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# MiniCycle

K 47745

FEBRUARY 1973 / 75¢

**BUILD TOCCO'S WINNING GEMINI  
TWO SIZZLING 50's  
PACESETTER 3-WHEELER • SNOW FUN**



**HONDA'S SUPER MINI-FIRST TEST**

# BREATHING ON THE GEMINI 80

## File and grinder resuscitation generates new life

Last year Bobby Tocco won the closest thing to a national championship on a Gemini Boss 80 when he took the Yamaha Perpetual Trophy at Saddleback Park, California. The engine on his machine was de-stroked to bring it within the 72cc limits of the class. It was a close race and Tocco won it fair and square, proving that the Boss 80 *can* be a potent racing machine. But the San Tong Co., importers of the Gemini machines, would be among the first to admit that the stock engine is not a racing machine. Very few stock engines are.

There are many thousands of Boss 80's out there and their owners must be wondering how the devil Tocco pulled it off. Well, first off, Tocco is a superior rider. Even with a jillion horses in the machine, you don't win a national championship unless the rider is among the best.

But, just as important, are the people behind the rider and his machine. In the case of Tocco, the man behind the machine is Elsworth Miller, San Tong's race team director. San Tong is one of the few manufacturers of mini machines that makes a serious effort to campaign their machines, instead of leaving it up to their dealers. Els Miller spends all his time at the San Tong plant in Gardena,

California, happily messing around modifying racing engines and figuring out ways to make the production machines better. It's a nice job and Els, a slim young man with a quizzical manner, seems happy, although he spends a lot of time cheerfully complaining to anybody who will listen, in the manner of master mechanics.

It was Els who developed the engine that carried Tocco to his victory. Frankly, the people at MiniCycle were surprised at the outcome and a little hesitant at asking Els how he did it. Before he would talk to us, Els consulted his colleague, national sales manager Roger Holdaway, who said, "Sure! Before anybody tries to make Bobby's engine, they've got to buy a Boss 80 first and that suits me fine." There's a salesman for you.

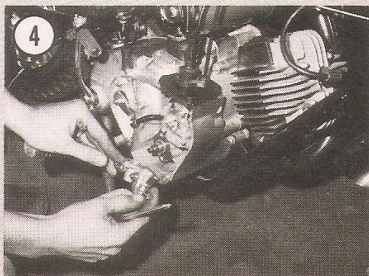
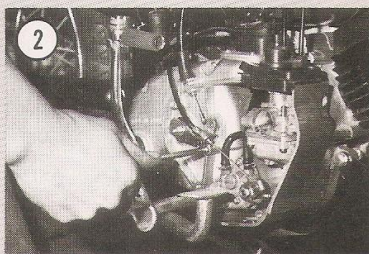
Most people tend to think of hop-up artists as secretive guys who lock up their engines every night before going home and who will never tell you how it's done. Our experience has been the opposite. Scratch a master wrencher and you'll find a showman. After all, the only time they get any recognition is when they open up their engines. All the glory goes to the rider. We found Els to be no exception to this rule. Of course, we still suspect that he must be

holding something back but he swears, eyes wide with innocence, that this is the truth, the whole truth, and nothing but the truth, about the Bobby Tocco engine.

In this how-to-do-it story, we have left out only one thing. The de-stroking of the engine to lower the displacement. That is because, by the time our readers are trying this out, there is likely to be an 80cc mini-cycle racing class and there will be no need to go to the bother of de-stroking the engine.

The Boss 80 engine is an oil-injected rotary valve engine similar to the old Yamaha 80 engine and its smaller brother the pre-1973 Mini-Enduro. Thus, if you can get your hands on an old Yamaha 80 rotary valve engine (cheap) you could probably turn it into the same screamer we are describing here. Similar procedures can be followed for the Yamaha Mini-Enduro but, of course, the port dimensions will be different.

As with all our hop-up stories, we are as much concerned with reliability as we are with getting more power. Most of the stock engines used in mini-cycles are so badly de-tuned that power can be increased dramatically without adversely effecting longevity. This is true of the Gemini rotary valve 80. We have

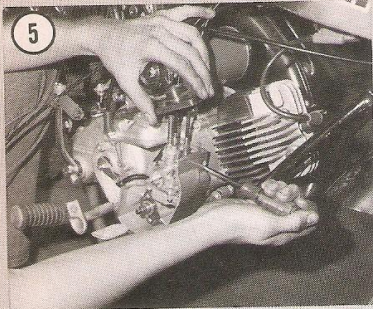


1) First step in removing the engine is to open up the carb and oil pump cover. This is a new machine but the aim is to get a used machine as clean.

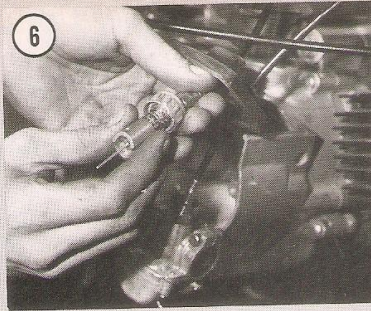
2) Disconnect the clutch cable, and the oil pump cable adjustment clamp.

3) Remove the oil pump (this can be saved until the engine is on the bench).

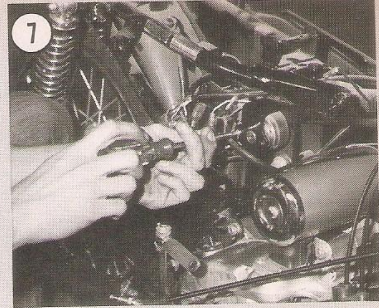
4) If possible, save the oil pump gasket. It can be used with a plate to block up the hole in the case when the oil pump shaft is later removed.



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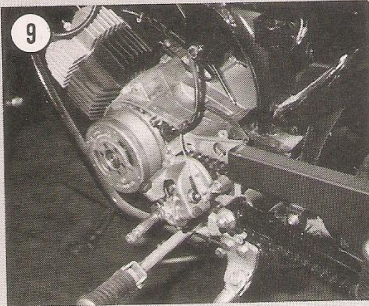
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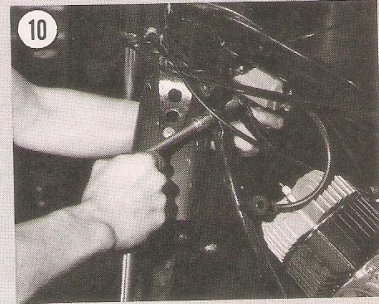
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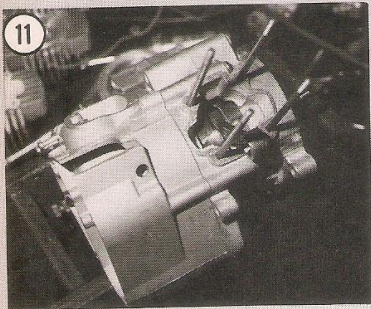
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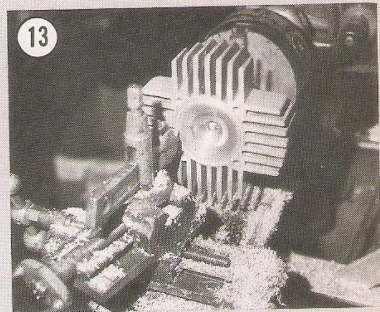
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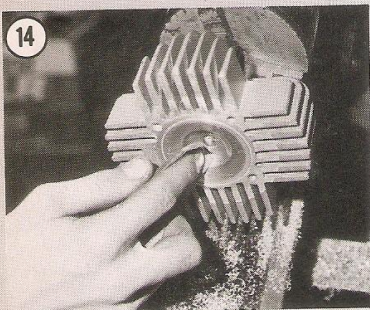
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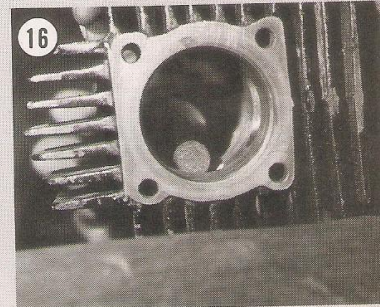
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16

5) Disconnect the carb.

6) Remove the slide from the carb and release the cable.

7) Before anything is done on the machine, the gas tank and seat are removed. While preparing to remove the engine, the wiring harness, lights, horn and speedo can also be removed. However, leave the wire from the horn button in place, it will be used as a kill switch later.

8) Attached to the frame, under the tank, will be found a cable yoke for the accelerator and oil pump. Remove the cable for the oil pump.

9) Remove the gear shift lever and the flywheel cover. Disconnect the chain at the master link.

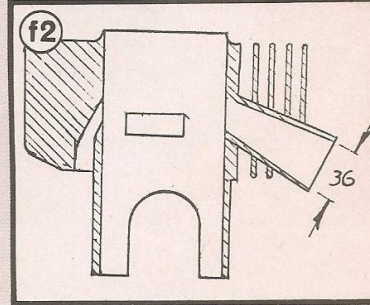
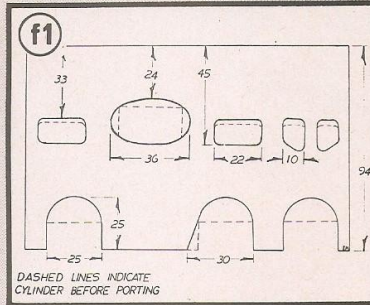
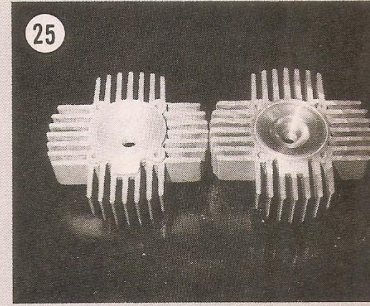
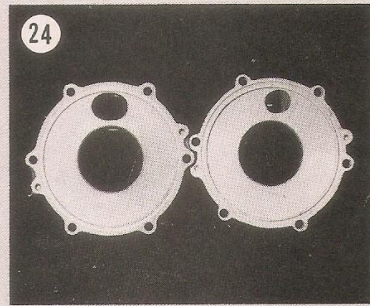
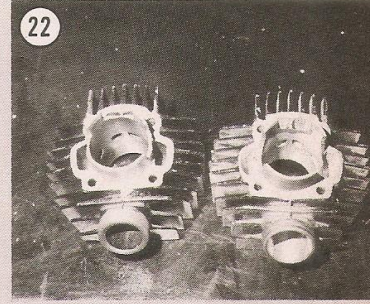
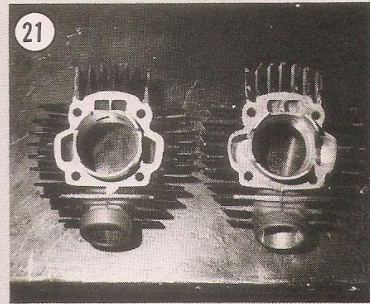
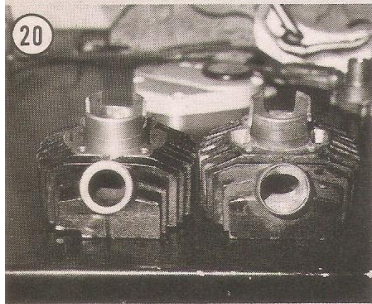
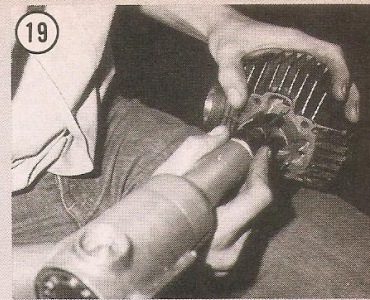
10) Remove the bolt holding the engine cradle at the steering head gusset and the forward engine mount bolt. This allows the engine cradle to swing down, permitting the rear mounting bolts to be removed and the engine to be lifted out.

11) Remove the four head nuts and pull off the piston head and cylinder. The picture shows the piston removed as this will be necessary for a used engine.

12) Chucking the head in a lathe preparatory to milling.

13) Remove the head boss down to the level of the cooling fins. In this picture Els Miller has just milled in a groove around the squish area. This permits the aluminum head gasket to "flow" into the groove when the head nuts are torqued down, preventing blown gaskets from the increased compression.

14) With the head still in the chuck, the squish area inside the head is relieved. The amount of metal to remove is problematical as Els Miller says he has run milled heads, with only a polish job on the squish area, without having the piston contact the head. Still, he advises some relieving since this is going to be a high revving engine (around 14,000 rpm) and there could be some "con



rod stretching." After milling the squish area, the combustion chamber is cleaned up with fine emery cloth and then polished with a compound such as Semichrome.

15) Removing the rotary valve cover is a simple job and is not shown. Replacing the oil seal is advisable so there is no need for excessive care. As mentioned in the text, a valve cover (pictured) with a larger boss to accommodate a bigger carb is available from San Tong. Otherwise, it will be necessary to fit a sleeve on the existing boss and then grind it out to fit the venturi of the new carb.

16) Els Miller prefers to do his grinding with the work supported on his thigh, saying that this gives him greater freedom. He always

wears goggles, of course. In this shot he is using a grinding bit with a flat face to raise the transfer ports.

17) Working on the exhaust port.

18) Extending the boost ports which help scavenge the combustion chamber of spent gases.

19) Carefully opening up the bottom of the transfer ports to make a smooth flow of fuel from the crankcase.

20) View down the exhaust port indicates how much the breathing has been improved on the modified engine (right). We have been assured that there is still enough meat on the exhaust flange to support the expansion chamber.

21) Looking down on the ports of both modified (right) cylinder and an unmodified cylinder reveals the amount of metal that can be safely removed. Note that the ports are clean but not polished. Polishing has an adverse effect upon fuel flow.

22) It is difficult to get a good photographic view of the inside of the cylinder but the view shows, to some extent, the amount of work on the third or boost, ports at the back of the engine.

23) Modified carburetor cover and valve cover when compared to the stock cover on the right. The modified carb cover is drilled with an ordinary keyhole saw and a lipped area

cleaner, available from most good motorcycle dealers, is fitted. Increased air flow is necessary for the bigger carb.

24) A comparison between the back of the modified valve cover (left) and the unmodified cover.

25) Stock head (left), modified head (right).

26) Because of the higher revolutions of the modified engine, it is necessary to give the flywheel deeper support so that slight imbalances do not cause oscillations that could break the end of the crankshaft at high speeds. The specially modified flywheel, right, is available from San Tong on an exchange basis.

Figure 1 - Modified port layout with dimensions in millimeters.

Figure 2 - Cross section of modified Gemini 80 engine showing the exhaust port modification.

Figure 4 - Modified rotary valve layout. Note direction of rotation in relation to the locating notch. An aluminum valve is available from San Tong, cut to this configuration, and it is recommended that this be used in place of the fiber stock valve.

Figure 5 - Expansion chamber design and dimensions. The head pipe is, of course, bent around the frame to meet the mounting flange. This expansion chamber is designed for TT or motocross racing and produces good low end torque. Also available from San Tong.

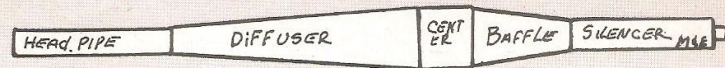
Figure 6 - Rotary valve cover showing the expanded inlet. Dotted lines represent the stock inlet. The diagram is full-size and can be used as a template. A new rotary valve cover is offered by San Tong, as a hop-up accessory, with an enlarged boss to take a 22mm Mikuni carb. Unless this new valve cover is used, it is necessary to slip a sleeve over the stock boss, weld or braze it in place, then open up the inside of the boss to the venturi size of the carb.

not been able to confirm the output of the engine as modified in this story but the Gemini people claim that it is a true ten horses *at the rear wheel*. This compares with the rated power of the stock engine of 6.5 hp.

Before we begin with the job, we have to re-state a basic rule of modification work. Find an area to work that is clean and uncluttered. Your work will go much smoother if the bike is thoroughly cleaned before you start. Els Miller says that cleanliness is next to Godliness in engine work and he wasn't kidding. Tools you will need include a complete set of socket wrenches, a torque wrench

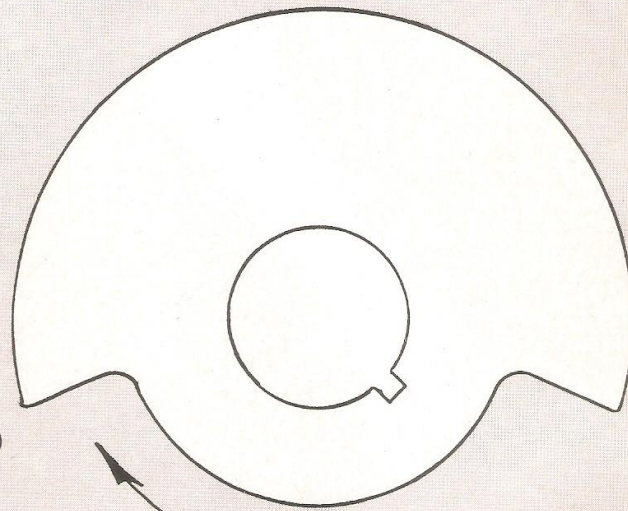
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## EXPANSION CHAMBER



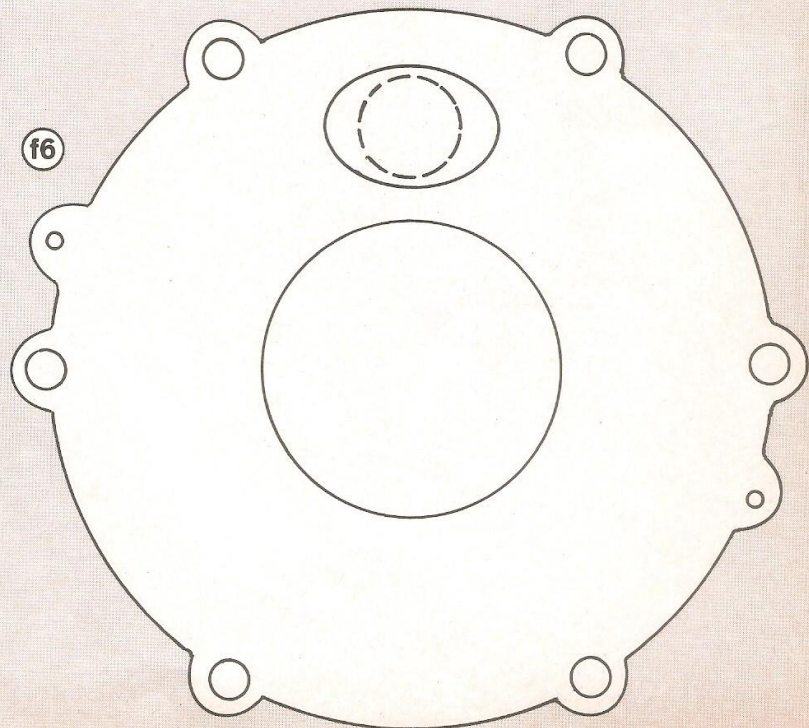
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HEAD PIPE	1.5 X 8
DIFFUSER	1.5 X 14 X 3.5
BAFFLE CONE	3.5 X 9 X 1
CENTER	3.5 X 3
SILENCER	J & R SMALL



f4

DIRECTION OF ROTATION



f6

Continued from page 46

and, most importantly, a hand grinder with a good assortment of grinding bits. An electric drill is not suitable for modifying this particular engine since the barrel is cast iron and you'll need the faster rpm of an electric hand grinder. Give yourself enough room so that the parts can be laid out methodically, in the order that you remove them from the machine.

New parts involved in this job include valve modifications we have seen, it will be necessary to split the cases of the Boss 80 engine. Do not panic about this. It is relatively easy (although it takes a complete set of gaskets; a new rotary valve; possibly a new rotary valve cover (more about this later); a carburetor; a high-speed flywheel; and an expansion chamber. Outside work will probably include milling the head and, if the engine has been used any length of time, re-boring the cylinder. If re-boring is necessary, you'll need the appropriate over-sized piston. All these high-performance parts are now available from San Tong. If these expenses are not within your means, don't begin the job.

The first job is to remove the engine and, while you are at it, you can lighten the machine by removing the oil tank and all the street legal junk. You will not need the oil tank, oil pump and oil lines because you are going to be running pre-mix fuel.

Because Elsworth Miller's modification job is more thorough than some rotary little more time), and the results are worth the effort. There is an additional advantage in splitting the cases. It will give you a chance to examine the transmission and to reassure yourself that all is well in there.

San Tong readily admits that some Boss 80 owners have had trouble with their transmissions but they hasten to add that they believe it to be one of the best transmissions around. The fault does not lie in the design of the gear box but in the way some less-than-efficient dealers set up the machines. There is a couple of adjustments on the detent (the mechanism that should prevent the 'box from missing gears) that have to be done properly.

In order to explain this and the lower end modifications properly, we are going to run this story in two parts. This part will deal with the top end of the engine. The next part will deal with the lower end and reassembly, and we will have a price list on the parts.

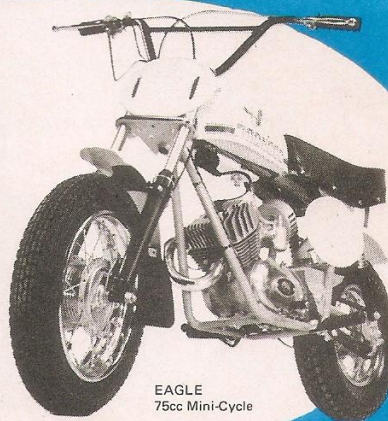
# IF YOUR BIKES AREN'T REALLY TOGETHER

## You Don't Make It To The Indy 500.

### BRONCCO Made It Twice, and More's Comin'!!



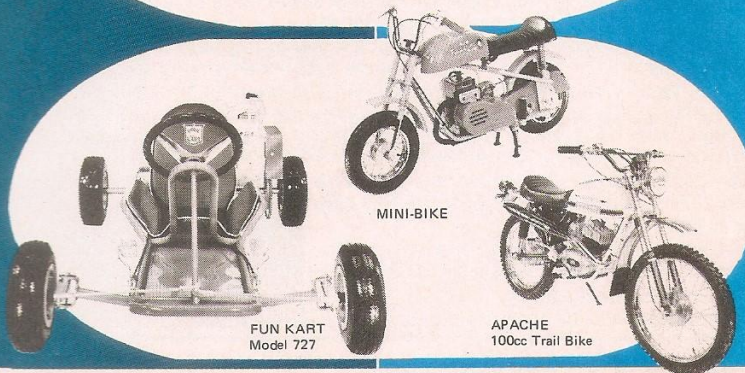
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75cc Mini-Cycle

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