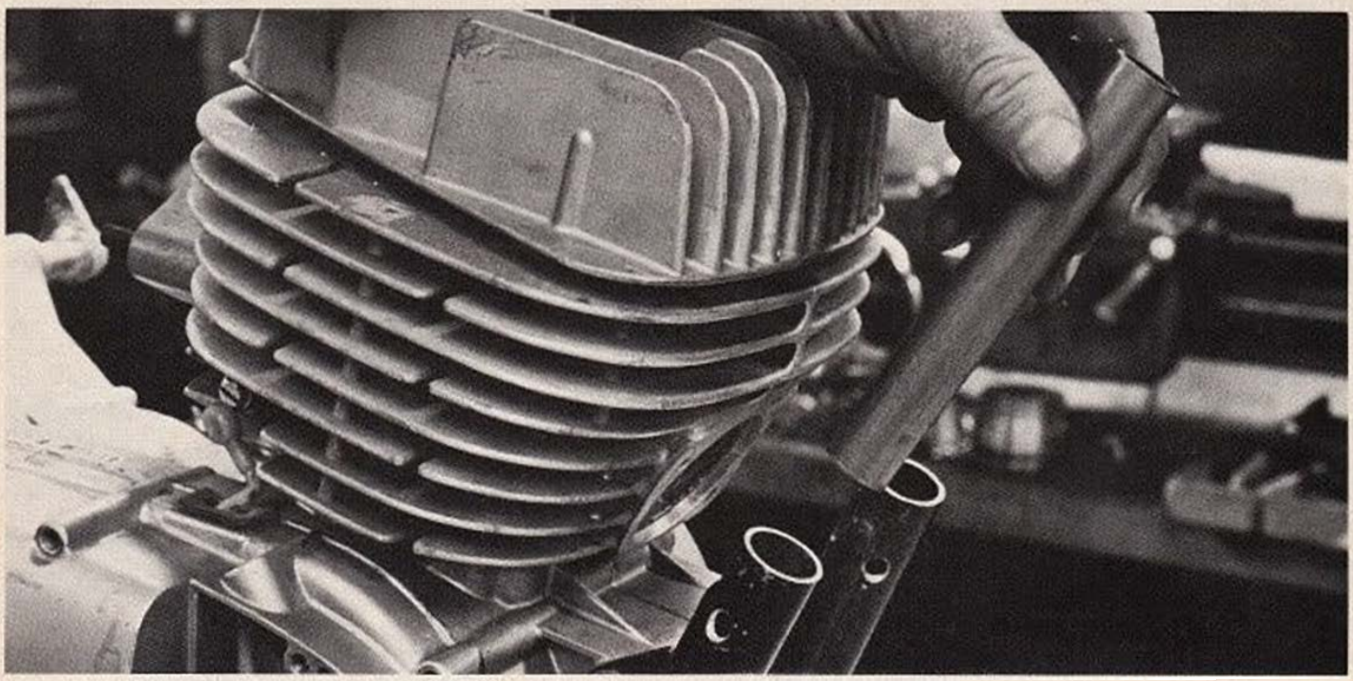
SUSPENSION+CHASSIS=HANDLING



15 *The ID measurement you took earlier will determine the OD of the supporting tubes. They should be about four inches long for the down and rear tubes.*

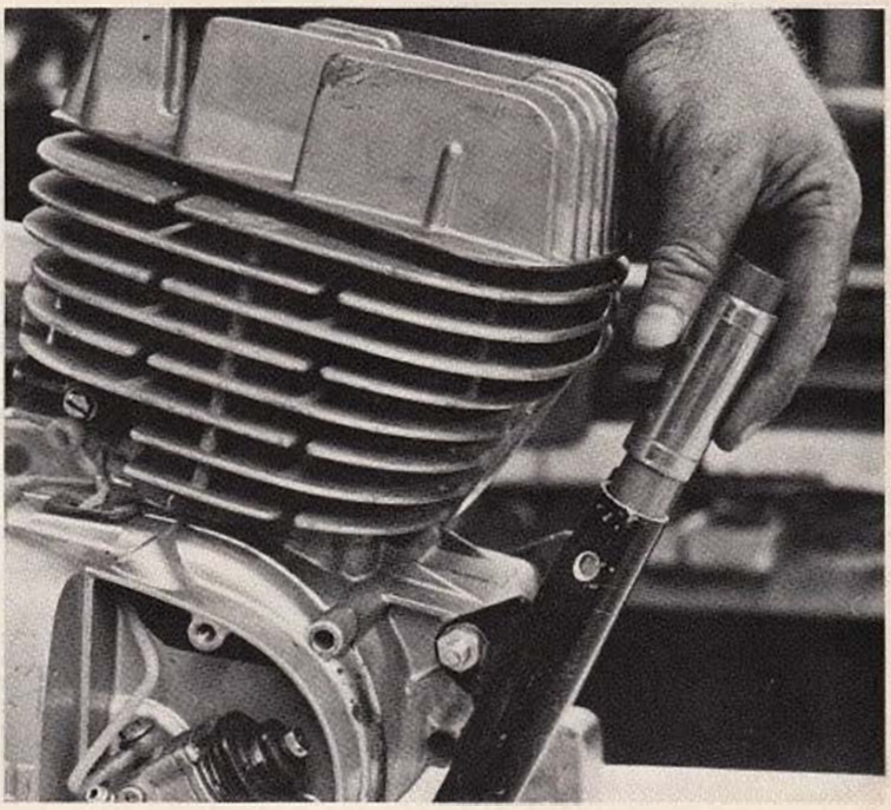
by Dave Holeman

The final chassis mods.

Now that we have the chassis cut apart, reassembling it into its improved design comes next. With Neil Fergus doing most of the work, I was allowed to spend more time shooting the adjoining detailed photos. The first problem we ran into was having to squeeze the upper half frame down tubes together. This permitted the upper tubes to line up with the lower. (#17)

As shown in photo 18, we welded the spacers in the bottom frame half first. To replace the rear brace will involve the greatest amount of work if you want to do it right. Photos 19 through 27 cover this part in detail. The last change made to the chassis was strengthening the head stock. Many of the early DT-1 chassis were vulnerable to having the head stock fracture under stress if not beefed up. As shown in photo 28, we wrapped a piece of malleable sheet metal all the way around the head stock and heli-arced it in place.

Next month we will show the finished machine, with all the new and improved suspension units. These, combined with the chassis mods, will result in some drastic but beneficial changes in the overall geometry. The things that changed were the wheelbase, center of gravity, foot peg location, swing arm angle, weight distribution and the resultant improvement in handling.



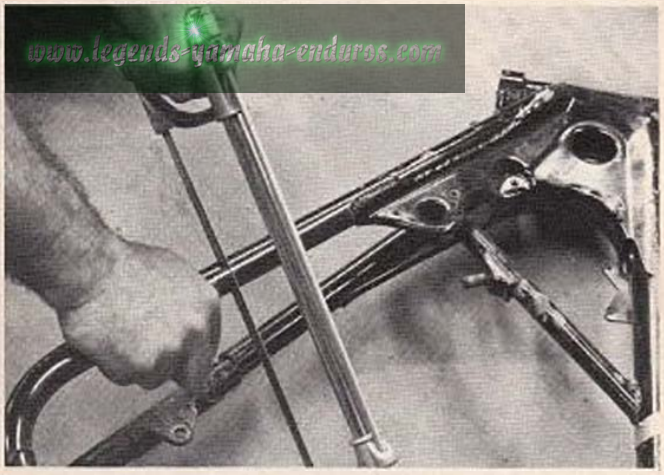
16 *The ID and OD measurement will determine the size of the spacer. This slips over the supporting tube and between the frame halves.*

Practicing what we preach

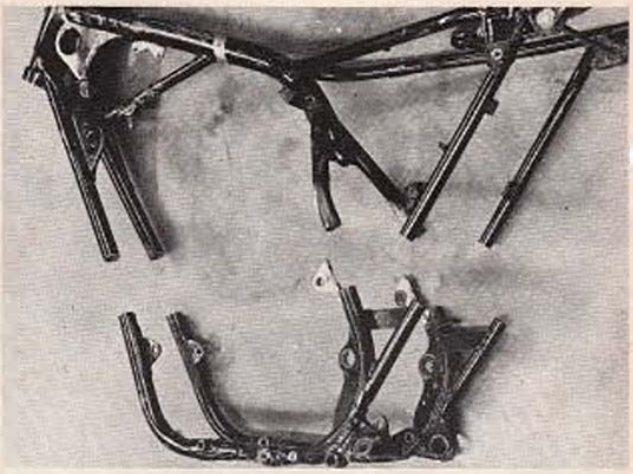
For the past four months (issues) you have been reading about the theory and principles used in designing a good handling motorcycle. The previous HANDLING articles have the lead to this, the 'practice what I preach' construction project. In deciding to do a finale, I thought it would be best to reconstruct an already familiar and popular machine rather than build one from scratch. Initially I thought that this would be most descriptive in allowing you to see what to do to make a machine handle good. As it turned out this method of reconstructing rather than scratch building proved to be more interesting by being able to compare the project machine with a standard mount. Also, I was able to save a lot of time and money this way, as well as perform a task that can be done to just about conventional motorcycle with the same end results.

Upon deciding to tackle this project, I knew that I would need the experience and knowledge of someone else to insure proper execution of the basic principles to be followed. Here I was fortunate enough to acquire the aid of Neil Fergus, one of the best authorities on motorcycle chassis design and suspension around. To review a few of his qualifications, he is the only man to ever capture the number one plate in desert racing on a Honda. Hopping up the engine was elementary, but his magic with chassis modification and suspension units made him a local legend of sorts. Also, he has just returned from Italy with the American Ducati distributor. There, he designed the chassis and suspension to be used on the soon to come Ducati scrambler. He has also done similar work for Bultaco, the now defunct American Eagle moto-crossers and many others.

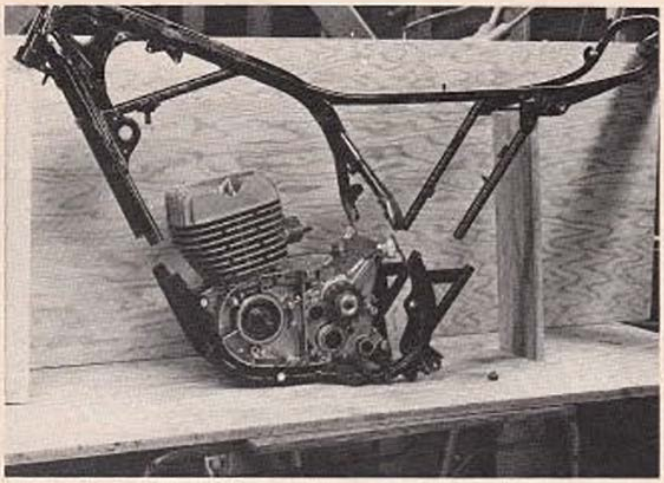
The fact that I was using a DT-1 Yamaha Enduro as the project machine made my final decision though. Back in 1967, both Neil and myself were two of three people involved in testing and designing of the original DT-1 prototype. The other American involved was Yamaha's R & D manager. Many months were spent riding



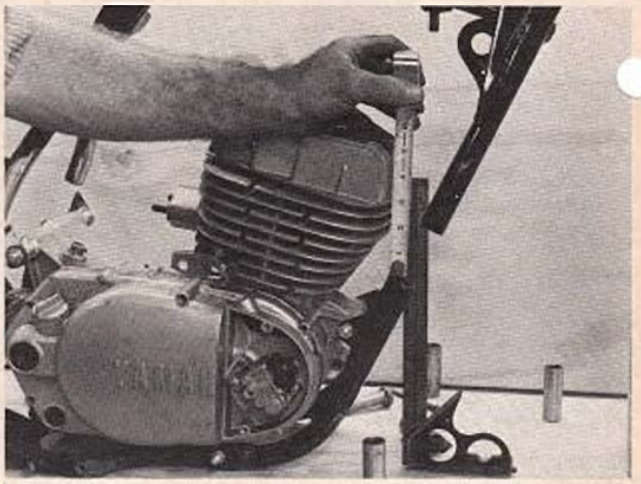
5 The front down tubes should be cut in half two inches above the top of the front engine mounts. On the last cut cover your eyes as the frame flexing may break the hacksaw blade.



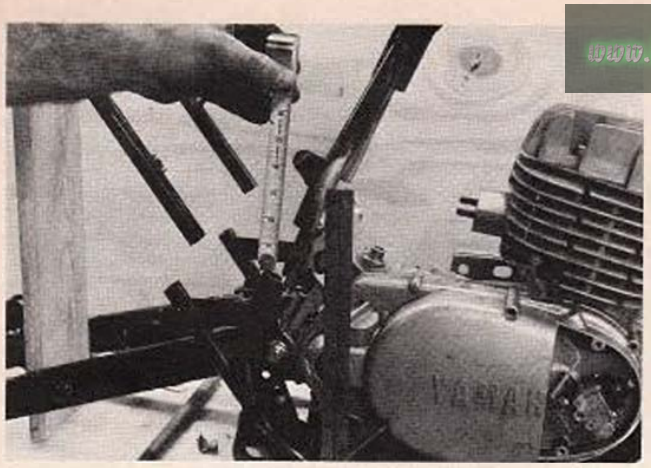
6 We cut the rear brace tubes indiscriminately as they were to be replaced by new members. Cutting them off at the bottom will save some extra work later.



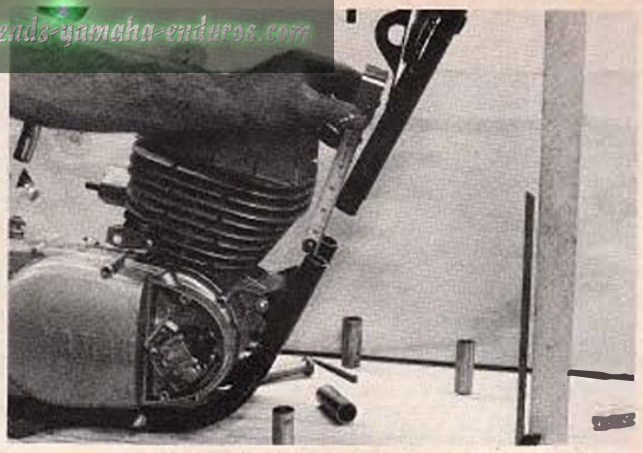
7 Bolt the engine into the bottom frame half to insure alignment. Set the lower half on a flat table and jerry rig a jig for the upper frame section.



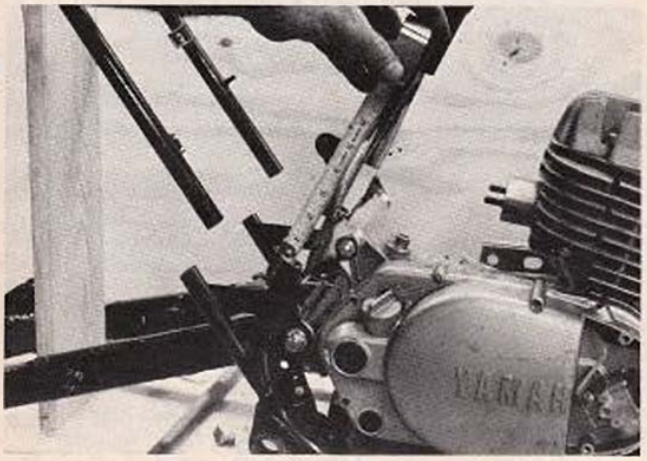
8 Keep the down tubes parallel with each other and measure up vertically two inches from the top of the lower tube to the bottom of the upper. Raise or lower the jig to get the correct measurement.



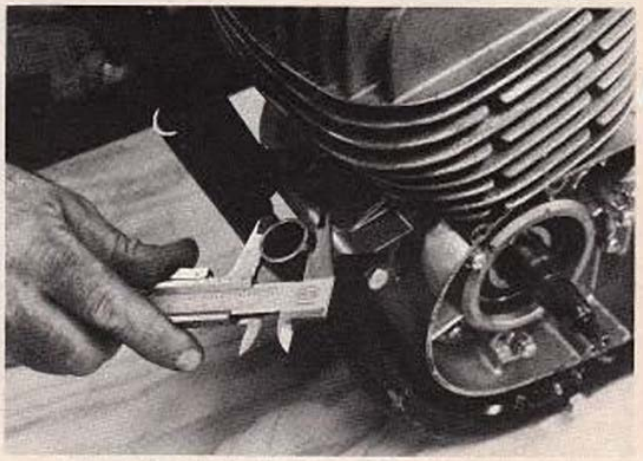
9 *With the down tubes set at two inches, set the main rear tube at the same vertical measurement. With the down tubes parallel the rear, tubes will be close on.*



10 *With the upper frame half raised two inches for and aft measure the parallel distance (about 2¼") between the down tubes and record it.*



11 *Measure the rear main tubes also as insurance. The distance should be identical to the front if everything is lined up correctly.*



12 *With the length of the spacers recorded (about 2¼"), measure and note the outside diameter of the down tubes. Do the same at the rear main tubes.*

changing and testing the original prototype until it reached near perfection. In these months I acquired a first hand view of the magic and uncanny ability of Neil. As it turned out though, most of the work was in vain. Being in a rush to get the jump on the market, the factory started producing the Enduro before the finished prototype got back to Japan. Needless to say the chassis and suspension units of the present DT-1 resemble that first outstanding handling prototype in appearance only.

With this experience as background, Neil and I were able to start out with a format that ran back to the first prototype days. The DT-1 has all the equipment to make a fine, rather than mediocre, handling dual purpose or racing machine. All we have done is move a few pieces to acquire the desired results. The format and principles we have followed are not at all unique to the DT-1. In fact they are all applicable to just about any conventional motorcycle, especially the dual purpose Japanese machines.

Following the principles talked about in the series of articles on handling we literally started from scratch. In fact the complete machine was built from used or throw away parts rather than from a new machine. In the long run this saved a lot of money, as there were few parts that were thrown away. We started out with a scrap DT-1 chassis that I acquired from a junkyard for $25.00. It had been in an accident and the head stock had been ripped open.

The first thing that Neil and I knew had to be done was to lower the center of gravity. This is probably the single biggest downfall to most Japanese machines, too high CG. Also we wanted to get the angle of the swing arm parallel and eliminate the extreme position it is in stock. Naturally, the only components needed here were the frame and swing arm. The only other components we needed in the reconstruction process were the engine (just the bare crankcases would do) and a rear shock. The engine was bolted into place during the welding process to insure proper alignment when the hot frame members cooled.

The rear shock was bolted in place and a measurement taken to determine how much the swing arm bolt would have to be lowered to make the unit parallel (horizontally). This figure came out to two inches. This figure was just about the distance Neil wanted to lower the engine, so the two-inch dimension is our basis.

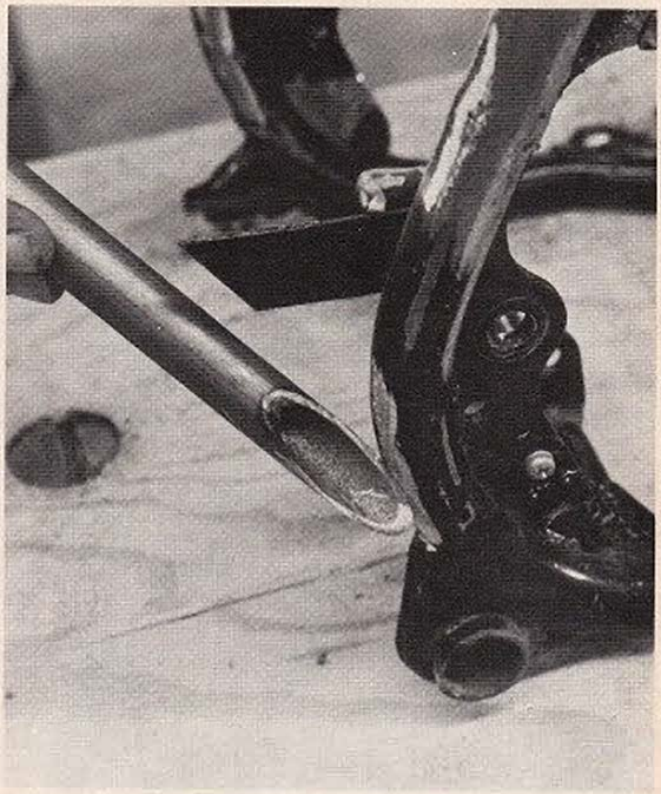
The first thing to do was locate the places where we would cut the frame members. We had to keep in mind that the location of the cuts would

Continued on page 112

21 *Cut off the bottom of the bracing tube as close to the frame member as possible. Leave the bracing ear in place.*

2 *By grinding off the old weld, a larger and better welding surface will become available. It will also make for a better looking job.*

23 *The bottom of the new bracing tube should ideally be ground to conform to the bend of the frame member. Protect your eyes from the sparks.*



24 *With both the new bracing tube and the frame member ground an ideal large welding surface is available. Also clean the bracing ear for welding.*


WEBCO INC.
218 MAIN STREET • VENICE, CALIFORNIA 90293 • (213) 870-7758 / 399-772
FRAME LOWERING KIT
YAMAHA DT-1 & RT-1