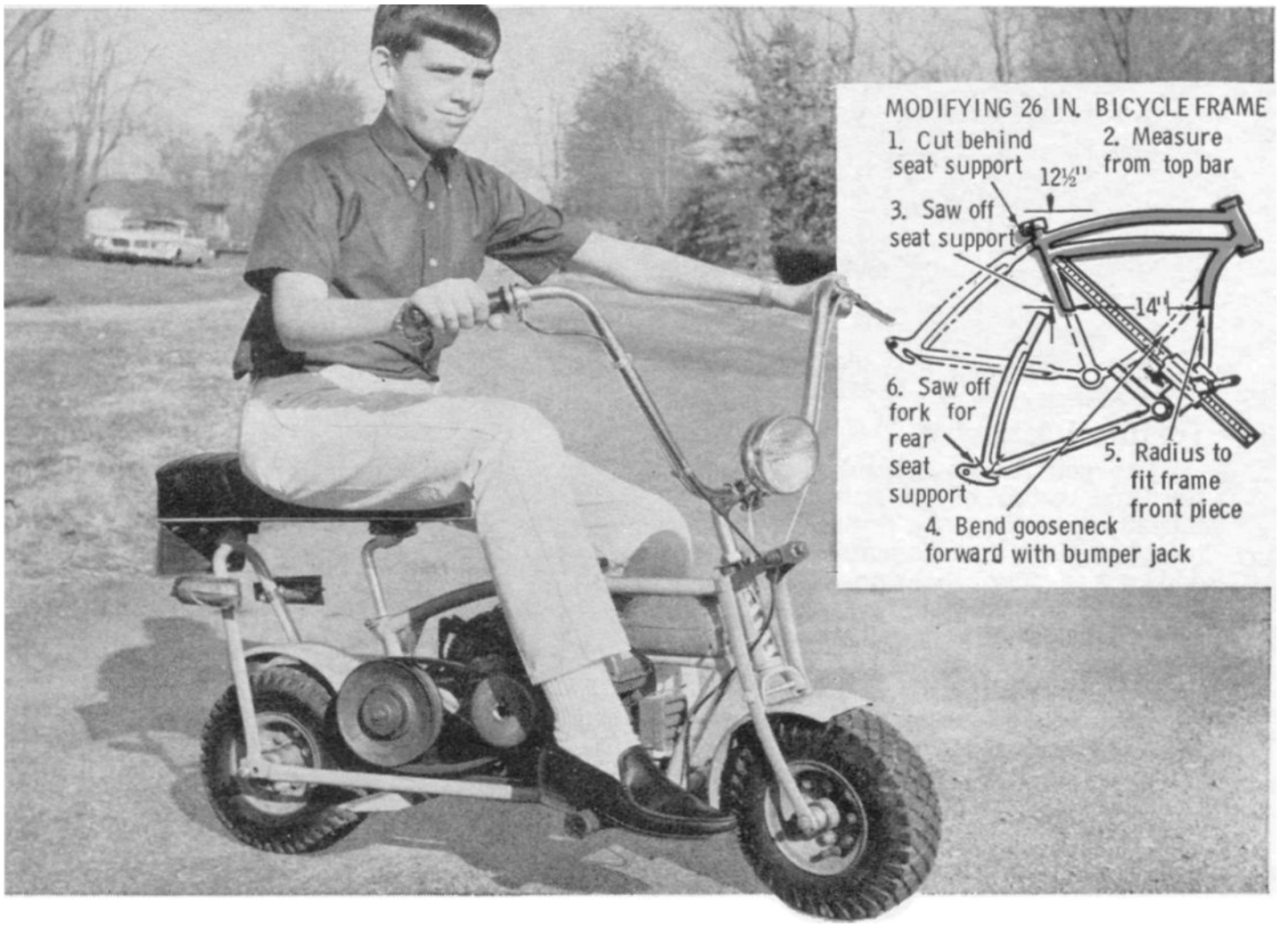
Take a small kart engine, add a slick variable-ratio belt transmission and you'll have a real performance 'bear' for half the cost of a commercial motor scooter

Build



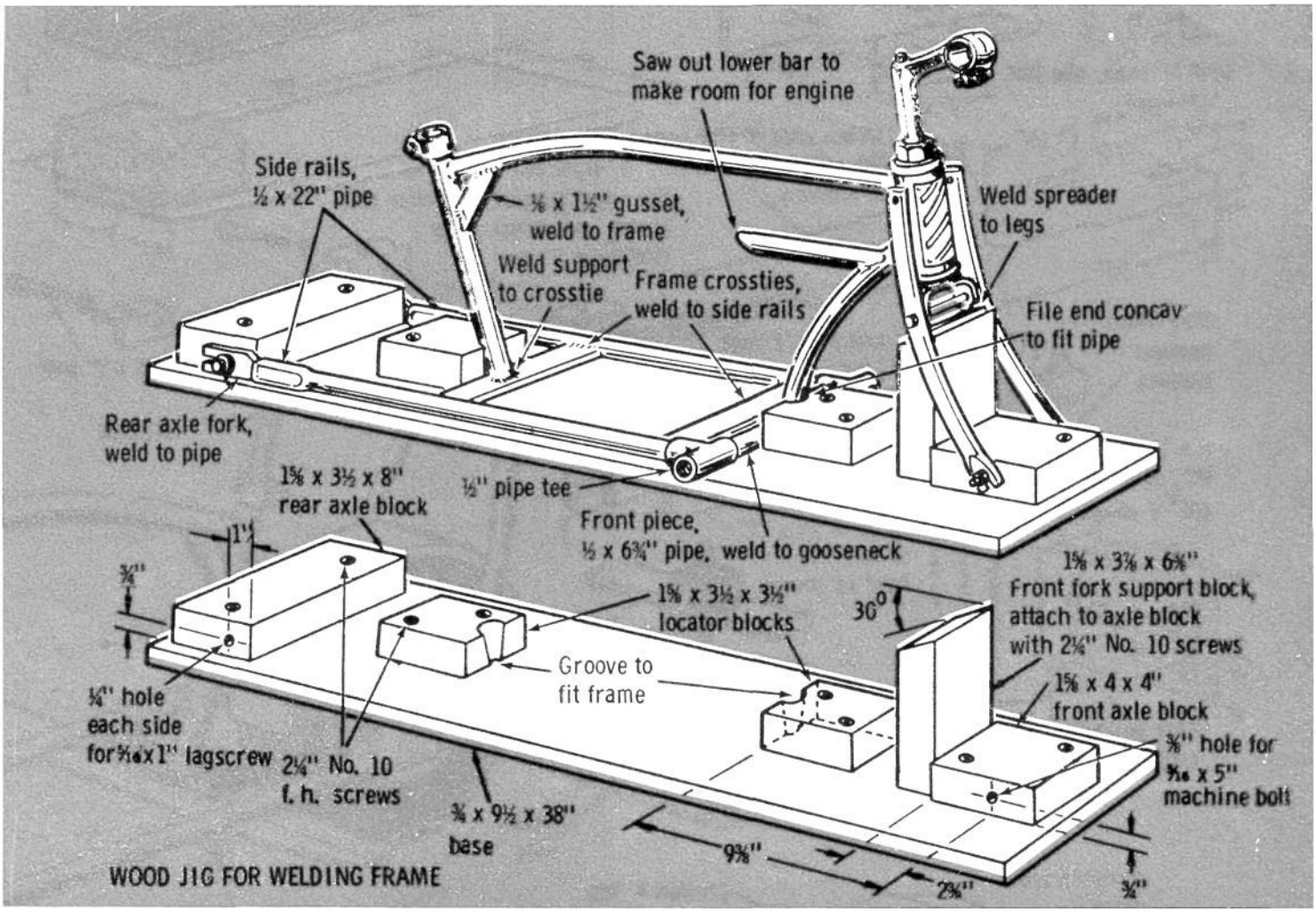
FLAT OUT, this scrappy little motor scooter will hit up to 32 mph on a straightaway. When you come to a grade, it automatically downshifts to a lower drive ratio to give you rugged hill-climbing power. Although designed around a modest 2-1/2-hp engine, its variable-speed drive enables the PM minibike to equal or exceed the performance of many commercial scooters selling for twice as much. In most states, it can be licensed for road use with no difficulty.

The best part is the machine's lightweight, low-cost design. The basic frame comes from a discarded 26-in. boy's bicycle, which you can usually pick up for a few dollars at a bike shop or junk yard. Most of the parts are stock bike or kart items, easy to come by and easy to assemble. Even if you start with a new engine, the entire scooter can be built for $100 to $120. With a used engine, the cost is considerably less.

Special features include a two-passenger cushioned seat, a motorcycle-type twist-grip throttle and a novel, spring-action front fork made by modifying the conventional bicycle fork. The automatic belt transmission includes not only a centrifugal clutch but also a variable-diameter pulley system that adjusts drive ratio to load. For road use, lights and a horn can be added.

Start by cutting the bike frame so you come out with the portion shown in color in the drawing above. It's necessary to bend the "gooseneck" section of the frame forward to make room for the engine. This can be done with a bumper jack as shown. Bend carefully to avoid flattening the tubing. Heating with a propane torch will make the job easier.

Yourself a Minibike



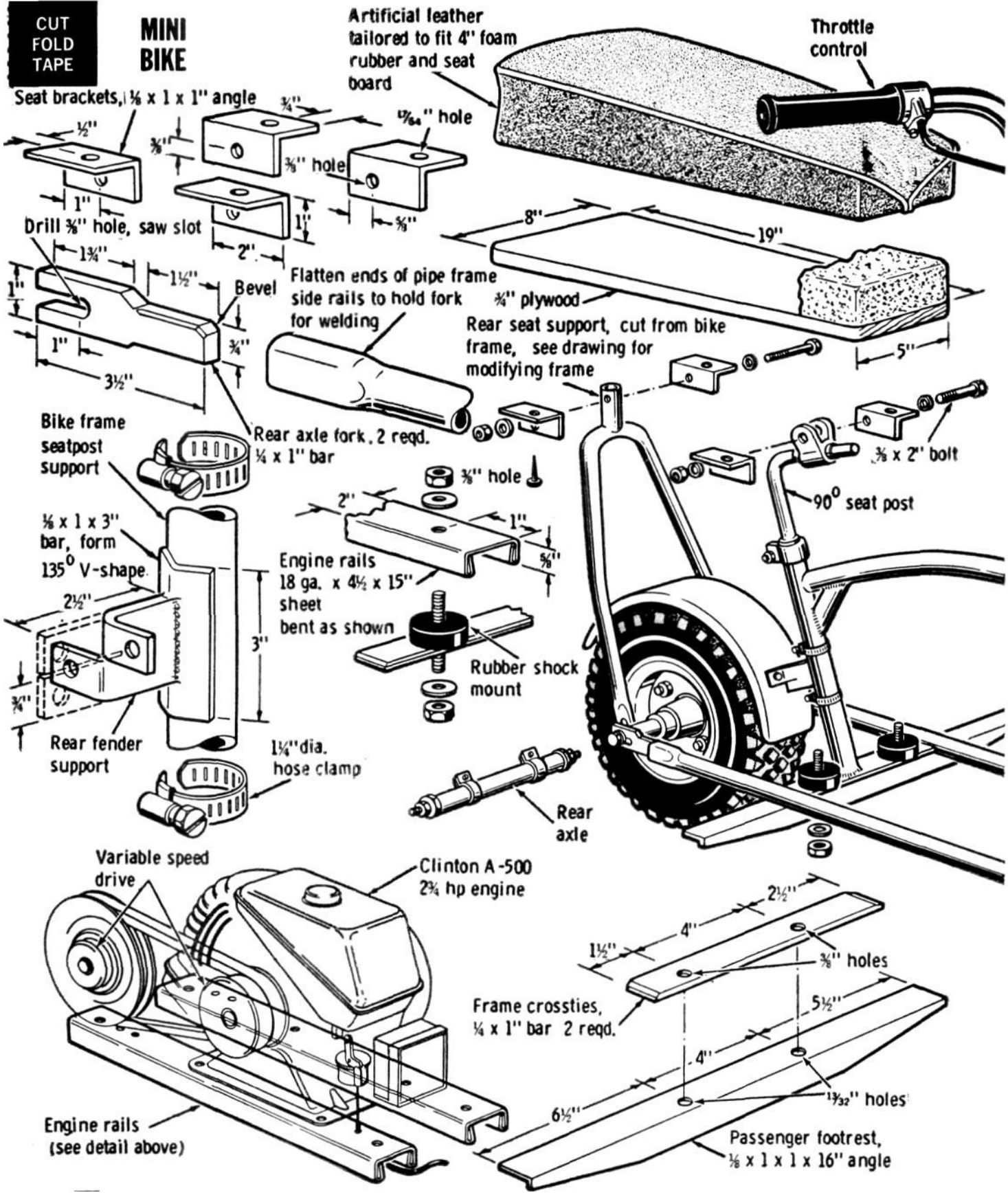
Remove the rear fork as shown, but don't throw it away. It becomes the rear support for the double seat. After bending the gooseneck forward, cut it and the seat post so they are both 12-1/2 in. long as measured from the top bar. Their ends should be spaced 14 in. apart.

The next step is to make the simple wood welding jig shown above. This holds all the parts in correct alignment and makes assembly easy. It's especially handy if you don't do your own welding since you can bundle the entire jig" off to a local welding shop and have all the parts set up and ready for a quick job.

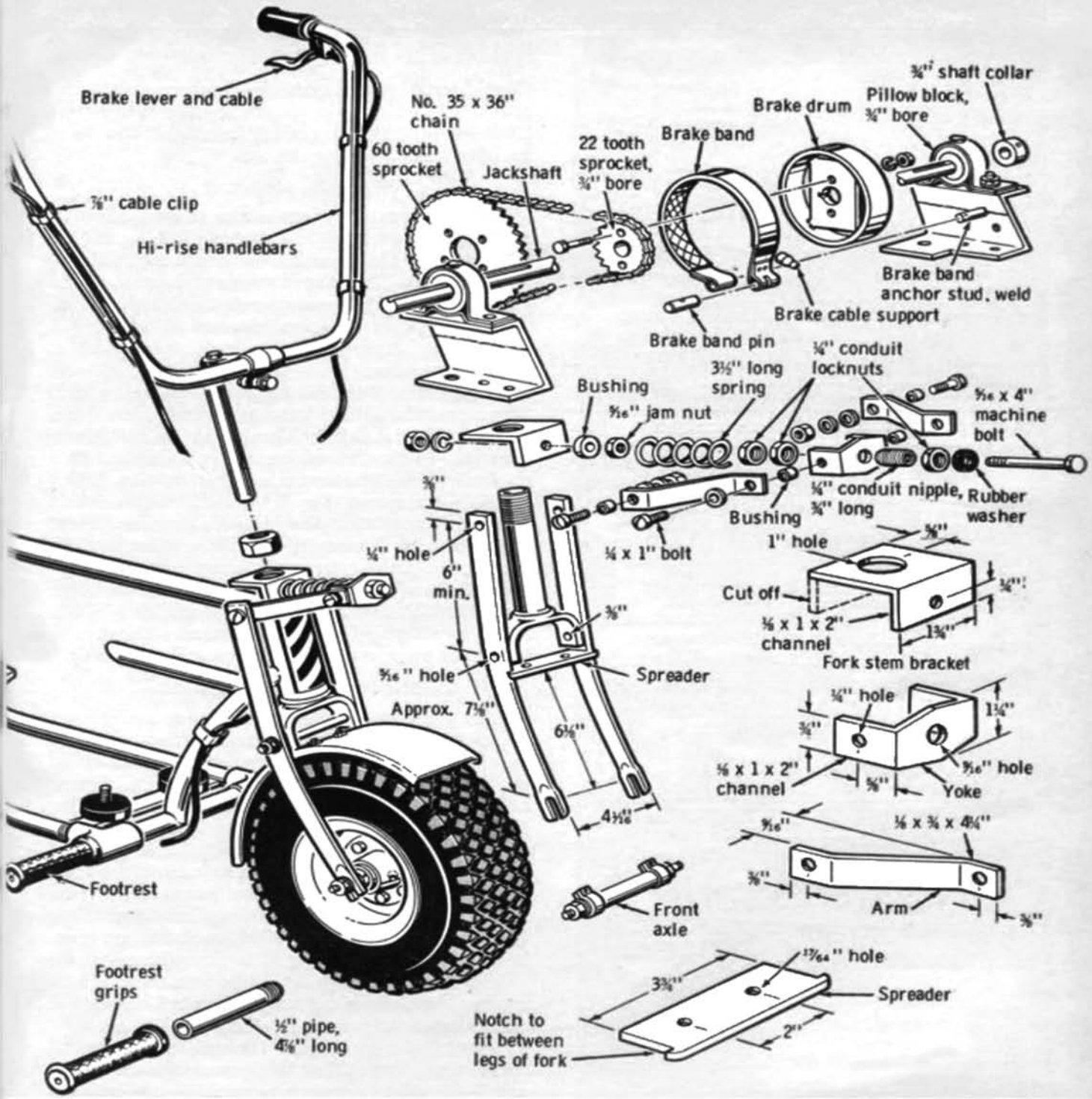
The lower part of the minibike's frame is made from 1/2-in. pipe. You'll need two 22-in. lengths for the side rails, each threaded on one end, one 6-3/4-in. length threaded on both ends for the front cross-bar, and two 4-7/8-in. lengths threaded on one end for the footrests. Cut the rear forks from 1/4x1-in. bar stock, flatten the ends of the pipe side rails, and insert the forks in the flattened ends.

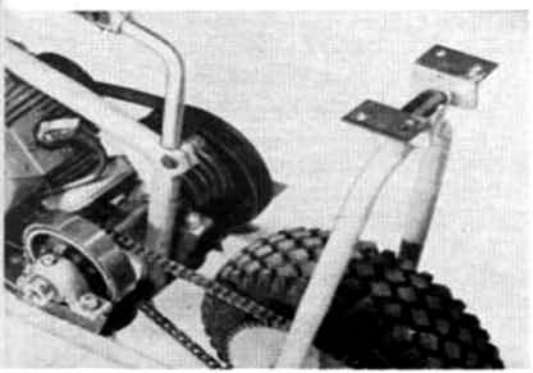
The spring-action front wheel is made by cutting the legs off a regular bike fork just below the post, leaving a stub fork. Bolt the legs to this stub fork as shown, with the spreader bar inserted between them. The upper ends of the legs, which now extend above the fork, are anchored to a spring that bears against a plate on the steering column. As the legs pivot on the fork, they compress the spring, giving the front wheel a soft, cushiony suspension.

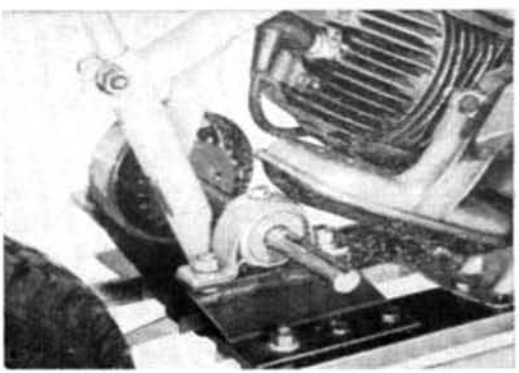
Fasten the front and rear forks to the blocks on the jig, and you are now ready for welding. Shape the crossties as shown for a close fit inside the side rails. For clean welds, remove the paint from all weld points. Tack-weld all joints to hold

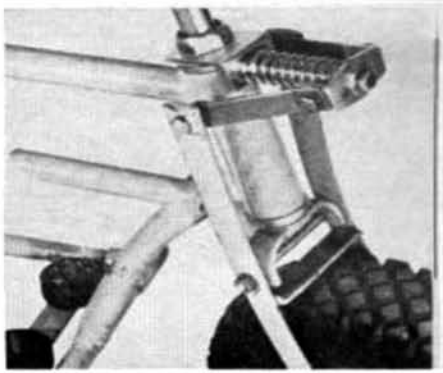


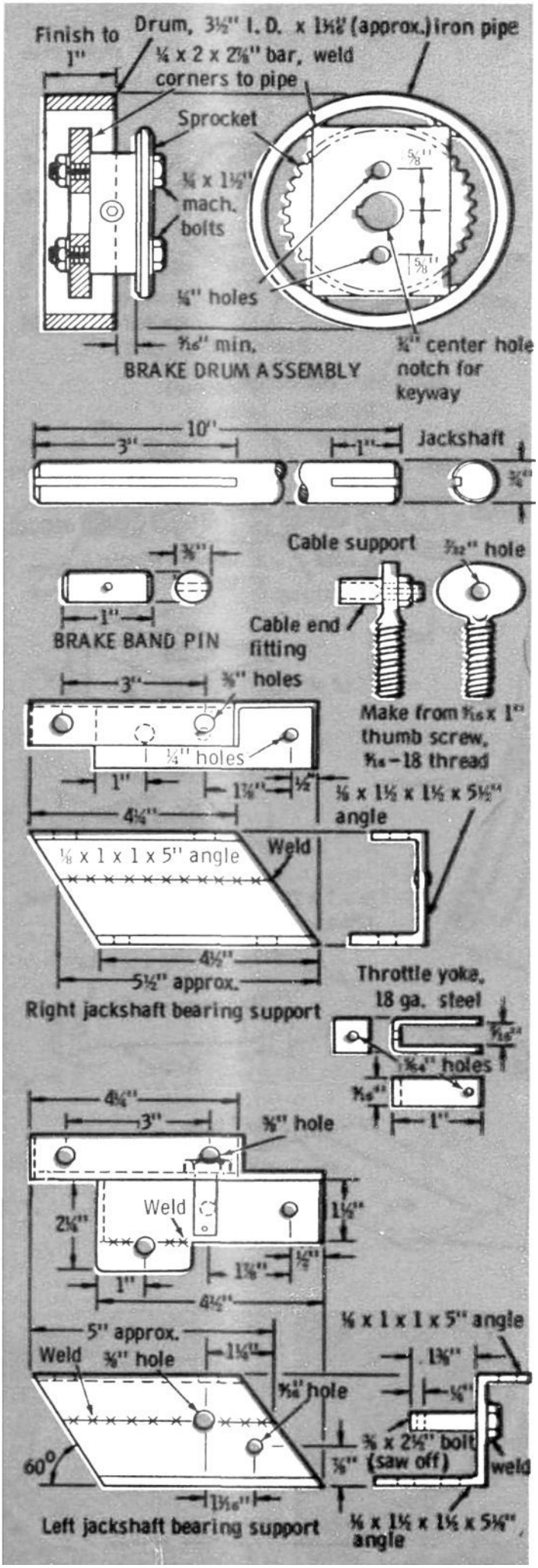
EXPLODED VIEWS above and across the page show the major parts in the mini-bike assembly. In the first two photos on the opposite page you can see how the jack-shaft is mounted behind the engine with the drive chain running from the small sprocket on the brake drum to a large sprocket on the rear wheel. A V-belt running from a centrifugal clutch on the engine shaft to a spring-loaded split pulley on the jackshaft provides a self-adjusting variable-ratio drive. The photo at far right shows how the original front-wheel fork is altered to improve the suspension. The upper ends of the pivoted fork legs bear against a spring on the steering column. As the wheel rocks back and forth, it compresses the spring, cushioning road shocks


Brake lever and cable
⅜" cable clip
Hi-rise handlebars
No. 35 x 36" chain
60 tooth sprocket
Jackshaft
22 tooth sprocket, ⅜" bore
Brake band
Brake drum
Pillow block, ⅜" bore
¾" shaft collar
Brake band anchor stud, weld
Brake cable support
Brake band pin
¼" conduit locknuts
3½" long spring
Bushing
⅜" jam nut
⅜ x 4" machine bolt
¼" conduit nipple, ¾" long
Rubber washer
Bushing
¼ x 1" bolt
¼" hole
6" min.
⅜"
⅜" hole
Spreader
Approx. 7⅛"
6½"
4⅛"
1" hole
Cut off
⅛ x 1 x 2" channel
1⅜"
Fork stem bracket
¼" hole
1¼"
⅛ x 1 x 2" channel
⅜" hole
Yoke
⅛ x ¾ x 4¼"
Arm
Footrest
Front axle
Footrest grips
½" pipe, 4⅛" long
13/64" hole
3⅜"
Spreader
2"
Notch to fit between legs of fork









the assembly rigid, then remove the frame from the jig to complete the welding. Tack-weld the threaded joints at the tees to prevent their twisting.

Wheels and axles

Recommended wheels are the pneumatic kart type 4.10/3.50x5 in. (11-1/2 in. in diameter). You could also use 4.10/3.50x4-in. wheels. The front wheel has a 4-in. centered hub. The rear wheel should be of the type that has an extended hub and mounting flange on one side to attach a drive sprocket.

The axles are 3/4-in. cold-rolled steel. The front is 5-13/16 in. long overall, and the rear is9-3/4in. long. The ends on both are turned down for a length of 7/8 in. and threaded 3/8-24 for mounting in the forks with 3/8 in. nuts. Use 3/4-in.-diameter shaft collars to position the wheels on the axles. (For convenience, if you'd prefer not to make the axles yourself, they can be purchased ready to install from Gilliom Mfg. Co., 1109 N. 2nd St., St. Charles, Mo. 63301. Also available from Gilliom are the parts for the spring-action front-wheel fork.)

Engine and jackshaft

The engine-support rails are formed from 18-gauge sheet metal as shown. Any furnace or airconditioing sheet-metal shop can bend these up for you. Drill 3/8-in. holes at the ends of the rails to match the holes in the crossties. Do this *after* the frame has been welded to insure precise positioning. The rails are mounted on 3/4-in.-thick rubber pads that serve as shock mounts to cushion engine vibration. You can purchase commercial mounts or run headless bolts through thick rubber pads.

The two jackshaft supports are each made from one piece of 1/8x1x1-in. steel angle and one piece of 1/8x1-1/2x1-1/2-in. angle welded together as shown in the detail drawings. Note that the two sizes of angle are joined to form a channel for the right-hand support and to form a Z-shape for the left-hand support. The Z-shaped left support also requires a 1/8x3/4-in.-wide extension welded to the base. A 3/8-in. bolt welded into the support forms a stud to anchor the brake band. A cotter pin and washer hold the brake band on the stud.

The two jackshaft supports are positioned flush with the rear ends of the

engine rails. The rearmost holes in their flanges fit over the same shock-mount bolts that hold the engine rails to the crossties. The remaining holes are for short bolts directly through the rails.

The jackshaft is held in two 3/4-in.-bore pillow blocks bolted to the supports. Make the shaft from 3/4-in. cold-rolled steel rod with 3/16-in. milled keyways as shown. Mounted on the shaft between the two pillow blocks is a combined brake drum and drive sprocket assembly. The drum itself is merely a narrow ring sliced from a piece of 3-1/2-in. iron pipe. A rectangular metal plate is welded inside the ring to form a hub.

Drill the 3/4-in. shaft hole in the hub only after welding to be sure of accurate centering. If a metal lathe is available, it's a good idea to chuck the shaft with the drum on it and turn the rim true. This is not a must, however, as exact roundness is not critical in this type of brake drum.

The 22-tooth sprocket is bolted to the hub of the brake drum with two 1/4-in. bolts. Lock the drum-sprocket assembly to the jackshaft with a3/16x3/16x1-in.steel key. Align the sprocket with the 60-tooth sprocket on the rear wheel and tighten the setscrew. With the jackshaft installed, temporarily set the engine in place to be sure there's adequate clearance. If there's any problem, the sheet-metal part of the muffler can be trimmed back slightly.

While you can make your own brake band, it's simpler to purchase a commercial band made for the purpose. A band like the one shown can be obtained from Automatic Steel Products Co., 1201 Cowden Ave. S. W., Canton, Ohio (part No. 4557).

One end loop on the band slips over the anchor stud on the left jackshaft support. A standard bicycle hand-brake cable is attached to the other end loop. Notch the loop as shown, insert a cross pin with a hole in the middle, and run the brake cable through the notch and the pin. A cable stop can be adjusted to lock the cable at the desired tension.

An anchor for the brake-cable sleeve is made from a thumb screw and mounted on the left jackshaft support. The cable runs to a bicycle hand brake on the handlebars. When the hand lever is squeezed, the cable pulls the brake band tightly around the brake drum.

Engine and transmission

The drive is by V-belt from the engine to the jackshaft and by No. 35 roller chain from the jackshaft sprocket to the rear-wheel sprocket. The engine used here is a2-3/4-hpClinton Model A-500 with clockwise rotation. The clockwise rotation is important and is available on order, but be sure to ask for it specifically.

The variable-speed drive consists of a pair of split-sheave V-belt pulleys, one on the engine shaft and one on the jackshaft. As engine speed increases, the centrifugally operated drive pulley forces the belt out toward the rim, increasing the pulley's effective diameter. At the same time, the belt is forced closer to the hub between the spring-loaded halves of the pulley on the jackshaft. This lowers the drive ratio and increases the scooter's speed. When the scooter slows down under a load, as in climbing a hill, the reverse occurs. The belt drops to the hub on the engine pulley and rides up the rim on the jackshaft pulley. This automatically increases the drive ratio to provide greater torque.

The drive specified here is made by the V-Plex Clutch Corp., Hagerstown, Ind. (part No. 66-535). It gives a low-gear ratio of about 8.5 to 1 and a high-gear ratio of 4.3 to 1. This produces a top speed of about 32 mph at 3.800 rpm. Alternate drive ratios can be obtained by changing the sprockets.

Engine speed is controlled with a motorcycle-type twist-grip throttle. These are available to fit on standard 7/8-in handlebars. The A-500's throttle linkage has a built-in spring return to the idle position. On engines not having this feature, it is necessary to install a separate return spring to pull the cable back when you let go of the twist-grip.

Final details

A two-passenger seat can be made as shown, or you can purchase a long "banana" seat from a bike shop. The rear support is made from the rear fork originally cut off the bike frame. A 90° seat post, a stock bike item, is needed to move the front seat support farther forward. High-rise handlebars, another standard bike accessory, complete the job.

If you're planning to fit out the scooter for road use, check with your local license bureau to see what extras are required by law. Fenders are optional, but are advisable for road travel. (In addition to the items already noted, the Gilliom Mfg. Co. can supply fenders, engine rails, engine shock mounts, twist-grip thottle, jackshaft, axles and a combined brake-drum-sprocket assembly—all designed to fit the PM minibike. Mail-order houses like Sears and Wards are sources for engines, -wheels, sprockets, clutches, bearings, belts and chains. Kart-supply centers and motorcycle shops can also provide many of the items listed. * * *