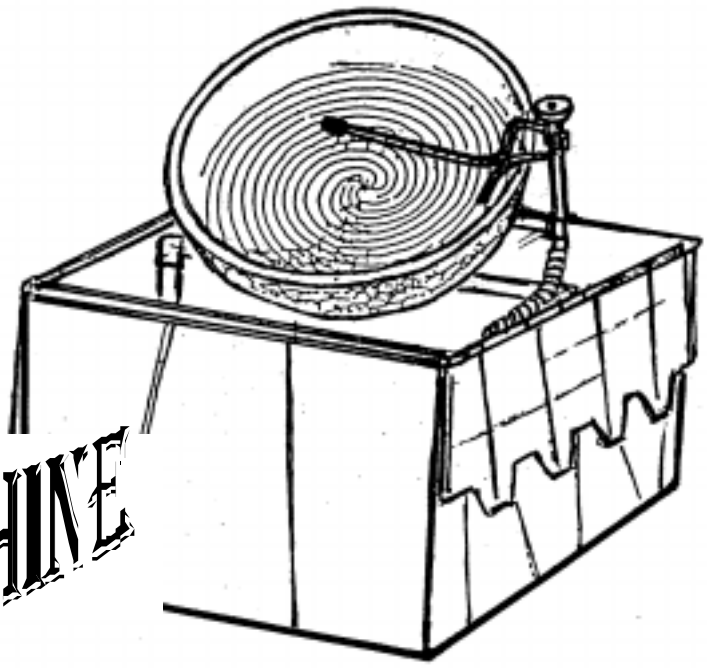
BUILD YOUR OWN SPIRAL PANNING MACHINE



This article appeared a few years ago in GOLD PROSPECTOR MAGAZINE AND POPULAR MINING MAGAZINE

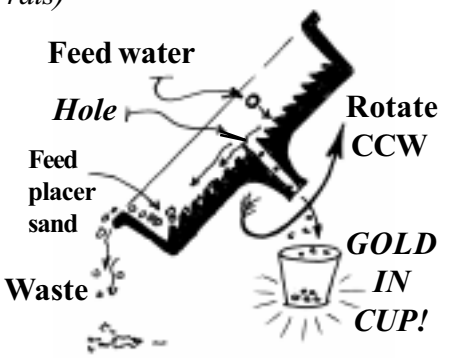
By special arrangement with *Camel Mining Products,* You can now build your own Spiral Panning Machine based on the famous Camel 7 spiral wheel!

There have been many articles on how to build sluices, rocker boxes and dry washers... *This* article is about Spiral Panning Machines! Spiral Panners have been around for a long time. They use water, motion and gravity to separate gold or other heavies from sand or gravel. The machine we are going to describe here is based on the *Camel Mining Products* spiral wheel which is a proven design with an efficiency record unparalleled in the gold mining industry... We will describe a wet type spiral gold separator in this article. Now you can build your own!

The typical panning machine is composed of four basic systems, The ***wheel,*** the ***motor drive and frame,*** the ***spraybar and feed pump*** and the ***water recycling system.*** The wheel should have multiple spirals so that the gold is picked up and carried up the face several times per revolution. There must be enough capacity in the lower section to work material and it should be large enough to have a riffle board effect for cleaning the gold. The gold delivered to the center of the wheel will fall through to a catch cup on the back. Due to the complexity of the design and equipment needed to make a wheel it is the only component that the home craftsman can not make in his home workshop. *Camel Mining Products* offers several different wheels for sale and you can build the rest of the machine. The motor and frame assembly simply holds and rotates the wheel. ***For safety reasons it should be 12 volt D.C. powered,*** and in this author's opinion it should be portable. The water system is composed of a pump, feed hose, spraybar assembly and water recycling system.

Let's take a look at what is actually required in each component and once you understand how each component is used and how it works you will be better equipped to build your own machine. We will base this machine on a *Camel Mining Products* 16.5" diameter white wheel. It has 7 spiral riffles which start at the wall and end at the hole in the middle. The hole in the middle is a 7/8" O.D. aluminum tube a couple inches long. This tube will mate with a tube on the drive unit and the gold or heavy concentrates from the wheel will pass through these tubes and catch in a cup on the back of the drive unit. The riffles are roughly 3/8" in height and about 5/8" wide. They have a straight 90° face and a sloped face on the other side. They act just like the riffles in a sluice, the gold being trapped behind the 90° face while the other material is washed away. That is where the similarity to a sluice ends! The wheel rotates and the gold is carried upwards by the lifting action of the spirals. *(On a sluice, you*

always have to stop and clean the gold out or it overloads and you start losing values) The more riffles you have on a wheel the faster it can process material. Unlike sluices, *Camel brand* wheels are able to take the gold out of the sand clean. *(Some other manufacturer's wheels are not separators or have less than 7 spirals)*



How the wheel works!

In this article we are only discussing building a machine with at least 7 spirals and which has a center hole which goes all the way through the wheel. An active water spray system is also necessary for accurate separation.

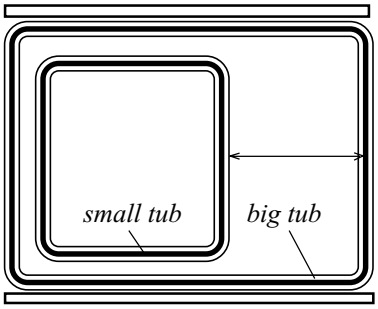
The drive system is basically an electric motor and frame arrangement to rotate the wheel and allow positioning of the wheel. The drive mechanism can use belts, gears or chains to connect drive tube to motor. I recommend plastic gears because they waste the least power and give the least trouble. Chain drives are very acceptable but are expensive compared to gears. Belts are the last choice simply because they must be run tight and so put a higher load on the motor and bearings. The drive unit and its components will be detailed later on. 1/2" PVC plastic pipe and fittings will make an excellent low cost frame.

The water system is based on a 12 Volt D.C. marine bilge pump and the spray bar assembly is built up from plumbing shop items.. Water recovery is accomplished via a tub in which the whole machine sits. Portability and water economy are considerations when selecting an appropriate water reservoir. You can use just about any kind of a tub to catch the water but items like the folding top storage box shown in the picture have the added advantage of also being suitable storage cases for the machine as well. If you use the machine in the field and if you have to carry water with you then you should give water reservoir size and type some serious consideration.

The wheel is adjustable and can be tilted back to about 45°. It rotates Counter-Clockwise at from 15 to 35 RPM. The drive unit in this design is variable speed. The most efficient speed is determined by running the placer sand and adjusting the wheel speed, wheel angle and water volume for best gold recovery. Let's get started building this machine! You will need some basic hand tools, a small adjustable wrench, pliers, screwdriver, hacksaw, file, sandpaper, electric drill & bits and soldering iron & solder. A few other supplies you may need include instant glue and/or epoxy *(J B Weld or similar brand is fine)*.

WATER RECYCLING SYSTEM

We shall start with the water recycling system. This is because the frame and all components should store inside of the water tank when you are not using the machine and also because you need to know what the size and shape of the tank is before you start building the frame. I suggest the folding top storage boxes similar to the illustration as an ideal starting point. These boxes are molded plastic and usually available from hardware and department stores for $10.00 or less. There are other types with removable lids and some with single sided hinged lids. *When you put 4 or 5 gallons of water in the box the water should be at least 3 inches deep.* The box should be water tight on the bottom, should be light weight and should be large enough to house all the components of the machine but not so large as to require a water truck to fill it. You should be able to find a box or tub that will fit this bill.



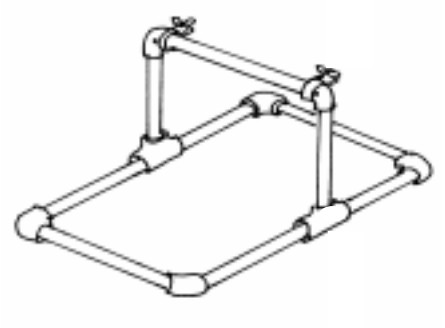
The small tub is at least 6" shorter and not as wide as the big tub... If the big tub is 14" wide and 22" long the little tub should not be larger than 12" x 16". Big tub should be 12" deep, small one 6" deep.

Find a smaller tub that is at least 5 inches deep that will fit inside of the storage box and allow at least 6" clearance on the long direction and 3" or 4" clearance on the short direction. This smaller tub will be used to catch the tailings from the machine. .

BUILDING THE FRAME

The frame must fit inside of the water recycling system. If you selected the storage box then build the frame to fit inside of the box.

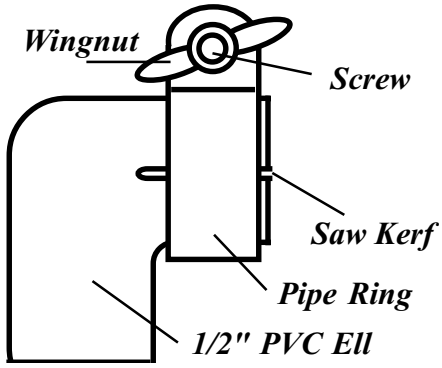
I suggest that you use 1/2" PVC thick wall water pipe because it is inexpensive and available everywhere. You will need one 10' stick of pipe, 6 ells and 2 tees, you will also need 2 pipe straps like those pictured in the frame illustration and you will need 2 1/4-20 x 1" bolts and wingnuts..



Frame made of PVC pipe

Build a frame to fit inside of the bottom of your box similar to the illustration shown here.

The uprights should be about 1/2" shorter than the inside dimension of the box. It should not be necessary to glue the joints of the frame as most PVC fittings are pretty snug if you push them all the way onto the pipe. Sand the ends of the crossbar so that it will rotate freely in the split ells when the wingnuts are loosened. Saw a slot in those Ells so that they can be closed with a pipe strap or hose clamp, see illustration.

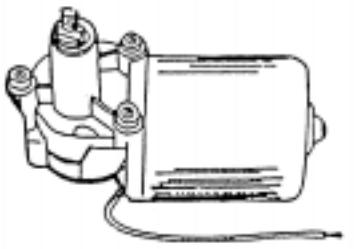


Modified Ell adjuster, 2 required.

If you use a pipe ring like the one pictured you can use a 1/4-20 bolt and wingnut to make an easy to use no tools required adjuster... Can't find a pipe ring? A hose clamp can also be used but you will have to carry a screwdriver to adjust your pitch. The two holes to mount the drive unit will be drilled later when the drive unit is fitted to the frame. See illustrations.

BUILDING THE DRIVE UNIT

This drive unit is heavy duty and it is nearly identical to current production Spartan drive units. The drive unit is based on the compact and intermediate type Ford windshield wiper motor found on Ford and Mercury cars such as the Granada, Fairmont, Zephyr, Fairlane, and AMC automobiles such as the Hornet and Gremlin. These motors are all similar to the illustration and have a 5/16" fine thread shaft.

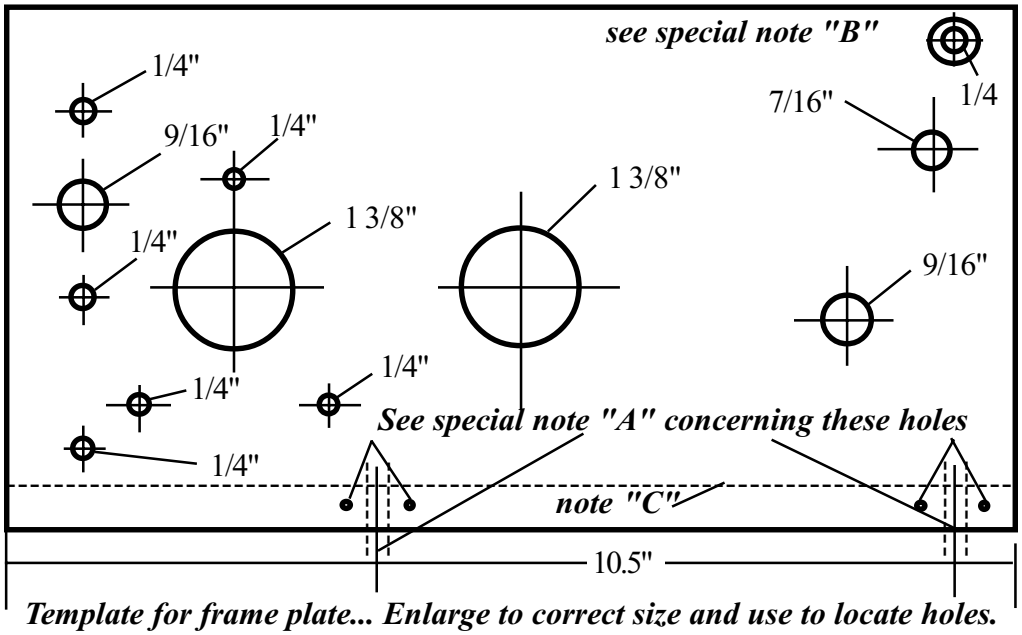


5/16" Shaft Ford Wiper Motor.

At most salvage yards you can buy a motor for under $20. *Be sure to clamp the crank arm in a vise when you remove the nut because a plastic gear inside of the motor can be damaged by the force required to remove the nut.* Save the spring wave and flat washers from under the crank you took off the motor, you will need these two parts but you can discard the crank and the nut you removed from the motor. The motor will have four wires coming outof the top. You will only use the white wire, cut the rest off flush with the rubber grommet on the motor, keep the wire scraps to wire the drive unit with.

Refer to the parts list for the drive unit and acquire those parts or materials... Some notes about material substitutions is in order. This drive unit is based on a plastic frame plate but if you have the equipment and ability it could be made from metal or fiberglass sheet. Use what you have if you understand what is expected of the part and how it is to be used in the machine. This design is similar to earlier *Camel* drive units and uses the same gears and bearing used in current production *Camels*.

If you are building your own frameplate you can take the frameplate template to a copy shop and have it enlarged to full size on a photocopier. The correct size is given on the template, enlarge until the measure line is correct as checked with a ruler. Most copy shops have a proportional calculator to determine the percentage of enlargement necessary to match the size correctly. If you are not using a gearbox cover on your machine then the size of the frameplate is not critical but the hole relationships between bearing and motor are and you still need to use that template. *I seriously recommend that you use the gearbox cover for safety reasons because the gear motor has a lot of torque and if you get a finger caught between the gears they will bite and they will draw blood!* The frameplate as shown is made of 1/4" ABS plastic. A strip about one inch wide is glued on the back side at the bottom edge to be a stiffener and also to provide the extra width required for the two drive unit



Special Notes:

"A" *Drill two 3/32" holes at each location and re-inforce doubler with two #8 sheet metal screws..Drill two #7 holes (.201") from bottom, tap these 1/4-20.*

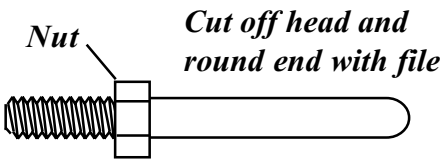
"B" *countersink for flathead screw on this side*

"C" *Dotted line denotes position of frameplate doubler on back side.*

Template for frame plate... Enlarge to correct size and use to locate holes.

mounting pins. (*Hint, some copy shops have self adhesive label stock that they can copy your template on... You just peel and stick the template to the blank!)* After you finish the holes you can remove the template from the blank and you are ready to build your drive unit. Note that there is a pair of holes drilled from the bottom edge into the frameplate between the stiffener and the frameplate. Before you drill these two holes you must install a screw on either side to reinforce the glue joint. Take care to drill the holes for the two mounting pins as parallel as possible. If the pins are not parallel it is very difficult to mount the unit. The two mounting pin holes will be drilled #7 and tapped 1/4-20. *(see detail "A")*

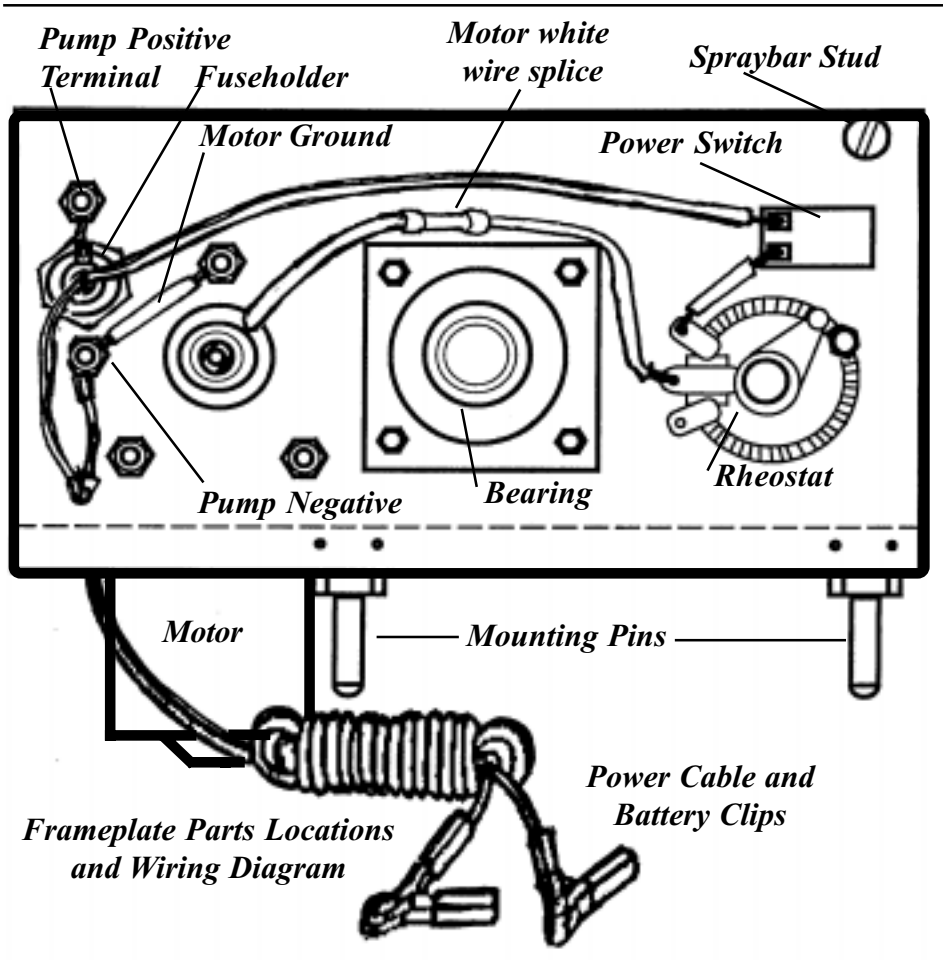
Cut the heads off a couple of 2.5" or so standard 1/4-20 bolts and grind or file the edges smooth.



Mounting Pin, 2 required, make from 1/4-20 bolts...

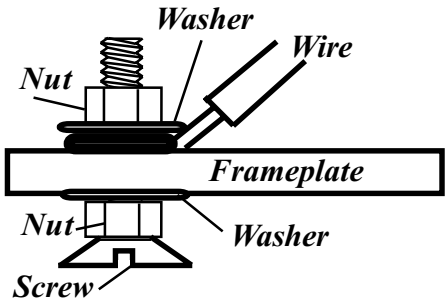
Run a nut to the end of the threads on each of the two pins and screw them into the two holes on the bottom edge of the frameplate.

Mount the motor on the frameplate with three 1/4-20 bolts as shown. Use an equal number of flat washers on each bolt between motor and frame plate to achieve a 1/2" standoff. Place a short wire (4" pigtail) under the head of the top motor bolt. This wire will be the electrical ground for the motor. Tighten the motor bolts. Install the rheostat, power switch and fuseholder at this time.



Frameplate Parts Locations and Wiring Diagram

Begin wiring the Frameplate by inserting the end of your power cord through the hole at the right lower side of the motor *(from back side)*. Split the two insulated conductors about 4" from the end and tie a simple knot. One side of the power cord should be identified with either a paint stripe or small ridges. Strip 1/2" of insulation from that wire and push it through the hole in the fuseholder. Put a 12" pigtail wire through the hole with the power wire and solder both together to the fuseholder. Solder the other end to one terminal of the power switch.



Pump Terminal Detail...

Place two 1/4-20 flat head screws with stop nuts in the holes on either side of the fuseholder. These will become the terminals where you clip the pump leads. Solder a short wire to the fuseholder tab and wrap it around the screw. Place a washer and nut on the screw and tighten. Place a 1/4" ring lug on the other wire of the power cord and put it over the other screw. The grounding wire from the motor also goes under this terminal. Install washer and nut and tighten.

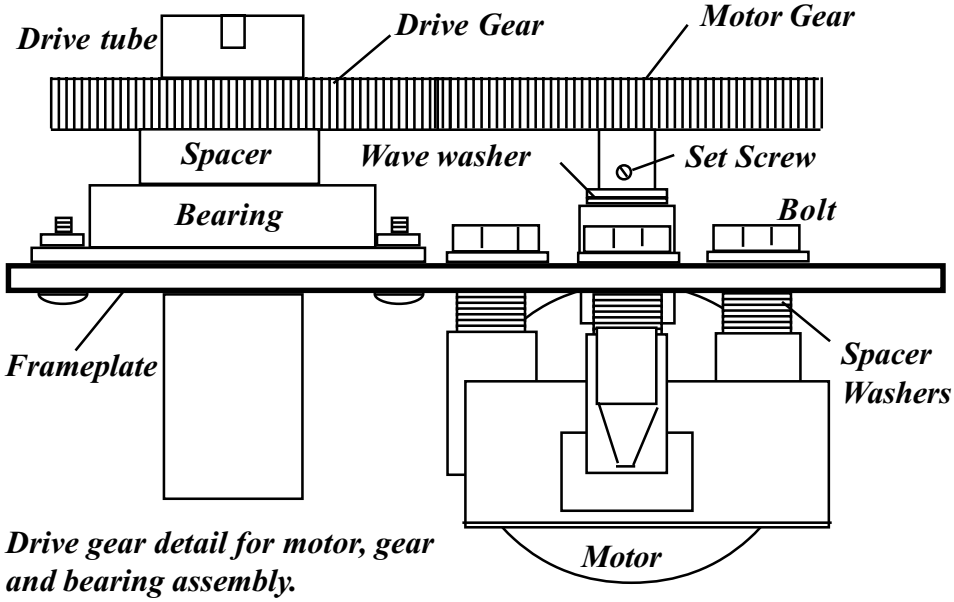
Splice a wire onto the white wire from the motor if it is not long enough to reach the center terminal of the rheostat. Route this wire through the hole by the motor shaft and cut it to an appropriate length and connect it to the center lug of the rheostat. Note that this wire must be left long enough to clear the bearing when it is installed, refer to the location diagram for more information. Solder this connection. The final wiring connection is to connect the power switch to the rheostat. *(The remaining Rheostat terminal is not used.)* Install the power clips on the power cord... The red clip goes on the striped or ridged wire, black on the other. While your soldering iron is still hot, put clips on the wires to the pump. Put a drop or two of red paint on the clip on the brown wire and paint the top of the head of the top screw terminal above the fuseholder red.

Place the wave and flat washers on the motor shaft and screw the gear onto the motor shaft as far as it will go. The gear must compress the spring wave washer at least 75% but not 100%. Adjust gear position and then tighten locking setscrew on the threaded adaptor of the gear. If your motor makes a motorboating or machine gun like sound when it is running then this wave washer is too loose. If it is too tight the motor may seize or draw too much current. A drop or two of motor oil on these washers is a good idea.

Place the bearing over the hole and put the drive tube into the bearing. You must center the drive tube in the hole of the frame plate and hold that position. The gears should be meshed but not loose nor binding. Drill one 1/8" hole through the bearing and frame plate. Put a screw and nut on this and snug it down but do not over tighten it. Check to make sure the gear to gear contact is correct before drilling the other screw holes in the bearing and frameplate. Secure it when it is right. The next step here is to set the gear height. Cut a small piece of 3/4" PVC pipe or similar material and place it between the gear and bearing to achieve an exact gear to bearing height match. The bearing tube will be glued in after the gearbox cover is fitted.

The gear tube and motor on

The gears must mesh and be flush when the unit is assembled. Cut the spacer under the drive tube gear to fit on assembly.



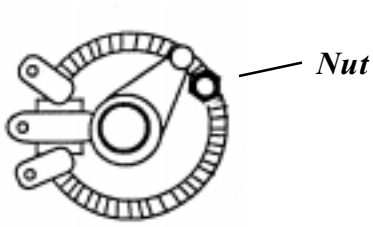
Drive gear detail for motor, gear and bearing assembly.

the drive unit must now be checked. Hook the battery cables to a 12 volt battery, red clip to positive. When you turn the power switch on the motor should run. Looking at the drive tube gear it should be turning counterclockwise. If it is not, double check your wiring. If the motor is not running turn the rheostat fully clockwise. If the wiring is correct and the motor is running backwards then the motor magnets are reversed.

To reverse the motor magnets remove the two 5/16" hex head screws from the end of the round black part of the motor. Be very careful not to pull the magnet housing off because it is very difficult to reassemble. Carefully rotate the magnet housing 180° and then reinstall the screws. Do not overtighten these screws, they are aluminum and are easy to break.

While the motor is running, adjust the rheostat knob counterclockwise until the motor is timed at about 15 RPM.. *(count revolutions and time with second hand on a clock or watch)..*

Epoxy a small nut on the Rheostat as shown. Locate the position by timing the motor. Set at aproximately 15 RPM as slowest.



Using a small amount of epoxy, glue a small nut to the surface of the Rheostat to prevent it being turned beyond the 15 RPM mark. Be very careful not to get any epoxy on the rheostat wiper and set the drive unit aside until the epoxy sets.

Remove the drive tube from the bearing and push it into the bearing from the back side. Fit the cover over the drive unit and then adjust the drive tube until it touches the inside of the cover. Using a long pencil, mark the inside of the cover through the drive tube. This is where the hole must be cut in the cover. It must be at least 1 3/8" in diameter and there must be at least 3/16" clearance all around the drive tube when the cover is installed. The hole can be enlarged if necessary.

Put the drive tube back into the correct side of the bearing. Double check all clearances and fits. If you are satisfied, mix a little epoxy and glue the drive tube into the bearing. You need a good glue contact but don't over do it! Put the drive unit aside while the epoxy sets.

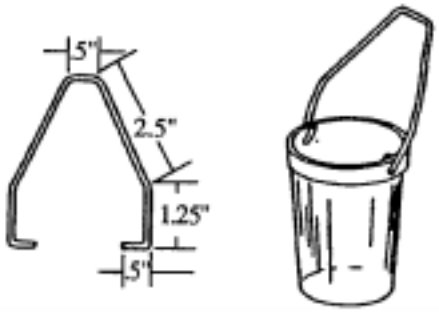
Install a 1" long flathead 1/4-20 screw through the hole above the switch. Put a nut on the outside of the plate and tighten. This will be the mounting stud for the spraybar.

Place the cover on the drive unit and drill two 1/16" holes, one in each top corner of the cover and through the frameplate. Remove the cover and drill the holes in the cover out to about 1/8". Put the cover back in place and attach it with two short #6 sheet metal screws. Repeat the procedure on the bottom edge of the drive unit between the mounting pins.

Mount a small cup hook above the drive tube on the back side of the drive unit. Install the knob on the rheostat. The drive unit is finished.

Make a gold catch cup from 3/32" wire and a small plastic cup. Bend the wires upward after assembly to keep the bail in the cup.

The drive unit is to be mounted with the bearing tube centered above the frame rail. Hold the drive unit above the frame rail with the bearing tube centered between the two adjuster elbows. Locate the positions of the pin holes and drill them 1/4". Insert the drive unit into the two holes just drilled. Lean the drive unit back at a 45° angle and tighten the adjuster wingnuts finger tight.



Catch Cup Detail...

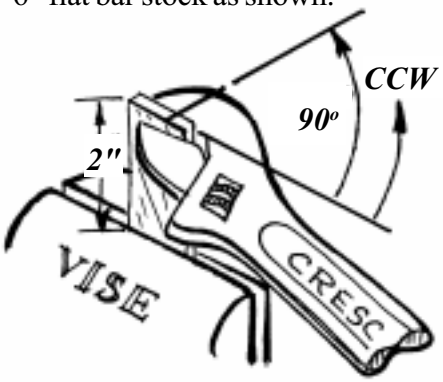
Insert the tube on the back side of your wheel into the hole of the drive tube and rotate the wheel while gently pushing down until the drive pin mates with the notch in the drive tube.

BUILDING THE SPRAYBAR

The spraybar is made of refrigeration grade 3/8" copper tubing. Start with a piece 18" long which you must make as straight as possible. Make file marks 3" from each end and then use a center punch to mark the spray hole locations on 3/8 inch centers starting 3/4 inch back from one of the file marks. DO NOT DRILL THESE HOLES UNTIL AFTER

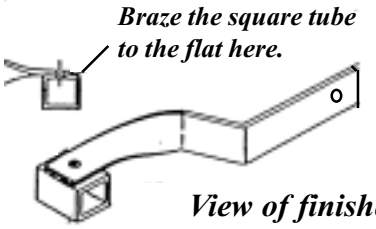
THE TUBE IS BENT. The drawing shows the finished spraybar tube. If you do not have professional tube bending equipment, we suggest you try the following technique: Since the finished tube is 12" long you will have 3 inches of waste at each end. Close one end by flattening 1" and folding it over tightly. Now fill the tube with fine sand and pack it tightly. *(You must have about 1/2" of empty tube at the top end)* Now flatten and fold the top end and fold it over making sure that the tube is completely full of sand. Next, bend the tube over a pipe or round bar about 1" in diameter to the measurements shown in the drawing making sure the line of hole marks ends up on the bottom. Now cut off the straight end of the tube, *(leave the scrap part on the bent end at this time)* shake out the sand and the tube is ready to drill. Drill all spray holes with a #47 drill.

The spraybar support is made by twisting and bending the 1/8" x 3/4" x 6" flat bar stock as shown.

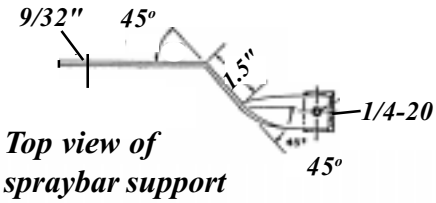


Twist the support strap 90°

Drill a 9/32" hole .5" from the straight end. Braze or weld the 1" piece of 3/4" square tubing to the strap as shown in Detail A shown. Drill a No.7 hole as shown and tap 1/4-20 threads. (The short 1/4-20 bolt goes here to hold standpipe). De-burr and rusturoof paint this finished spraybar support.

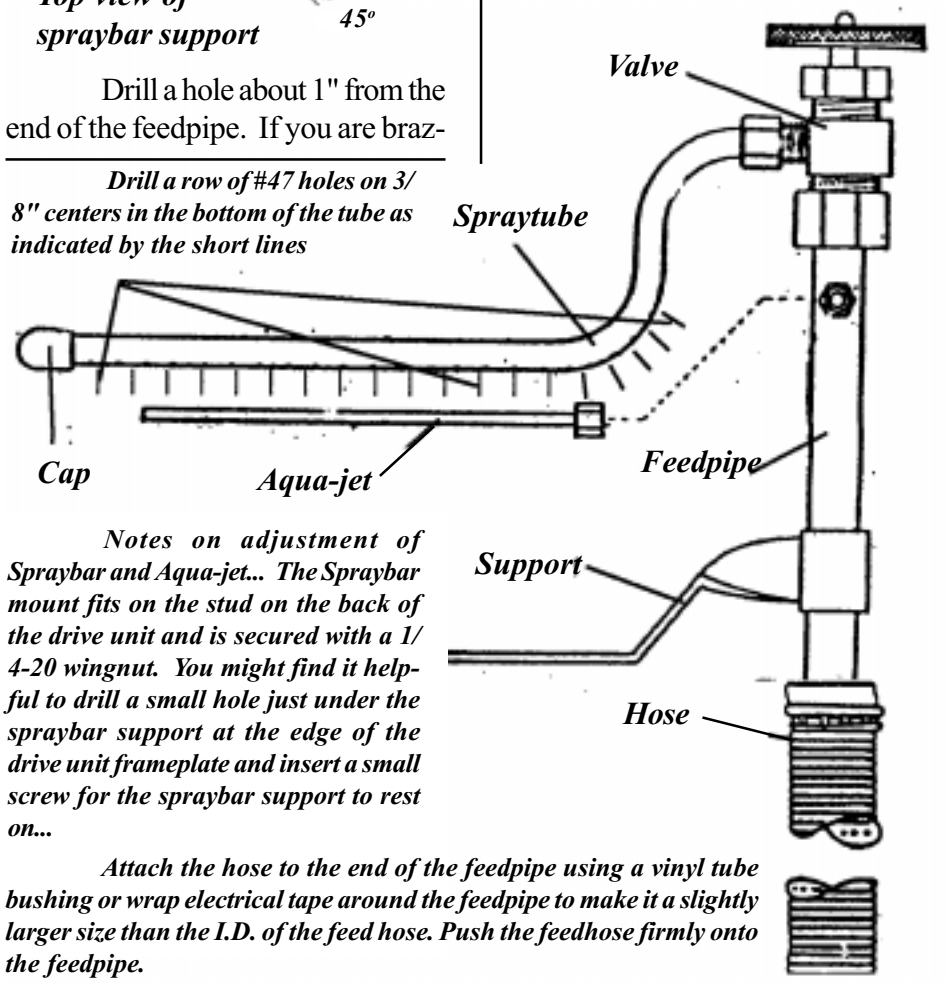


View of finished Spraybar Support



Top view of spraybar support

Drill a hole about 1" from the end of the feedpipe. If you are brazing the aqua-jet in place this hole is 3/16" dia. If you are using the pipe - compression fitting the hole is Letter Drill "R" and is tapped 1/8 NPT. Assemble your spraybar per drawng below. Note that the aqua-jet is turned 90° CCW from the spraybar on assembly as seen from the top of the valve looking down. Notes under the spraybar drawing detail spraybar assembly... *Your machine is finished!*

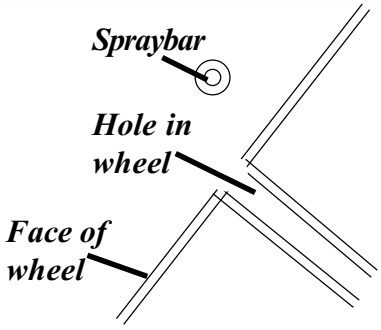


Notes on adjustment of Spraybar and Aqua-jet... The Spraybar mount fits on the stud on the back of the drive unit and is secured with a 1/4-20 wingnut. You might find it helpful to drill a small hole just under the spraybar support at the edge of the drive unit frameplate and insert a small screw for the spraybar support to rest on...

Attach the hose to the end of the feedpipe using a vinyl tube bushing or wrap electrical tape around the feedpipe to make it a slightly larger size than the I.D. of the feed hose. Push the feedhose firmly onto the feedpipe.

The pump pushes onto the other end of the feed hose. Tape may also be necessary on the pump.

The Spraytube should be approximately one inch above the surface of the wheel and one inch above the hole in the middle... See sketch at right. The Aqua-jet points into the wall of the wheel at approximately 4:00 o'clock. Cut the spraybar to length so that it just reaches over the edge of the wheel from the valve. Place a cap over the open end.



PARTS LIST FOR THE SPIRAL PANNING MACHINE

The following is an inclusive listing of all the basic parts and materials needed to build an operational machine. The parts marked with an "*" are only available from Camel Mining Products... all other parts may be obtained from other sources, such as hardware and electronics stores. The motor can be purchased at nearly any automotive salvage yard. Auto parts houses also have rebuilt wiper motors sometimes for as little as $40.00 each.

PARTS LIST

Quan.	Description
1	Base tub
1	Tailings Tub
1	Length PVC Pipe
6	1/2" PVC Elbows
2	1/2" PVC Tees
1	Frame blank, 3/8" ABS 10.5" x 6.5"
1	Formed gear cover*
1	16.5" spiral wheel*
1	Waterfeed hose
1	Motor gear*
1	Drive tube gear*
1	3/8" tube cap
1	small plastic cup
1	Flanged Bearing
2	3/4" pipe ring
1	3/32"x 9" wire bail
1	3/8"x 1/2" stop cock
1	strap 1" x 1 1/8" x 5.5"
1	sq tube 3/4" x 3/4" x1"
CopperParts	
1	pipe, 1/2"x 7"
1	tube, 3/8"x18"
1	tube, 3/16" x 7"
1	(1/8" pipe x 3/16 brass connector, optional)
Screws	
4	8-32 x 3/4" screw
1	1/4-20 x 1/2" bolt
5	1/4-20 x 1 1/4" bolt
2	1/4-20 x 2 1/2" bolt
3	1/4-20 x 1" FH screw
4	#6 x .5" sheet metal
4	#8 x .5" sheet metal
1	#8 x .75" sheet metal
1	small cup hook
Nuts	
5	8-32 nuts
7	1/4-20 nuts
3	1/4-20 wingnuts
Washers	
24	1/4 flat washer
Electrical parts	
1	Ford Wiper Motor
1	450 GPH pump
1	15 ohm 25 W Rheostat
1	Control Knob
1	Panel type fuseholder
1	3ACG 3 Ampere fuse
1	SPST Toggle Switch
1	Power Cord
1	Pair Battery clips
1	Pair alligator clips
1	Blue butt connector
1	1/4 x 14 GA solder lug
Miscellaneous	
1	Ladies nylon stocking

IMPORTANT NOTE: The list of threaded fasteners here is subject to changes. You may want substitute fasteners you have in your shop. Our "raw materials" kit will have sufficient fasteners to build a machine but may not be the same length and size as those in the parts list

CAMEL MINING PRODUCTS PARTS AND KIT SPECIALS....

The following list is components which are available from Camel Mining Products, Box 3179, Quartzsite, Az. 85346 and may be ordered by mail or by phone at 520-927-4009, Visa and MC accepted. include $5.00 S & H)

450 Gallon per hour pump	27.50
Power clips for pump	2.25
Gear set, one motor, one drive	20.00
Flange Bearing	10.00
Fuseholder with fuse	3.50
Toggle switch	4.50
Rheostat and Knob	21.00
Gearbox cover with screws	10.00
Frameplate, cut and drilled	15.00
Power cable with clips	6.25
Water feed hose	3.50
Finished spraybar support bracket	10.00
Finished spraybar tube	15.00
Finished spraybar feed pipe with aqua-jet brazed in	10.00
Pipe rings for adjuster rail, one pair with bolts & wingnuts	3.00

..... The following Kits each contain all parts necessary unless noted. Complete instruction set sent with every kit order!

Spraybar assembly kit with pump and hose	75.00
Spraybar assembly kit less pump	47.50
Drive unit kit with hardware, less motor.	55.00
White wheel assembly, factory finished	80.00

Master Craftsman's RAW MATERIALS Kit Special- - - - - - - - - - - - - - - - - - $165.00

(This Master Craftsman's Kit has everything you need to build an automatic panning machine described in this article EXCEPT pvc pipe and fittings for stand and tub-carrying case. Please understand that this is RAW MATERIALS KIT. The frameplate is blank for you to drill all holes.Copper tubing must be siver soldered and 3/8" tubing must be accurately bent and drilled. We suggest you order finished parts if you do not have a well equipped work shop).