

Directions for Erecting

SOUTHERN CROSS "G" Pattern Windmills

and for Fixing Troughing

March, 1922

Read carefully right through before starting erecting, and take care that each bolt is used in its correct place. Before starting to erect check over all the parts in order to make sure that the complete outfit is on the ground. The detail of the 7ft. "C" Pattern Mill is somewhat different from the other three sizes, but these instructions will be sufficient to erect it correctly.

To assemble a tower, bolt the tower legs together in their full lengths, using $\frac{3}{4}$ in. x 5/16in. cup head bolts at the joints for 7ft. and 8ft. mill towers, $\frac{3}{4}$ in. x $\frac{3}{8}$ in. for 10ft. mill towers, $\frac{3}{4}$ in. x $\frac{3}{8}$ in. cup head bolts for 12ft. mill towers. Lay out two legs and raise their top ends on to a stool or other suitable article, and bolt in the tower castings *A* and *B*, figure 1. The tower legs fit inside the top tower castings, shown at *A*, and are bolted to them by bolts as under.

7ft., 8ft., 10ft. and 12ft. mill towers, 6 bolts, 1in x $\frac{3}{8}$ in. hex head.

The bottom tower castings, or mast pipe guides, are bolted to the tower legs by bolts, as under:—

7ft. and 8ft. mill towers, 3 bolts, 1 $\frac{1}{2}$ in. x $\frac{3}{8}$ in. hex.

10ft. mill towers, 3 bolts, 1 $\frac{1}{2}$ x $\frac{3}{8}$ in. hex.

12ft. mill towers, 3 bolts, 1 $\frac{1}{2}$ in. x $\frac{3}{8}$ in. hex.

These bolts also take three of the brackets supporting the top platform.

Bolt the cross angles between the legs, but note that one of each set is provided with two holes for bolting the ladder to, and these cross girts with the holes in must be all kept on the same side of the tower.

Before screwing the nuts on the bolts which hold the cross girts, put on one of the links as shown at *C*, but omit them at *D* and *E*. Then bolt the third leg in place and put in the bottom set of cross girts to support the projecting end, after which the remaining cross angles may be bolted in, and the links bolted on, omitting them at *D* and *E* as before.

Before putting the flat braces on the tower, it is necessary to pack the centre of the tower up so that there will be no sag in it. The braces are now put on, the lower ends of the bottom set are bolted on to the tower legs by the bolts at *D*, but the top ends are bolted to the free ends of the link at *C*, the lower ends of the next series of braces being fastened by the same bolts to these links, but on the opposite side, so that the link comes between the two braces. The ends of all the braces will be fastened to these links in like manner, but the top end of the upper set of braces will be bolted one on each side to eyebolts *F*, which pass through three holes in the mast pipe guide "B." A careful study of the figure before starting to put together will save the erector time and trouble.

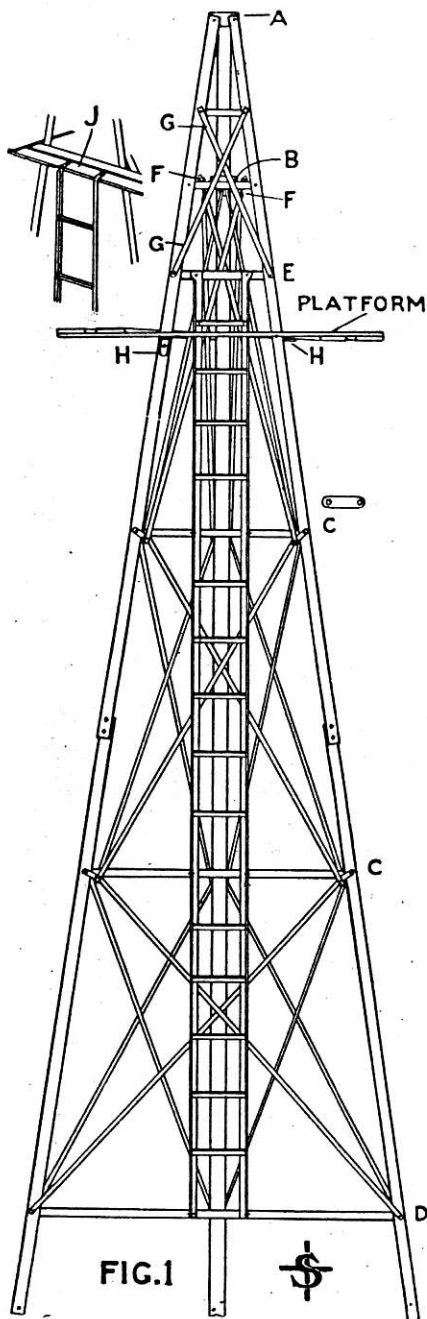
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The Toowoomba Foundry Co. Ltd.

Toowoomba

Townsville, Rockhampton (*Fitzroy Foundry*), Qld.

N.S.W.: The Southern Cross Windmill Co. Ltd., ST. PETERS



The eyebolts are now to be tightened up simultaneously by giving the nuts on each a few turns at a time; all other nuts to be left fairly loose till the diagonal braces come tight, when all nuts must be nipped up. The short braces *GG* are simply bolted on, and serve to prevent twisting in this part of the tower; they should be put on before tightening up the eyebolts.

The ladder is fastened at the top by bolting to the cross girt in the 7, 8, 10 and 12ft. mill towers, and is secured to the other cross girts by two hook bolts at each intersection. The main platform is bolted to three bent wrought-iron brackets which are bolted to the tower legs at *H*.

There is one particular way to put the platform on so that it will be level when the tower is erected.

The top platform is fitted on 10ft. and 12ft. mills only, and consists of three pieces of hardwood, each bolting to two brackets. Three of the brackets are put on at the same time as the mast pipe guide. The other three brackets bolt to the round holes adjacent to the mast pipe guide, using $1\text{ in.} \times \frac{3}{4}\text{ in.}$ hexagon bolts.

Round hardwood blocks, about 12 inches in diameter, set in the ground about 4 or 5 feet, and shaped to suit the tower leg, which is inclined 2 inches to the foot, make a very satisfactory foundation. The blocks should be shouldered 12 inches down for the tower legs to rest on, and shaped to the required angle and incline.

Use a level with a plumb glass in it to get the right incline; if the block is shouldered down 12 inches a level held upright against the corner at the bottom should be 2 inches off at the top. The shoulders of the blocks must be perfectly level, each with the other.

When specially ordered, steel anchor posts with cast iron feet can be supplied suitable for Southern Cross towers.

The tower being assembled, measure the distance between the inside of tower legs at the bottom. Make a triangle 4 inches narrower than the spread of tower at base, out of tankstand boards or other material on job, place it across bore, or well, taking care that each point of triangle is an equal distance from centre of bore, or that part of well where it is intended to place the pump piping. To allow for the inward slope of the tower blocks keep the centres of holes six inches further apart than the distance measured across the base of the triangle just made.

The following table as to the depth of holes to be sunk for the different size mills, and the size of blocks should be strictly observed. Too much stress cannot be laid on the importance of having the blocks of large diameter and well sunk in the ground. The approximate spread of towers is also given:—

Size of Mill.	Depth of holes for blocks.	Length and approximate diameter of blocks.	Height of tower.	Approximate spread at base.
7ft.	3ft. 6in.	5ft. x 10in.	16 feet	5ft. 4in.
8ft.	3ft. 6in.	5ft. x 10in.	20 feet	6ft. 8in.
10ft.	3ft. 9in.	5ft. 6in. x 10in.	25 feet	8ft. 4in.
12ft.	4ft.	5ft. 6in. x 12in.	30 feet	10ft.

Place the blocks in position, the outside edge of each block at top should project about *three inches* beyond triangle. Ram the blocks well, especially the bottom two feet or so. Nail battens horizontally on side of posts about 18 inches above ground surface, and cut off tops of blocks *level*. Remove battens to 12 inches lower, and make sawcuts into side of posts. Take measurements carefully to ensure the legs of tower fitting the posts, and also that the tower when erected will be plumb over the centre of bore. The posts may be squared off with an axe or adze, and cut down with the saw. The figures 2 and 3 explain this clearly. The platform must always be bolted on to the tower before the mill engine is put in place.

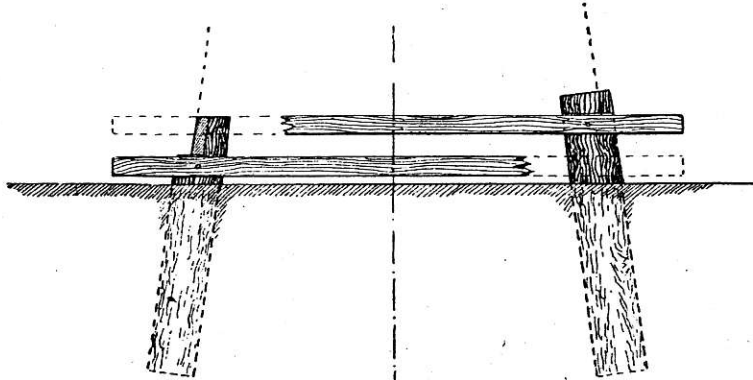


Fig. 2.

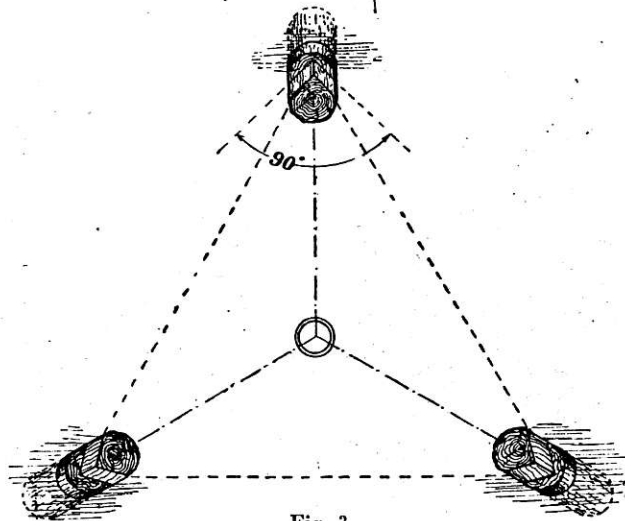


Fig. 3.

Special Instructions for "G" Pattern Windmills Packed for Shipment by Sea

In this case the main windmill engine is partly dissembled and the parts packed in a case, so that they are fully protected.

Re-assemble the windmill engine as follows:—

Bolt the angle iron rocker bracket to the windmill. The two top bolts go through the holes drilled in the main casting and a longer one with a washer goes through the drilled hole in the bracket and through the groove in the main casting below, and to the rear of the bottom vane bracket. The washer goes under the head of the bolt and bears on the main casting.

Fit the vane hinge casting No. 10 in position, put the top vane bracket No. 11 on and bolt this to the angle bracket, as shown in Fig. 5. Bolt the rocker bearing No. 14 to the outer end of angle bracket No. 103. Then bolt the angle iron pump rod No. 104 to the cast iron connecting rod No. 15, and put the angle pump rod down through the mast pipe of the main engine until the cast iron connecting rod fits roughly into the recess in the main casting above the mast pipe. Take out the set screw from the centre of the crank pin and take off the cast iron washer. Put the wooden pitman rod No. 116 on the crank pin and replace the washer and set screw.

Now take the rocker, consisting of two arms each marked No. 12 bolted together. Take out the bolt. The bosses on the arms then fit into the rocker bracket No. 15 at the outer end and through the wooden pitman rod and cast iron connecting rod at the other end, and the bolt is tightened up.

The reefing bars 62, 63, 64 and 67 are sent out bolted together. Arrange them as shown in Fig. 5 and bolt on to the lugs on the main casting. This completes the re-assembling of the mill engine ready for putting in the tower.

Fig. 1 shows how the wooden platform is assembled. *Note.*—One end of each pair of boards goes under and the other end over the next pair.

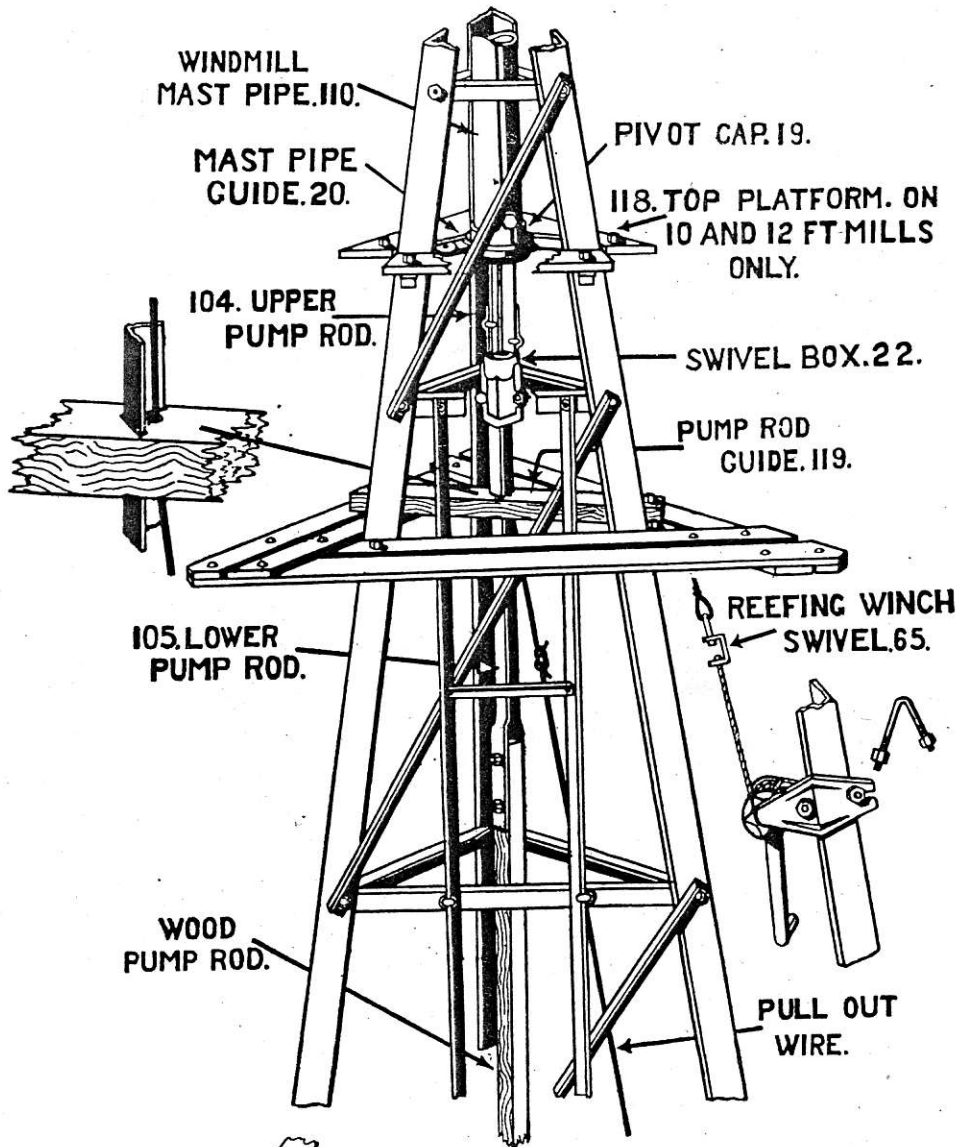


Fig. 4.

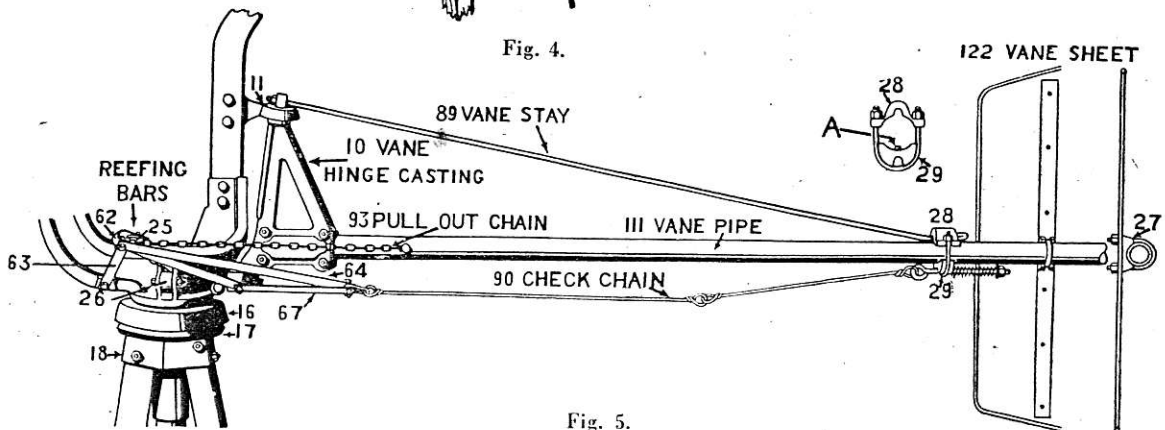


Fig. 5.

To put the windmill engine into the tower, first take off the mast pipe pivot cap No. 19. Place the gimbal ring No. 16 and roller cage No. 17 and rollers in position at the top of the mast pipe. The mast pipe then goes through the top tower casting and the lower end of it through the bottom casting or mast pipe guide No. 20. Replace the pivot cap.

Undo the bolts through swivel box No. 22, carefully observing how this attaches to the lower angle pump rods so as to be able to put it back the same way later. Bolt the pump rod swivel No. 21 to the upper pump rod No. 104 by means of the two hook bolts attached to it. Now fix in position the wood guide No. 119. It is first necessary to decide on which leg of the tower the pullout winch will be fixed, and then place the wood guide so that the pullout wire after coming through it will pull away from the angle pump rod. It will be necessary to cut No. 119 wood guide away slightly to clear one of the diagonal braces of the tower.

Having fixed No. 119 wood guide, put the lower angle pump rod No. 105 through it, and connect up to the pump rod swivel by bolting on the swivel box No. 22 in the same way as it was originally.

Next put in the vane pipe. There are two holes drilled in it—one near the centre through one side only, and one nearer one end, drilled right through. Put the end of the vane pipe with this latter hole in it into the semi-circular recess in the vane hinge casting. The hole near the middle of the pipe must come on the side that will be underneath when the windmill is erected. Clamp the pipe with two U bolts.

Bolt the vane sheet on to the vane pipe, using U bolts, and the vane clip castings No. 27 as shown in Fig. 5. The vane sheet must be in line with the windmill mast pipe, so that when the windmill is erected the sheet will be vertical.

Vane stay bar No. 89 and check chain No. 90 are put on together, using a U bolt and clips Nos. 28 and 29, which are sent out assembled as shown in Fig. 5. The pip marked "A" goes into the hole in the vane pipe, and so locates the end of the bar and check chain correctly. The other end of the vane stay bar goes through the hole in the top of No. 10 vane hinge casting and the nut is tightened up. The other end of the check chain is attached between bars Nos. 64 and 67 as shown. Undo the bolt, put the link between the bars, replace the bolt and distance piece, through the link and bars.

Put the pull-out chain on as follows:—The wire or rod goes down through the mast pipe, pump rod swivel and hole in the wood guide Fig. 4. The chain goes over roller No. 26 and sheave No. 25, and is then attached to the vane pipe by a bolt through the last link going through the hole drilled in the pipe Fig. 5.

The windmill is now ready to be pulled up.

The mill is hoisted before the sail wheel is bolted on. Fasten a plumb line to the pump rod of the mill and rest two of the tower legs on the shoulders of the wooden blocks to which the tower is to be bolted.

For hoisting the tower we recommend a pole rigged as per Figure 6. This requires to be kept in a vertical position by two or three good guys fastened to pegs securely fixed in the ground at convenient distances from the pole, the base of the pole to be sunk into the ground.

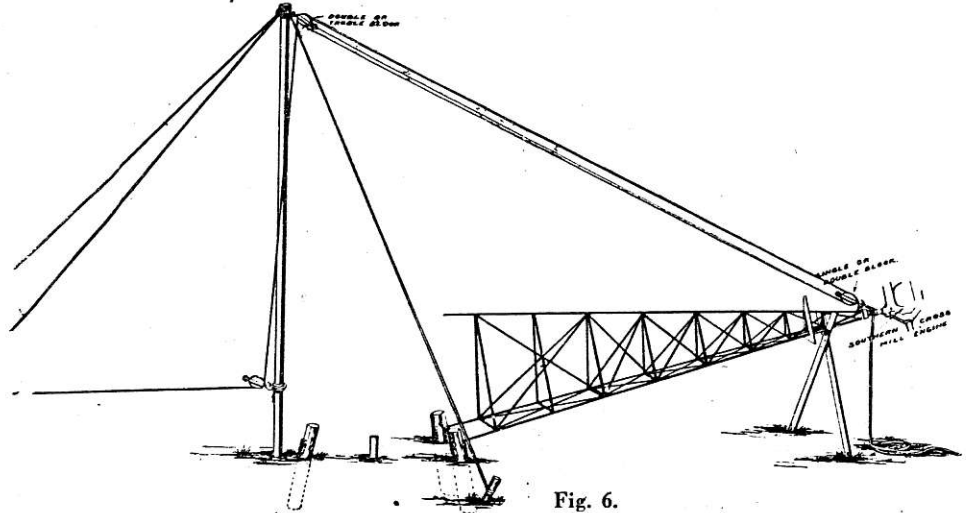


Fig. 6.

Before raising the pole attach to its upper end a treble or double block, according to the size of mill to be hoisted, and through it and the corresponding double or single block thread the ropes. When the pole is up run out the lower block and fasten it by a suitable sling to the tower near the top tower casting. Fasten a back guy to the top of the tower and round a stout peg driven into the ground about 20 feet away in a direct line with the tower and proceed to hoist, either by pulling down on the loose end of the rope, or, if a straight out pull is desired, through a snatch block at the base of the pole. If the latter plan is adopted, a Spanish windlass may be used on the loose end when the weight is too great for the assistance available. The pole employed should be at least two-thirds the height of the tower to be raised.

Towers higher than 40 feet should always be built up from the blocks, and even 40-ft. towers may with advantage be built up in this manner, starting by bolting the three bottom legs to the blocks and placing cross girts, diagonal braces, etc., in position until the tower is completed, the mill itself to be put in to the tower after erection.

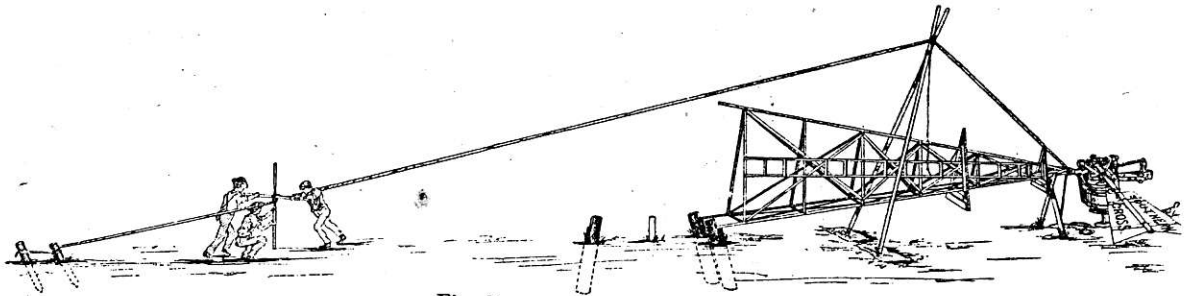


Fig. 7.

Another method of erecting is as shown in Figures 7 and 8; the hoisting is done by a "Spanish windlass." The windlass is usually a length of pipe for a winding lever, and the upright piece, the discharge pipe, sent with almost every windmill outfit, or two stout saplings may be used instead of the pipes.

Figure 9 shows the lever attached to the vertical pipe forming the body of the Spanish windlass and the position of rope during hoisting. When hoisting by this method two back guys are necessary.

Immediately the tower is in position, measure to the plumb line (attached before the tower was hoisted) from each leg, and if all three measurements do not correspond the tower is not plumb. Cut the shoulder away from under the legs which show the longest measurement from the centre plumb line till all are correct. Then bore the holes through the posts and bolt the tower in place.

If the mill is erected over a bore the plumb bob must hang directly over the centre of the bore when the tower is up.

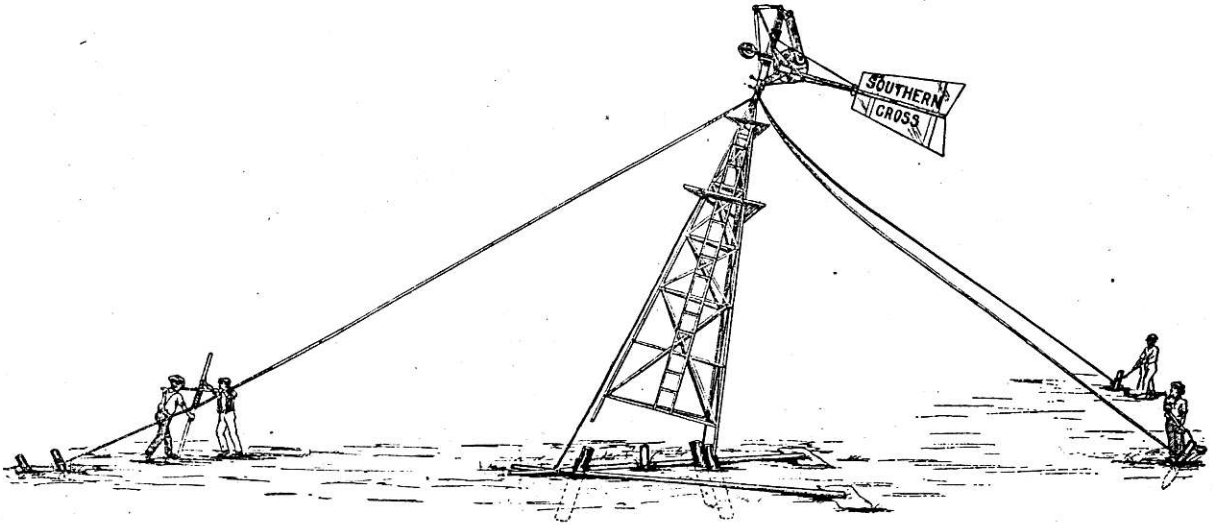


Fig. 8.

Before proceeding to assemble the wheel attach the pullout winch to the tower leg, as shown in Fig. 4, using the V bolts shown. See that the winch is on the right leg of the tower so that the pullout wire will be pulling away from the angle iron pump rod. The pullout wire is now joined to the wire coming down from the mill, its length adjusted to reach the wire rope unwound from the winch drum, and the end is then passed through the hole in the swivel on the end of the rope and made fast.

Wind the Windmill out of gear before starting to assemble the wheel

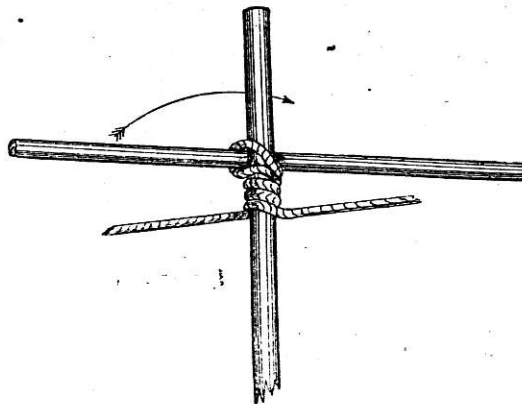


Fig. 9.

Assembling the Windmill Wheel

In the whole of these instructions it is taken that the erector is standing on the platform and working from the back of the wheel.

First bolt on the arms, using $1\text{in.} \times \frac{3}{8}\text{in.}$ hexagon bolts, two bolts in the back disc and one in the front. The arms bolt on the back of the discs, as shown in Fig. 10.

INNER RIM.—This is single and is bolted in the centre of the inner cross bracket in the arm with $1\text{in.} \times \frac{5}{16}\text{in.}$ black hexagon bolts. The sections have at one end a hole for a $\frac{5}{16}\text{in.}$ bolt. At the other, first a hole for a $\frac{1}{4}\text{in.}$ bolt, then one for a $\frac{5}{16}\text{in.}$. Place the first section in position on top of the bracket so that the holes for the $\frac{5}{16}\text{in.}$ bolts coincide with the holes in the arm brackets, and the end with $\frac{1}{4}\text{in.}$ hole in it extending beyond the bracket to the LEFT. Now work to the right, bolting on one section at a time, with the extension or lap to the left, and on top of the previous section. **PUT IN ONLY THE $\frac{5}{16}\text{in.}$ BOLTS**—the $\frac{1}{4}\text{in.}$ bolts will be put in when the fans are bolted on. The right hand end of the last section goes UNDER the left end of the first section so that the joint at each arm is the same.

INTERMEDIATE RIM.—This is double and bolts on to the middle bracket on the arm with $\frac{3}{4}$ in. x $\frac{5}{16}$ in. black hexagon bolts. The sections for the inner and outer divisions of this rim are the same. They have a hole for a $\frac{5}{16}$ in. bolt at one end, and at the other first a hole for a $\frac{1}{4}$ in. bolt and then one for a $\frac{5}{16}$ in. bolt.

Take two sections of this intermediate rim and turn them end for end, that is so that the hole for a $\frac{5}{16}$ in. bolt is at the right hand end of one and at the left hand end of the other, that is so that distance "A" comes opposite distance "B." Place the section nearest the tower in position in the wheel on top of the bracket, so that the $\frac{5}{16}$ in. holes coincide with the holes in the arm brackets, and that extension with the $\frac{1}{4}$ in. hole is to the left. The section away from the tower goes in with the extension to the right.

Now continue working to the right, bolting on the inside sections with the lap or extension to the left, and on top of the previous section, and put the outside sections with the lap or extension to the right. **THE $\frac{5}{16}$ in. BOLTS ONLY ARE PUT IN.** Again the $\frac{1}{4}$ in. bolts go in when the fans are bolted on.

OUTER RIM.—This is put on in exactly the same way as the intermediate.

FANS.—There are three of these in each section of the wheel, except in the 7ft. mill, which has four in each. The inside end of each is turned and punched to bolt to the inside rim. Brackets are riveted on with holes punched to bolt on to the intermediate and outer rims. The fans are placed so that the concave surface is towards the front of the wheel—that is, the side away from the tower. The brackets are shown in full and the outline of the fans dotted in in Fig. 10.

Bolt the first fan in position on the immediate left of one arm. The brackets come on top of the outer and intermediate rims.

The right hand side of the fan will bolt with $\frac{1}{2}$ in. bolts to the holes in the inside sections of the intermediate and outer rims just to the left of the arm, and to the hole in the inner rim where the lap comes just to the left of the arm again. When this is done the bolts on the other side of the fan will come in easily.

Now work to the left. The holes for the next fan will show up plainly, and the third fan in the section comes in just to the right of the next arm.

The fan bolts on one side of the first and third fan in each section, also make the joint in the lap of the rims as will be seen. Where the fan bolts to the lap of the inner rim use a 1 in. x $\frac{1}{4}$ in. bolt, otherwise use $\frac{3}{4}$ in. x $\frac{1}{4}$ in.

Do not tighten any bolts until the wheel is all together. Then go over them and tighten all most carefully.

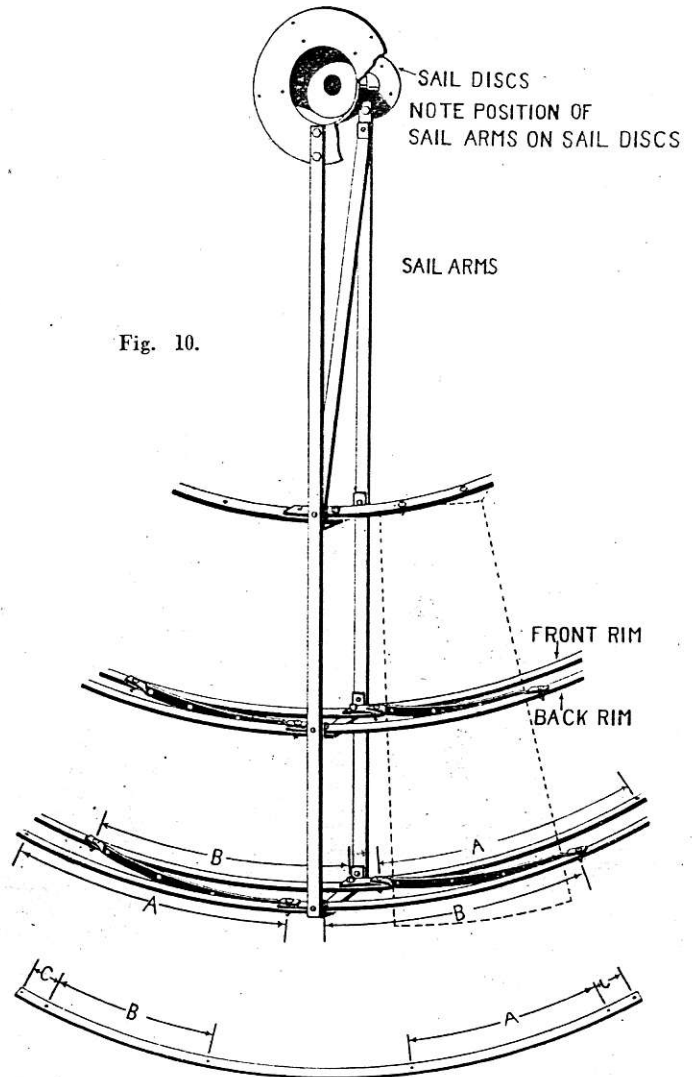


Fig. 10.

DISTANCE "A" IS GREATER THAN DISTANCE "B."
NOTE POSITION OF ENDS "A" AND "B" WHEN ASSEMBLED.

Special attention should be given to a windmill during the first month or so after erection, as it is during this period that accidents are most likely to occur. Bolts may work loose while the mill is new, and they should be gone over once or twice and tightened up. The set screws holding the crankpin to the large gear will require a half turn or so after working some time.

Oiling

The windmill is now ready for oiling, and it is most important that every working part should be well lubricated before it starts work.

FIRST, using an oilcan, well saturate with oil the felt pads in the two oil boxes on the wooden pitman rod and the one on the rocker arm bracket.

SECOND, put about $\frac{3}{4}$ pint of oil into the main oil box—that is, enough to make the level of the oil just about half an inch from the bottom. Do not put in more than this—it is unnecessary and the excess will be wasted.

THIRD, pack with grease the grooved recesses in the two vane hinge brackets and in the mast pipe guide round the pivot cap, and grease the teeth of the gear wheel and pinion.

ALWAYS USE SOUTHERN CROSS WINDMILL OIL AND GREASE.

We have selected good bodied lubricants best suited for the work, and we see that the quality is uniform. Cheap oils and grease always result in greater expense in the long run.

Fixing Pumps in Wells, Bores, Etc.

Never allow the bottom of a suction pipe to rest on the bottom of a well or bore. Silt and debris usually accumulate just at the bottom and this blocks up the strainers, and if it does not stop the pump working by getting into the valves it prevents the inrush of water on the suction stroke and results in diminished delivery. If the bore is shallow there is not much weight of pipe, etc., and no useful purpose can be served by resting on the bottom. If it is deep it is especially harmful, as the pipe sags and goes into curves with the weight, and the rods must rub round these curves every time.

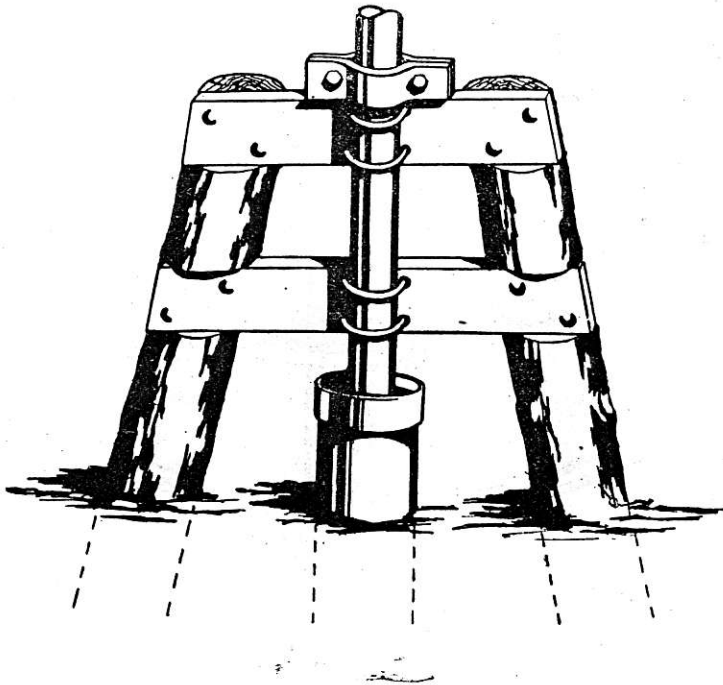


Fig. 11.

For bore holes hang the pipe from a strong cross timber checked into posts at the sides of the bore hole. If extra heavy pipe or deep bores use two sets of cross timbers and four U bolts, also a special iron clamp bolted on to the top of the cross timber in addition to the usual pipe clips will be useful. The top of the pipe should be stayed up the tower. Figure 11 shows how to fix the posts, cross pieces, and clamps for securing the piping when hung in a bore. For wells the pipe should be stayed every 30 feet or so down the well, but never below the maximum height of water or foul air.

We always recommend our special brass strainer and our brass intermediate valves below pumps in bores or wells. They save no end of trouble. Avoid suction pipes longer than 12 or 14 feet, and if convenient it is well to put pumps below the water level in bores and just immediately above the water for wells.

For pumping from creeks or dams Syphon pumps are recommended. They never require priming, but they must not be more than 20 feet (vertical) above the water level, and the closer they are placed to the water the less trouble they give. The discharge pipe from a windmill should be extended well over the edge of tank as the mill pumps most on windy days, and the water will be blown over the edge of the tank if the discharge is too short.

Troughing

Standard troughing consists of, and is sent out as, curved galvanised sheets, bent angle framing legs, screwed and curved outside clip bands of round iron and inside curved bow of flat iron, side angle framing with angle cross stays, flanged ends, holding down spikes and bolts.

To assemble the trough lay sleepers in the ground, all level at 7ft. 10ins. distance from one another for 8ft. sheets, and 5ft. 10in. for 6ft. sheets, centre to centre. In levelling these blocks it is necessary to level all from the first one, to do otherwise is taking risk of error. As the fixing proceeds, test every couple of sheets with water, raising or lowering the sleeper logs to an exact level according to the run of the water.

Take a trough leg and *loosely* spike it down to the end sleeper. Put in an outside bow and screw about half a full nut both sides, hang the end of one trough sheet in this bow and thickly coat a couple of inches of the end of it with paint or tar and pitch.

Put two inside angles (4ft. length for 8ft. sheets and 3ft. for 6ft. sheets) in under the top of the trough leg and over the sheet, the angle extending inwards. Bolt a cross stay across the middle of the sheet of troughing, securing these to the side angles and trough sheet by $\frac{1}{4}$ in. galvanised bolts. Place the trough end in the trough, back from the end, flange inwards, push and tap up to the end. It is difficult to get the end in from the outside.

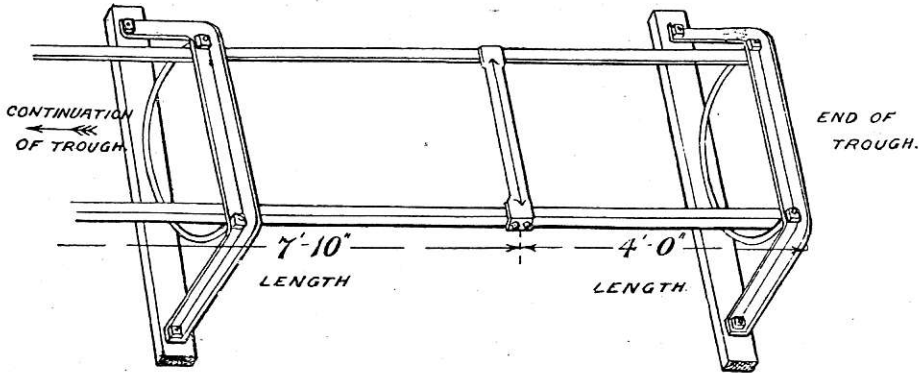


Fig. 12.

Screw up the outside bows on to the end tight, and take another leg and spike loosely to the next sleeper at such a distance from the first leg, that the centre of the outside bow just comes 1 inch on to the end of the trough sheet. Let the end of the first sheet hang in the bow of the second leg and spike the first leg down hard. Shove two 7ft. 10in. side angles for 8ft. lengths and 5ft. 10in. for 6ft. lengths, under the second trough leg up to the end of the first two joints of 2in. well painted, and support the end in a bow slung from a third leg as before. Put in an inside bow under the side angle and tighten the second bow and proceed, ending up with a short length of side angle as at beginning. The joints of the side angles always come in the centre of the sheets, not at the joints. The side angles are joined by bolting to the sheets and through the cross angles. This is an easily erected and serviceable trough.

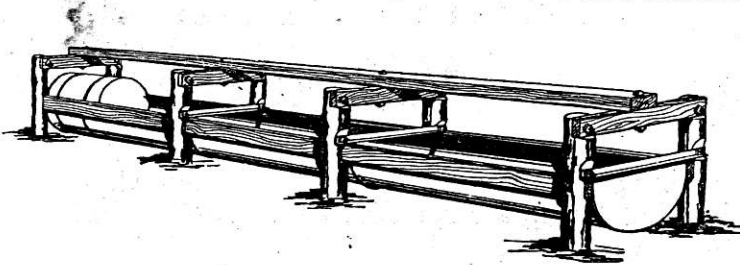


Fig. 13.

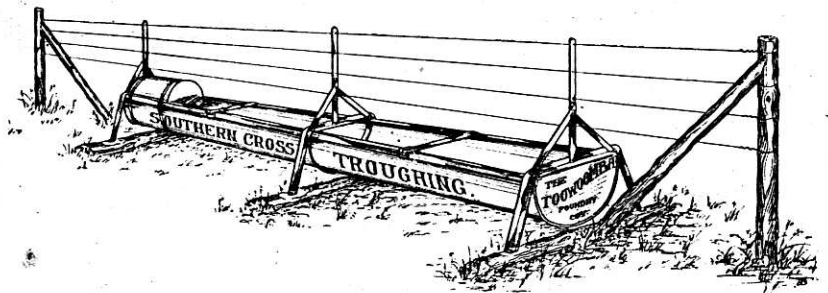


Fig. 14.

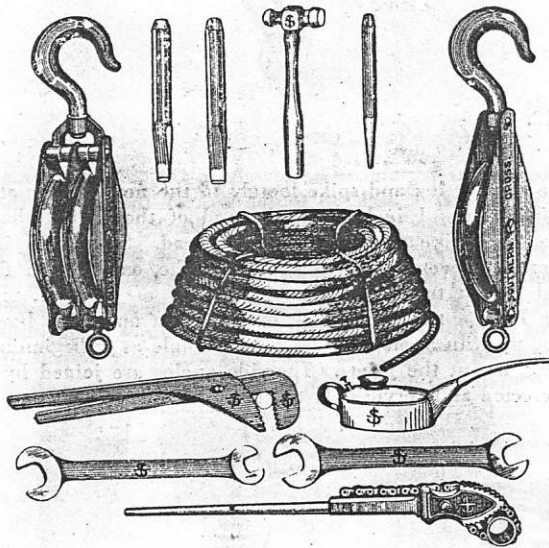
The preceding instructions apply to erecting our standard troughing in steel framing. Where cattle or mixed stock are to be watered the trough may be fixed as just described and an independent protecting rail built, or the trough may be supplied with fittings for wood framing and built in the frame as shown in Figure 13 and as described hereafter.

Where troughing is supplied with fittings for wood framing, a pair of uprights of round timber should be placed at each joint, and to these spike or bolt the straight angle steel cross bars, sent in lieu of standards; clip the troughing together as before described and fix a wood rail along each side of the trough sheet, these rails to be checked into the uprights and fix the edges of the trough sheets to the rail with stout screws spaced about 12 inches apart. If a top rail over the trough is wanted provide long uprights, bolt cross pieces at the height desired, and bolt a centre rail along these cross pieces.

Troughing can also be supplied with attachments for readily fixing a wire fence in its centre, the method requiring no further explanation than Figure 14.

A Good Kit of Tools

will quickly pay for itself

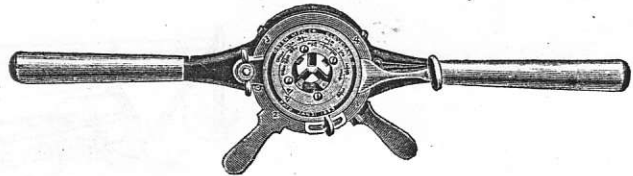


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