



The business end of the Southern Sailplane Winch. This design will serve 99% of sailplane fliers 100% of the time.

SOUTHERN SAILPLANE WINCH

KENNETH CASHION

The designer/author launches a 118 in. Sensoar. This winch has launched 12-foot Sailaires in competition without a problem. The strength of the line is the limiting factor.



In a 1966 “Model Airplane News” article Maynard Hill introduced the electric winch to launch a model sailplane. His design did not propose a turnaround, so with 1,000’ between the winch operator and sailplane pilot, visual communication — flag-waving — was required.

After a few early attempts with rather inefficient turnaround designs, a West Coast flier, Marshall Watson introduced a bicycle axle-type turnaround. Later another West Coaster, Keith Brewster designed a foot-operated winch switch. It was then determined the safest way to launch sailplanes was with an electric winch and the sailplane was to ROG (Rise Off Ground).

According to the quintessential soaring writer, Le Gray, Wally Wallberger made the first ROG winch launch with a Graupner “Foka”. All of this occurred in the early 70s.

Of note is that no one person “invented” the electric winch as we presently know it. It was the evo-



Winch door is closed and secured with small brass clasp. Foot-switch will fit in box under motor. Turnaround has bicycle axle secured with commercial hardware parts and hole or eye screw is used to stake turnaround in place on the field. Bright colors and polyurethane from the weather and are visible on the flying field.

lutionary product of many people.

My Designs

I was one those isolated sailplane fliers who was trying to develop an electric winch. I was making the common mistakes plus a few that were uniquely mine.

Early on, with only moderate success, we used a 2-inch-diameter reel with a 6-volt system. In a dead-air

launch, the line wouldn't come in fast enough to even close the chute — our sailplanes were not going "up, up, and away", but rather "way, way, far away" to the turnaround. There were times when the sailplane beat the chute down.

By 1973, we were using a 12-volt, long-shaft Ford starter motor and a 6-volt battery, but had found the optimum reel diameter to be four inches. This was similar to what Hill had proposed.

For a while, our winch used two solenoids, one 6-volt and one 12-volt. On the field, we switched between 6- and 12-volt batteries and different-sized reels. As we shifted permanently to a 12-volt system, a few of us tried to keep our four-inch reels, but we paid the price for it in damaged aircraft. We went back to the 2-inch diameter reels and it is this 2-inch/12-volt combination that is used today.

There were several types of "constant torque" pulley and lever devices developed to make the neophytes more comfortable with winch launches and some of these were very imaginative, but they finally disappeared.

This Winch

This winch is the second of this design and it was built solely for this article — it is identical to the first. The original is still serviceable but shows the wear of 24 years of use. I replaced the motor brushes perhaps five times, had the armature resurfaced twice, and had the motor rebushed three times.

This design will serve 99% of sailplane fliers 100% of the time. It has easily launched Sailaires in competition and a few 12' scale sailplanes. I am confident it will launch larger scale sailplanes ROG, which is coming back in vogue. (When the LSF started, flights had to begin with ROGs to qualify for LSF credit, and in 1973, all of our flying crew met their LSF requirements this way.)

The limiting factors of this winch are the size of the battery and the tensile strength of the line. For sport flying, it will launch all day with a standard car battery and 2,000 feet of 100-pound-test line — the twisted, nylon type. Yes, I know there are fliers with CNC machine-molded models who might prefer more powerful winch motors with pulleys, belts, etc., but even they



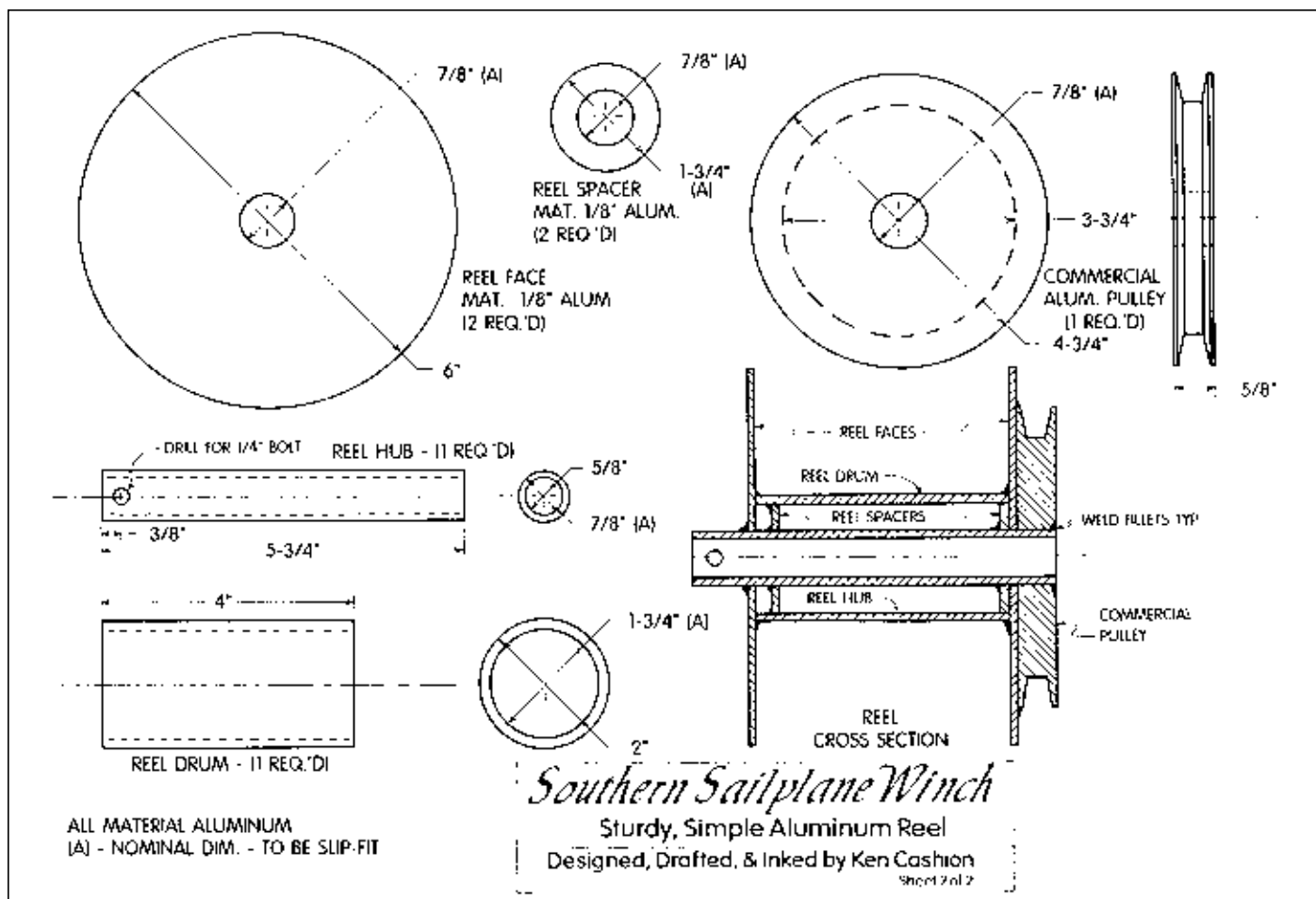
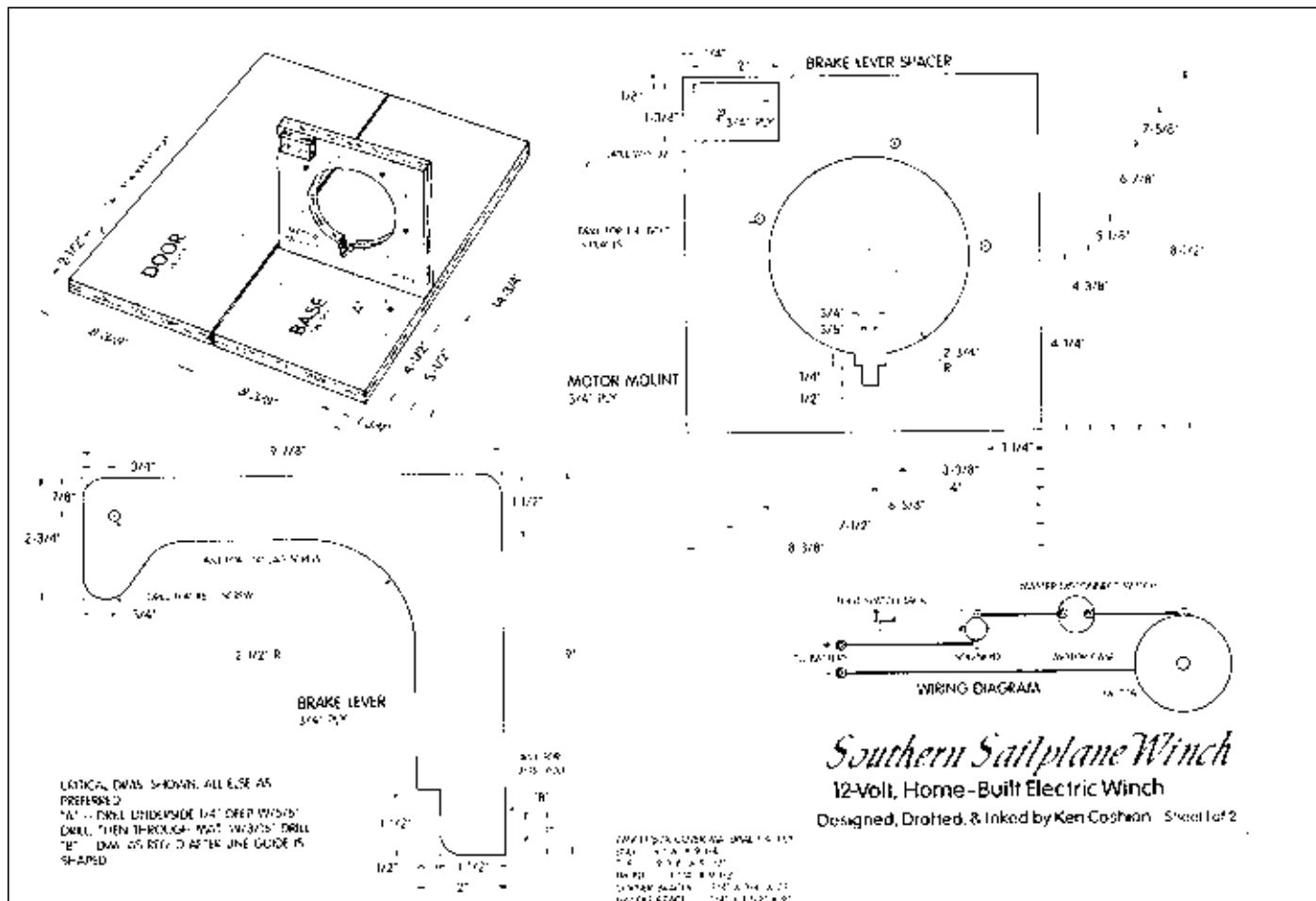
Phoenix
ELECTRIC ARF
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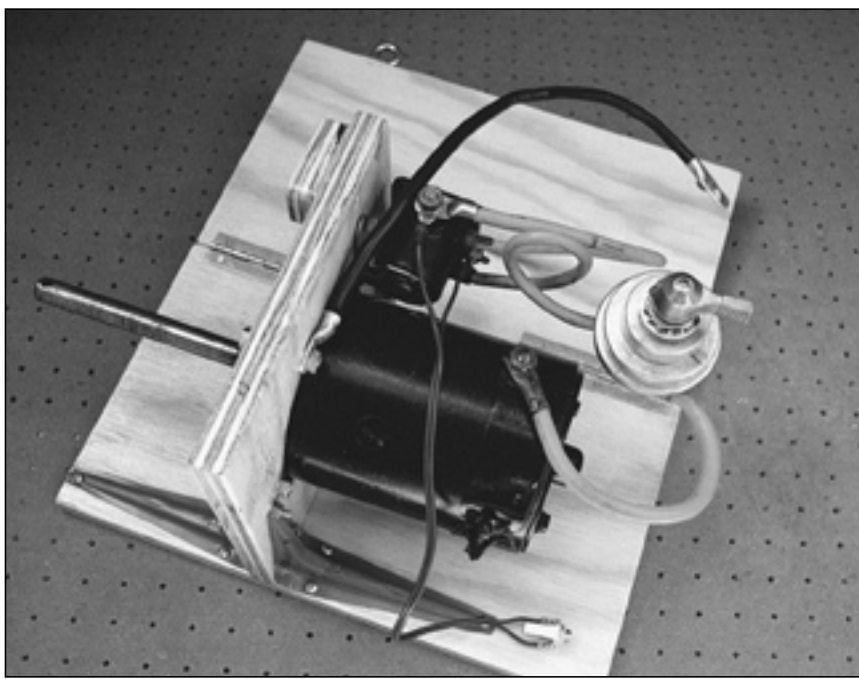
You can be up and soaring in just minutes!

SignatureSeries



Wingspan	79 in.
Length	43 in.
Wing area	554 sq in.
Weight	48 oz
Battery	7.2 or 8.4 V Sub-C
Radio	3 Channels
Motor	550 Mabuchi (included)
Color	Red and white





Wired and ready for 1/4-inch plywood cover. Motor is a long-shaft Ford starter with Ford solenoid. Master disconnect switch with large lever and foot-switch jack (lower center) will mount through cover.

can use this winch if they use a heavier, deep-cycle battery and perhaps 200-pound braided line.

My winch design has a small-but-firm footprint on the field and in the car. In operation, the battery sits on the opened winch door and, if necessary, the winch can be staked down through the winch door eye screw and the door corner hole. Also, with this layout, the line takes in from the bottom of the reel, keeping the pull on the winch closer to the ground and contributing to its stability.

I tried many turnaround designs and settled on this one. If I used more expensive line and I was flying from bare ground, I would use an elevated turnaround to raise the line as soon as it was under tension. This would reduce line abrasion. When launching over hard stubble grass, the line will snag and cut into the grass, and besides wearing the line very quickly, it will act as an unexpected turnaround. An elevated turnaround would be useful on this field, as well.

The brake arrangement I use works well and will keep the reel from freewheeling — the cause of most backlashes.

To minimize the number of winch pieces to look after, the foot-switch and chute are carried inside the winch box. The stakes are wedged from the top beside the brake belt.

CONSTRUCTION

With all of the parts in one place, it looks like a complicated project, but any kit, or scratch, builder should have

no difficulties building one, particularly if the project is approached in a systematic manner. The plans and instructions assure an easy and orderly construction process.

Though there are a lot of construction steps, many are simple 30-second operations that just need to be performed in a particular sequence to avoid unnecessary steps.

The total effort will be well worth it, because this winch will last decades — even if used every weekend.

Parts

The principal parts are winch base, winch cover, hardware, turnaround, foot-switch, and reel.

Power Tools

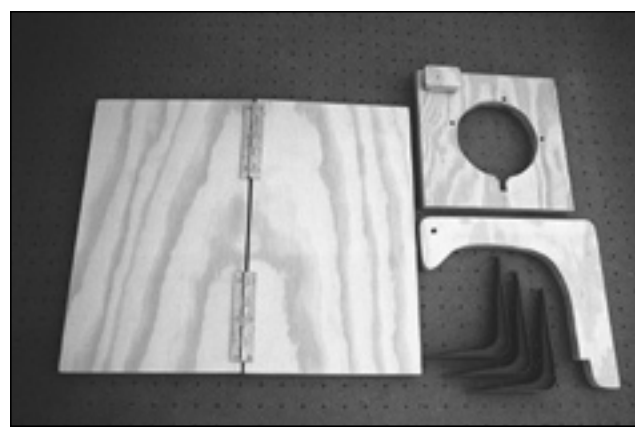
The only power tools needed for the construction, with exception of the reel, are a saber saw and a drill.

Parts List

Review the parts list and purchase all that is not available from your scrap box.

Winch, General

1. Lay out 3/4" plywood to produce the winch base, door, motor mount, brake lever, brake lever spacer, and foot-switch base.
2. Saw pieces to shape.
3. Attach brake lever spacer to motor mount by gluing and screwing (or nailing).
4. Drill as per drawing.
5. Remove the brush cover from the motor and trial-fit motor and motor mount. The notch in the mount is to clear the motor terminal.



Door, base, motor mount, and brake lever are made from 3/4-inch plywood. Motor mount, upper right, can be sawn with saber saw—the general shape for the brake lever is not critical.

6. Sand, seal, and apply final finish.
7. Add braces to motor mount. By proper alignment, two braces can share common mounting bolts through the motor mount.
8. Attach motor mount to winch base.
9. Attach door to winch base with hinges.
10. Attach motor and solenoid.
11. Wire motor, solenoid, master switch, and foot-switch jack as per wiring diagram. Mount solenoid bracket directly to motor mounting flange. Short, commercial battery cables will work well.
12. Leave brake lever and brake belt assembly until drum is procured.

Winch, Cover

Since each winch will have minor variations, the cover material is cut AFTER the winch box is constructed, as some cover measurements will need to be confirmed.

The provided dimensions are for 1/4" plywood. If paneling is used, adjust dimensions accordingly.

The 3/4" square material is used to reinforce the edge joints of the plywood, and there is a wider piece of 3/4" under the top in-line with the motor. The handle is secured to this, distributing the weight throughout the top.

1. Measure winch box for proper sizes of plywood for cover.
2. Lay out plywood (or paneling).
3. Saw pieces to shape.
4. Confirm fit.
5. Sand and seal.
6. Glue and nail handle bracing and corner braces using #18 x 3/4" wire brads.
7. Glue and nail cover together.
8. Drill for foot-switch jack, master switch, handle screws, and cover-mounting screws.
9. Apply final finish.
10. Mount foot-switch jack and

master switch.

11. Attach cover to winch using #8-3/4" pan head sheet metal screws.

12. Attach handle and small clasp for door.

Footswitch

I used a heavy-duty, surplus switch that has two switches on a single metal base with a common wire between switches and plug. (Switch source is on the parts list.)

These switches are removed from the base and the cover of the switch closest to the plug (switch #1) is removed (taking care not to lose freed internal spring). In switch #1, the wires to switch #2 are cut on both sides of the strain-relief and switch #2 is discarded.

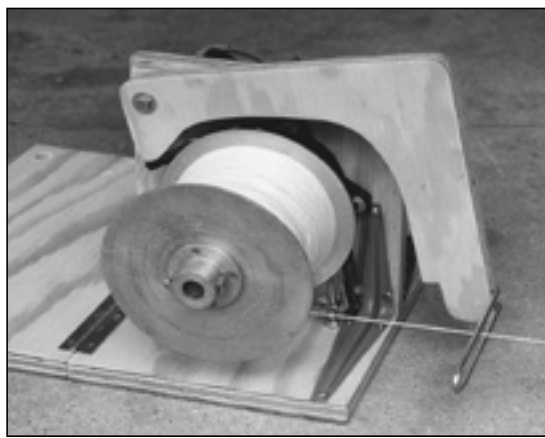
Switch #1 is already wired with a plug to connect to a two-terminal phone jack. (Step 6 is unnecessary if the recommended switch is used.)

1. Cut switch plywood base to shape.
2. Sand, seal, and finish.
3. Lay out switch position on switch base.
4. With switch top removed, drill through base for mounting screws.
5. Screw switch bottom to base.
6. Attach wire to switch terminals and to plug.
7. Reassemble switch.
8. Test switch operation with an ohmmeter to confirm proper wiring.
9. Using foot-switch, test winch operation — including master switch.

Turnaround

Detailed drawings are not provided because of the turnaround's simplicity and the variety of bicycle front axles. The turnaround design, photos, and these instructions will accommodate any axle.

1. Cut 2"x8" to 12" length.
2. Sand and seal.
3. Attach eyebolts to ends of bicycle axle.
4. Lay out position of axle on base and mark base for drilling.
5. Drill through base for axle eyebolts.
6. Lay out and drill through base for rear stake and rear eye screw. (Either hole or eye screw might be used but rarely both.)
7. Temporarily mount axle and mark location for winch line guide. (Made from coat hanger wire.)
8. Cut wire to length and bend as necessary to make guide. (Guide prevents slack line from fouling axle mounts or sides of axle.)



Winch line is under tension, brake lever is lifted, releasing the belt from the pulley at the top of the reel and allowing the reel to rotate freely.

9. Finish base.

10. Permanently mount eye bolts, axle, and guides with washers and nuts on base bottom.

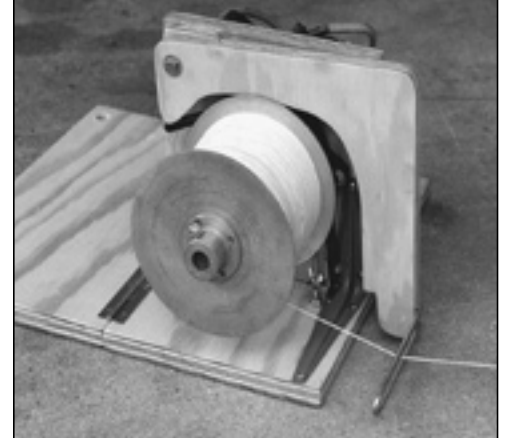
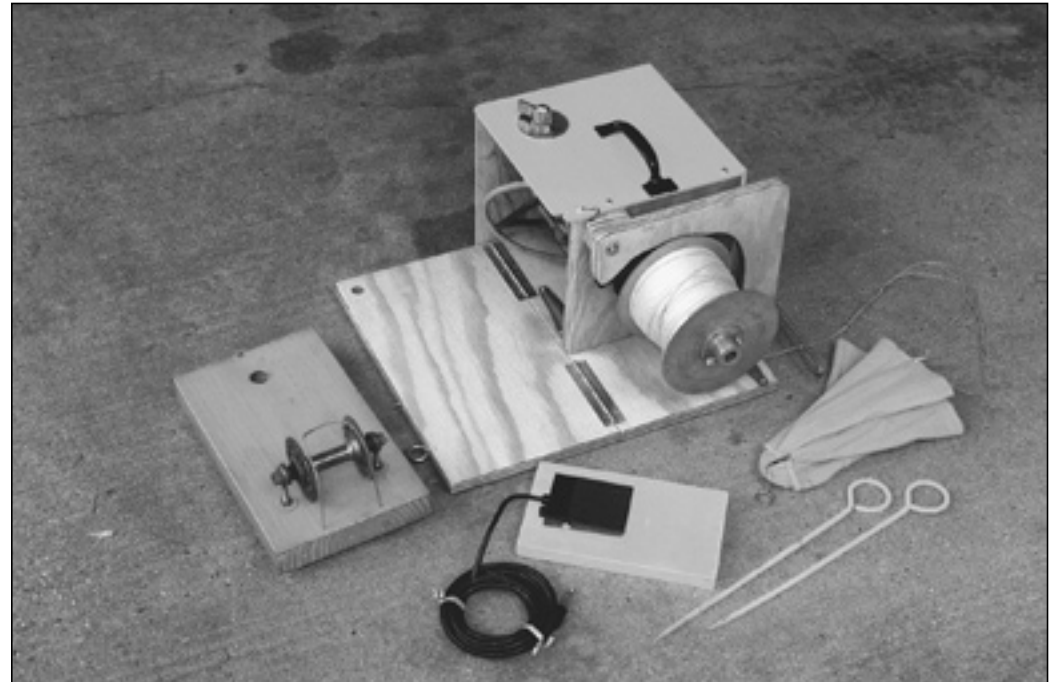
Reel

The reel shown in photos is a labor-intensive design but was within my capability, however, since most builders will have to purchase their reels, I have developed a more cost-effective design. The dimensions are the same as for the reel shown in the photographs.

I would think that other commercially available reels would work with this winch, though some dimensions would have to be confirmed before purchase.

Since the winch uses a long-shaft Ford starter motor, the reel must have

Completed winch with cover. Inside edges of the cover are reinforced with strips of 3/4 inch-square wood. handle is at the center of gravity, over the motor and has a strip of 3/4-inch bracing under the cover to reinforce the top. Stakes are used through eye screw at the edge of the winch door if needed. Another hole at the corner of the door is sometimes used as well. Foot-switch is transported in box.

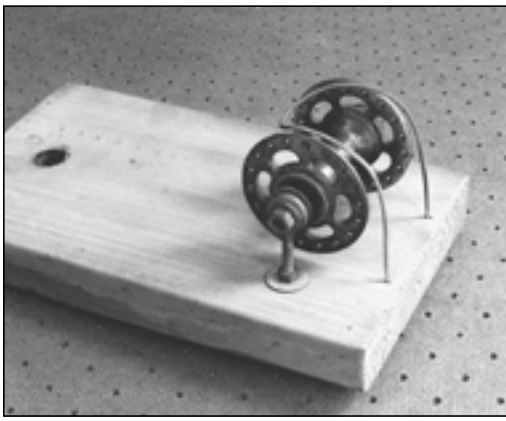


Winch line tension is removed and weight of brake lever lowers, engaging the belt in pulley at the end of the reel.

a 5/8" hole through the center and be 5-3/8" from the outer face of the brake pulley to the hole where the reel is secured to the end of the motor shaft. Most small machine shops can do the machining and the small amount of welding for this reel. The reel has been designed for a minimum of fabrication hours, yet will still provide a good, serviceable reel.

The following instructions are provided as a guide for the machinist. They are need not be followed to the letter if the machinist prefers a different approach.

Note — The machinist should understand the application and the nature of expected torque loads so adequate weld beads and/or fillets may be applied. It is not necessary for the

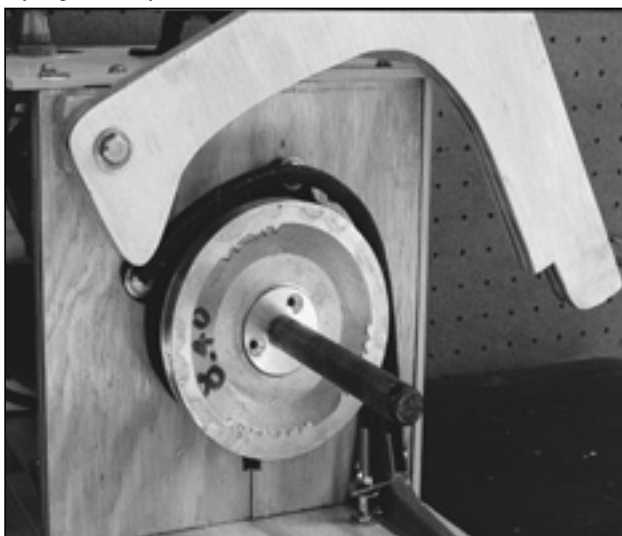


Many different axes can be used for a turnaround. I chose one with a large hub to help keep the line in its proper place. Wire guide is made from coat hanger wire.

full circumference of any piece to be welded; a few short welds would be sufficient.

1. Central hub is constructed from a 5-3/4" length of aluminum tubing with 5/8" id and approximately 1/8" to 1/4" wall thickness.
2. Acquire aluminum pulley 4-3/4" od and 3-3/4" pulley diameter. Reduce pulley to 5/8" maximum thickness and make pulley a slip-fit on central hub. Bevel outside edge of center hole for welds to central hub, but do not weld at this time.
4. Drum is constructed from a 4" length of 2" od aluminum with approximately 1/8" to 1/4" wall thickness. Turn drum to ensure ends are parallel and at right angles to central axis.
5. From 1/8" aluminum, cut two reel faces slightly over 6" diameter and two reel spacers slightly over id of drum.
6. Turn two reel faces to 6" diameter with center holes being a slip-fit on central hub.
7. Turn two reel spacers for od slip-fit inside drum and with center holes a slip-fit on central hub.

When line tension lifts brake lever, the belt is sufficiently cleared of pulley to permit easy rotation.



8. At 3/8" from end of central hub, drill for 1/4" bolt to mount central hub to motor shaft.
9. To make assembly jig, slip 5/8" diameter steel rod approximately 10" long through central hub and secure end of steel rod in vise.
10. Slip pulley, inner reel face, one reel spacer, drum, second reel spacer, and outer reel face onto central hub to confirm fit. Pulley should be flush with end of central hub.
11. Spot-weld pulley to reel face.
12. Move pulley to be flush with end of central hub and spot weld pulley to central hub.
13. Slip reel spacer to inner reel face and spot-weld spacer to central hub.
14. Slip drum over inner spacer. Push outer spacer approximately 1/4" inside the outer end of drum and spot-weld outer spacer to central hub.
15. Press outer reel face to drum and spot-weld drum to inner reel face and outer reel face.
16. Weld outer reel face to central hub.
17. Remove 5/8" steel rod and test-fit winch reel on motor shaft.

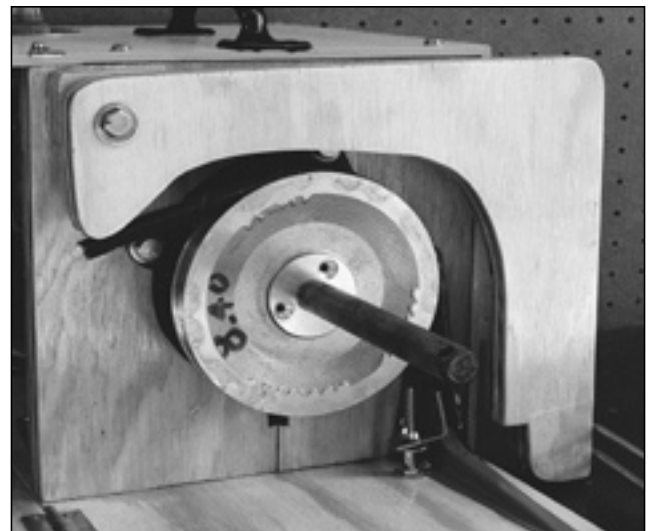
Brake Lever

After reel has been fabricated, assemble brake.

The drawing shows critical dimensions of the brake lever. The corners and detailed shape are not important provided the lever is not lightened too much — it needs the weight to function well.

1. Drill winch base for brake belt tension bolt. First drill with 5/8" drill, 1/4" deep in underside and then with 3/16" drill through base.
2. Push #10-24 x 2-1/2" tension bolt

Pulley, brake lever, and brake belt in lowered position. This stops free-wheeling and prevents backlashes.



(with washers) through base and secure with nut and washer on top of winch base.

3. For line guide, cut 3/16" diameter soft steel rod 12-3/8" long.
4. At center, bend over 1/2" diameter rod to form "U".
5. Place 1" of ends in vise, clamp securely, and bend "U" 90 degrees.
6. Position line-guide at front of brake lever, mark for two holes and drill for hand-press fit.
7. Cut drag belt to 11-1/2" inches long.
8. Drill holes in end of drag belt and mount angle to forward end with #6-1/2" FH screw w/flat washer and nut.
9. Drill underside of rear of brake lever and secure rear of drag belt with #6-1" sheet metal screw.
10. Apply small amount of grease to 1/4"-2" lag-bolt and to surfaces where brake lever and spacer interface; then w/flat washer on lag bolt, attach lever to motor mount.
11. Press line guide into holes. A small amount of contact cement will hold it in place. (Friction holds mine.) Take care not to force this and split the plywood.

12. Remove points from #10 blind nut, screw on the tension adjusting bolt, place drag belt angle over bolt, and place wing-nut over it.

13. Adjust tension on lag bolt pivot so that when brake lever drops, drag belt engages pulley.

14. Adjust belt tension with blind nut and wing nut so when the winch line through the line guide raises brake lever, the reel rotates freely, but when gate is dropped, reel rotation is limited in the counter-clockwise direction (as viewed from reel end).

CONCLUSION

This project provides for a good, serviceable winch in a small package with critical parts protected.

Should there be any questions or comments, please contact author — Ken Cashion, 157 Tennyson Cove, Picayune, MS 39466 or kcashion@datasync.com.



A boy and his winch. The Southern Sailplane Winch is small and easy to transport.



Stake is through eye screw at end of turnaround. A piece of wood this size permits the turnaround to swivel slightly on the field and align to the winch line.



Ready for operation. Single stake aligned with line tension on reel is usually sufficient. Weight of battery on winch door makes a heavy footprint. Master disconnect switch is obvious and accessible.

Materials

Winch box, 3/4" plywood

- 8-3/8" x 14-3/4" base
- 8-3/8" x 8-1/2" motor mount
- 8-3/8" x 14-3/4" door
- 9-7/8" x 9" brake lever
- 1-3/8" x 2" brake lever spacer

Winch box cover,

- 1/4" x 9-1/8" x 9-1/4" ply cover end
- 1/4" x 9-3/8" x 9-1/2" ply cover top
- 1/4" x 9-1/4" x 9-1/2" ply cover front
- 3/4" x 3/4" x 27" cover corner material
- 3/4" x 1-1/2" x 9" handle brace

Winch box hardware

- 3 ea. 4-1/4" x 5-1/2" angle braces
- 3 ea. #8-32 x 1" RH bolts w/flat washers and nuts for braces
- 12 ea. #8-3/4" RH WD screws for braces
- 2 ea. 4-1/2" hinges (narrow)
- 12 ea. #4-1/2" FH WD screws for hinges
- 1 ea. 1/4"-2" lag screw w/flat washer for brake lever pivot
- 1 ea. #4 1/4"-2" eye screw
- 1 ea. #10-24 x 2-1/2" bolt w/flat washers for brake belt adjustment
- 1 ea. #10 blind nut for brake belt adjustment
- 1 ea. #10 wing nut for brake belt adjustment
- 3 ea. 1/4"-20 1-1/2" hex head bolts w/flat washers and nuts for mounting motor
- 1 ea. 5-3/4" handle (Stanley)
- 14 ea. #8-3/4" pan head sheet metal screws w/flat washers
- 1 box #18 x 3/4" wire brads

Turnaround

- 2" x 8" x 12" solid wood
- 1 ea. #4 1/4"-2" eye screw
- 2 ea. 1/4"-4" eye bolt for axle
- 4 ea. 1/4" washers for axle
- 4 ea. 1/4"-20 nuts for axle
- 1 ea. front bicycle axle
- 1 ea. piece of coat hanger for line guide

Foot-switch base 3/4" x 5" x 8-1/2" ply

Additional parts and sources:

- Ford starter motor, long shaft reconditioned, 12-volt
- Ford starter solenoid, 12-volt — Autozone p/n F496 (\$8)
- Master disconnect switch — Northern, 800-533-5545, p/n 1610 (\$20)
- Foot-switch — Line Master dual switch, Electronic Goldmine, 800-445-0697 p/n G1149 (\$20)
- 1/4" phone jack plug — Radio Shack p/n 274-1539*
- 1/4" phone jack — Radio Shack p/n 274-252*
- 10' two-conductor lamp wire — Wal-Mart*
- 5' #4 gauge battery cable — Wal-Mart
- 8 ea. battery connectors — Wal-Mart

*If Electronic Goldmine foot-switch not used.