Making the "Venture MK II"

Some information based on the two first winches I put together

Just a little warning!
*Due to the temperature variations and the different materials in use on the winch, all screw connections **must** be secured. This can be done either with lock washers, nylock nuts or chemicals (Locktite), but it must not be omitted!*

After getting the first two sets of castings from the foundry, I went over my drawings and made sure everything was OK and printed a set for the machineshop that was going to do the work.

Not having any lathe or milling machine in my shop I had to turn the whole machining job over to a nearby machineshop.

The "piston alloy" used in the castings is not entirely forgiving according to my man with the lathe. Some experimenting with cutting speed, feed rate and cooling is well advised before you make the critical cuts. Buildup on the cutter seemed to be the problem.

If you are familiar with using a lathe you probably also know what kind of tolerances the various bearings require. If you contract out the job like me, discuss this point with the shop so that you get what you want.

Here is what I ordered:

On the drum you can use press fit on all bearings as well as the flexible coupling. This means that you will have to have access to a hydraulic press or some form of heat source (heat-gun or blowtorch) for mounting the bearings. After machining there is either a lot of labor or money invested in the drum.
I would not chance it on a hydraulic press. Use heat!

On the various housings I suggest a tolerance that allow you to mount the bearings and the stator house by hand. This way you can mount all the bearings on the drum permanently, and put the various housings together by hand for all the trial fitting you will have to do before you are finished. When everything is ready for final assembly you can secure the housings to the bearings using Locktite or something similar.

So, if all the turnings are ready lets assemble!

I started by fitting the flexible coupling to the drum. The coupling has setscrew holes (M5) that you can use if the fit in the drum is loose. This will require holes to be drilled through the surface where the bearing will fit later. I decided that the press-fit and some Locktite 638 would be sufficient. Next I fitted the big bearing. The bearing was heated with my heat-gun until I could slide it down in place. Done!
Next comes the one-way bearing. It has to be fitted with a steel collar that has been drilled or notched to accept the piston in the stop mechanism. I drilled four holes in mine and used an angle grinder and some files to clean up the cuts. This was not a precision job. Nor is that necessary. You just want to ensure good purchase for the piston when it drops down to engage the brake.
The ring was then heated and slipped over the bearing. Use Locktite!
Now this assembly is mounted on the drum.
One-way bearings are simple things. They do just that. Move ONE way!
Before you mount the one-way bearing you HAVE to make sure your drum will rotate in the correct direction. Check, check and check again! Heat, Locktite and sliiide. Done!
Next is the spacer then the outer bearing: heat and sliiide.
I initially ordered a one-way bearing said to be 15mm thick. When I received it, it turned out to be 12 like it should according to the standard. This is the reason for the rather generous spacer between the bearings. Check your bearing thickness before you order the spacer. Adjust its thickness if necessary.

The drum is now almost ready. It needs some small holes, but they will have to be drilled during a trial assembly.

<u>The motor bearing house</u>

This part is not really necessary. You can run the winch with the bearing supplied from Bosch, but I assume I can tweak some extra performance out of it by fitting a ball bearing. If you decide to do like I did you need to drill some holes in the house for assembly: two 6mm for the motor assembly screws, and two 5mm for the motors brush plate. Then you need to cut the notch for the cable and rubber grommet to exit the housing. Basically you copy the measurements on the original housing.

There is one catch.
The brush plate **must not** be in contact with the bearing house **where the positive brushes are riveted to the brush plate**, or you will have yourself a magnificent short-circuit when you step on the pedal for the first time. To avoid this you drill "dimples" inside the bearing house where the rivets are (or you can have your friendly local workshop turn a recess in the bearing house. That will serve the same purpose). See photo. Holes, dimples and all.

The motor is a Bosch 00001 311 108. After you buy it, it has to have some parts removed. Remove the solenoid, the engagement house and the engagement mechanism.
This involves cutting a small ring witch is attached to the outer end of the axle. You should be left with the motor housing, the anchor and the back end of the motor. If you are going to modify the back end, then remove it too. If you are going to keep the old back end, remove it anyway since you need to take the anchor out of the motor to work on it.

The motor house does not require any work other than paint. This is recommended since it will rust quite happily if you don't.
The back end is used as it is, or for measuring the holes for the ball bearing housing if you are going for that.

The anchor needs some work. The front end (towards the drum) has to be turned down to 12mm and cut as specified on the plan. If you are opting for the ball-bearing solution in the back, then have the rear axle turned down to 12mm as well (it is 12,7mm originally). Two flat spots needs to be filed or ground on the axle to give the setscrews in the flexible coupling good purchase on the motor.

Next is the inside drum house.

This part needs three holes: two for the m6 screws that holds the motor, and one M12 for fixing it to the undercarriage.
Made sure you orient the holes in correct relation to each other. I mounted the motor with the positive cable down towards the undercarriage and bored all the other holes accordingly.
Drill and tap and that's it.
The two 6mm pin screws supplied with the motor should be replaced with 6mm threaded rod. Then you can use a stainless cap-nut and washer that will not rust.

Now we get to the outer drum housing.

It too will need a M12 hole for fixing it to the undercarriage. Then one M16 hole for the brake selector. In addition to that it will need one 3.5mm hole drilled from the outer side towards the drum. I drilled mine 9mm in from the outer edge of the housing. Make a trial mount of the drum and the outer housing and put the 3.5mm drill-bit into the hole again starting a new hole in the inside of the drum flange. Do not drill through the drum flange. Just mark it with the drill-bit. Rotate the drum some 15mm and repeat. Now you take the drum out of the housing again and you will have a drum flange with two marks approximately 15mm apart. Drill holes on the marks 2.5mm in diameter. Counterbore one hole (4.0-5.0mm) to accept the knot on the line. See photo. Countersink the other holes so that they will not damage the line when you tie the line to the drum These holes will allow you to tie the line to the winch without having the knot disturb the line as it reels in. Take a look at my pictures to see what I mean. I made my hole in front of the winch. Putting it on top probably makes for easier mounting of the line when you are standing over the winch.

All that is left now is the brake selector. Again I left the turning to someone else. The M16 threads were also cut on the lathe since I don't have tools of that size. The pictures together with the drawings should explain how it goes together. I started with the coil-spring and made all the measurements from there. I suggest you do the same, and then modify the piece as necessary to suit the spring you have.

Undercarriage

There is no drawing of the undercarriage. Once you have it, it is fairly straightforward to prepare it. I did however mill the surfaces where the motor/drum assembly rests on the undercarriage. This is the key point in the whole construction. Once you have set up the milling machine to the required angle make sure you mill both the front surfaces in one pass. Then the back surfaces in one pass. This to ensure parallelism of the surfaces. The diameter of the two bearing housings need to bee exactly the same and the undercarriage has to be milled true at the contact surfaces to ensure easy, friction free rotation.

Once the top is done it is easy work to flip the undercarriage over and mill the area around the holes inside the undercarriage flat as well(see the photos of the bottom of the winch). This prevents the m12 bolts from pulling sideways on an uneven surface. While you are there why don't you mill the bottom edge true also?
Holes need to be drilled and tapped M10 at each end for the locking handles. Mark, drill and file four square holes for the legs (The wall thickness increases where the locking handles are located. Place the square holes accordingly). Drill the holes for the M12 bolts that fix the drum/motor assembly to the undercarriage. These holes can be drilled oversize (12,5-13,0) to let the motor/drum assembly settle freely onto the undercarriage.
Depending on what kind of pedal system you decide to use, mark drill and file the hole for the connector. I find the three-pin plug used on P/C power supplies easy and reliable in use. Plugs, cables and receptacles are available in a variety of shapes and sizes.

Somewhere convenient you should drill and tap a M5 hole and screw in a hook to hold the parachute.

The legs are easy. I used 20mm stainless square tubing. Cut to suit and weld at 90 degrees. In the hardware store you will find plastic-caps for the ends. The kind they use on furniture legs. Drill holes for the anchoring-plugs.

After all the holes where drilled and tapped I mounted the various round parts in my wood lathe and sanded from 240 to 1200 grit and then polished.
The material can take a much better polish than I obtained, but hey… I am old and ugly.
What do I need a mirror for?

Electrical

My local electronics shop has supplied me with a solenoid from Woodauto.
Part # SND 157. www.woodauto.com/woodauto/Default.aspx
They are cheap, small and easy to install. But I have to admit they have failed on two occasions. They have been replaced free of charge, but I am thinking of using something else. There are many of them out there. Help yourself!

Why not use the solenoid that came with the motor you say?
Sure, but I am not sure the manufacture of the mounting bracket is any cheaper than a solenoid (or two). The solenoid supplied with the motor serves two functions. It connects the juice from the battery to the motor and it mechanically connects the motor to the car-engines flywheel. You have to find some way to mount it in the undercarriage and cover up the mechanical movement. But, some makers do it I believe. Once it is there I am sure it will do the job nicely.

For cables I used 50square mm flexible battery cable. An autopart supplier should have all you need of mounting lugs and battery connectors.
Depending on how you go about solenoids and cables, there will have to be some more drilling and taping in the undercarriage. This is not complicated and has to be adjusted to the parts and solutions you choose. Just don't paint any of the surfaces that grounds the motor!

For the Kanthal resistor I am currently experimenting a little bit with different materials. 4x 3mm pins is the one that you see on some quality winches, but they are labor consuming to make (too many small holes to tap). I will try to make a simpler one that does the job. I`ll get back to you on that.

This is all I can remember at the moment. If you have any questions just mail me! IMBGW@c2i.net

Oh! One thing... Once you have polished and painted everything nice and shiny, treat yourself to stainless bolts and screws. Anything else will just look sad.

Gjermund