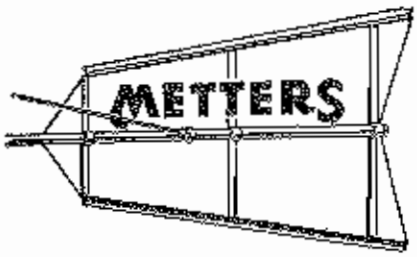
INSTRUCTIONS FOR ERECTION
AND OPERATION
PARTS AND PACKING LISTS
FOR

METTERS M windmill



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DIRECTIONS FOR THE ASSEMBLY AND ERECTION OF TOWERS FOR METTERS M WINDMILLS

ASSEMBLE ON GROUND IF POSSIBLE

The most efficient method of erecting a Metters windmill is to assemble the tower on the ground, erect it, then fit the head, tail and windwheel. When the location of the mill is such that it cannot be assembled on the ground, the tower can be built up piece by piece from the bottom and a derrick used to pull up the head and lower same onto the tower. See Page 7 for this alternative method.

GROUND PREPARATIONS FOR FOUNDATIONS

It is imperative that the anchor posts be embedded in concrete, as this is undoubtedly the most reliable method of ensuring safe anchorage against storm.
First prepare the holes so that the concrete bases may set and be ready to take the weight of the tower to be assembled.

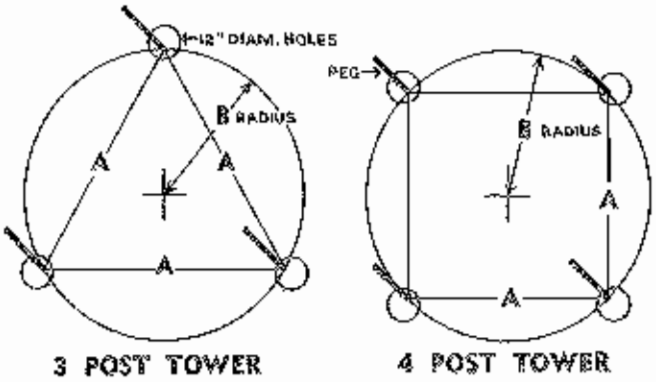


FIG. 1

The tower dimensions at ground level are given in tables at right. The diagram above shows the most reliable method of marking the positions for the holes.

Using the dimension "B" as the radius, mark a circle around the centre peg driven in a position where the centre of the mill is to be, bearing in mind that the pump rod connecting the mill to the pump must be absolutely plumb centre. Drive a peg into the ground on the circle where one leg is to be, then another where the dimension "A" cuts the circle measured from the first peg Mark the third peg position similarly from the first, then check the distance between the second and third. In the case of a four-post tower, proceed as above, but establish the fourth peg from the second or third. If all measurements have been correct, all the pegs will be equi-distant from each other. If not, check the measurements until they agree with the plans as in Fig. 1. These pegs now represent the spot at which each leg enters the ground. Before disturbing them, start a hole 12 inches in diameter. The pegs should be deep enough so that their exact location will not be lost. The holes should be made to slope outwards, so as to follow the slope of the tower legs, which is 1½ inches per foot of depth.

The bottom of the hole should be enlarged in diameter to provide a good footing for the concrete
Sink the holes:

3' 3" deep for 6' and 8' Mills.

4' 0" deep for 10, 12, and 14' Mills.

If the windmill is being erected on a hillside, the lowest hole must be the full depth as stated and the others deeper, so that the bottoms are all level.

NOTE These directions are for average soil conditions. Where ground is swampy, consult Metters for further information.

POSITION OF LEGS AT GROUND LEVEL

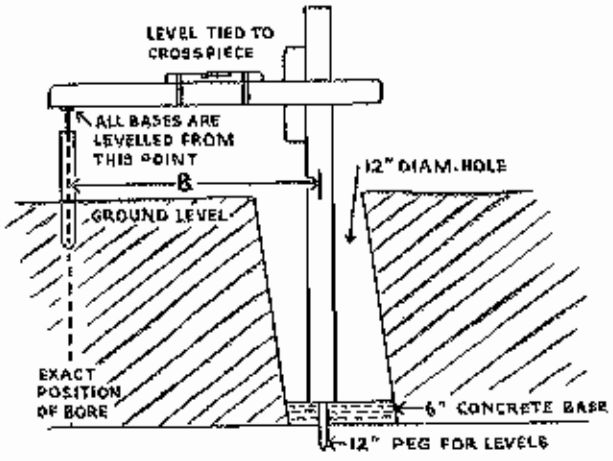
TYPE M

HEIGHT OF TOWER	6 ft., 8 ft., 10 ft., 12 ft. and 14 ft. MILLS			
	3 POST		4 POST	
	A	B	A	B
15'	4' 10"	2' 9½"	3' 6"	2' 5⅜"
20'	4' 6½"	2' 7⅝"	4' 6½"	3' 2½"
25'	5' 6⅜"	3' 2 5/16"	5' 5½"	3' 10½"
30'	6' 7½"	3' 9⅜"	6' 6⅝"	4' 7⅜"
40'	8' 7 11/16"	4' 11⅞"	8' 7 3/16"	6' 9⅛"

DIRECTIONS FOR THE ASSEMBLY AND ERECTION OF TOWERS FOR METTERS M WINDMILLS

LEVEL CONCRETE FOUNDATIONS

The illustration below shows the method of obtaining level concrete foundations. Drive a wooden peg, 12 inches long, six inches into the bottom of each hole, leaving six inches above the bottom. It is advisable to leave the pegs slightly on the high side as it is easier to tamp the pegs down than to raise them. Then place the perpendicular staff—a length of timber 4 ft. to 5 ft. long— in the centre hole, with the bottom end resting on the top of the wooden peg and determine the level by holding the short vertical crosspiece attached to the



straight edge against the perpendicular staff. Adopt the same procedure in respect to the remaining holes. By using this method all of the holes are levelled from the one point, namely the centre peg, thus ensuring uniformity. Mix and pour sufficient concrete to fill in to the exact peg tops and make the concrete wet enough to tamp so that it settles level.

Place reinforcements such as old rods or bolts to project out of the concrete approx. 6". This then ties all the footing to one mass when top is poured.

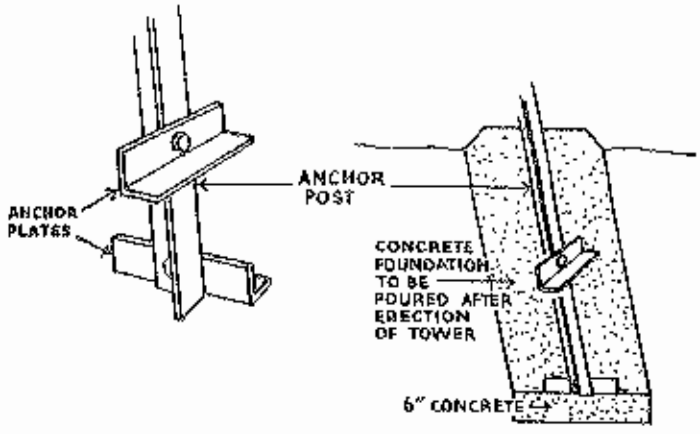
Should circumstances such as the erection of the mill over a well, prevent a centre peg from being driven into the ground, a suitable alternative would be a length of timber secured to the ground, with the peg firmly fixed in an upright position in the centre of where the tower is to be erected.

In the case of a steel cased bore a wooden plug could be driven into the top of the casing and a nail driven into the centre of the plug.

ERECTION OF TOWER (ASSEMBLY ON GROUND)

Bolt the anchor plates to the anchor posts as shown and place one in each foundation hole. Place the leg bolts in a handy position ready for use. Firmly bolt a board, long enough to span two of the holes and strong enough to support two legs, across the outside of the legs lying on the ground. Adjust the tower with the boarded legs mid-way across and over two of the foundation holes.

In the case of towers 30 ft. or more high, the two legs taking the strain when the tower is being pulled up should be temporarily supported from the bottom to above the bottom girt by a short length, approx. 3-4 ft of timber or piping securely lashed to each in the form of a splint. These supports must not protrude below the legs.



DIRECTIONS FOR THE ASSEMBLY AND ERECTION OF TOWERS FOR METTERS M WINDMILLS

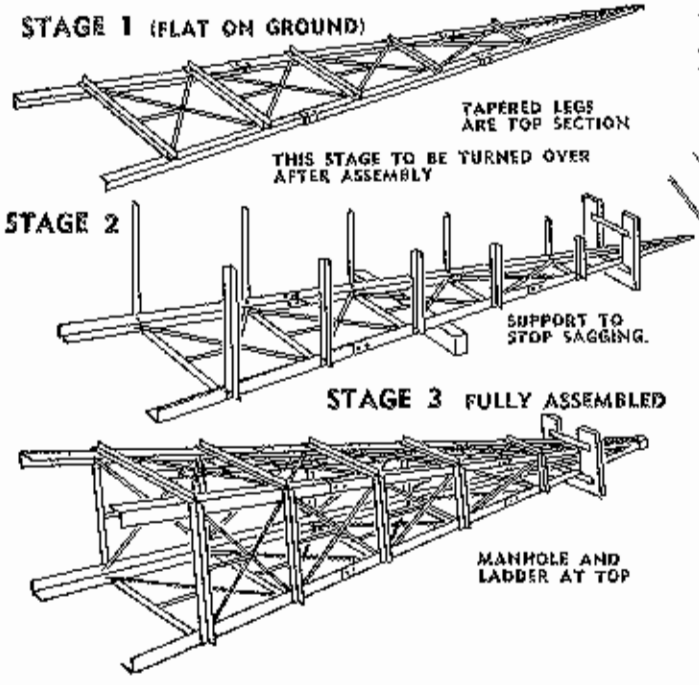
ASSEMBLY OF TOWER ON GROUND (continued)

Unwire all bundles and lay out tower legs (these are the larger angles), stays and girts in proper sets and sizes; sort out all bolts in the various lengths and check with packing list

To simplify assembly, follow directions exactly as given below.

Take two (2) tower legs and lay them on the ground Now make these two legs up to their full length (20 or 30 ft., or whatever height the tower is to be) by bolting on the lower angles, being careful to note that these angles have the outer corners rounded off a little at the top to allow their fitting closely inside Before proceeding to position cross girts and diagonal stays remember that all girts are bolted to outside of main angle legs and stays on inside of main angle legs. The top angles have two (2) extra holes just below the four holes used to bolt stub tower to main tower. These holes are used for shortest girts and shortest flat stays above platform ladders bolted inside girts.

Working from the cross girts and diagonal stays which are supplied in sets. Take one girt from the longest set and bolt it across the two legs as shown in illustration below, at the third hole from the bottom, with the flat side of the angle girt to the top of the tower. Now bolt one of each set of girts in the same way to the two tower legs. Take any two (2) of the longest diagonal stays (if there is only 1 set they will be of equal length) and bolt them together in the form of the letter X.



Then with the two long legs downward, bolt them to the lower legs as shown in illustration, on the same bolt as the girt, beginning at the bottom of the tower. V stays are then bolted from centre of X formed by diagonal stays to centre of cross girt below. These V stays start from centre of No. 2 stays then on all cross stays below For four (4) post towers there are 3 V stays of each length. For three (3) post towers two of each length. V stays are not required on side where ladder is fixed All bolts should be placed with nuts outside of tower. Leave bolts loose until tower has been completely assembled

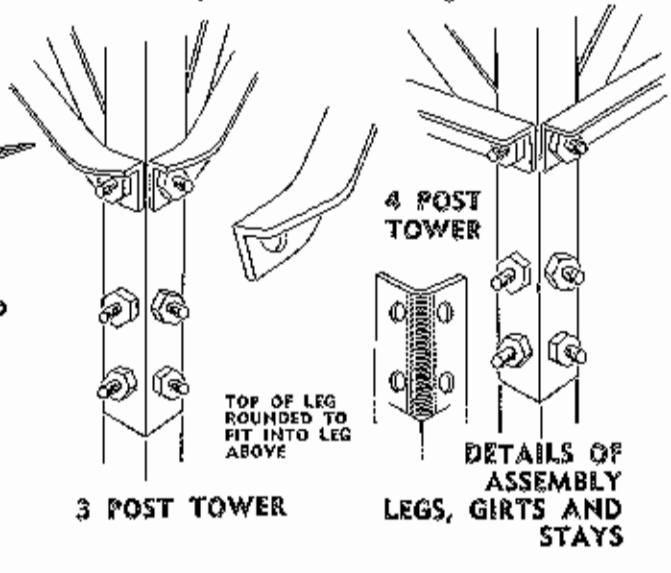
When you have completed putting this side of the tower together, turn it right over and raise the top end of tower high enough to enable you to put on the platform Bolt the platform to the tower legs at holes which meet the holes in platform irons. Now take away any supports you may have under tower and allow the platform to rest on the ground See that tower is not allowed to sag downwards under its own weight. To prevent this, place a block under angles about halfway between platform and the bottom end of the tower.

Now proceed with side girts in their proper rotation and follow on with tower legs. When tower is completely assembled, tighten all bolts The tower is now ready to erect (see page 6).

Platform irons for 6 ft.–8 ft 3–post M Mills are 1 foot girts extended.

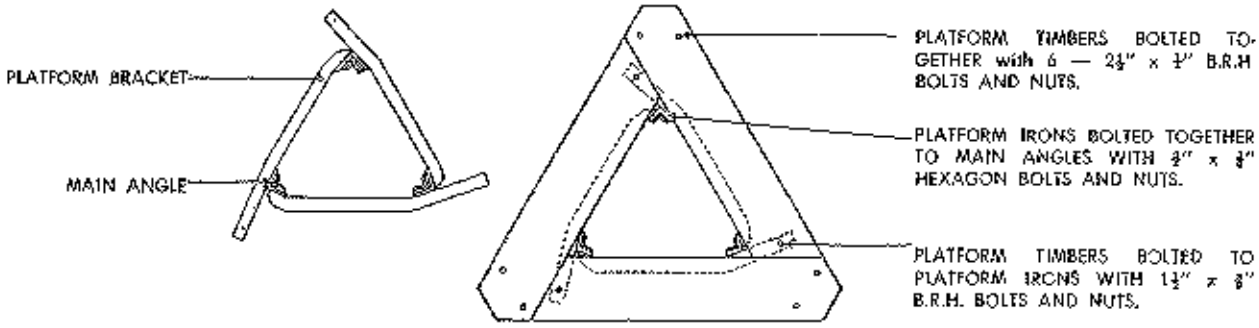
Platform irons for 6 ft.–8 ft. 4–post M Mills take place of (2) 1–ft girts on opposite sides 10 ft

M towers are supplied with L shaped brackets which bolt to same holes as 1–ft. girts. In the case of 6 ft. and 8 ft. M Mills, the head and tail may be bolted in position before lifting tower.

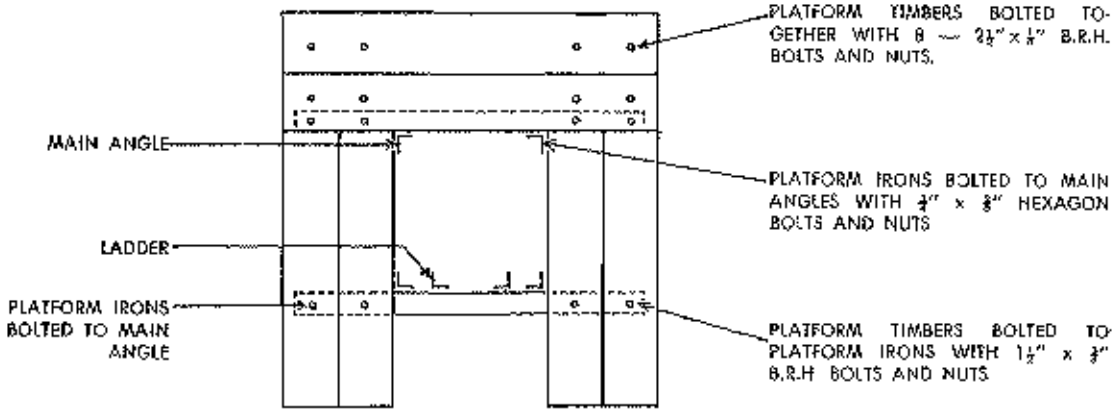


DIRECTIONS FOR THE ASSEMBLY AND ERECTION OF TOWERS FOR METTERS M WINDMILLS

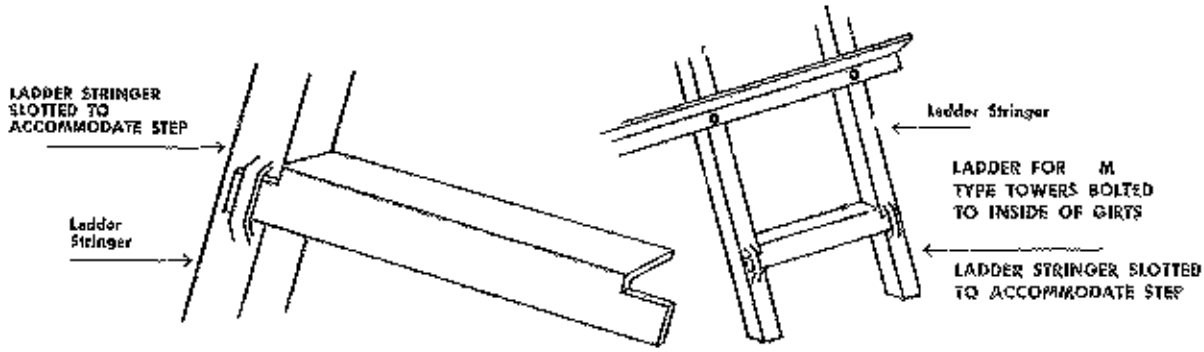
3 POST PLATFORM DETAIL



4 POST PLATFORM DETAIL



DETAILS OF LADDER CONSTRUCTION

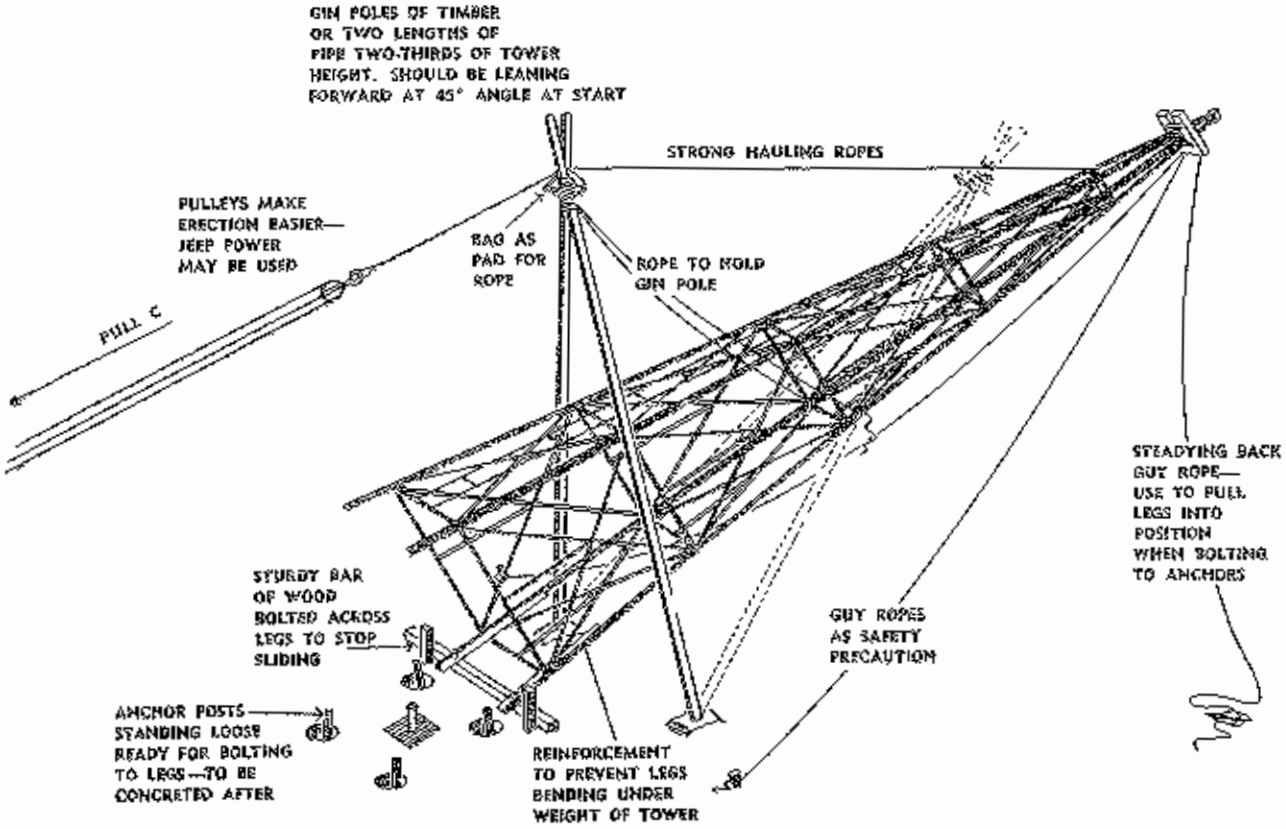


DIRECTIONS FOR THE ASSEMBLY AND ERECTION OF TOWERS FOR METTERS M WINDMILLS

LIFTING TOWER INTO POSITION

The length of the hauling rope from the tower to the gin poles should set the gin poles at an angle of approximately 45 degrees before taking the lift.

The pull on the hauling rope by men, truck or tractor, can be direct or with the aid of double and single tackle, according to the weight of the tower. If tackle is used, the block with the fall rope should be attached to the primary pull "C" when the free leg or legs approach their positions over the foundation holes, bolt the anchor posts to them, then lower the leg or legs gently on to the concrete bottom. Pull one guy so as to take the weight of the other leg or legs, unbolt the board and bolt the legs to anchor posts, then lower onto concrete. Three post tower legs are anchored separately. Four post tower legs are anchored in pairs With the tower now resting on its legs in the holes. test it for plumb with a spirit level placed on a straight edge held across the bottom girts close to the legs. Test each side and, if necessary, pack a low leg until the tower is plumb. Use spirit level only as a rough check. Plumb the tower for centre over pump bore, and with four-leg tower, measure across corners to see that the tower is square, then pour the concrete into the holes. adding a few four to six-inch stones, tightly packed. The concrete mixture should consist of 5 parts ¼ to ¾ inch stones, 2½ parts clean. sharp sand and 1 part cement. An earth mound tightly tamped down around each leg is advisable, so that water will drain away from leg.



DIRECTIONS FOR THE ASSEMBLY AND ERECTION OF BUILT UP TOWERS FOR METTERS M WINDMILLS

ERECTING TOWERS VERTICALLY IN POSITION

Unpack the tower bolt box—do not mix the various size bolts.

Unpack the tower parts, laying out the stays, girts etc., in their respective lengths.

After preparing the foundation holes (see Page 2), build up the bottom 10 ft. section of the tower, leaving all bolts loose until complete. Up-end the section over the foundation holes by first placing a plank across the holes. Support the section by blocking up underneath the girts, making sure all the girts are horizontal and the section is central with the bore or well. Check by using a spirit level placed on a straight edge held firmly across the bottom girts and against the legs. This is better than checking on the girts themselves. Make sure, also, that the main angle of the section on the highest ground will be about 1" above the concrete footing.

Remove the planks across the holes and bolt on the anchor posts, with plates fitted, to the main legs. Check the girts again horizontally and, if necessary, pack up a low leg between bottom of anchor post and concrete base. Make sure, also, that the centre lines up with the bore hole. Now pour the concrete tower foundations using 5:2½:1 mix. The size of the footings are as stated on Page 3.

NOTE: It is essential that the tower be erected vertically, so extreme care should be taken when levelling up the bottom section.

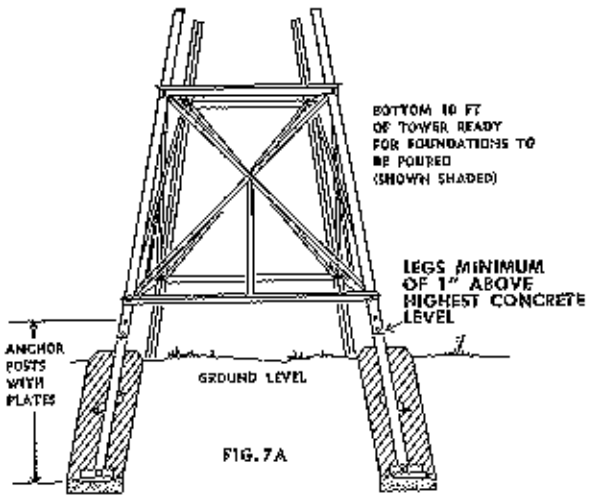


FIG. 7A

Allow concrete to set and then continue to build up tower, member by member. Do not pull the bolts right up tight until all the tower has been erected and the head fitted in, then tighten evenly, commencing from the top. M stub tower to be fitted to tower before tightening tower bolts.

For both safety and comfort, it is advisable for the erector to stand on a wooden board placed immediately inside of the tower leg and resting on the girts of two sides of the tower.

NOTE: Illustrations on Page 3 show details of anchor plate and post.

ASSEMBLING HEAD ON TOWER

Small heads can be fitted to the tower before it is raised, but the larger heads require the use of a block and tackle and gin pole. A wooden pole 4 in. in diameter, or a length of steel piping 1½ to 2 in. in diameter will make a suitable gin pole or derrick for heads up to 8 ft. For 10 ft., 12 ft. or 14 ft. heads, piping with a minimum diameter of 2½ in. will be needed. The length of the gin pole must be sufficient to allow the head to be raised high enough to be lowered into the tower cap.

A strong sling consisting of either stout rope or chain must be secured to the head and the hook on bottom pulley block attached to the sling. The use of a guide rope attached to the head is also recommended.

Where U bolts are supplied, the gin pole and lifting tackle should be erected as shown in Fig. 7B, and where no U bolts are supplied, the method shown in Fig. 7C should be followed.

For 6 ft and 8 ft mills on up to 30 ft. towers, use two 5 in. single blocks and about 120 ft. of rope not less than ⅜ in. diameter. For higher towers use 30 ft. of extra rope for each 10 ft. of height.

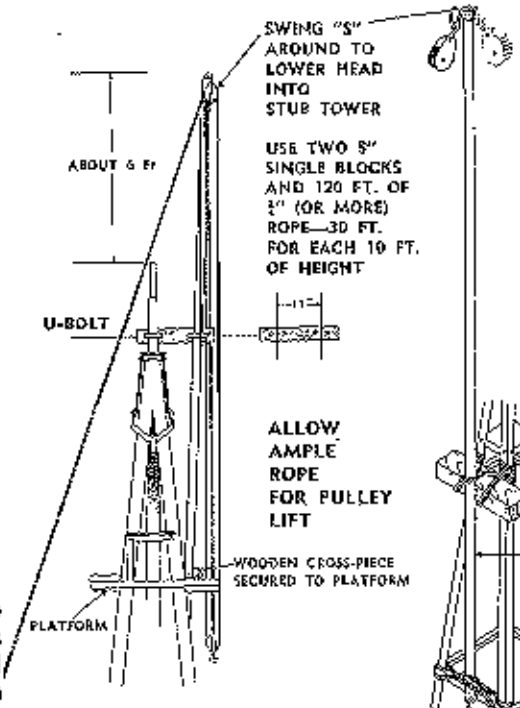


FIG. 7B

FIG. 7C

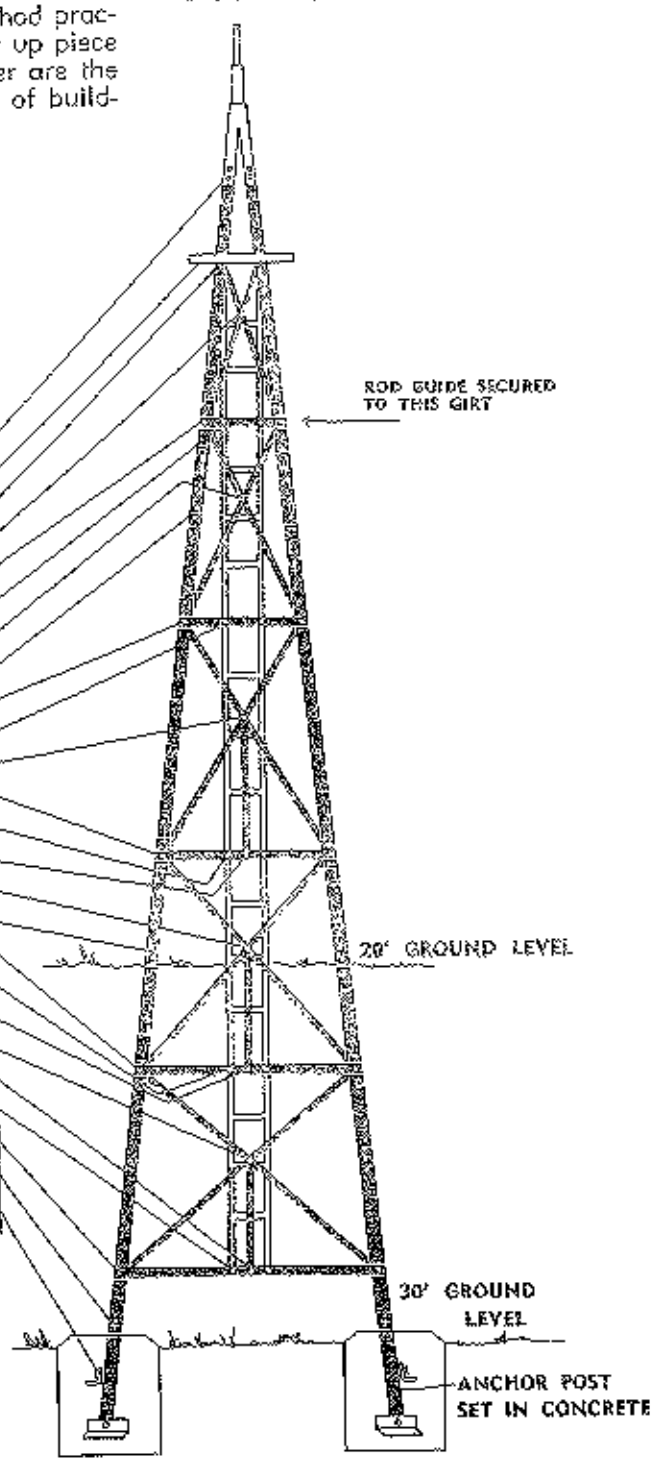
TOWER M PARTS LIST FLAT BRACED TOWER

NOTES ON ASSEMBLY

The most efficient method of erecting the tower is to assemble it on the ground, then raise it with the aid of a gin pole or derrick. Where the site is too uneven to make this method practicable, the tower can be erected vertically, i.e., built up piece by piece. Factors determining the height of the tower are the locality in which it is to be erected and the presence of buildings or large trees in the vicinity of the site

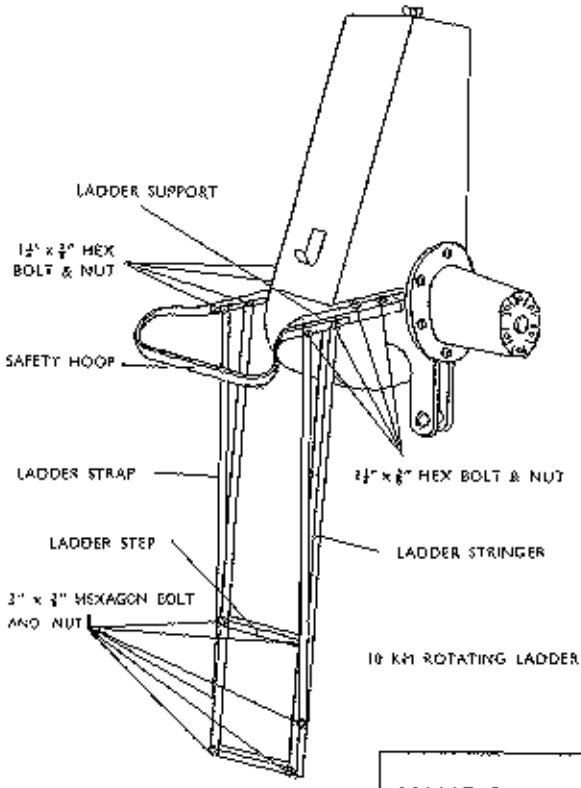
- All anchor posts set in concrete.
- Girts bolted outside main angles.
- Diagonal stays bolted inside main angles.
- Ladder bolted inside girts.
- No V stays on ladder side of tower.

NAME OF PART	HEX. BOLTS
STUB TOWER	⅜" x ⅞"
PLATFORM IRON	⅜" x ⅞"
LADDER	⅜" x ⅞"
CENTRE STAY	⅜" x ⅞"
GIRT	½" x ⅝"
LADDER	⅜" x ⅞"
CENTRE STAY	⅜" x ⅞"
MAIN ANGLE JOINT	⅜" x ⅞"
GIRT	½" x ⅝"
LADDER	⅜" x ⅞"
CENTRE STAY	⅜" x ⅞"
GIRT	½" x ⅝"
LADDER	½" x ⅞"
VERTICAL STAY	⅜" x ⅞"
CENTRE STAY	⅜" x ⅞"
MAIN ANGLE JOINT	⅜" x ⅞"
GIRT	½" x ⅝"
LADDER	⅜" x ⅞"
VERTICAL STAY	⅜" x ⅞"
CENTRE STAY	⅜" x ⅞"
VERTICAL STAY	⅜" x ⅞"
LADDER	⅜" x ⅞"
GIRT	⅜" x ⅞"
MAIN ANGLE JOINT	⅜" x ⅞"
ANCHOR PLATES	½" x ⅜"

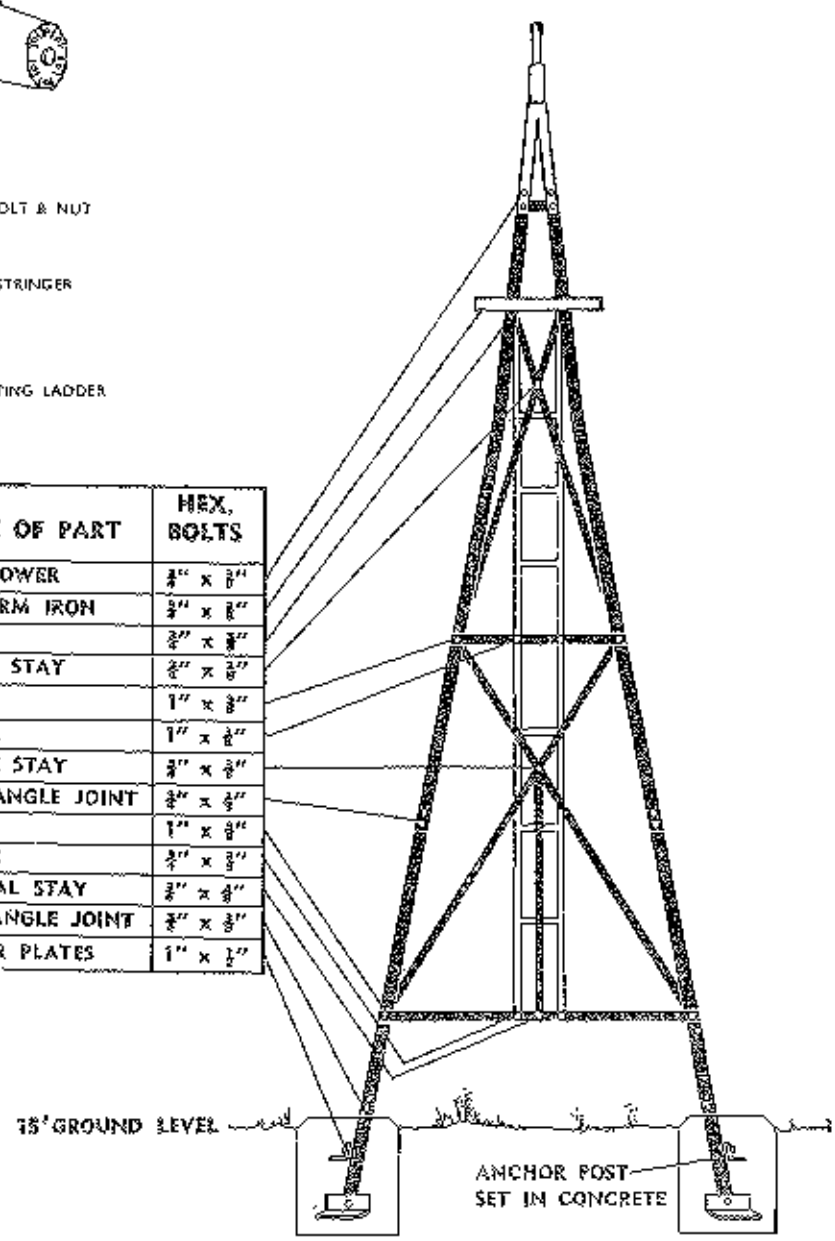


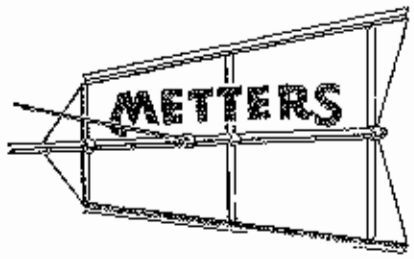
TOWER M SPECIAL 15 ft. TOWER

THE SPECIAL 15 FT. TOWER IS DESIGNED FOR LOCALITIES WHERE EXTREME VELOCITY WINDS ARE PREVALENT



NAME OF PART	HEX. BOLTS
STUB TOWER	¾" x ⅜"
PLATFORM IRON	⅜" x ⅜"
LADDER	⅜" x ⅜"
CENTRE STAY	⅜" x ⅜"
GIRT	1" x ⅜"
LADDER	1" x ⅜"
CENTRE STAY	⅜" x ⅜"
MAIN ANGLE JOINT	⅜" x ⅜"
GIRT	1" x ⅜"
LADDER	⅜" x ⅜"
VERTICAL STAY	⅜" x ⅜"
MAIN ANGLE JOINT	⅜" x ⅜"
ANCHOR PLATES	1" x ½"





TOWER M PACKING LIST

FOR 6 FT., 8 FT. AND 10 FT. M —CHECK EACH BUNDLE AND CONTENTS
20 Ft.—Numbers 1, 2, 3, 3A and 4 Bundles. 30 Ft.—Numbers 1, 2, 3, 3A, 4 and 7 Bundles
25 Ft.—Numbers 1, 2, 3, 3A, 4 and 6 Bundles.

3 POST TOWER

BUNDLE MARKED No. 1 x 3
3 Main Angles 10 ft long.
2 Ladder Rails each 10 ft.
2 Ladder Rails each 5 ft.
6 Steps
3 Girts each 1 ft. (Replaced by platform irons in 6 ft. x 8 ft. M).
3 Girts each 2 ft.
3 Girts each 3 ft.
3 Girts each 4 ft.

BUNDLE MARKED No. 2 x 3
3 Main Angles each 10 ft.
6 No. 1 Stays each 4 ft. 10 5/8 in.
6 No. 2 Stays each 5 ft. 2 13/16 in.
6 No. 3 Stays each 5 ft. 9 in.
2 No. 2 V Stays each 2 ft. 10 5/16 in
2 No. 3 V Stays each 2 ft. 8 5/16 in
1 Bag Bolts for 20 ft Section containing
Hex Bolts and Nuts: 57 ⅜ x ⅜, 18 1 x ⅜, 6 1 x ½,
BRH Bolts and Nuts 6 2½ x ½, 3 1½ x ⅜, 2 1 x ⅜;
Hook Bolts and Nuts, 2 2 x ⅜;
6 ½ in. Washers.

BUNDLE MARKED No. 3 x 3
3 Platform Irons (10 ft. differ from 6 ft and 8 ft.).
3 Anchor Posts
6 Anchor Plates.
1 Pipe Stay with U Bolts and Rod Guide.

BUNDLE MARKED No. 3A x 3
3 Platform Timbers.
1 Package—No. 4 Pump Rod

BUNDLE MARKED No. 6 x 3
(20 to 25 ft. Section).
3 Main Angles each 5 ft.
3 Girts each 5 ft.
6 No. 4 Stays each 7 ft 4⅜ in.
2 No. 4 V Stays each 2 ft. 7 15/16 in.
2 5 ft. Ladder Rails.
2 Ladder Steps.
1 Bag Bolts for 25 ft. Section containing.
Hex. Bolts and Nuts, 23 ⅜ x ⅜, plus 3 1½ x ⅜.

BUNDLE MARKED No. 7 x 3
(20 to 30 ft. Section).
3 Main Angles each 10 ft.
3 Girts each 5 ft
3 Girts each 6 ft.
2 Ladder Rails each 10 ft.
4 Steps
6 No. 4 Stays each 6 ft. 4⅜ in.
6 No. 5 Stays each 7 ft. 1⅜ in.
2 No. 4 V Stays each 2 ft 7 15/16 in
2 No. 5 V Stays each 2 ft. 7⅜ in
1 Bag Bolts for 30 ft. Section containing
Hex. Bolts and Nuts, 32 ⅜ x ⅜, 6 1 x ⅜, 6 1½ x ⅜

4 POST TOWER

BUNDLE MARKED No. 1 x 4
4 Main Angles 10 ft. Long.
2 Ladder Rails each 10 ft.
2 Ladder Rails each 5 ft.
6 Steps.
4 Girts each 1 ft (Replaced by platform irons in 6 and 8 ft M).
4 Girts each 2 ft
4 Girts each 3 ft.
4 Girts each 4 ft.

BUNDLE MARKED No. 2 x 4
4 Main Angles each 10 ft.
8 No. 1 Stays each 4 ft. 10⅜ in.
8 No. 2 Stays each 5 ft. 2 13/16 in.
8 No. 3 Stays each 5 ft. 9 in.
3 No 2 V Stays each 2 ft. 10 15/16 in.
3 No. 3 V Stays each 2 ft. 8 15/16 in
1 Bag Bolts for 20 ft. Section containing
Hex. Bolts and Nuts. 70 ⅜ x ⅜, 24 1 x ⅜, 8 1 x ½;
BRH Bolts and Nuts, 8 2½ x ½, 8 1½ x ⅜, 2 1 x ⅜;
Hook Bolts and Nuts, 2 2 x ⅜;
8 ½ in. Washers.

BUNDLE MARKED No. 3 x 4
2 Platform Irons (10 ft differ from 6 ft and 8 ft).
4 Anchor Posts.
8 Anchor Plates
1 Furl Lever.
1 Pipe Stay with U Bolt and Rod Guide (Angle Iron).

BUNDLE MARKED No. 3A x 4
3 Platform Timbers.
1 Package No. 4—Pump Rod.

BUNDLE MARKED No. 6 x 4
(20 to 25 ft Section).
4 Main Angles each 5 ft
4 Girts each 5 ft.
8 No. 4 Stays each 6 ft 4⅜ in
3 No. 4 V Stays each 2 ft. 7 15/16 in.
2 5 ft Ladder Rails.
2 Ladder Steps.
1 Bag Bolts for 25 ft Section containing
Hex. Bolts and Nuts, 30 ⅜ x ⅜. 4 1½ x ⅜.

BUNDLE MARKED No. 7 x 4
(20 ft to 30 ft Section).
4 Main Angles each 10 ft.
4 Girts each 5 ft.
4 Girts each 6 ft
2 Ladder Rails each 10 ft.
4 Steps.
8 No. 4 Stays each 6 ft. 4⅜ in.
8 No 5 Stays each 7 ft. 1⅜ in.
3 No. 4 V Stays each 2 ft. 7 15/16 in.
3 No. 5 V Stays each 2 ft. 7⅜ in
1 Bag Bolts for 30 ft. Section containg
Hex. Bolts and Nuts, 42 ⅜ x ⅜, 8 1 x ⅜, 8 1½ x ⅜.

15 Ft. Flat braced Towers for 6 ft. and 8 ft. Type M Windmills.

3 POST TOWER

BUNDLE MARKED No. 1 x 15 x 3
3 Main Angles bent each 10 ft.
2 Ladder Rails each 10 ft
5 Ladder Steps.

BUNDLE MARKED No. 2 x 15 x 3
3 Main Angles each 5 ft.
1 Bag Bolts containing
Hex. Bolts and Nuts, 54 ⅜ x ⅜, 6 1 x ½, 6 1 x ⅜;
Hook Bolts, 2 1½;
BRH Bolts and Nuts, 7 2½ x ½, 4 1½ x ⅜;
7 ½ Washers.

BUNDLE MARKED No. 3 x 15 x 3
3 Platform Irons.
3 Anchor Posts.
6 Anchor Plates.
1 Pipe Stay with U Bolt and Rod Guide.

BUNDLE MARKED No. 3A x 15 x 3
3 Platform Timbers

BUNDLE MARKED No. 4 x 15 x 3
1 Pump Rod.

BUNDLE MARKED No. 5 x 15 x 3
6 No. 1 Long Stays each 4 ft. 11 1/16 in.
6 No. 2 Long Stays each 5 ft 6⅜ in
3 No. 1 Girts each 1 ft. (Replaced by platform irons in 6 ft and 8 ft. "M")
3 No 2 Girts each 2 ft. 2⅜ in.
3 No. 3 Girts each 3 ft. 10 13/16 in.
2 No. 2 V Stays.

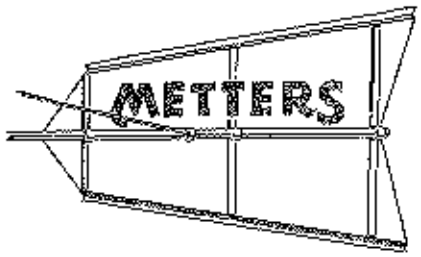
4 POST TOWER

BUNDLE MARKED No. 1 x 15 x 4
4 Main Angles each 10 ft.
4 Main Angles each 5 ft.
2 Ladder Rails each 10 ft.
4 Ladder Steps
8 No. 1 Long Stays each 4 ft 10⅜ in
8 No. 2 Long Stays each 5 ft. 2 13/16 in
3 No 2 V Stays each 2 ft 10 15/16 in.
4 No 1 Girts each 1 ft. (Replaced by platform irons in 6 ft. and 8 ft. M)
4 No 2 Girts each 2 ft.
4 No. 3 Girts each 3 ft.
1 Bag Bolts containing:
Hex. Bolts and Nuts, 69 ⅜ x ⅜, 8 1 x ⅜, 8 1 x ½;
BRH Bolts and Nuts, 8 2½ x ½, 8 1½ x ⅜;
8 ½ Washers.

BUNDLE MARKED No. 3 x 15 x 4
2 Platform Irons
4 Anchor Posts.
8 Anchor Plates.
1 Pipe Stay with U Bolt and Rod Guide.

BUNDLE MARKED No. 3A x 15 x 4
3 Platform Timbers.

BUNDLE MARKED No. 4 x 15 x 4
1 Pump Rod.



TOWER M PACKING LIST

FOR 12 FT. AND 14 FT. MODELS CHECK EACH BUNDLE AND CONTENTS

20 ft.—Numbers 1, 2, 3, 3A, and 4 Bundles

25 ft.—Numbers 1, 2, 3, 3A, 4, and 6 Bundles

30 ft.—Numbers 1, 2, 3, 3A, 4, and 7 Bundles

40 ft.—Numbers 1, 2, 3, 3A, 4, 7, and 8 Bundles

3-POST TOWER

● BUNDLE MARKED NO. 1 X 3.

3 Main Angles 10 ft. long.
2 Ladder Rails each 10 ft.
2 Ladder Rails each 5 ft
6 Steps.
3 Girts each 1 ft. (replaced by platform irons in 6 ft. x 8 ft. M
3 Girts each 2 ft.
3 Girts each 3 ft.
3 Girts each 4 ft.

● BUNDLE MARKED NO. 2 X 3.

3 Main Angles each 10 ft.
6 No. 1 Stays each 4 ft. 10⅛ in.
6 No. 2 Stays each 5 ft 2⅛ in.
6 No. 3 Stays each 5 ft. 9 in.
2 No. 2 V Stays each 2 ft. 10⅛ in.
2 No. 3 V Stays each 2 ft 8⅛ in.
1 Pipe Stay.
1 Bag Bolts for 20 ft. Section containing:
Galv. Hex. Bolts and Nuts: 52 1" x ¼", 21 ⅜" x ⅜", 27 1" x ⅜".
Galv. BRH Bolts and Nuts: 7 2½" x ¼", 4 1½" x ⅜".
Galv. Hook Bolts and Nuts and Washers 2 2½" x ⅜".
Galv Flat Washers: 7 ⅜".
U Bolt for Pipe Stay: 1.
Rod Clip for Pipe Stay 1.

● BUNDLE MARKED NO. 3 X 3

3 Platform Irons (10 ft. differ from 6 ft and 8 ft.).
3 Anchor Posts.
6 Anchor Plates.

● BUNDLE MARKED NO. 3A X 3.

3 Platform Timbers.
1 Package—No. 4 Pump Rod.

● BUNDLE MARKED NO. 6 X 3.

(20 to 25 ft. Section.)
3 Main Angles each 5 ft
3 Girts each 5 ft.
6 No 4 Stays each 7 ft 4½ in.
2 No. 4 V Stays each 2 ft. 7⅛ in
2 5 ft Ladder Rails.
2 Ladder Steps.
1 Bag Bolts for 20-25 ft. Section containing:
Galv. Hex. Bolts and Nuts. 14 1" x ¼", 8 ⅜" x ⅜", 7 1" x ⅜"
Galv. Hook Bolts and Nuts and Washers: 2 2½" x ⅜"

● BUNDLE MARKED NO 7 X 3.

(20 to 30 ft. Section.)
3 Main Angles each 10 ft
3 Girts each 5 ft
3 Girts each 6 ft.

● BUNDLE MARKED NO. 7 X 3 — Cont'd.

2 Ladder Rails each 10 ft
4 Steps.
6 No. 4 Stays each 6 ft. 4½ in
6 No 5 Stays each 7 ft. 1⅜ in.
2 No. 4 V Stays each 2 ft. 7⅛ in.
2 No. 5 V Stays each 2 ft. 7½ in
1 Bag Bolts for 20-30 ft Section containing.
Galv. Hex. Bolts and Nuts. 14 1" x ¼", 16 ⅜" x ⅜", 14 1" x ⅜".
Galv. Hook Bolts and Nuts and Washers. 2 2½" x ⅜".

● BUNDLE MARKED NO. 8 X 3.

(30 to 40 ft. Section.)
3 Main Angles each 10 ft
3 Girts each 7 ft
3 Girts each 8 ft.
2 Ladder Rails each 10 ft.
4 Ladder Steps
6 No 6 Flat Stays.
6 No. 7 Flat Stays
2 No. 6 V Stays
2 No 7 V Stays.
1 Bag Bolts for 30-40 ft Section containing
Galv. Hex Bolts and Nuts: 14 1" x ¼". 16 ⅜" x ⅜", 14 1" x ⅜".
Galv Hook Bolts and Nuts and Washers: 2 2½" x ⅜"

4-POST TOWER

● BUNDLE MARKED NO. 1 X 4.

4 Main Angles 10 ft. long.
2 Ladder Rails each 10 ft.
2 Ladder Rails each 5 ft.
6 Steps.
4 Girts each 1 ft. (replaced by platform irons in 6 and 8 ft. M").
4 Girts each 2 ft
4 Girts each 3 ft
4 Girts each 4 ft.

● BUNDLE MARKED NO 2 X 4.

4 Main Angles each 10 ft
8 No. 1 Stays each 4 ft 10⅛ in
8 No. 2 Stays each 5 ft. 2⅛ in
8 No. 3 Stays each 5 ft 9 in.
3 No. 2 V Stays each 2 ft. 10⅛ in.
3 No. 3 V Stays each 2 ft. 8⅛ in
1 Pipe Stay.
1 Bag Bolts for 20 ft Section containing
Galv Hex. Bolts and Nuts: 68 1" x ¼", 26 ⅜" x ⅜", 36 1" x ⅜".
Galv. BRH Bolts and Nuts 9 2½" x ¼", 9 1½" x ⅜".
Galv Hook Bolts and Hex. Nuts: 2 2½" x ⅜".
Galv. Flat Washers: 9 ⅜"
1 U Bolt and Rod Guide.

● BUNDLE MARKED NO. 3 X 4.

2 Platform Irons (10 ft. differ from 6 ft. and 8 ft.).
4 Anchor Posts.
8 Anchor Plates.
1 Furl Lever..

● BUNDLE MARKED NO. 3A X 4.

6 Platform Timbers.
1 Package No. 4—Pump Rod.

● BUNDLE MARKED NO. 6 X 4.

(20 to 25 ft. Section.)
4 Main Angles each 5 ft.
4 Girts each 5 ft.
8 No. 4 Stays each 6 ft. 4½ in.
3 No 4 V Stays each 2 ft. 7⅛ in
2 5 ft. Ladder Rails.
2 Ladder Steps
1 Bag Bolts for 20-25 ft. Section containing:
Galv Hex. Bolts and Nuts: 18 1" x ¼", 10 ⅜" x ⅜", 9 1" x ⅜".
Galv. Hook Bolts and Hex Nuts: 2 2½" x ⅜".

● BUNDLE MARKED NO. 7 X 4.

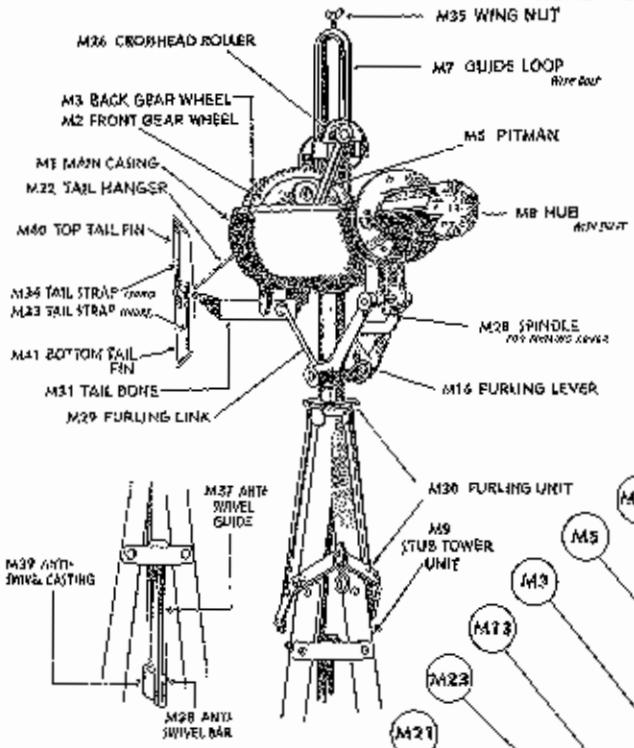
(20 ft to 30 ft. Section.)
4 Main Angles each 10 ft.
4 Girts each 5 ft.
4 Girts each 6 ft.
2 Ladder Rails each 10 ft.
4 Steps
8 No 4 Stays each 6 ft. 4½ in.
8 No. 5 Stays each 7 ft 1⅜ in
3 No 4 V Stays each 2 ft. 7⅛ in.
3 No. 5 V Stays each 2 ft 7½ in

1 Bag Bolts for 20 ft.-30 ft. Section containing:
Galv Hex. Bolts and Nuts: 18 1" x ¼", 20 ⅜" x ⅜", 18 1" x ⅜".

● BUNDLE MARKED NO. 8 X 4.

(30 to 40 ft Section.)
4 Main Angles each 10 ft.
4 Girts each 7 ft
4 Girts each 8 ft
2 Ladder Rails each 10 ft.
4 Ladder Steps
8 No. 6 Flat Stays
8 No. 7 Flat Stays.
3 No 6 V Stays.
3 No 7 V Stays.
1 Bag Bolts for 30 to 40 ft Section containing:
Galv. Hex. Bolts and Nuts: 18 1" x ¼", 20 ⅜" x ⅜", 18 1" x ⅜".
Galv Hook Bolts and Hex. Nuts: 2 2½" x ⅜".

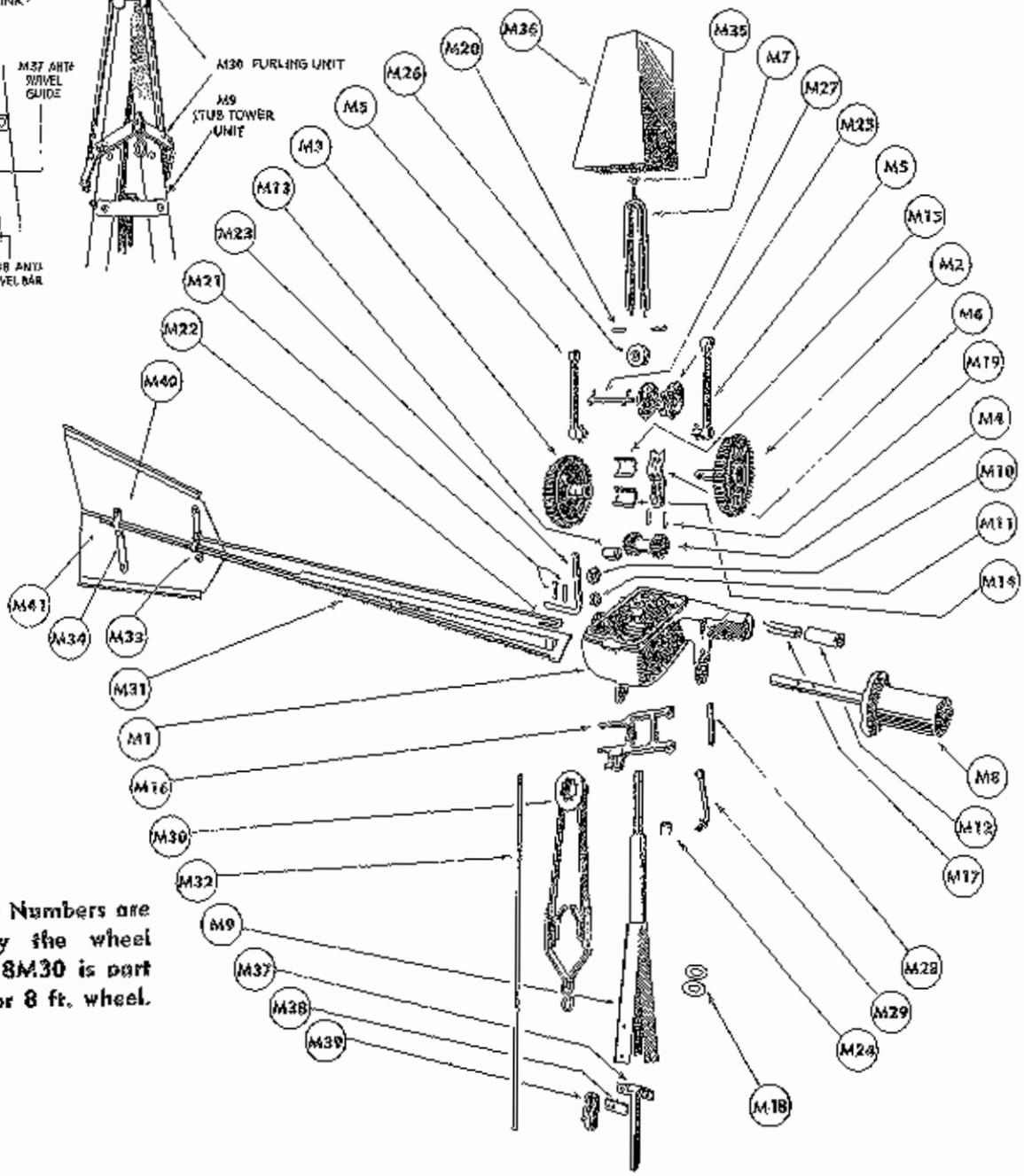
HEAD M COMPONENTS OF WINDMILL HEAD



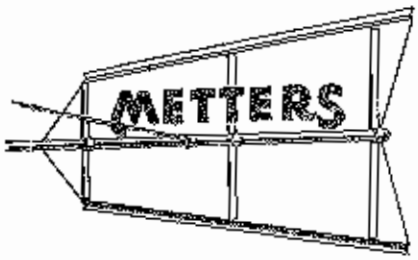
All parts used in the assembly of the head, wheel and tail are numbered according to the parts list. These illustrations show clearly each part and where it is used.

TO ASSEMBLE HEAD ON TOWER

Clean and oil stub tower shaft. Fit and check furl unit for freeness. Pull up the windmill head, place the head over stub tower shaft. Then lift lock washer to top end of stub tower shaft, which is fitted over the top. This is a safety device to prevent the head from lifting.



NOTE: Part Numbers are prefixed by the wheel size. E.G., 8M30 is part No. M30 for 8 ft. wheel.



HEAD M PARTS LIST AND INSTRUCTIONS

PARTS ARE ILLUSTRATED ON PREVIOUS PAGE

When ordering replacement parts, please state size, pattern and age of windmill and the names, letters and serial numbers of the parts required.

Name of Part	6 ft.	8 ft.	10 ft.	12 ft.	14 ft.
Main Casting with Drain Plug	6M1	8M1	10M1	12M1	12M1
Front Gearwheel	6M2	8M2	10M2	12M2	12M2
Back Gearwheel	6M3	8M3	10M3	12M3	12M3
Twin Pinions	6M4	8M4	10M4	12M4	12M4
Pitman with Split Pin	6M5	8M5	10M5	12M5	12M5
Bearing Clip with ⅜ in. Bolt and Washer	6M6	8M6	10M6	12M6	12M6
Guide Loop with Cover Bolt	6M7	8M7	10M7	12M7	12M7
Hub with Shaft Pressed on	6M8	8M8	10M8	—	—
Stub Tower Unit	6M9	8M9	10M9	12M9	12M9
Tail Pin Washer (Top)	6M10	8M10	10M10	12M10	12M10
Tail Pin Washer (Bottom)	6M11	8M11	10M11	—	—
Hub Shaft Bearing (Long)	6M12	8M12	10M12	12M12	12M12
Hub Shaft Bearing (Short)	6M13	8M13	10M13	12M13	12M13
Bottom Gearwheel Bearing	6M14	8M14	10M14	12M14	12M14
Top Gearwheel Bearing	6M15	8M15	10M15	12M15	12M15
Furling Lever	6M16	8M16	10M16	12M16	12M16
Oil Sleeve	6M17	8M17	10M17	12M17	12M17
Friction Washers	6M18	8M18	10M18	12M18	12M18
Dowels (2) with Twin Pinions	6M19	8M19	10M19	12M19	12M19
Dowels (2) for Guide Loop	6M20	8M20	10M20	12M20	12M20
Tail Pin Bolts and Nuts	6M21	8M21	10M21	12M21	14M21
Tail Hanger	6M22	8M22	10M22	12M22	14M22
Tail Pin	6M23	8M23	10M23	12M23	14M23
Lock Washer for Stub Tower	6M24	8M24	10M24	12M24	12M24
Cross Head with two Oil Rings and two Oil Ring Guides	6M25	8M25	10M25	12M25	12M25
Cross Head Roller	6M26	8M26	10M26	12M26	12M26
Cross Head Spindle with Split Pins	6M27	8M27	10M27	12M27	12M27
Spindle for Furling Lever	6M28	8M28	10M28	12M28	12M28
Furling Link	6M29	8M29	10M29	12M29	12M29
Furling Unit	6M30	8M30	10M30	12M30	12M30
Tail Bone	6M31	8M31	10M31	12M31	14M31
Pump Rod (Top Section) with Split Pin	6M32	8M32	10M32	12M32	12M32
Tail Straps (Short)	6M33	8M33	10M33	12M33	14M33
Tail Straps (Medium)	—	—	—	—	14M44
Tail Straps (Long)	6M34	8M34	10M34	12M34	14M34
Wing Nut for Cover	6M35	8M35	10M35	12M35	14M35
Galvanised Cover	6M36	8M36	10M36	12M36	12M36
Anti-Swivel Guide	6M37	8M37	10M37	—	14M37
Anti-Swivel Bar or Pump Rod	6M38	8M38	10M38	—	14M38
Anti-Swivel Casting	6M39	8M39	10M39	—	—
Top Tail Fin	6M40	8M40	10M40	12M40	14M40
Bottom Tail Fin	6M41	8M41	10M41	12M41	14M41
Hub	—	—	—	—	14M45
Hub Spindle	—	—	—	—	14M46

PREPARATION FOR OPERATION OF METTERS TYPE M WINDMILLS

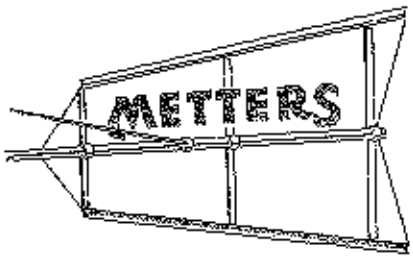
OILING WINDMILL HEAD

After checking over general erection of windmill head, wheel, tail and tower, take off the galvanised cover and turn the wheel slowly to see that everything is quite free, then place the special windmill oil in the main casting. There is an oil level mark on the outside of the main casting. Do not fill over this mark, otherwise surplus oil will be discharged from the hub spindle. After every 12 months' use, flush out main casting and replace with Metters Special Windmill Oil. (Do not, under any circumstances, use any other than windmill oil) After oiling, place galvanised cover in position and tighten up wing nut.

PUMP

Take pump out of water and try plunger to see that it is not too tight. it should work smoothly. If it is too tight, smooth down the leathers and again soak pump in water for a few hours. When the plunger is working correctly place pump in position. Before connecting pump rod push pump plunger down until it is resting on bottom of the pump. Turn mill till it is at the bottom of its stroke (i.e., when the anti-swivel (No. 39) is as far down the tower as possible). Before starting on the up stroke, cut pump rod level with bottom stud on anti-swivel casting so that when pump rod is inserted in this casting it lifts plunger of the pump about two inches (2 in.) above bottom casting of pump. This prevents the plunger from striking either bottom or top casting of the pump.

To ensure silent running bring pump rod through the anti-swivel casting and butt it against the rod (with ferrule) that comes down from head. After pump rod is coupled, turn mill wheel slowly round and rotate head on turntable to make sure that there is nothing fouling the line between mill and pump. Recheck all points; release furl handle and allow mill to run.



HEAD M PARTS LIST AND INSTRUCTIONS

Pipe Stays or Rod Guides

Pipe Stays should be fitted to the discharge pipe to stop any movement of the pipe which will eventually wear the pump rod Always fit one Pipe Stay as close as possible to the top of the spill pipe, except in case of a ground installation Always fit one pipe stay for each length of pipe above ground level.

Air Chambers

The function of an airchamber is to keep water flowing through the delivery pipe at a steady rate instead of surging. It should be fitted as close as possible to the pump along the delivery pipe. A checkvalve must be fitted on the delivery side of the airchamber to prevent water in the pipe running back when airchamber is opened for draining. The airchamber must not be completely full of water as it is then useless A plug is normally fitted to an airchamber to drain. This should be done periodically

PACKING LIST FOR TYPE M HEAD, WHEEL AND TAIL

Size is shown on case in letters after the case no. e.g., No. 1 6M, No. 1 8M.

CASE MARKED No. 1.

Contents.

1 Head Type M".

1 Furl Lever.

1 U Bolt.

1 Tin Special Windmill Oil.

CASE MARKED, No. 2

1 Stub Tower with Thrust Race Dust Cover and Lock Washer.

6 Spokes for Wheel

1 Set (3) Tail Straps.

1 Furl Handle.

1 Furling Unit.

1 Furl Wire.

6 Outer Rings for Wheel

6 Inner Rings for Wheel

1 Pair Tail Fins.

18 Fans, with small clips attached.

18 Large Clips.

1 Bag Bolts and Nuts for Wheel, Tail and Stub Tower.

1 Tail Pin with 2 Cast Washers, Top and Bottom.

1 Spindle for Furling Lever.

1 Galvanised Furling Link

1 Wood Pumprod, 3 ft.

1 Wood Pumprod Connection

1 Wood Block (Cross Guide)

1 **Bundle Containing:—**

1 Tail Bone, 1 Pump Rod for Head

1 Anti-Swivel Casting and Bar, 1 Tail Hanger.

DETAILS OF BOLTS FOR TYPE M WHEELS

6 Ft.

Spokes to inside of Hub—
6 1 in. x 5/16 in. Hex. Bolts and Nuts.

Spokes to inside of Hub—
6 Spring Washers.

Spokes to Outside of Hub—
6 1 in. x 5/16 in. Set Screws.

Spokes to outside of Hub—
6 Spring Washers.

Inner Rings to Spokes—
6 1 in. x 5/16 in. Hex. Bolts and Nuts.

Outer Rings to Spokes—
6 1¼ in. x 5/16 in. Hex. Bolts and nuts.

Outer Rings on Overlap—
6 ¾ in. x 5/16 in. Hex. Bolts and Nuts.

Clips to Rings—
54 ⅝ in x ¼ in. Mushroom Head Bolts with Hex. Nuts.
54 Spring Washers.

8 Ft.

Spokes to inside of Hub—
6 1¼ in x ⅜ in. Hex. Bolts and Nuts

Spokes to inside of Hub—
6 Spring Washers.

Spokes to outside of Hub—
6 1 in. x ⅜ in. Set Screws

Spokes to outside of Hub—
6 Spring Washers.

Inner Springs to Spokes—
6 1 in. x ⅜ in. Hex. Bolts and Nuts.

Outer Rings to Spokes—
6 1¼ x ⅜ in Hex Bolts and Nuts.

Outer Rings on Overlap—
6 ¾ in. x ⅜ in. Hex Bolts and Nuts.

Clips to Rings—
54 ⅝ x ¼ in. Mushroom Head Bolts and Nuts with Hex. Nuts.
54 Spring Washers.

10 ft.

Spokes to inside of Hub—
6 1½ in. x ⅜ in. Hex. Bolts and Nuts.

Outer Rings on Overlap—
6 1 in. x ⅜ in. Hex. Bolts and Nuts

Inner Rings to Ring and Spoke—
6 1 in x ⅜ in. Hex. Bolts and Nuts

Outer Rings to Ring and Spoke—
6 1½ in. x ⅜ in. Hex Bolts and Nuts

Spoke to Hub (Outside)—
6 1¼ in. x ⅜ in. Set Screws.

Clips to Rings—
36 ⅝ in. x 5/16 in Hex. Bolts and Nuts

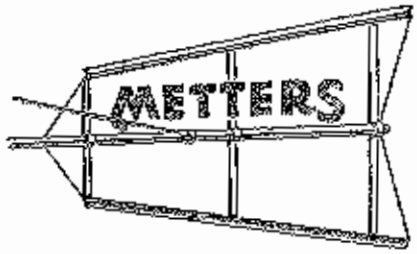
Clips to Rings—
36 ⅝ in. x 7/16 in. Hex. Bolts and Nuts.

Clips to Rings—
18 ⅝ in. x ¼ in. Mushroom Head Bolts and Nuts.

Spokes to Hub—
12 ⅜ in. Spring Washers.

Clips to Rings—
36 5/16 in. Spring Washers.

Clips to Rings—
18 ¼ in. Spring Washers.



M HEAD, WHEEL AND TAIL PARTS AND PACKING LIST

12 ft. and 14 ft. models.

SIZE IS SHOWN ON CASE AFTER CASE No. (e.g. No. 1—12M, No. 1—14M)

CASE MARKED No. 1

Contents—

1 Head Type M .

1 Furl Lever.

1 U Bolt

1 Tin (1¼ galls) of special Windmill Oil.

CASE MARKED No. 2

1 Stub Tower with Thrust Race, Dust Cover and Lock Washer.

6 Spokes for Wheel.

1 Set (5) Tail Straps.

1 Furl Handle

1 Furling Unit.

1 Furl Wire with 2 Clamps.

6 Outer Rings for Wheel.

6 Inner Rings for Wheel.

1 Pair Tail Fins.

18 Fans with small clips attached (12 ft. M).

24 Fans with small clips attached (14 ft. M).

18 Large Clips (12 ft. M).

24 Large Clips (14 ft. M).

2 Bags Bolts and Nuts for Wheel, Tail and Stub Tower.

1 Tail Pin with 2 Cast Washers, top and bottom.

1 Spindle for Furling Lever.

1 Galvanised Furling Link.

1 BUNDLE CONTAINING:—

1 Tail Bone, 1 Pump Rod with Fork.

1 Steel Pump Rod with Fork.

BOLTS FOR M WHEELS 12 ft.

Spokes to Hub.

24 2-in x ½-in. Hex. Bolts and Nuts.

24 Hex ½-in. Lock Nuts.

Outer Ring Overlap

6 1-in x ½-in Hex. Bolts and Nuts.

6 ½-in. Spring Washers.

Inner Ring Overlap.

6 1-in. x ½-in. Hex. Bolts and Nuts.

6 ½-in. Spring Washers.

Inner Ring to Spokes.

6 1¼-in. x ½-in. Hex. Bolts and Nuts.

6 ½-in. Spring Washers.

Outer Ring to Spoke.

6 1¼-in. x ½-in. Hex. Bolts and Nuts.

6 ½-in. Spring Washers.

Large Sail Clips to Rings.

36 ¾-in. x $\frac{5}{16}$-in. Hex Bolts and Nuts.

36 $\frac{5}{16}$-in. Spring Washers.

Small Sail Clips to Rings.

18 ¾-in. x $\frac{5}{16}$-in. Hex. Bolts and Nuts.

18 $\frac{5}{16}$-in. Spring Washers

BOLTS FOR M WHEELS 14 ft.

Spokes to Hub.

24 2-in. x ½-in Hex. Bolts and Nuts.

24 Hex. ½-in. Lock Nuts.

Outer Ring Overlap.

6 1-in. x ½-in. Hex. Bolts and Nuts.

6 ½-in. Spring Washers.

Inner Ring Overlap.

6 1-in. x ½-in. Hex. Bolts and Nuts

6 ½-in. Spring Washers

Inner Ring to Spokes.

6 1¼-in x ½-in. Hex. Bolts and Nuts.

6 ½-in. Spring Washers.

Outer Ring to Spoke

6 1¼-in. x ½-in. Hex. Bolts and Nuts.

6 ½-in. Spring Washers.

Large Sail Clips to Rings.

48 ¾-in. x $\frac{5}{16}$-in. Hex Bolts and Nuts.

48 $\frac{5}{16}$-in. Spring Washers.

Small Sail Clips to Rings.

24 ¾-in. x $\frac{5}{16}$-in. Hex Bolts and Nuts.

24 $\frac{5}{16}$-in. Spring Washers.

M WINDMILL HEAD

PARTS MODIFICATIONS

Part Nos M37, M38 and M39 as illustrated on diagram page 12, and detailed on page 13 have been replaced with Wood Guide for part M37, Wood Pump Rod for part M38 and Wood Pumprod connection for part M39

This applies to all M Windmill models from 6 ft. to 14 ft. sizes. Spare parts for M Windmills supplied before February, 1964, and fitted with Anti-Swivel Guide, Anti-Swivel Bar or Pump Rod and Anti-Swivel Casting are readily available.

DETAILS OF REPLACEMENT PARTS:—Wood Pump Rod, ¾ in. x 2 in. x 3 ft. long.
Wood Guide, 4 in. x 2 in. x 14 in. long with 2¼ in. x 1¾ in. hole in centre.

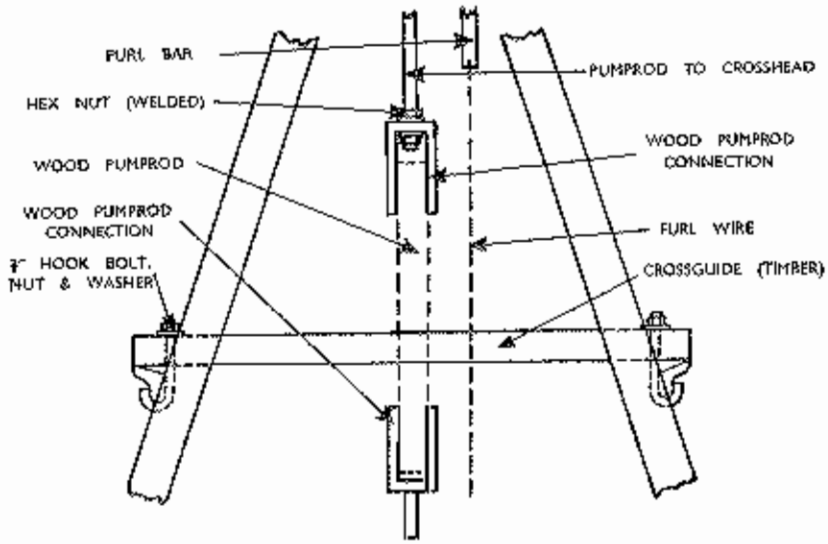


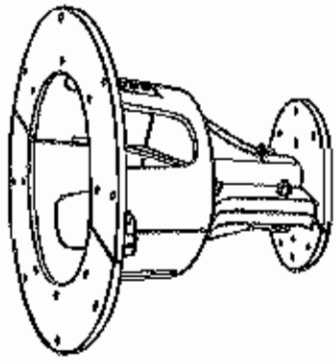
Diagram of Wood Pump Rod fitting for all M Windmills.
Use as a guide to assembly.

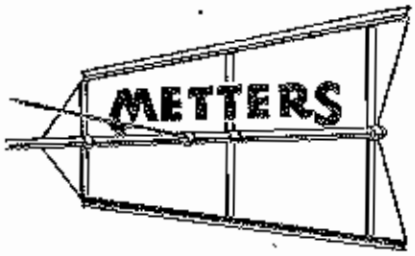
PART Nos. FOR MODIFICATIONS AS ABOVE

Name of Part	6 ft.	8 ft.	10 ft.	12 ft.	14 ft.
Pumprod (Top Section) to crosshead	6M32/64	8M32/64	10M32/64	12M32/64	14M32/64
Wood Pumprod connection (Top)	6M47	8M47	10M47	12M47	14M47
Wood Pumprod connection (Bottom)	6M48	8M48	10M48	12M48	14M48
Wood Pumprod	6M49	8M49	10M49	12M49	14M49
Cross Guide (Timber)	6M50	8M50	10M50	12M50	14M50

HUB 12 ft. and 14 ft. M WINDMILLS

The diagram at right illustrates this hub as the "split type", and is supplied only with the 12 ft. and 14 ft. models in the M range. Assembly to the hub shaft is by means of four bolts, nuts and washers provided. Split hub part number is 14M45.



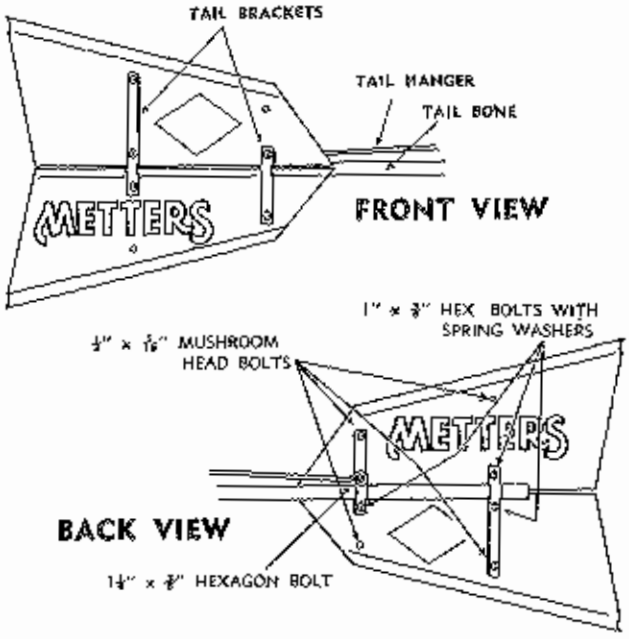


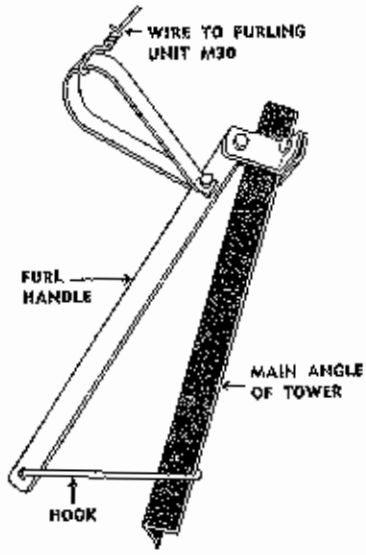
ASSEMBLY OF TAIL AND WHEEL

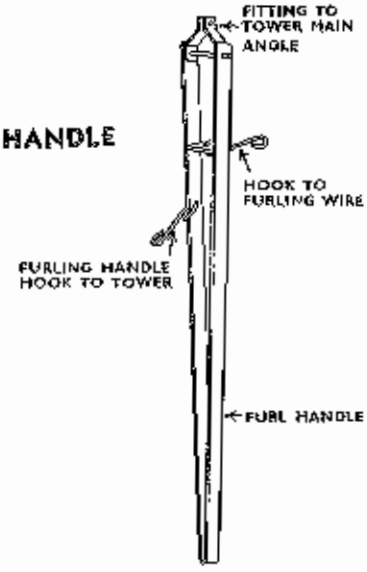
ASSEMBLY OF M TAIL, PUMP ROD AND FURL GEAR

Assemble tail on ground. See illustration for position of parts Grease tail pin, No. 23; also grease ball of Furling Link, No. 29; place end with two holes into hole of tail triangle entering through tube section, then fit cast washer No. 11 with flat side up on tail pin. Lift tail (refer to Page 11) Insert top end of tail pin into bottom of hole in main casting, then fit cast washer No. 10 with groove upwards. Now lower tail and hook tail hanger M22 through top of tail pin. Place the two bolts (1¾ x ¼ in. hex. with spring washers) through the two holes in triangle of tail Remove gin pole etc.

Fit pump rod M32 into cross head M25 by screwing up into position, lining up hole in pump rod with hole in cross head. Place cotter pin in position, and open up so that it cannot fall out. Fit furl handle to main angle near bottom of tower and couple up furl wire from furl handle to furling unit M30. Test for shutting off







12 ft. and 14 ft. FURL HANDLE

12 ft. and 14 ft. TAIL

These models have an extra set of tail straps

ASSEMBLY OF M WHEEL

ASSEMBLY OF WHEEL .M.

The tail must be in position before fitting wheel. Reef the tail before starting to assemble wheel. Put outer fan bracket on fan, making sure clip of bracket goes through slot in fan so that it will hook over inside of fan when ring is in place. Refer Figs. A and B. After assembling the six sections of wheel, bolt the six spokes to hub No. 8. Refer Page 14 for size and position of bolts, nuts and spring washers. Do not tighten up any bolts until wheel assembly is completed

Then take a section of wheel and bolt this into position. For 6 ft. and 8 ft. Type M windwheels, the inner rims are placed on top of the cross bar inside the spokes and the outer rims on the outside end of the spokes (refer Fig. C.).

Now turn spokes so that the section just assembled is at top of wheel. Place in position. two more sections at the present bottom of wheel, then again turn wheel and fix in other sections. Tighten all bolts and nuts. keeping wheel as true as possible while doing so.

After tightening and trueing wheel turn it slowly to make certain that it does not foul at any point inside or outside the head.

If the rings of the wheel run parallel with each other, the wheel should be reasonably true, but it is advisable to check it by one of the tower legs, turning wheel round slowly by hand. The outer ring should be the same distance from tower leg at all points. A wheel that is not true causes undue wear on bearings and other moving parts of mill.

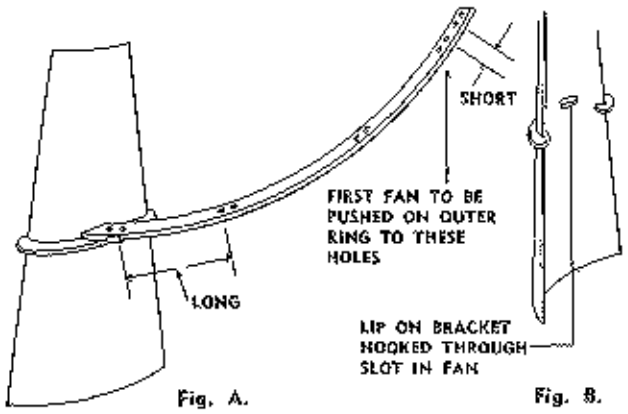
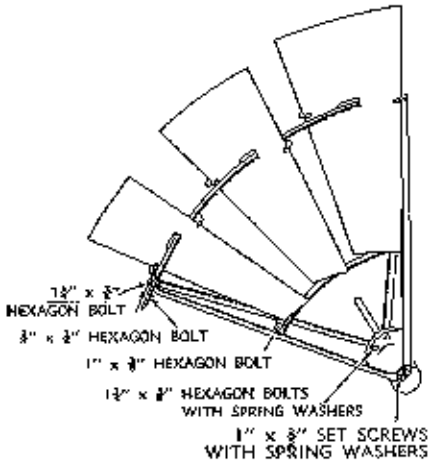


Fig. A. Fig. B.

14 ft. M WINDMILL SAILS

Assembly of the sails for this model is the same procedure as with other M. models. The only difference being that there are four sails in place of the usual three to each section.



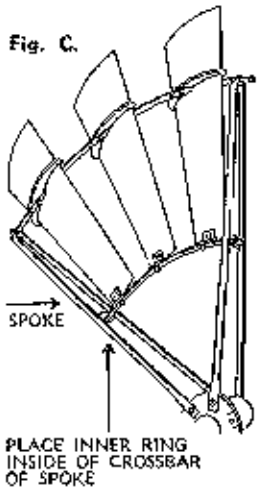


Fig. C.