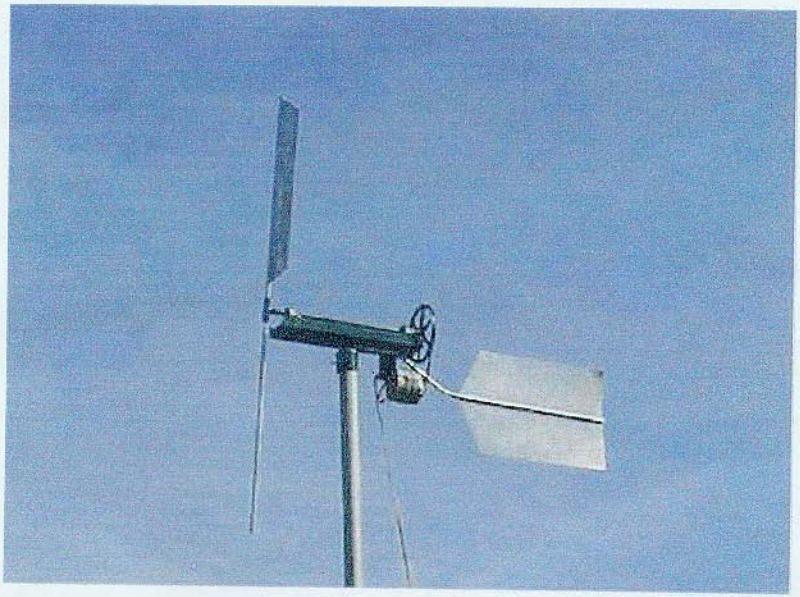
WindPower



Windpower

The *Windpower* wind generator was developed in the Mojave Desert of Southern California to take advantage of the high prevailing winds that cross the mountain ranges to enter the desert. It uses readily available parts found at most hardware stores. The power unit is a very popular automotive alternator found in most General Motors vehicles from the late 1960's to the late 1980's.

There are many good, efficient, lightweight wind generators available on the market today, but I have found them very expensive, and it is hard to find replacement parts. I wanted a dependable wind generator with parts I could build and repair and get immediately from the local hardware store and auto parts store.

The *Windpower* wind generator has evolved from trial and error and if built to the enclosed specifications, will perform surprisingly well, from a 10 mile per hour breeze, to a 60 mile per hour windstorm.

Windpower

The ***Windpower Generator is*** fabricated of steel and weighs approximately 45 pounds. The unit comes shipped in two boxes, some assembly required.

It is composed of a 24 inch long steel frame on which a 27 inch long, ¾ inch diameter shaft is mounted on pillow block bearings.

On one end of the shaft is attached the hub onto which two, 36 inch long blades are attached, creating a 6 foot diameter rotor with an area of over 240 square inches. The blades are made from galvanized steel tubing and 24 gauge galvanized sheet steel.

On the other end of the shaft is attached a 10 inch diameter pulley.

Below the frame and under the pulley is mounted a 12 volt, 60 amp General Motors automotive alternator. The alternator is connected to the pulley with a V-belt.

Behind the alternator and fastened to the frame is the rudder. It is made from a 48 inch long galvanized steel tube extending out behind the unit and to which a 18 inch by 27 inch galvanized steel sheet is attached.

The whole assembly is connected to a 2-1/2 inch mounting collar with a 1 inch bolt and a 1 inch tapered roller bearing. This collar is designed to slip over an installed 2-1/2 inch pipe cemented into the ground.

When mounted atop a 20 foot pole, and in a 20 mph breeze, the whole unit will immediately face into the wind, the rotor will turn at about 150 rpm and the alternator will produce about 500 watts.

Parts List
And Instructions

The ***Windpower*** wind generator unit is composed of seven major components.

They are described here and referred to in the drawings as:

1. Frame
2. Shaft and bearings
3. Top cap & spindle
4. 36" blades
5. Tail rudder
6. Hub assembly
7. Alternator unit

Frame

The frame should be built of heavy-duty steel material as described in the drawings, as it takes a lot of load during high winds. I built my units from 6" channel, but it could also be fabricated from similar dimensions of flat stock steel welded together.

Shaft and Bearings

This can be relatively light in construction. I used a 3/4" x 27" hollow steel shaft and pillow block bushings made for an evaporative cooler, which are very prevalent in this area of the desert. The drive pulley installed on the end should be either 8" or 10" in diameter. A smaller diameter will allow quicker starts in low breeze conditions. Also use the shaft collars and leather thrust washers used in evaporative coolers. If oiled twice a year, they will last for years.

Top Cap & Spindle

This is to be fabricated from 3" pipe by cutting a short 4" piece, welding a round 1/4" steel plate to the top that has a 1" hole drilled in the center. Drill and tap for a 3/8" bolt. This will allow you to mount the unit on top of a 2-1/2" pipe as indicated on the plans. You can substitute smaller pipe, but you may find the need to use guy wires on 2" pipe.

36" blades

This is much easier to make than you think. Cut two 36" pieces of 1/2" emt from a piece of conduit. Draw a straight line with a felt pen down each piece. Cut two 32" pieces of 24 gauge galvanized steel which you can get from roof flashing. Drill 9/64" holes every 2" from the end of the conduit and fasten with 1/8" aluminum pop rivets along the line you made with the felt pen. Make sure your rivet line is about 3/8" from the edge of the sheet metal. When you're done riveting, use a light body hammer, and work the leading edge around the conduit. Grind the outboard end of the conduit to match the edge of the sheet metal (45'), or it will whistle. (you may like whistle). Double-check both blades to make sure they are the same weight, length, etc. They will soon be rotating very fast.

Tail rudder
The tail rudder is made from bending a 48" piece of 1/2" emt as shown in the drawings, and attaching sheet metal as shown with 1/8" pop rivets. Then bolt the completed unit to the bottom back, of the frame assembly.

Hub assembly
The hub assembly requires the most precision in manufacture. It is made of 3/4" pipe. After drilling and tapping, grind and weld the two pieces together making sure they are assembled at an exact 90' angle. The 1/4" hole in the middle lets you visually see the inboard ends of the blade assemblies, and make precise adjustments.

Alternator Unit
The heart of this unit, the 12 volt DC charging unit, is a General Motors, automotive alternator, found on most General Motors vehicles, from the late 1960's to the late 1980's. It is undoubtably the most easy to find, prevalent, and most reliable 12 volt DC charging unit in the world today. It uses a built in regulator which means it requires only a two wire hookup, 12vdc + and 12vdc -. Bond the negative cable to the alternator body and run the cable in a loop [as shown in the drawings to allow for movement.] Mount the unit by applying a light tack weld from the swivel bracket on the alternator to the flat stock on the frame. This will allow the alternator to use gravity to hang and its own weight to keep belt tension right, which should be very loose to allow startup in low breeze situations. The pulley on the main shaft is changeable, depending on conditions and preferences. Size the belt by using 1/4" rope, and wrapping around the pulley. Measure, and mark the rope, and get a belt that size from your auto parts store.

This unit will perform as good or better than most commercial units if a little care is observed in the manufacture. Make sure all your rivets are installed nice and tight on the blades. All setscrews on the hub must have ***locktite*** thread sealant applied on them or at high speeds it will pitch the blades!
If your unit is manufactured correctly, you will not need a brake, but just in case, I recommend a simple brake installed. As noted in the drawings, a leather strap, (an old belt), attched to one side over the top of the shaft, or looped around it and attached to a length of rope dangling at a reachable length so you can grab it and stop the unit may be a good idea.

The Final Assembly
Mount the frame/shaft assembly/tail rudder assembly to the top of the pole.
Assemble the two blades to the hub by aligning the felt pen mark you made when installing the sheet metal, 1/8" "away" (downwind) of the set screws on the hub. This will be about a 35' angle. Experiment a few degrees either way.
Finally, on a calm day mount the blades and hub assembly to the unit.

Detailed Parts List

From Hardware Store

1- ¾" x 27" hollow shaft
2- ¾" pillow block bearings
2- ¾" shaft collars and leather thrust washers
1- 10" aluminum pulley with ¾" bore
(all above available in evaporative cooler section)
1- box 1/8" aluminum pop rivets
8- ¼-20 setscrews
6- 5/16-18 x 1" hex bolts, lockwashers, and hex nuts
1- 3/8-24 X 1" hex bolt
1- 3/8"-24 x 6" hex bolt
2- 3/8" flat washers
1- 3/8"-24 nylon lock nut
1- 1"-8 x 4" all-thread
1- 1"-8 hex nut
1- 1"-8 nylon lock nut
1- 10' –1/2" emt conduit
1- 1-1/4" conduit lock nut
3- 32" x 4" galvanized sheet steel, 20-24 gauge
1- 18" x 27" galvanized sheet steel, 20-24 gauge
(above, look in roof flashings)

From Hardware Store or Pipe Supply

1- ½" x 3" sch 40 black pipe (for alt mount)
1- ¾" x 9" sch 40 black pipe (for hub).....
(3/4" tubing from steel yard provides tighter fit)
1- 3"x 6" sch 40 black pipe nipple (for mounting collar)
1- 21 foot, 2/12" sch 40 galvanized pipe (for tower)

From Hardware Store or Major Dept Store (Wal-Mart)

1- 1" trailer wheel bearing kit
1- tube ***locktite*** thread sealant

From Auto Parts Store

1- GM alternator, from 1978 Chevrolet pickup, C-20, 350 V-8 with no A/C
1- 40" long "A" belt (13/32" wide)

From Steel Yard

1_ 6" x 3/16" x 24" flat steel
1- 3" x 3/16" x 10" flat steel
1- 2" x 3/16" x 60" flat steel
*3/4" thickwall tubing (3/4 ID, 1" OD), will provide tighter fit. Substitue for ¾" pipe

Windpower

Final electrical installation and practical use.

At full peak power in a 30-mph wind, the ***Windpower Generator*** should, theoretically produce 720 watts of power. (12 volts x 60 amps = 720 watts) However, it would be wise to be conservative and assume 500 watts of usable power.
In a steady breeze over a period of several hours, this would be enough to charge 5 to 10 deep cycle batteries. Start out with 1 or 2 batteries. You can purchase deep cycle, (700 cold cranking amp) RV/Marine batteries at discount warehouses for about $50 each. Wire them together as indicated in the drawings.
There are two options that you have with a bank of fully charged 12-volt batteries.
First, you can wire your house or cabin with a separate 12-volt circuit, on which you can install low voltage lights, and appliances available at Camping/Trailer supply stores. Or you can mail order them from national suppliers such as JC Whitney. For a free catalog, call 312-431-6102, or visit www. jcwhitneyusa.com on the Internet.
Virtually everything for your home is available from light fixtures, TV's, fans, kitchen appliances, blenders, refrigerators, coolers, etc.
Of course the drawback to this type of installation is that you must install a separate 12-volt circuit, and purchase new appliances.
This option should be considered especially if you are powering a remote cabin where there is no permanent available 120/240 volt AC service from a utility company.
One rule of thumb to remember: every time you take an electrical power source and convert it to another, AC to DC, higher voltage to lower etc., you lose power.
It is always more efficient to use the voltage directly as it is generated.
The reason it is advantageous to generate electricity at 12 volt DC is that you can store it directly in batteries for later use. And remember, the ***Windpower Generator*** uses a General Motors automotive alternator that can be purchased locally for very little money.

The second option is to install one or more DC to AC Sine Wave power inverters. These state of the art electronic units convert 12 volt DC to a usable 120 volt AC. A good place to buy an inverter is Northern Hydraulics. For a free catalog call 1-800-533-5544, or visit them at www.northern-online.com on the Internet. A 1000 watt inverter costs about $300. Also check at truckstops, Truckers use these units to operate 120 volt appliances in their trucks.
You can wire these units directly into the existing 120 volt AC circuits of your house. Make sure you take the necessary precautions to isolate these circuits from the AC voltage being supplied by your utility company, even during a power outage!
Have a qualified electrician install the necessary switchgear for this.
An ideal system would be a hybrid of multiple 12-volt DC wind generators charging a bank of 12-volt deep cycle batteries. Wired directly from the batteries would be outside security lights and interior emergency lights using 12-volt DC light fixtures.

One or more DC to AC inverters would be connected to the batteries and powering the necessary circuits of your house. A 1000-watt inverter would be enough to power one circuit of a house, a color TV, and about 5, 40watt lamps.
A 3000-watt gasoline generator would be a perfect addition to this system to power additional AC appliances when needed and to provide DC power to keep the batteries charged during periods of insufficient wind.
At this time I do not recommend purchasing solar voltaic panels. They are too expensive for the amount of power they produce.
As for water well pumping, a shallow well jet pump can be powered through a DC to AC inverter, provided it is wired to operate at 120 volts. A typical jet pump is ½ hp and draws about 8 amps. This would require a minimum of a 1000-watt inverter and two deep cycle batteries by itself.

A more logical installation is that which the author has installed at his 5-acre ranch in the Mojave Desert of Southern California.
I have two ***Windpower Generators*** charging a bank of six, deep cycle batteries. Several automotive road lights provide outside security lighting. Interior R/V lights provide interior emergency lighting. A 1000-watt inverter provides necessary AC power for tools and appliances. If you are conservative, this will power most other lights, TV's, computers, etc. Just not all at once!

My water supply is a deep well, at 410 feet. It requires a 3 hp, 240-volt AC submersible pump. For this, a 3000-watt gasoline generator is installed next to the well house.
One hour a day, this generator is fired up, pumping water into a 1000-gallon storage tank. During this same hour, the generator is utilized to it maximum by powering the whole house (making sure the switch from the inverter is open!) The washing machine is used at this time, and a 50-amp battery charger is hooked to the battery bank during days of low wind to maintain them. A 12 volt "Sure Flo", on demand water pump, (available from JC Whitney for about $75) sends water from the storage tank and maintains 40 psi to the house. Or you could elevate the tank 6' in the air to achieve the same results.
The most difficult thing to deal with is the refrigeration of foods and the heating of water. If no permanent power source is available, you might consider propane for both of these. However, electrical refrigeration and hot water heaters are still practical.
A typical modern, efficient refrigerator draws about 5 amps at 120 volts. A second 1000-watt inverter would be recommended for this and would require additional batteries and charging capabilities.
A typical 30-gallon electric water heater draws 3000 watts and would have to be powered by a large generator for about 30 minutes prior to use. What is advantageous of electric water heaters is that they need not be vented, and can be packed with insulation around them. The water will stay hot for several hours. This is not so with a natural gas or propane water heater.

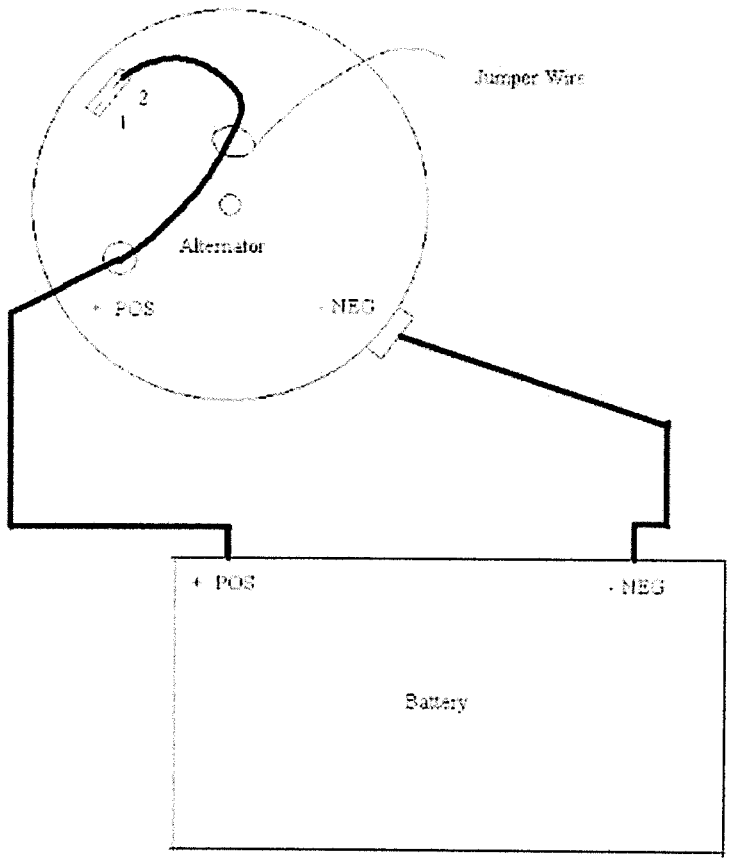
Please refer to the drawing details for further installation instructions.

Connect the wire from the Negative (-) battery post to any bolt

On the metal housing of the alternator.

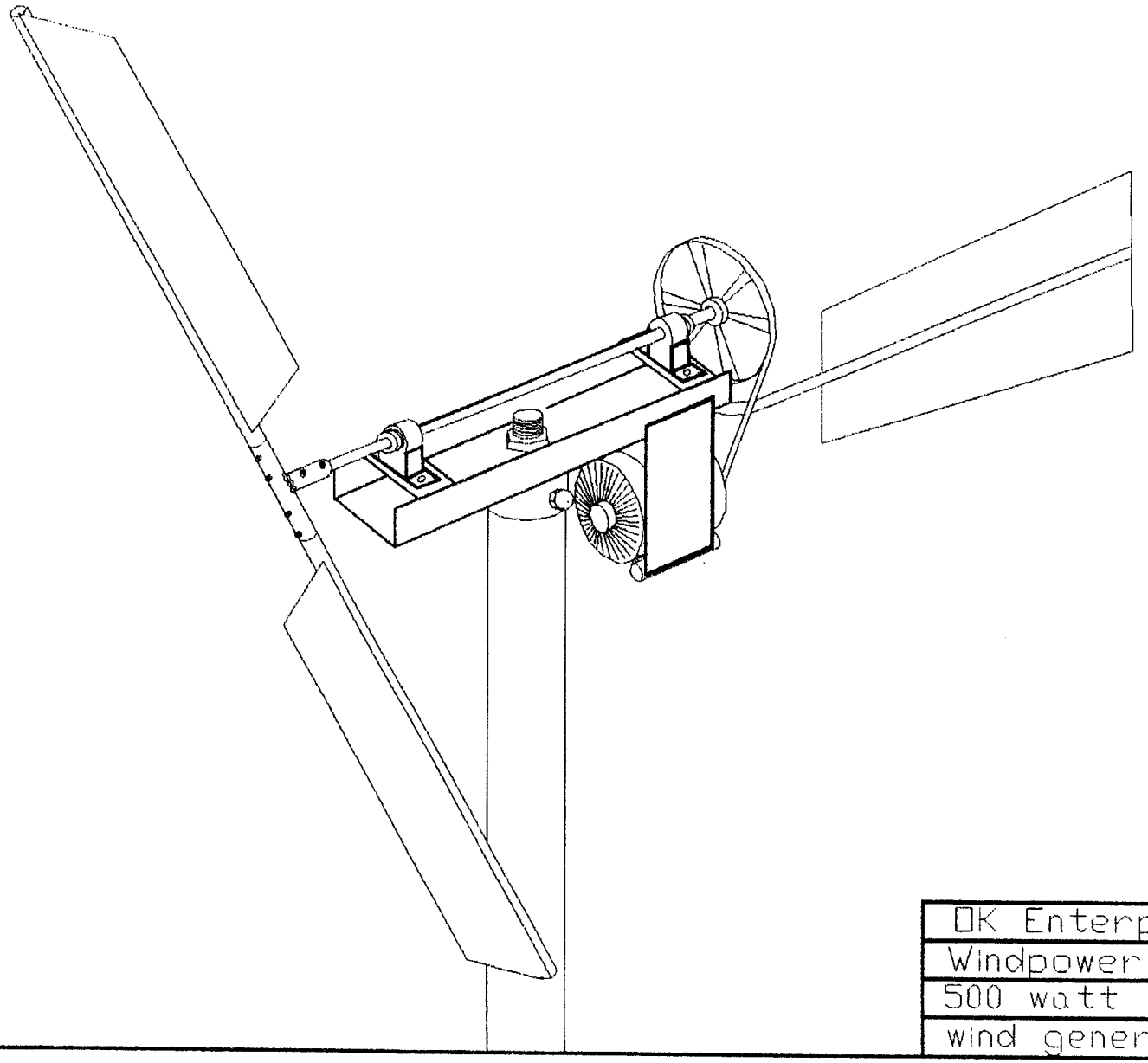
Connect the wire from the Positive (+) battery post to the big red post on the alternator marked (+) or (pos).

Also connect a small jumper wire from this post to the terminal marked "2" on the back of the alternator.

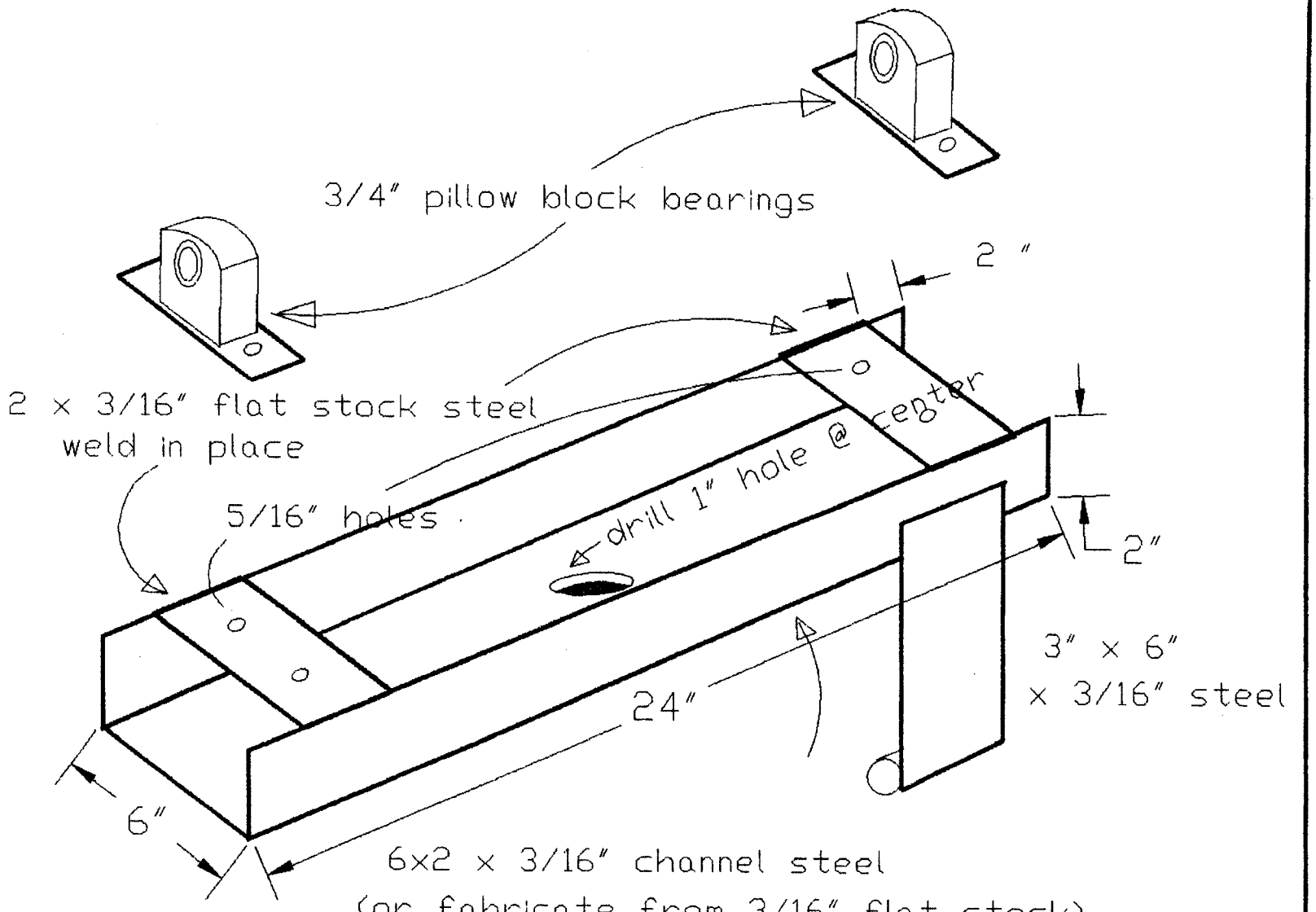


There is a diode built into the alternator which will prevent it from discharging the battery when it is not turning. Do not connect anything to the terminal marked #1. This is for the red light on the dash of a car and will discharge the battery if connected, like leaving the ignition switch in the "On" position.

Some remanufactured alternators require a higher start up speed than others. If the unit still wont charge, it may be necessary to replace the unit or wait for higher wind speeds.

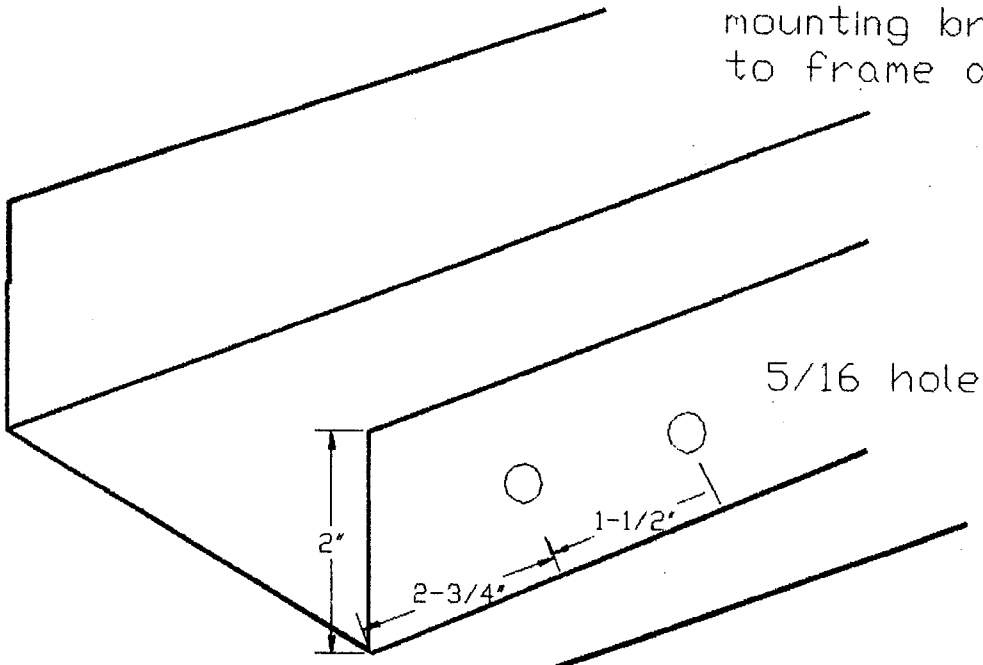


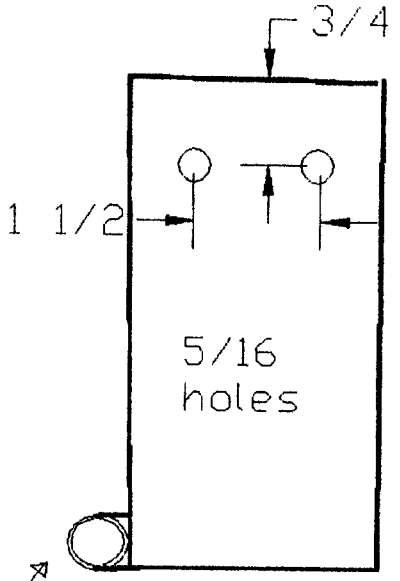
OK Enterprises
Windpower
500 watt
wind generator



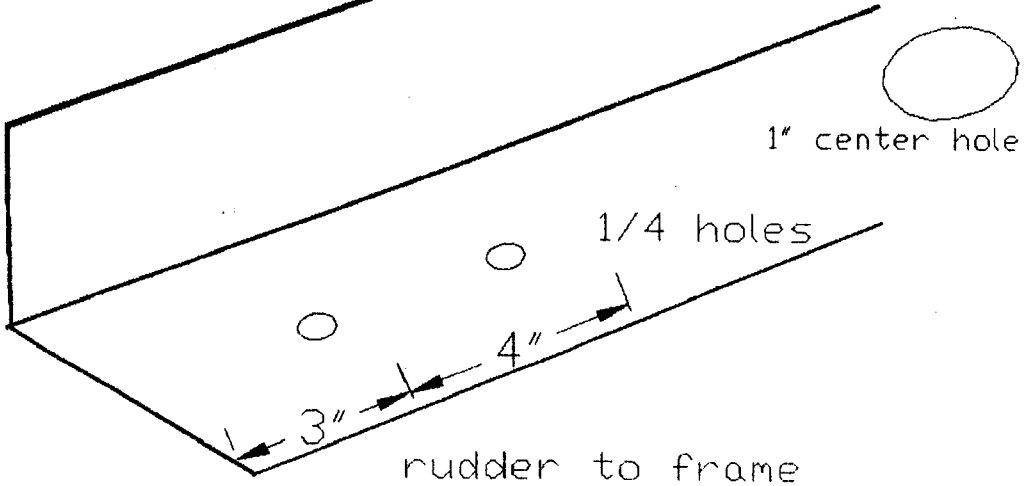
OK Enterprises
Windpower Frame
and bearings

alternator
mounting bracket
to frame dimensions



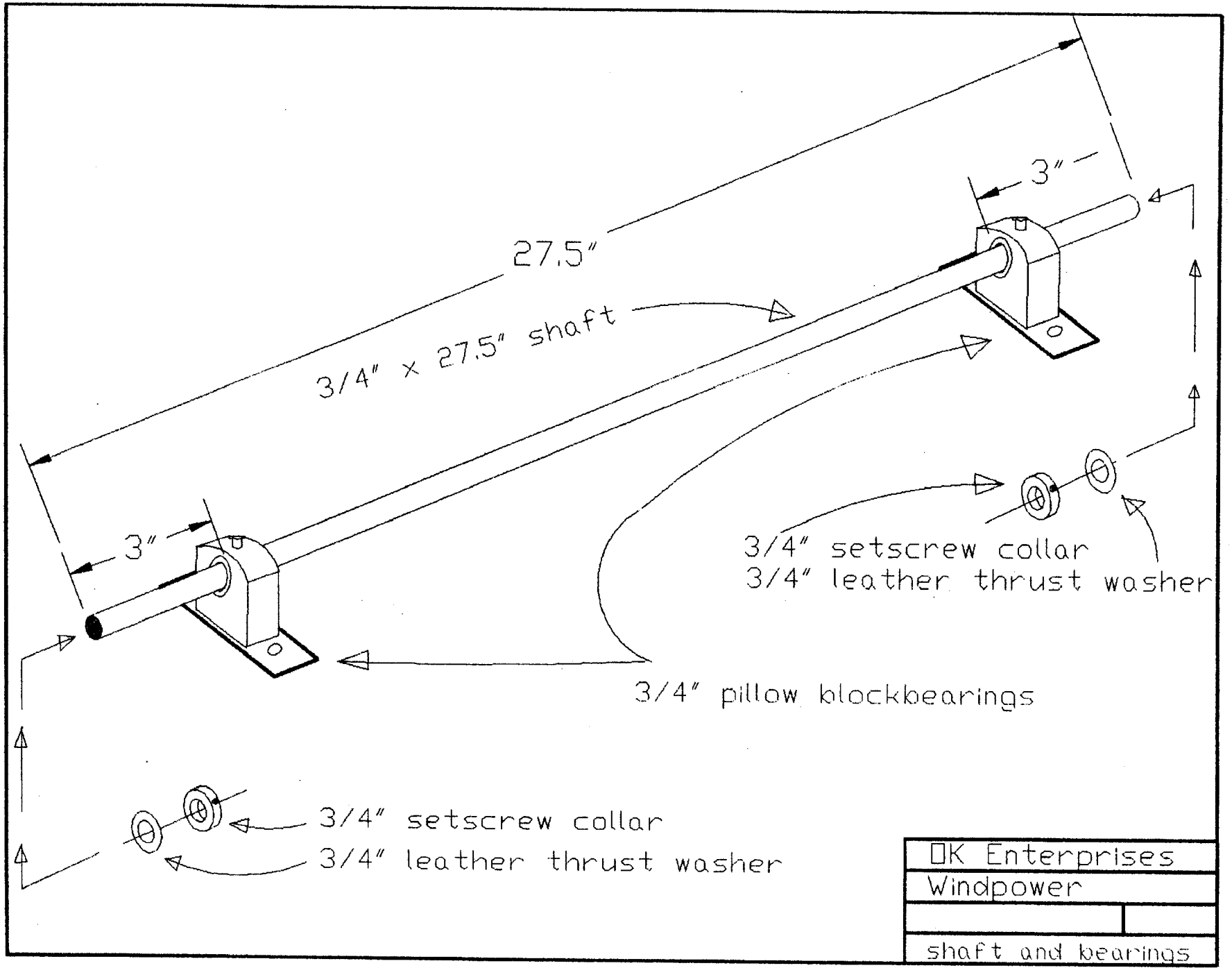


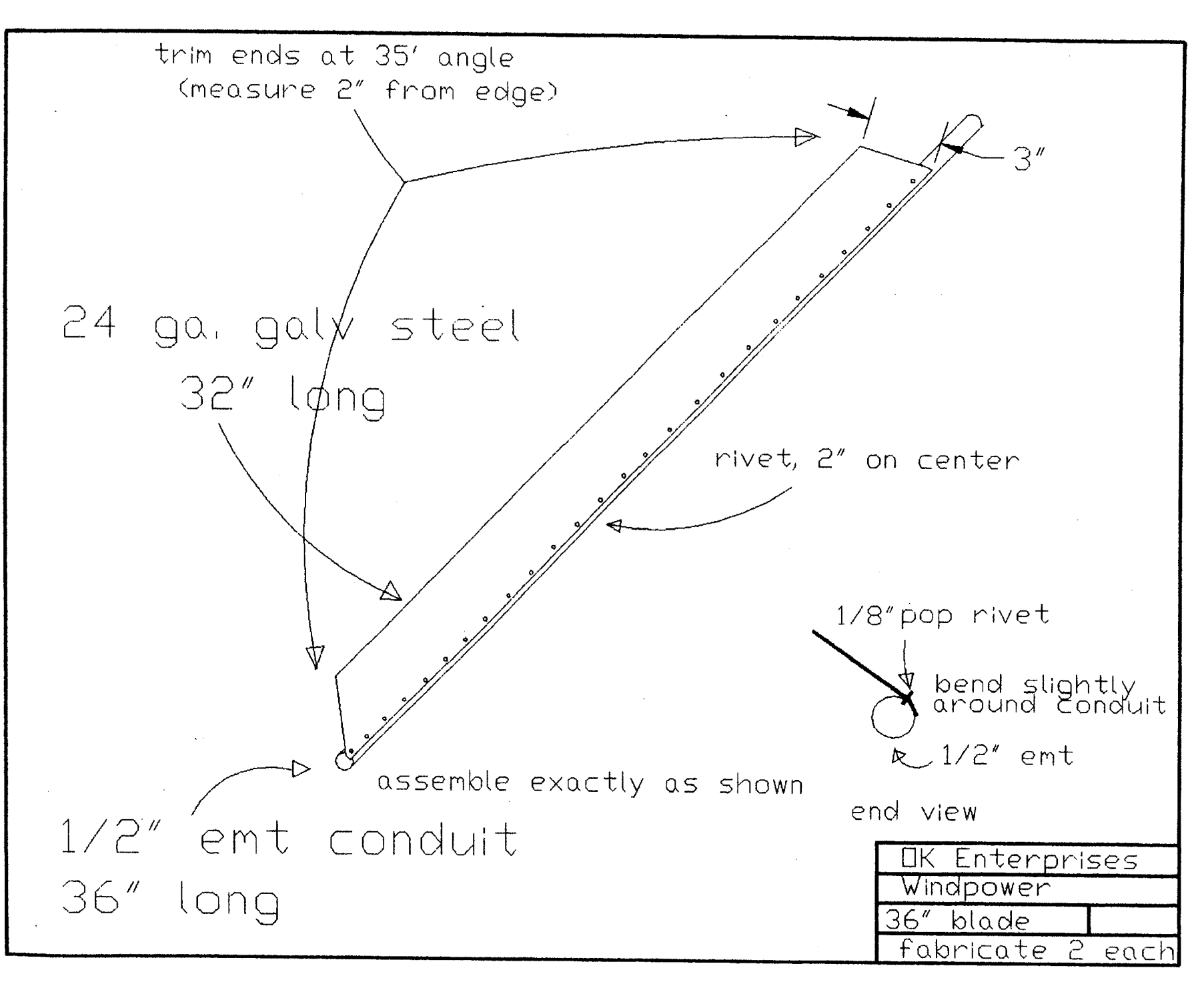
alternator
mounting
bracket

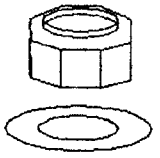


rudder to frame

OK Enterprises
details


27.5"
3/4" x 27.5" shaft
3"
3"
3/4" setscrew collar
3/4" leather thrust washer
3/4" pillow blockbearings
3/4" setscrew collar
3/4" leather thrust washer
OK Enterprises
Windpower
shaft and bearings


trim ends at 35' angle
(measure 2" from edge)
3"
24 ga. galv steel
32" long
rivet, 2" on center
1/8" pop rivet
bend slightly
around conduit
1/2" emt
assemble exactly as shown
end view
1/2" emt conduit
36" long
OK Enterprises
Windpower
36" blade
fabricate 2 each

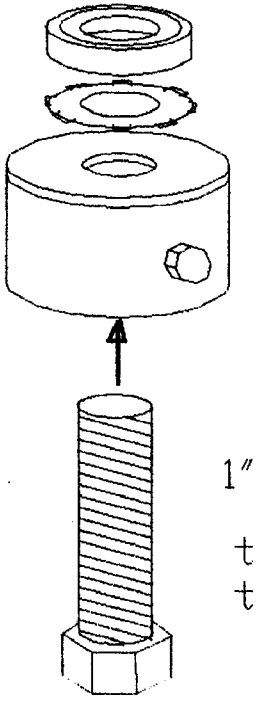


1″ nylon locknut

1″ washer



cutaway
of frame



1″ trailer wheel bearing

1″ conduit locknut (tabs poining up)

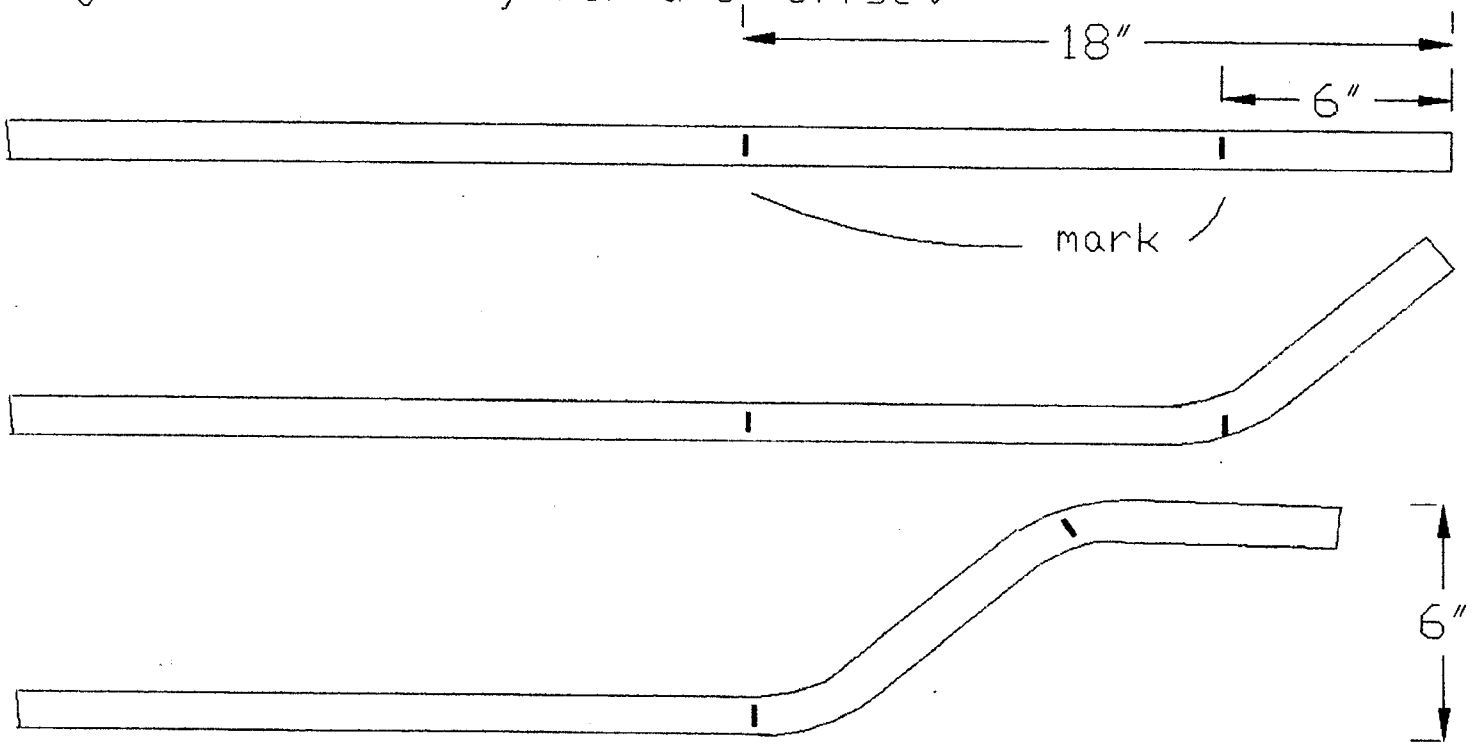
collar, 3″ pipe sleeve
weld top with 1″ hole
drill and tap 3/8″ bolt

1″ x 4″ allthread

tack weld nut
to thread and collar

OK Enterprises
Windpower
top cap & spindle

lay 48" piece of 1/2" emt on flat surface
measure and mark 6" and 18" from one end
take emt bender and put arrow on first mark and make a 22-1/2' bend
turn conduit over and with arrow on 18" mark, make another 22-1/2' bend
adjust as necessary for a 6" offset



OK Enterprises
tail rudder tube

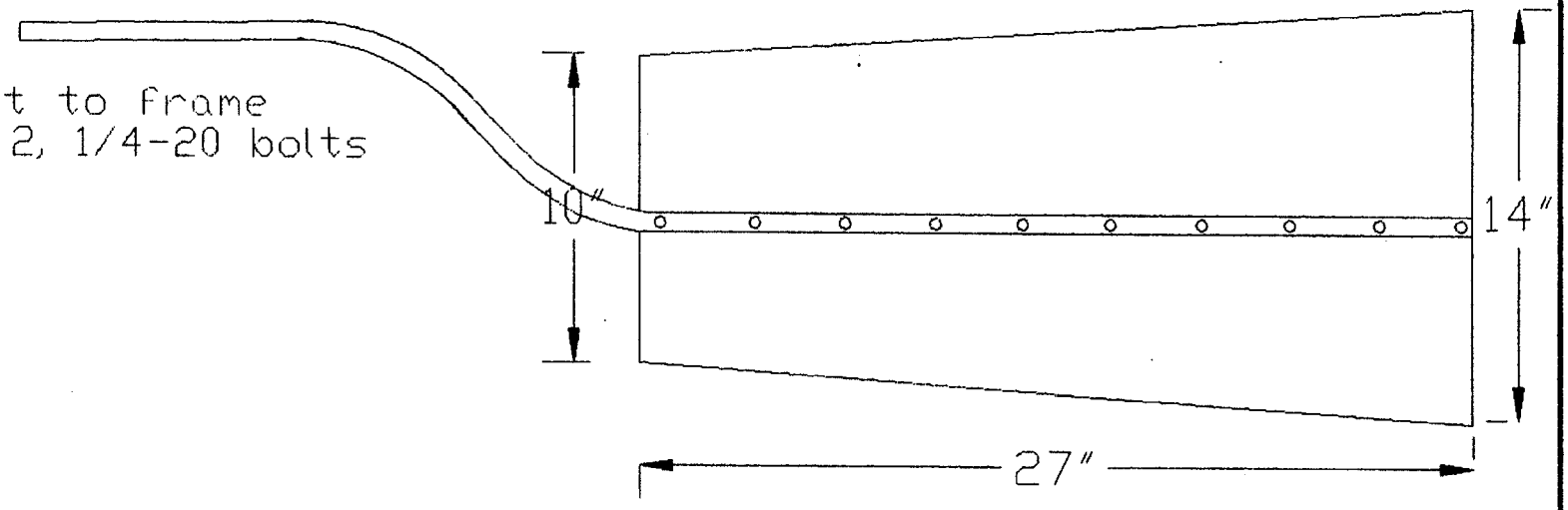
1/2" emt conduit

approx. 48" long

bend with 6" offset

24 ga. galv steel

approx 14" x 27"



mount to frame
with 2, 1/4-20 bolts

mount rudder with

1/8" pop rivets

2" on center

OK Enterprises
Windpower
tail rudder

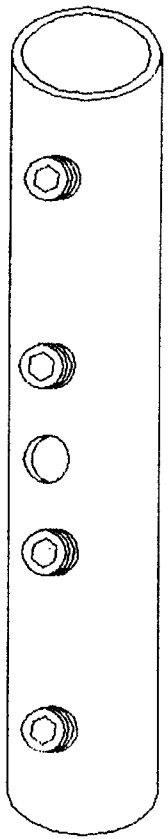
3/4" x 4"

pipe sleeve

1/4" hole

in center to

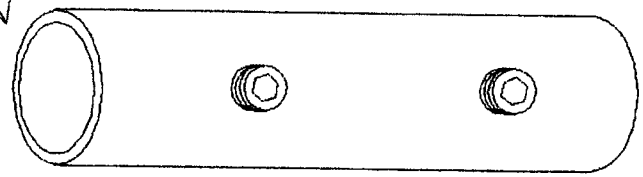
align blades



1/4-20 setscrews

4 in each piece

grind saddle in horizontal piece
and weld, insuring good 90" fit

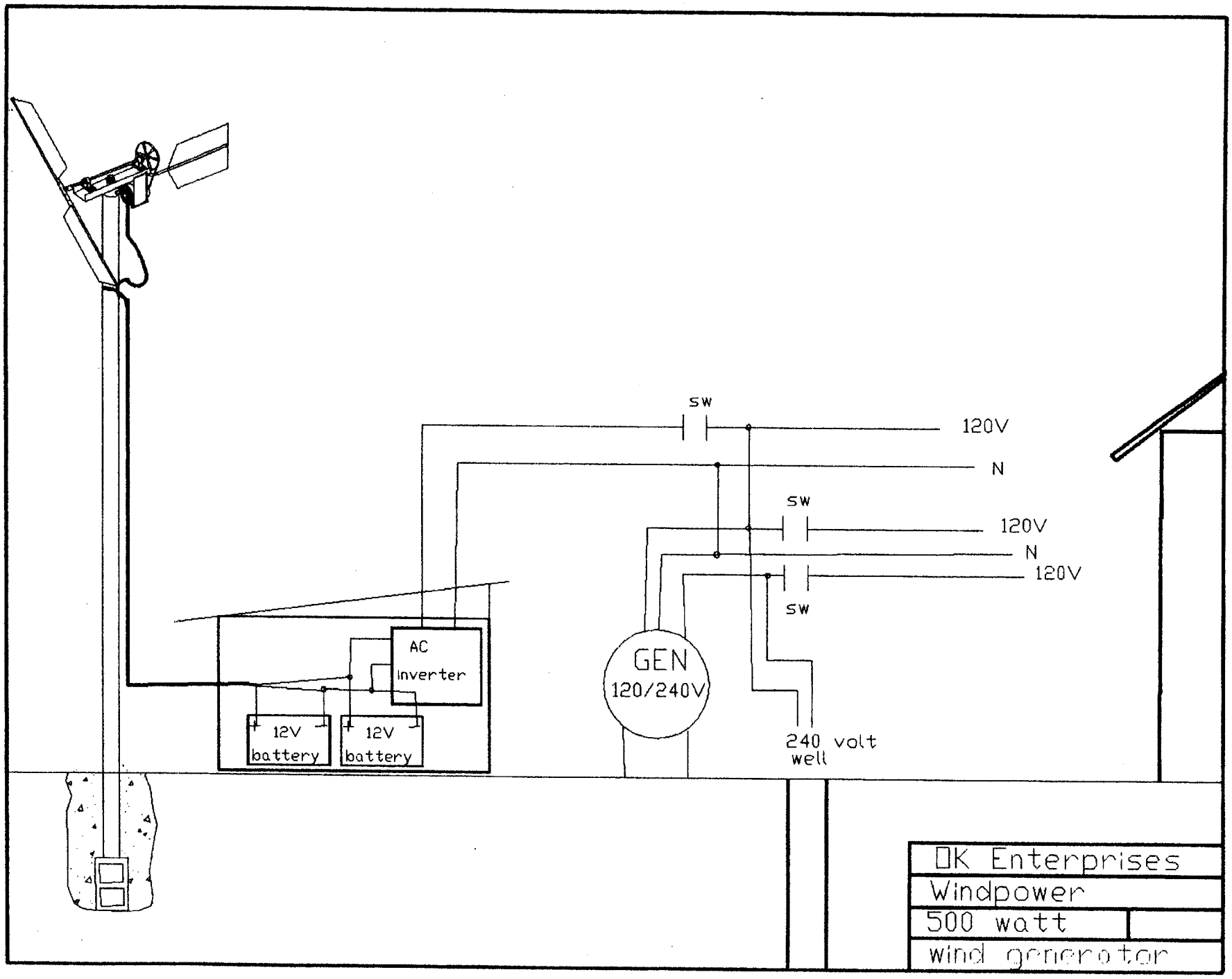


3/4" x 3"

pipe sleeve

(substitue 3/4" pipe for tubing
for tighter fit. see parts list)

□K Enterprises
Windpower
hub assembly


SW
120V
N
SW
120V
N
120V
SW
AC
inverter
GEN
120/240V
12V
battery
12V
battery
240 volt
well
OK Enterprises
Windpower
500 watt
wind generator

