Bicycle_Generator_Notes_1998.txt

Subject: Bicycle generator Part 1
sent: 10 oct 98

Doug Macintyre wrote:
>
> http://www.zetatalk.com/energy/tengy05d.htm
> 2) if so, how exactly would you go about it?

More thoughts on how to make an effective bicycle generator: Put an amp meter
(from a car or another source) in series with the alternator. This allows the
person pedaling to see how much output is produced.

Take the front wheel (tire, rim and spokes assembly) off and mount the remaining
yoke on a stable platform made of wood. Use the same bolt holes that held the
wheel on.

Raise the rear wheel about 1"-2" above the platform so that the rear wheel turns
freely. Bolt this to the frame of the bike about 3"-6" in front of the back
axle. This allows 2 support pipes on each side to bolt or strap it to. Could
use 2" x 4" wood for the front and back supports. Use triangle supports cut
from plywood or any other wood to make it stable (side to side motion). If
needed carefully cut a notch in the back right wood support, so that the chain,
and cables have plenty of clearance.

Purchase a V-belt or V-ribbed belt big enough to go over the alternator and back
rim. I have found it easier to find the Serpentine or 5, 6, or 8 V-ribbed flat
belts in the lengths needed. A 5 ribbed belt is 45/64" wide. A 6 ribbed belt is

27/32" wide. A 8 ribbed belt is 1" and 1/8" wide. These are more expensive and
cost about twice as much as the 11MM or 15MM wide single V-belts. However, they
should last longer and will transfer more power. Also the alternators that use
these have smaller diameter pulleys. Which is an advantage. Flat belts should
work better on the bare bicycle rim. They would be less likely to turn over.

The alternators that use flat belts are more expensive, deliver more amperage
and typically have an internal voltage regulator. The older alternators have
the voltage regulator separate and are a lot less to purchase. Typically local
rebuilt prices are estimated to be $20-$40 for the older 60 amp (Ford, GM in the
1970's) type and $110 to $170 for the newer 70 amp and higher

amperage. All of
these types from time to time can be picked up at yard or garage
sales.

Mount the alternator on a peace of wood that is hinged (door hinge)
to the
platform (plywood, plank, etc). This would be behind the back wheel.
 The
weight of the alternator helps to give it belt tension. A spring
could be
attached to add more belt tension if needed.

The result would take no welding, and no great modification of the
bicycle, so
that if you wanted to unbolt it and put the back tire and front wheel
back on
you could still ride the bike. It does take wood and a long enough
belt.

The only thing that is a question in my mind is - will this give the

proper
rotational speed for the alternator.

Analysis: I have measured alternators that have a single V-belt
pulley with
diameter between 2.5" and 2.8". Wide 6 ribbed belt alternators I
have seen use
pulley sizes between 2.2" and 2.5" diameter.

Taking my car as an example the diameter of the alternator is 2.6"
the engine
pulley is 7.25" diameter. Assume a minimum idle engine speed of 800
RPM is
enough to generate reasonable current to maintain some amount of
minimum
charging to keep the alternator light off.

The perimeter of a pulley is proportional to the diameter (Pie times
the
diameter). Thus the minimum rotational speed of an alternator in

revolutions/min (RPM) will be (7.25"/2.6")*(800 RPM) = 2230 RPM as a targeted
minimum speed.

To get full rated charging amperage one would need to run the engine at 2000
RPM. See: "Generator Output Testing" under the link
http://www.acdelco.com/parts/l1145_00.htm. To do this the Alternator in my case
would need to run (7.25"/2.6")*(2000 RPM) = 5,577 RPM for full charging
amperage. Other alternators may be designed to run optimally at other speeds.

More measurements/assumptions: A typical kids bike with 20" tires has a rim of
about 16" diameter and a 2.5:1 ratio between the back wheel and the pedal
rotation of one turn. A typical adult 10 speed bike with 26" tires has a rim of

about 23.5" diameter and a 3.75:1 to 1.37:1 ratio between the back wheel and the
pedal rotation of one turn. A typical exercise bicycle with 19.5" tires has a
rim of about 17" diameter and a 2.5:1 ratio between the back wheel and the pedal
rotation of one turn.

Pedaling speed: My test show an optimum pedal rotational speed in the range of
about 60 RPM. Note: One can do a maximum of 110-120 RPM for short bursts but it
is a strain.

Subject: Bicycle generator Part 2
sent: 10 oct 98

Exercise bicycle: Now if one mounts the alternator with a 6 to 8 ribbed pulley
directly against the hard rubber tire of the exercise bicycle. This

could be
spring loaded. May need to remove the fan on the alternator to miss
the tire.
May need to slightly grind the edge of the tire down to fit the grove
if a 6
ribbed pulley is used. An 8 ribbed pulley should work with out
modification in
most cases. Grind the sharp edge of the ridges of the pulley down so
it doesn't
cut the tire. This will also make it a bit smaller in diameter. For
a 2.2"
diameter multi-ribbed pulley modified in this way the diameter of
where the belt
travels is about 2.0". The rotational speed of the generator will be
about
(19.5"/2.0")*2.5*60RPM = 1,462 RPM. This a little low to expect much
output
power.

Most alternator shafts are .5" or .625" diameter. As a second test

one could
try the bare shaft on the hard rubber tire. Assuming a .625" shaft
this would
give the rotational speed of the generator to be about
(19.5"/.625")*2.5*60RPM =
4,680 RPM. This is more like it, however it probably will ware the
tire too
quickly.

As a third test one could then start building up the shaft by
epoxying or
bolting (with the nut that held the pulley) a pipe to the shaft to
make it
bigger until the optimum diameter is reached. What you are doing is
balancing
power output capability of the individual to maximize charging rate
and charging
time, while minimizing ware on the tire. My best educated guess at a
possible
end point optimum pulley size for this approach is a diameter between

1" and
1.5". The above approach should work well with alternators that have
internal
voltage regulation.

If an older type alternator is used with a external voltage
regulator, fine
tuning would then be done with a resistor in series with the field
circuit and
the battery. The lower the resistance the stronger the field will be
and the
harder to turn the alternator and the more current it will produce at
low
speeds. Note that once the alternator is not turning the battery
will drain
back through the field coil unless disconnected. You can get around
this by
putting a diode between the battery and output of the alternator.
This diode
would allow flow from the alternator to the battery, but not back

from the
battery through the field coil. The output of the alternator is also connected
through a variable resistor to the field coil. Note, the field coil is in
reality the rotating armature.

Now if one uses a 10 speed 26" tire bike what can be expected: Assume we are
going to use a belt to drive it and the rear tire will be removed. Rim diameter
is about 23.5". Assuming a multi-ribbed pulley (5,6,8 ribs) diameter of about
2.2" is used on the alternator. Assume the bike is running in 3.75:1 gear ratio
(in high gear). Assume we will be pedaling at 60 RPM. Then, the rotational
speed of the generator will be about (23.5"/2.2")*3.75*60RPM = 2,403 RPM. If
the pulley is 2.8", then the rotational speed of the generator will

be about
(23.5"/2.8")*3.75*60RPM = 1,888 RPM. Smaller pulley sizes are
desirable. This
arrangement should work fairly well, especially since you have the
other gears
of the bike to adjust the speed for the strength of the pedaler.
This
arrangement should work well with internal and external voltage
regulated
alternators.

Now what if all you have is a 20" kids bicycle: Using the belt over
the rim,
the rotational speed of the generator will be about
(16"/2.2")*2.5*60RPM = 1,091
RPM. Putting the tire in contact with a 2.2" diameter pulley would
give about
(20"/2.2")*2.5*60RPM = 1,363 RPM. Taking off the pulley and using a
5/8" bare
shaft against a 20" tire then (20"/.625")*2.5*60RPM = 4,800 RPM.

Highly likely
to ware out the tire quickly. None of the above options are optimum
but any may
work in a pinch. Especially if the pedaler is the size of the bike.

Summary: If you plan to use the pulley, get it as small as you can. A
small
change in pulley size can make a significant difference in final
speed of the
alternator. An old 10 speed 26" bicycle and a small diameter
multi-ribbed V-
belt over the back wheel rim, looks like the best approach. Next
most workable
solution, the exercise cycle with a small pulley put in direct
contact with the
hard rubber tire.

If I haven't made any faulty assumptions or mathematical errors, the
above notes
should give one a starting point. The links that follow should help

in
understanding alternators.

Alternators & Starters - Introduction to Electricity
http://www.hotrodsworldwide.com/pgs/pgs-info.htm
See "Is It an Alternator or a Generator?" under the following link
See "Generator Operation" under the following link
http://www.acdelco.com/parts/l1145_00.htm
Understanding the functions:
http://www.ibm2.com/charging.htm#ALTERNATOR
The ABCs and 123s of Stinger Alternators
http://www.stinger-aamp.com/articles/stinger-alternators.htm

Subject: Bicycle generator
Sent: 9 Oct 98

Doug Macintyre wrote:
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> http://www.zetatalk.com/energy/tengy05d.htm
>
> I've been reading the subject of bike/alternators from car parts. It's
> amazing, but I have some questions:
> 1) Is there a specific car alternator that is preferable, power-wise
> or
> make and model?

I will give you my opinion for what it is worth. I think any size above
30 amps should work. The reason being, the pedaler is going to have
trouble sustaining the pedaling on any kind of medium to high amperage.
Your biggest concern should be getting the right ratio of pedal
rotations to alternator shaft rotation. If this is off then it will be
too hard or too easy to pedal. Now that I think about it. It might be

smart to feed back some of the output through the field coil in
series
with a rheostat. This rheostat could be adjusted to determine the
amount of charging rate and thus determine the ultimate rotational
push
on the pedals. One would not use the 12V regulator in this case.

> 2) Can this be used to re-charge dead 12v batteries?

Yes and no. If the battery is freshly dead then yes. If it is a
Lead-Acid battery and if it sat for a while discharged, say for 6
months
to a year (I am not sure of the exact time frame), then I doubt you
will
get much charge in it. This is because the sulfation is crystallized
(hard) and will not go back into solution. This is where a radio
frequency pulser would come into play to help un-sulfate the battery.

> And if so, how

> exactly would you go about it?

Hook the output of the alternator and the case of the alternator
(ground) to the battery. Pay attention to proper polarity. Attach
the
field to a rheostat (size yet to be determined) and then to the
battery.
Sometimes the other side of the field will need to be grounded.

I like the idea presented: Take the tire off the rim and use the
grove
of the rim as a pulley. Use the pulley already on the generator and
install a long belt around these pulleys. Because of the size
difference
the generator will turn many times to that of the bicycle rim. Use
the
muli-speed bike gear shift and the rheostat (described above) to
adjust
for the proper peddling resistance.

> 3) Even though there is a description on how to convert an ordinary
> bike
> to generate electricity I was wondering if someone could draw up
some
> diagrams to better illustrate the process. Does anyone want to take
> this
> on?

Lots of different types of bicycles, and exercising devices. Becomes
difficult to cover all possibilities. I think as we make them - we
will
take a picture of the result and write up lessons learned.