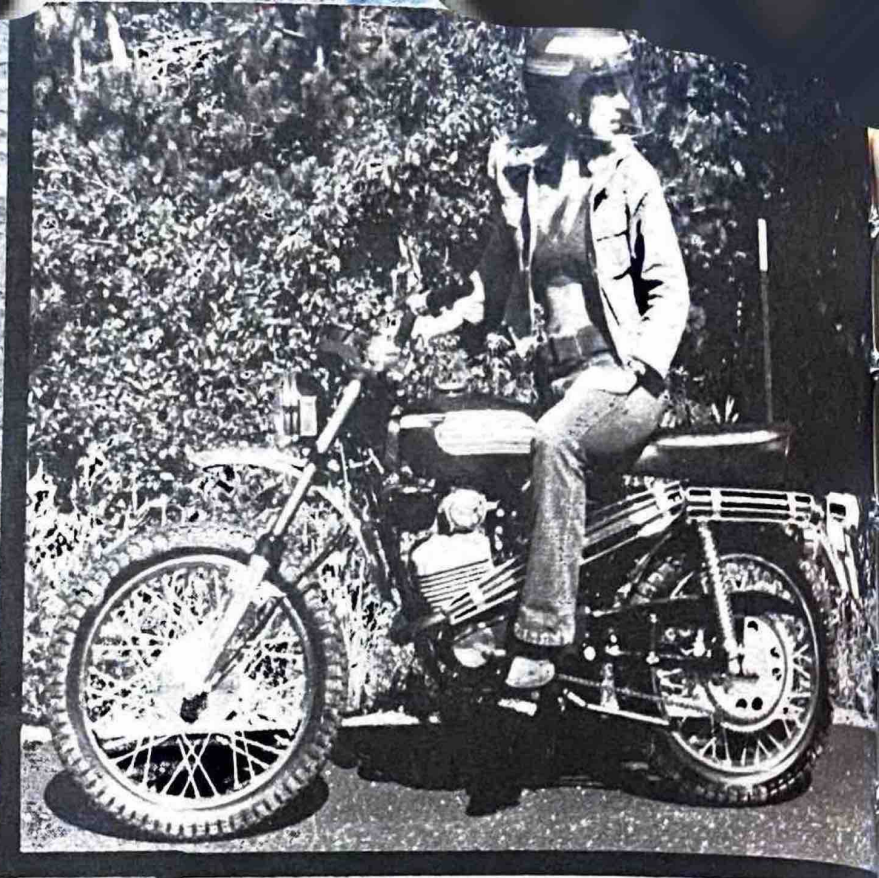
This page, beginning top left.

An instructor explains the importance of learning to coordinate clutch, throttle, and brakes. It takes practice to master the use and control of all the levers and instruments.

The instructor is pointing up the need to develop the habit right from the start of wearing safe riding apparel. Wearing a helmet is a law in most states and should be a law in all. Flared pants are discouraged as they can catch on the foot pegs. Note pegged "banana" pants on instructor.



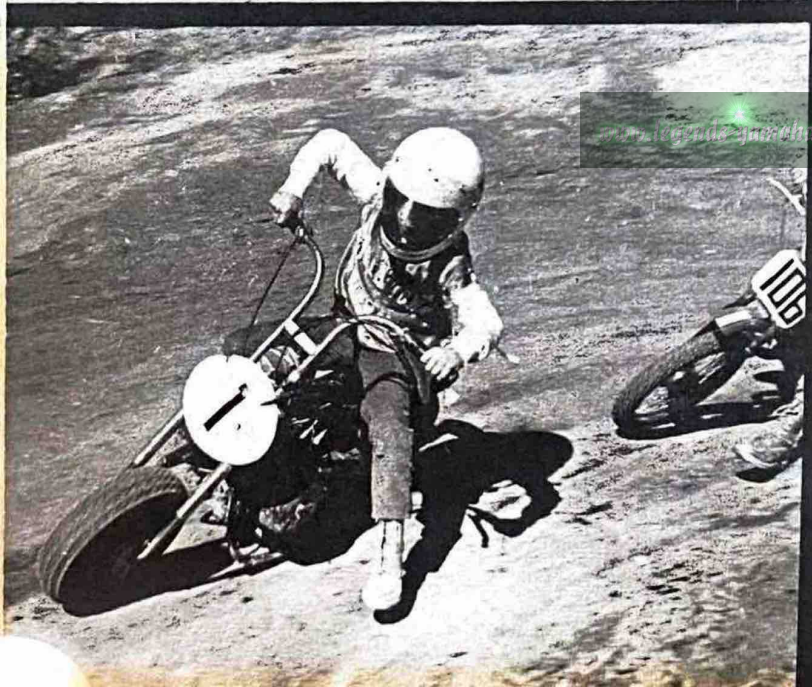
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**Top left: A bucking bronco**

**Above: Looking for the competition**

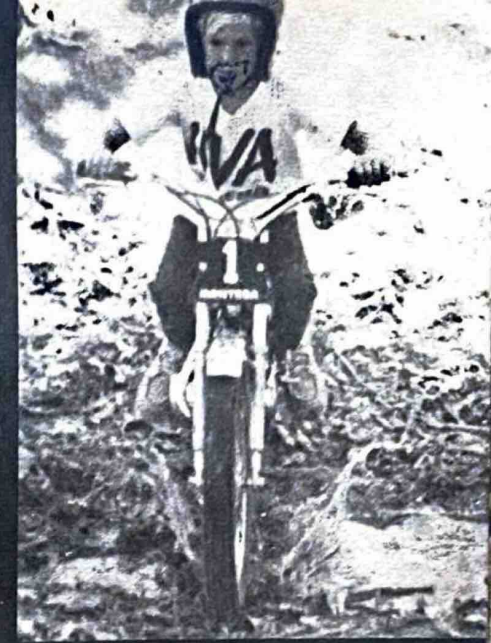
**Riding smooth**



**Lean into turn with foot out to brace and balance**



Too much lean



Through the mud

The best rider in the world, however, isn't going to be able to point a magic wand at you and make you into a skilled rider instantly. The only way to become a skilled rider is with experience and practice.

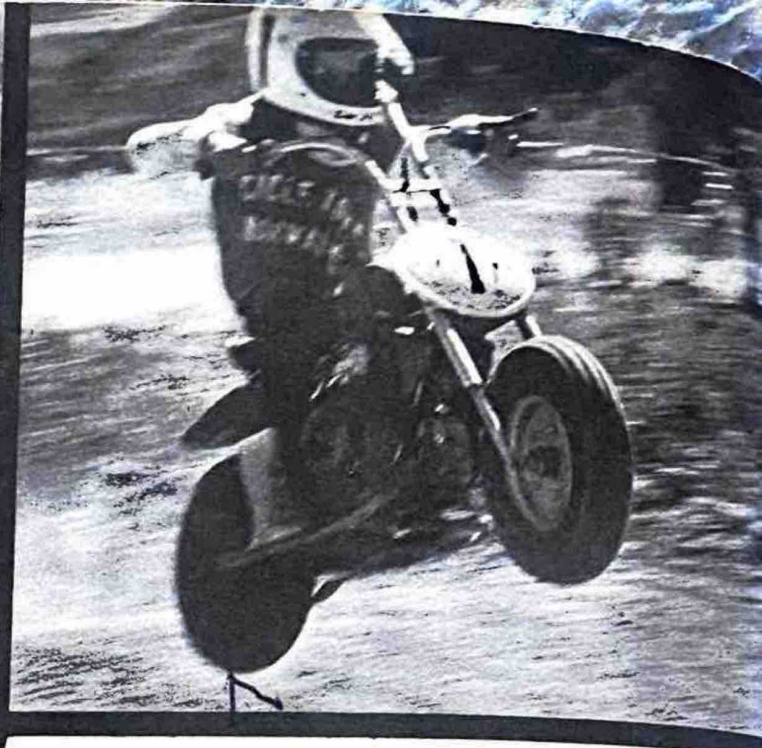
The first thing a good teacher will do, before you ever put a leg over your minicycle, will be to make sure you know the parts of the machine. Then he'll see that you're safely dressed with the necessary safety equipment.

The first thing the instructor will probably have you do when the engine is running, and you're raring to go, is go about twenty feet, in a straight line, at about two miles an hour, and then stop. This really isn't much fun, but it's like a baby's first couple of steps. You have to have the very basic things down pat before you can try anything else.

Gradually the distance you're going in a straight line will be longer and longer, and your speed will be up to "shifting" speed. Next will come, still in low gear, wide, sweeping turns, circling and circling around so that you can get the feel of your minicycle and begin to understand something about "leaning" your cycle as you turn.

Then the turns will get a little more complicated. They may be smaller circles, or figure eights, or long loops, during which you may be permitted to shift up to second gear in the straightaway.

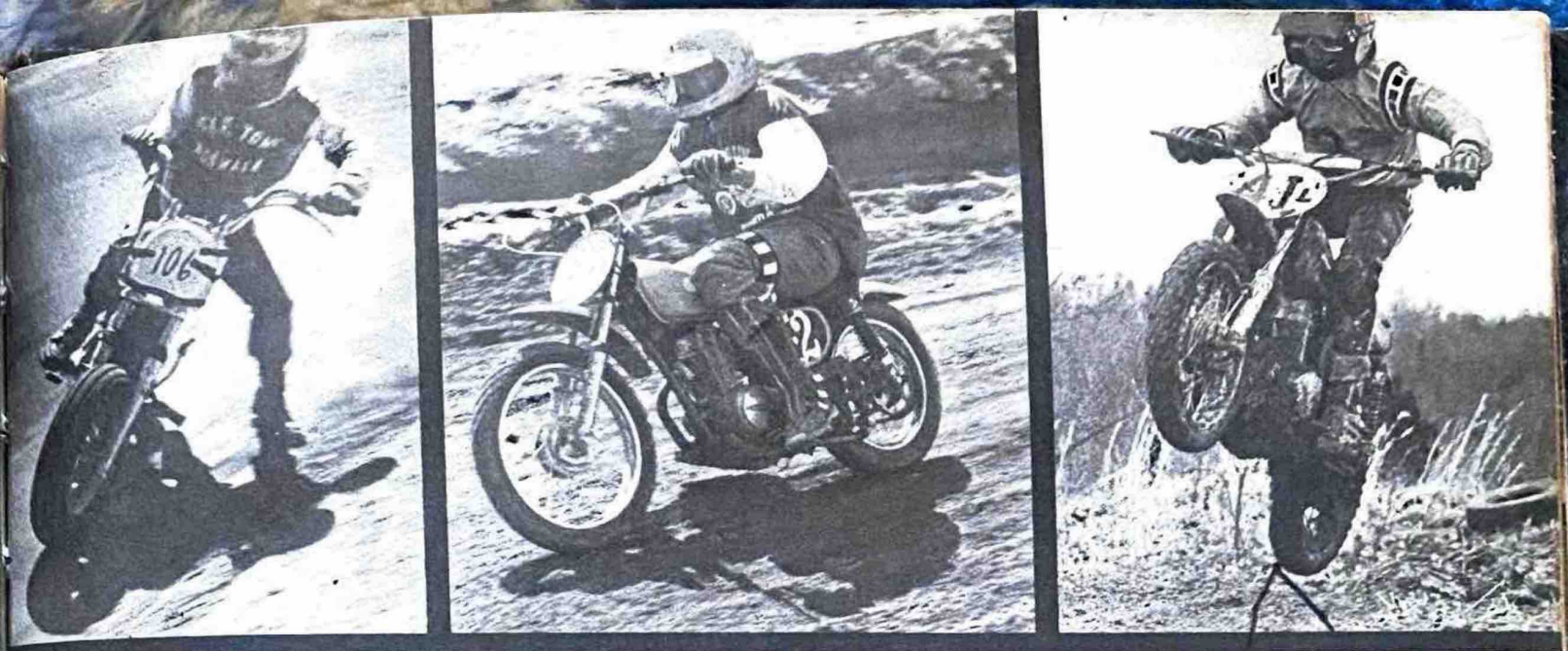




The riders pictured on these two pages are competing in various motorcross races. Successful competition requires good control of the cycle as well as alertness to the condition of the terrain.



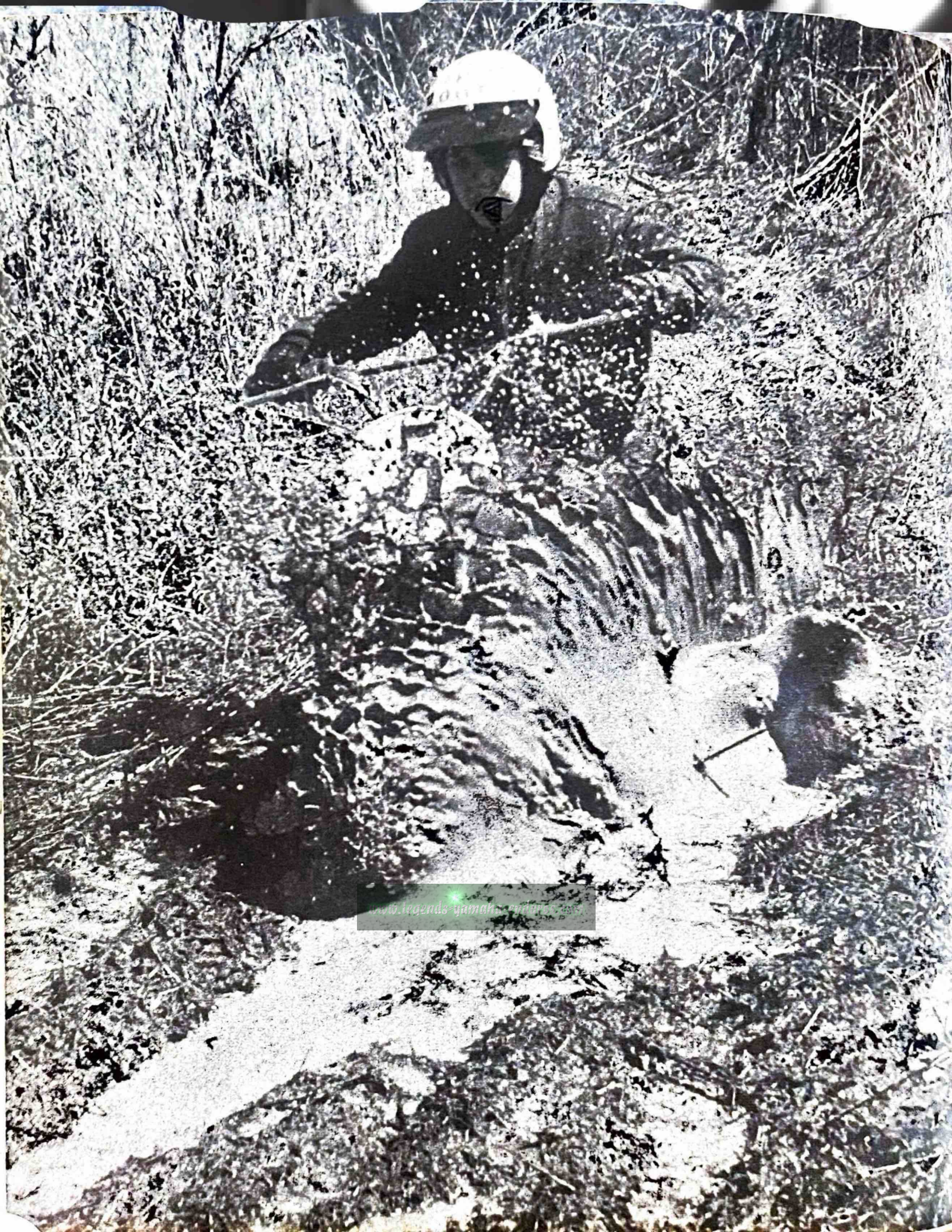
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Sooner or later, there will be riding around obstacles, either the plastic lane markers you see on the highways, or garbage cans, or even chalk marks on the pavement.

In many ways, this sort of instruction is very much like the way pilots were taught to fly in World War I. They were turned loose on large fields in airplanes with cut-off wings. They gradually got the feel of the airplane with as little risk as possible. Then they transferred to an airplane whose wings were a little longer, long enough to permit them to jump a few feet in the air, but not long enough for them to really fly. Eventually, of course, they developed enough skill to take a chance with a real airplane, off the ground. When that happened, they were on their own. Their instructor couldn't help them when they got in trouble any more than your instructor will be able to help you if you do something wrong or foolish.

Sooner or later, you'll be riding your minicycle across the practice area using all the gears, and weaving around the obstacles without knocking them over or falling off the minicycle. You can be proud of yourself, of course, but the thing you should keep in your mind is that when your instructor finally gives you permission to solo, you're just like those World War I pilots. You know *how* to ride, but your education in riding has really just begun. From here on, you're your own instructor; what happens to you and your minicycle—years of fun and pleasure, or a really nasty accident, is entirely up to you.



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## CHAPTER 5

### FUN WITH YOUR MINICYCLE

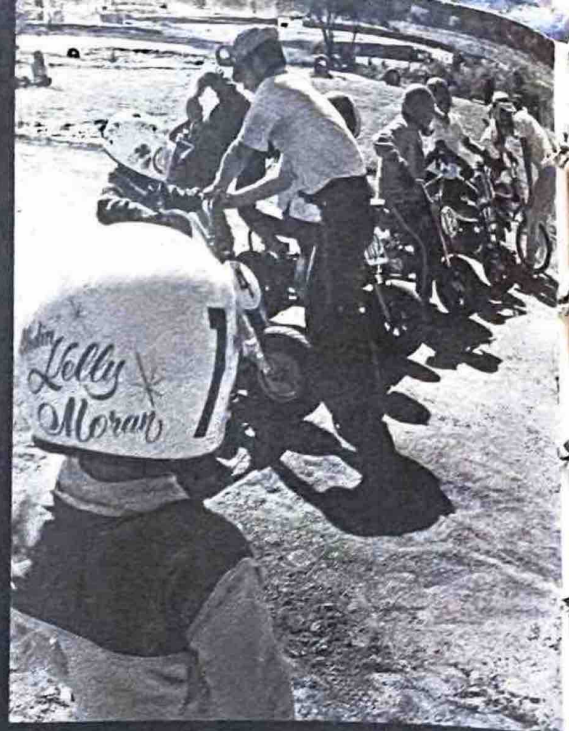
The first thing that many people think of when someone mentions fun with a minicycle is racing. In California, especially, there are regularly scheduled minicycle races just about every weekend. There are motocross races; cross-country races; races around circular (or oblong) paved tracks and hill climbs. There are in fact, nearly the same kinds of racing for minicycles as there are for full-size cycles. The races are well organized, with competent officials, rating systems for riders and cycles, and provide for minicycle riders lucky enough to live in the area just about everything they could ask for.

There are many other parts of the country, however, which have no formal, regularly scheduled competition for minicycle riders at all. This does not mean that the minicyclist who does not live near a place with an established racing program is just out of luck.

All it takes to get into minicycle competition is two people, one minicycle, and a little imagination.



Arriving for the race



On your mark

For example, the second time a minicycle rider makes a figure-eight loop through a farmer's field, going through it again the same way he went through the first time, he's already laid out a motocross course.

If the minicycle rider has a watch, he can start out by racing against himself, trying to get around the course in less time than he did the first time. If he is willing to loan his cycle to a cycle-less friend, he can race against him by simply carefully timing how long it takes each time to get through the course.

With two people and two minicycles, things are obviously going to be a little easier and more fun. The two riders can race against each other, by either starting out at the same time, or with a "delayed start." The delayed start is sometimes safer. One rider starts out around the course, and ten seconds later, the second rider starts. If the rider who started out second crosses the finish line less than ten seconds after the first, he wins. The delayed-start idea works especially well where the course is nothing more than a wheel track through a field, where passing would be either dangerous or impossible.



Get set

GO!

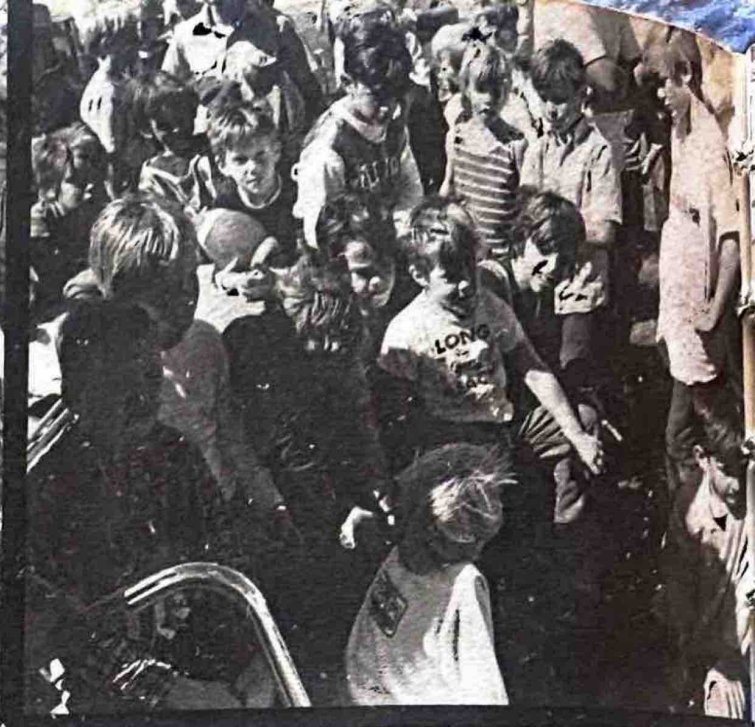
They're off



In the water

In the field





Clockwise, bottom left — This girl maneuvers her cycle over rugged landscape in a motocross competition; obstacles such as this log are commonplace on motocross courses; the driver of this half-buried minicycle went off-course and needs help freeing his cycle; waiting spectators





Speed isn't all there is to competition, and many minicycle riders prefer competition which tests the rider's skill more than the power of his cycle. There are any number of ways this can be done. One of the easiest ways to show how well you can handle your minicycle is by setting up sort of an obstacle course using empty plastic half-gallon milk bottles.

The simplest course of competition here is to line up a dozen or so bottles in pairs. The pairs of bottles are set just far enough apart to clear the cycle, with a couple of inches to spare. The winner is the rider who knocks down the fewest bottles as he rides through the course. If he doesn't knock any down, they may be too far apart.

This competition course can be easily modified by making the path between the bottles curved, so that it requires precise steering between pairs of the bottles. Or the ride through the path of bottles can be timed. That way, the competition shows who can ride not only precisely, but with some speed.

Minicycle riders who have permission to use a field, or a wooded area for their competition can set up all kinds of courses with very little effort. If the first course set up proves too easy, provide more challenges to your skill. Put a small tree trunk across the path, so that you have to slow down and ride over (or around) it, for example.



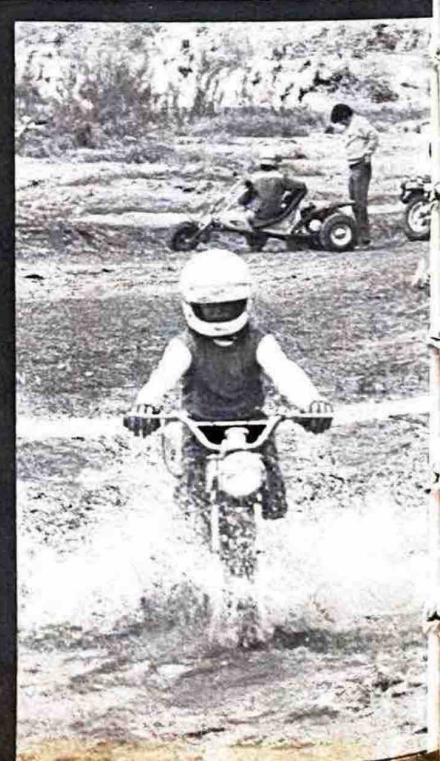
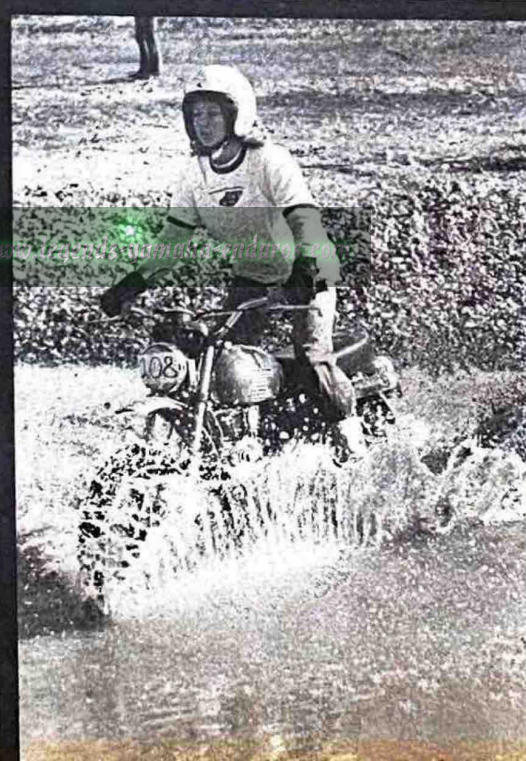
With a little trial and error, it's not hard to mark off a course that's exactly a mile, or half a mile, or so many tenths of a mile. This can be done with the odometer on the instrument panel, or actually measured off with a tape measure.

There are 5280 feet in a mile. It takes exactly four minutes to go a mile at 15 miles per hour. If your course is, say, exactly a quarter mile long, you compete to see who can go around it in exactly 60 seconds, or one minute. The winner is the rider who comes closest to sixty seconds. It's just as bad to go under 60 seconds as it is to go over. Precision riding is what's being tested here, not top speed.

"Fast-and-Slow" is another simple competition that's a lot of fun. Set up a twisting course with the empty plastic milk bottles. Place them close enough together so that it's a tight squeeze for the rider and his cycle.

The rider goes through the course twice. First, he goes through it as fast as he can, and his score is his time in seconds. If he hits a bottle, or lets his foot touch the ground, he loses.

Next, he goes through the course as slow as he can. Again, if he has to touch the ground to steady himself, or hits one of the milk bottles, he's out.

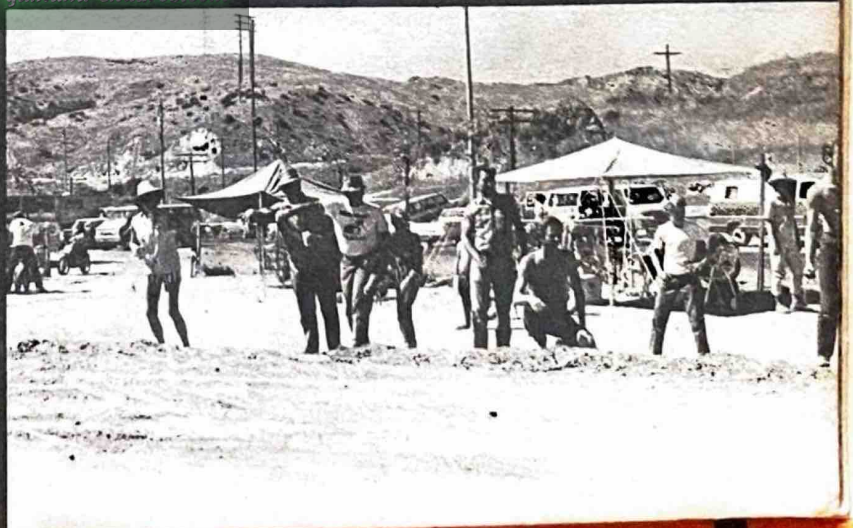




Scenes from an assortment of motocross competitions. Enthusiasm runs nearly as high among the spectators at these events as it does among the competitors themselves.



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His slow run is also timed, and his final score is reached by subtracting the fast-time from the slow-time. The winner, of course, is the rider with the highest score.

Anybody with enough initiative and imagination to earn money for a minicycle in the first place should have no trouble at all thinking up other minicycle games.

Minicycles are more than fun and games. They provide opportunities to develop good physical coordination and a sense of responsibility. The good minicycle rider is not the rider who can make the tires scream when he takes off, or skid to a stop in a cloud of dust and burned rubber. All that kind of riding does is wear out the cycle and give the sport a bad name.

The good minicycle rider is the one who has learned to make his cycle do what he wants it to do, and with a high degree of skill. And he's the one who'll be having fun with his cycle next week, while the so-called Hot Dog will be trying to raise the price of a new clutch. Or wondering how soon they'll let him out of the hospital.

Good Riding!

**Into the first turn; leading at the last turn; leaping into the home stretch**



**SOME STATISTICS ON CURRENT POPULAR MODELS**

<b>MANUFACTURER</b>	<b>MODEL</b>	<b>ENGINE TYPE</b>
Benelli	Dynamo Woodsbike	2 stroke, single cylinder
Benelli	Dynamo Trail	2 stroke, single cylinder
Benelli	Sprint	2 stroke, single cylinder
Benelli	Banshee	2 stroke, single cylinder
Benelli	Trail 90	2 stroke, single cylinder
Chaparral	ST-80	2 stroke, single cylinder
Chaparral	SX-80	2 stroke, single cylinder
Chaparral	T-96	2 stroke, single cylinder
Chaparral	ST-100	2 stroke, single cylinder
Chaparral	SX-100	2 stroke, single cylinder
Harley-Davidson	X-90	2 stroke, single cylinder
Harley-Davidson	Z-90	2 stroke, single cylinder
Hodaka	Dirt Squirt	2 stroke, single cylinder
Hodaka	Road Toad	2 stroke, single cylinder
Hodaka	Super Rat MX	2 stroke, single cylinder
Honda	QA-50 K3	4 stroke, single cylinder
Honda	Z-50A K6	4 stroke, single cylinder
Honda	MR-50 K1	4 stroke, single cylinder
Indian	M5-A	2 stroke, single cylinder
Indian	MM-5A	2 stroke, single cylinder
Indian	JC-5A	2 stroke, single cylinder
Indian	JX-50	2 stroke, single cylinder
Indian	MX-74	2 stroke, single cylinder
Indian	MX-76	2 stroke, single cylinder
Indian	ML-100	2 stroke, single cylinder
Indian	MT-100	2 stroke, single cylinder
Kawasaki	MTI-75	2 stroke, single cylinder
Kawasaki	MCI-90	2 stroke, single cylinder
Montessa	Cota 25A	2 stroke, single cylinder
Montessa	Cota 25C	2 stroke, single cylinder
Suzuki	TS-75 Colt	2 stroke, single cylinder
Suzuki	TM-75 Mini Cross	2 stroke, single cylinder
Suzuki	RV-90 Rover	2 stroke, single cylinder
Suzuki	TM-100 Contender	2 stroke, single cylinder
Suzuki	TC-100 Blazer	2 stroke, single cylinder
Yamaha	RD 60B	2 stroke, single cylinder
Yamaha	TY 80B	2 stroke, single cylinder
Yamaha	YZ 80B	2 stroke, single cylinder
Yamaha	GT 80B	2 stroke, single cylinder
Yamaha	RS 100B	2 stroke, single cylinder
Yamaha	DT 100B	2 stroke, single cylinder
Yamaha	MX 100B	2 stroke, single cylinder

PISTON DISPLACEMENT (cc's)	WEIGHT (lbs.)	MAXIMUM SPEED MPH	TRANSMISSION	INTENDED USE
65	95	50	4-speed	trail
65	100	50	4-speed	dual
50	125	30	4-speed	trail*
90	155	62	5-speed	dual
90	189	62	5-speed	dual
79.6	153		4-speed	trail
79.6	146		4-speed	trail*
96	130		**	trail
97	149		4-speed	trail*
97	149		5-speed	trail*
90	160	50	4-speed	trail
90	175	60	4-speed	dual
98	185		5-speed	trail
98	228		5-speed	dual
98	191		5-speed	trail
49	84	25	2-speed	trail
49	117	25	3-speed	trail
49	100	40	3-speed	trail
47	60	10	1-speed	trail
47	57	10	1-speed	trail
47	69	25	1-speed	trail
49	108	45	4-speed	trail
74	135	50	4-speed	trail
74	147	50	6-speed	trail
97	169	55	5-speed	dual
97	165	60	5-speed	trail
73	121	35	3-speed	trail
90	150	45	4-speed	dual
48.7	77		2-speed	trail
48.7			3-speed	trail
72	172	45	4-speed	trail
72	165	45	4-speed	trail
72	165	45	5-speed	trail
98	187	60	5-speed	trail
97	205	55	4-speed	dual
72		53	5-speed	dual
72			4-speed	trail
72			5-speed	trail
72		47	4-speed	dual
97		68	5-speed	dual
97		58	5-speed	dual
97			5-speed	trail

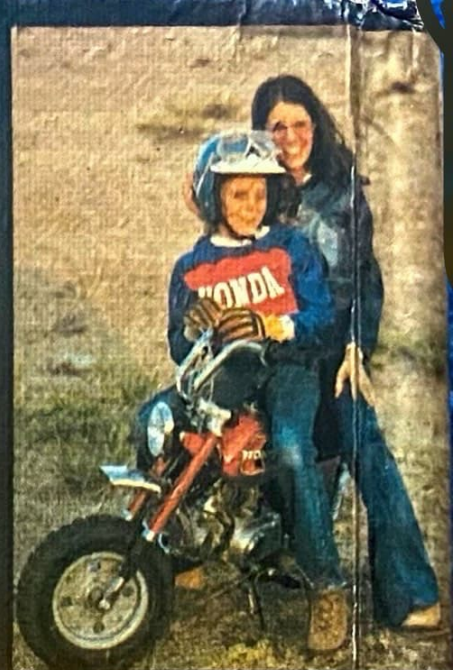
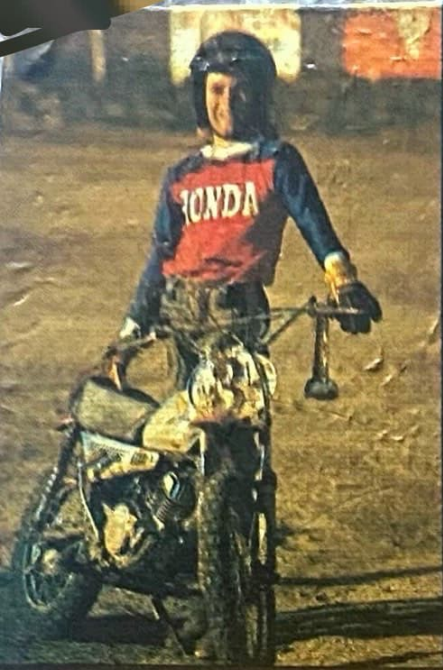
\* street legal with installation of additional approved equipment  
\*\* infinitely variable torque converter

## ***About the Author***

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William E. Butterworth is the author of countless books for young people and adults on subjects ranging from automobile racing to history and ecology. He began his career as a writer while serving in the Army as a combat correspondent during the Korean War. Later he was a civilian information officer. He makes his home in Fairhope, Alabama, with his wife and their children.

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