

All illustrations supplied by the author.

Fig. 34.01 (leading photograph) R-50 006-Frecaței Mill, Județul Tulcea. The double storied post mill with two side abutments, and two pairs of mill stones.

Fig. 34.02 (above) Molinographic Map of Drobrogea, Romania. Scale 1/M. cf. the watermill map in fig. 32.09, to scale 1/2.5 M.

Fig. 34.03 (frontispiece, opposite) From the Open Air Museum of Rural Technology in Sibiu, UTMn 35/278/5077. Left to right:

R-50 006 (see above).

R-50 001-Dunavat Mill , 35/675/4986 (see also fig. 34.05 ...08).

R-50 013-Enisala Mill , 35/645/4972 (see also fig. 34.09 ....14).

Fig. 34.04 The author.

# CHAPTER 34

## R R

### WINDMILLS IN DOBROGEA, ROMÂNIA. DISTRIBUTION AND TYPOLOGY

by

HEDVIGA RUȘDEA

UDC 621.548 (498)

Notes in page 450

Hedwiga Rusdea:

born 20-06-24, Sibiu, R.

Master of Philosophy, Keeper,  
and Sectional Officer in Mu-  
seum for Agricultural Tech-  
nology (responsible also for  
mills).

Studies in connection with  
Horizontal Mills and Windmills.  
Publication in this field:  
"Die Windmühlen der Nord-  
dobrudscha", Cibinium 1966.



Windmills were used in România from ancient times. The earliest documentary evidence<sup>1)</sup> dates from 1585 and refers to Dobrogea. In the 19th century windmills are found in greater numbers in the eastern and southern parts of Moldova, and particularly in Dobrogea. In Oltenia and Muntenia - both important cereal-producing areas with well developed traditional milling - the concentration of windmills was much lower. Official statistics from 1861<sup>2)</sup> mention only 196 windmills from these provinces, forming 3% of their total of 6352 available mills. Of these 196 windmills, 140 were situated in the city of Brăila<sup>3)</sup>; a port on the Dunărea (Danube) and the most important trade centre for cereals, the paramount article of export in Romania at that time. In Muntenia and Oltenia the windmills were replaced by modern steam roller mills at a fairly early date so that later official statistics mention only a single windmill<sup>4)</sup>. The same statistics (from 1901) list 127 windmills for the Moldova area and 639 for Dobrogea. Of these, 437 mills were situated within the Județ Tulcea (county of Tulcea). This northern part of Dobrogea was the area where windmills reached their highest concentration.

Dobrogea is an area with few watercourses, and consequently without the abundance of waterpower used for energy by the rural industries of other areas. The few streams in the northern part of the province have insufficient runoff to allow round-the-year use of watermills. However, where waterpower is almost non-existent we find very strong winds throughout the year, so it is not surprising that this "Country of the Winds", as Dobrogea is often called, was also the country of the windmills.

In areas where windmills have been replaced by modern roller plant the study is restricted to oral information and documents. Dobrogea is the only area where windmills have survived to the present day - with a few specimens still in operation - and here we have the opportunity to check all the technical details in situ.

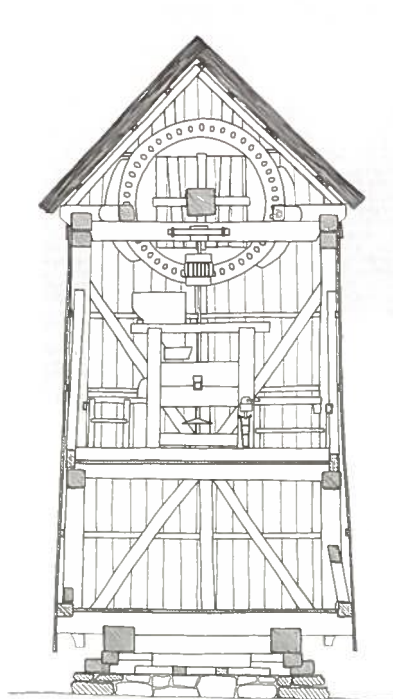


Fig. 34.05

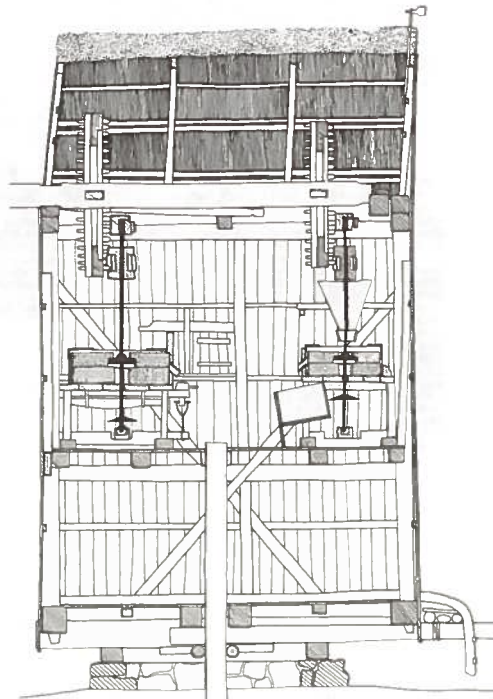


Fig. 34.06

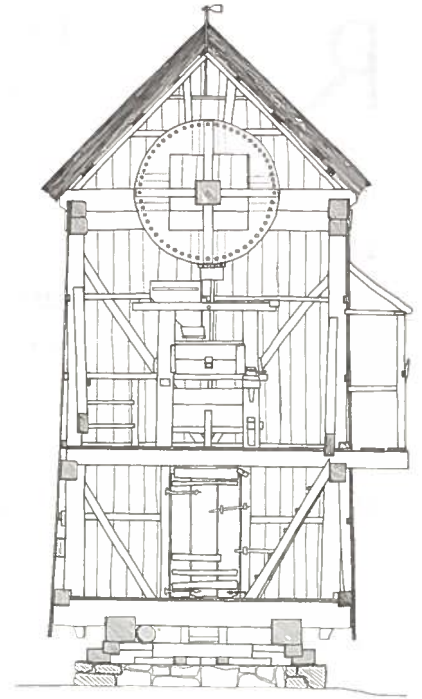


Fig. 34.07

Notes:

- 1) Busila, Valentina & Lazar, Gheorghe: Some new data concerning researches of the windmills of the Dobrogea, Comunication at the First Scientific Session of the Museums of Romania, Bucharest, 24-29 December 1964.
- 2) The statistical annals for knowing the Wallachian parts of Romania - The statistics of Mills.
- 3) Ciobanu - Stahl, Anca: Statistics concerning the traditional milling in Wallachia at 1861, Cibinium, Sibiu (in press).
- 4) Industry Poll made in 1900-1902.
- 5) Jespersen, Anders: Report on Windmills, Volume 4: Windmills on Bornholm, Danmark, Virum, Copenhagen, 1959 (page 35).
- 6) de Oliveira, Ernesto Veiga & co-authors: Moinhos de Vento. Acores e Porto Santo, Centros de Estudos de Etnologia peninsular, Lisboa, 1965 (page 14 & 50-57).

We will therefore restrict ourselves to describing the windmills of Dobrogea and establishing their typology.

The Dobrogea windmills fall into two main types; the turnable mills where the whole mill body is turned to bring the sails to face the wind (the Moara cu Pivot), and the cap-mill (the Moara Căciulată) where the body with the grinding stones remains fixed and only the cap with the sails is turned.

#### 1. The Pivot Mill (Moare cu Pivot) (a turning mill with a central pivot)

This type is characterised by a central post around which the mill body revolves to bring the sails into the wind (fig. 34.05-.06-.07-.08-.09-.10-.11-.12-.13-.14). This central post (babalŃc) is sunk deep into the ground (2.5 m) and extends up through the ground floor, ending in the structure in the middle of the mill. In this way the post acts not only as a pivot around which the mill turns, but also as an anchorage, preventing the mill from tipping over or sliding sideways off its curb. Unlike the turnable mills of Central and Western Europe and the Northern countries, known under the names of Bockwindmühle, Post-mill, Moulin a pivot, Standerdmoolen, Stubmølle, 5) the central post in the Dobrogea mill does not carry the load of the mill body. This load is carried by a square oak curb supported on a stone foundation. A similar - but much smaller - post is used in this way in the Portugese turnable mills in the Azores 6) . The mill body

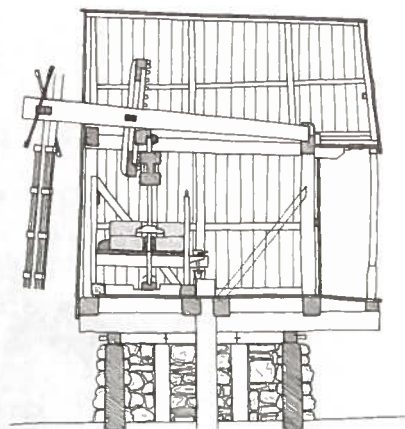


Fig. 34.09

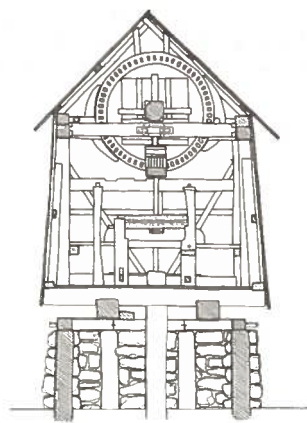


Fig. 34.10

Opposite and above:

R-50 001-Dunavăț, Județul Tulcea. UTMn 35/675/4986.

Opposite: drawing 1/100:

Fig. 34.05 Cross section, looking into the wind.

Fig. 34.06 Longitudinal section, seen from starboard.

Fig. 34.07 Cross section, looking with the wind.

Photograph above:

Fig. 34.08 The windward stone, and its gearing.

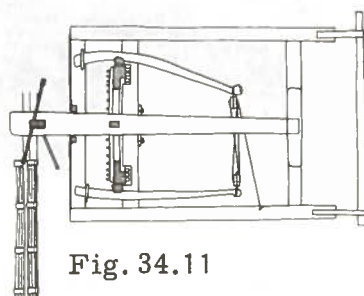


Fig. 34.11

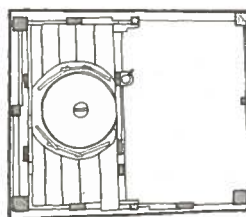


Fig. 34.12

Right columns:

drawings 1/100 of R-50 013-Enisala Mill. UTMn 35/645/4972.

Fig. 34.09 Longitudinal section, from starboard.

Fig. 34.10 Cross section, looking into the wind.

Fig. 34.11 Plan of cap with brake levers.

Fig. 34.12 Plan of stone ledge.

Fig. 34.13 Plan of mill bottom frame.

Fig. 34.14 Plan of curb frame.

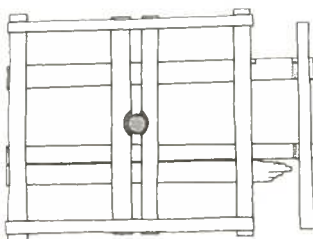


Fig. 34.13

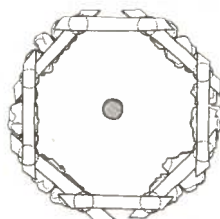


Fig. 34.14



Fig. 34.15 R-50 002-*Poșta* Mill, Județul Tulcea. UTMn 35/624/5003. The post mill on a stone socle.



Fig. 34.16 -.17 (below)  
System of winding the post mill by means of a portable capstan.

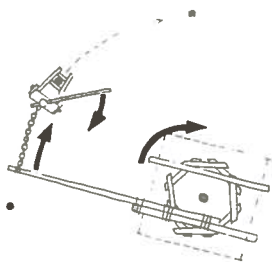
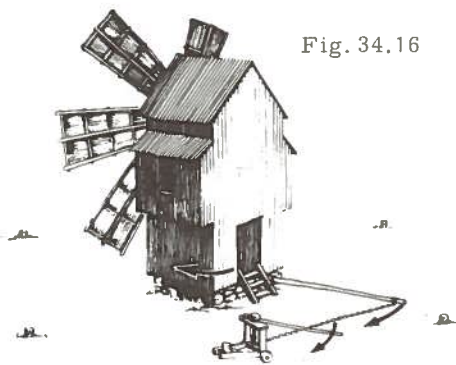


Fig. 34.17

is based on two parallel beams, called *sanie* (sleigh), which slide on the wooden curb. The tail pole (*proțap*) is fastened to the *sanie* and serves as a lever to turn the mill. The mill is wound by means of a movable winch (*capra*, literally ~ nanny goat) which pulls the tail pole with a chain. By this means the mill can be turned by one person (Fig. 34.16-.17). Although no significant differences occur within the pivot mill group as far as the winding gear or grinding system is concerned, there are certain differences in the construction of the mill body. If we consider the structure, and particularly the height, of the mill body, we can distinguish between the tall, two-storey mills and the lower single-storey mills on a socle.

a) The Tall Two-storey Mills  
(Figs. 34.21-.22-.23-.24 and 34.05-.06-.07)

These are tall, massive wooden structures, rectangular in plan, with vertically weatherboarded walls and a hipped roof. The mill body rests on a low row of stone blocks, since sails of sufficient length could be accommodated without a high base. A floor divides the interior into two storeys, the lower of which being used for storage, while the millstones are placed in the upper storey. In most cases these mills have two pairs of stones, but in a few examples only one pair was found.

The sacks were taken through a door in the wall at second-storey level by means of a simple horizontal manual hoist. Power-driven sack hoists were unknown in Dobrogea windmills. To ease loading and unloading, the millwright often extended the structure by means of a balcony, which was sometimes used as a cantilevered support

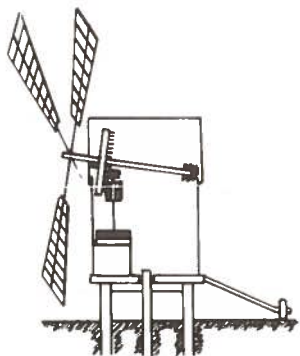


Fig. 34.18 Pivot mill with wooden support and wooden sails.

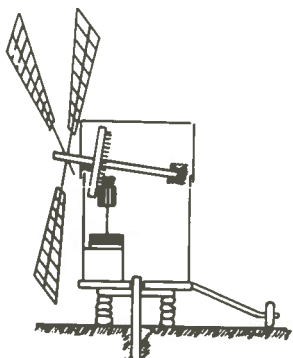


Fig. 34.19 Pivot mill with stone socle and wooden sails.

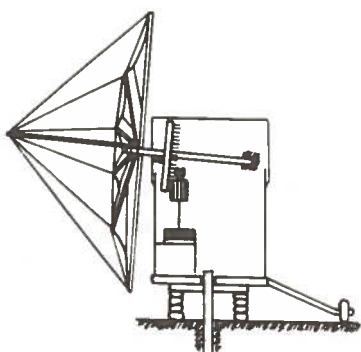


Fig. 34.20 Pivot mill with stone socle and lateen sails.

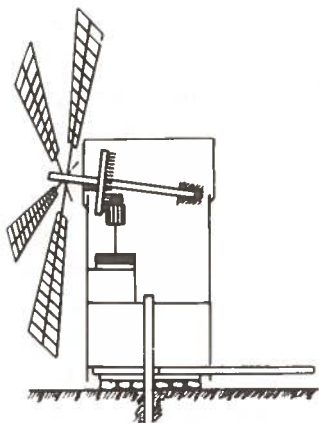


Fig. 34.21 Two storied pivot mill with one pair of stones.

for an extended upper storey. The number and construction of these balconies varied from mill to mill. There were mills with a balcony on one side only, which might be either open or closed, (Fig. 34.29) mills with one open balcony at the back, and mills with two symmetrical closed balconies at the sides (Fig. 34.01).

b) The Small Single-storey Mills on Socles  
(Figs. 34.18-.19-.20 and 34.09-.10-.11-.12 .13-.14)

These are also rectangular wooden mills with vertically-boarded sides and hipped roofs, but they are smaller, and above all, lower. They have only one storey, and only one pair of stones (Fig. 34.15). The sails must be placed at a reasonable height in order to catch the wind, and it was necessary, therefore, to place these comparatively small mills on a stone socle. This rectangular, polygonal, or circular base, which was always smaller than the mill body, could either be hollow or be filled out with boulders (in order to support the central post). This foundation supported a wooden curb, on which slid the *sanie*, forming the base of the mill, to bring the mill into the wind.

Where stone was not available - which was very unusual in Dobrogea - the foundation could be made of beams morticed together in a polygon, or in the smaller mills, by simply ramming poles in the ground and crowning them with a wooden curb (Fig. 34.18). The height of the socle depended on local conditions - topography and wind velocity - and could vary between 1 and 2 m. The central post, which was sunk into the ground, extended inside the mill and ended just above the ground floor.

These small pivot mills were also quite often fitted with open balconies at the back, where there was access to the mill. Unlike the two-storey mills, the one-storey mill had two tailpoles - one fitted to each beam of the *sanie* - meeting just above the ground, where they were fitted with a small wagon wheel. The sacks of corn and flour were carried in and out of the mill on the back, or were hoisted by a small sack hoist with a horizontal drum mounted on the side wall of the open balcony.

Since the sails, gearing, and millstone systems in both types of mill are almost identical we will treat them together below.

Sails

The Dobrogea windmills have 4, 6, and in certain cases 8 fairly long sailstocks. The sails themselves are attached to a stock (*nada*) morticed through the windshaft (*val* or *grindeu*). The sail frame (*inima*) is trapezeshaped and is made of light wooden bars covered with thin boards. The outer parts of this boarding (*capace*; literally "lids") can be removed to suit the available wind and the amount of work required of the mill. These sails were never cloth-spread as is so often the case on the wind-

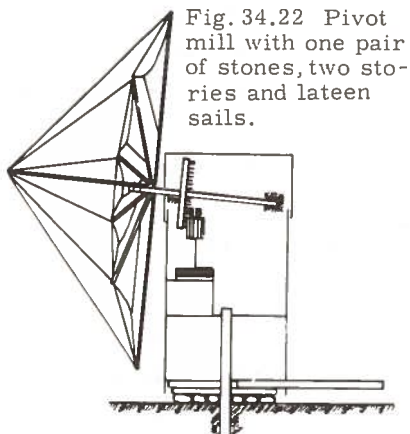


Fig. 34.22 Pivot mill with one pair of stones, two stories and lateen sails.

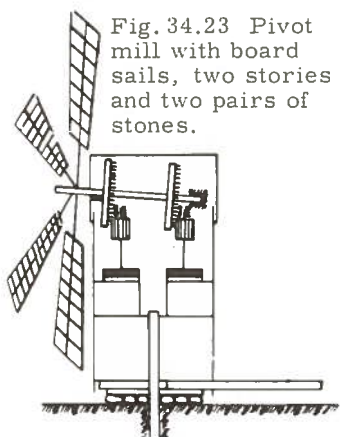


Fig. 34.23 Pivot mill with board sails, two stories and two pairs of stones.

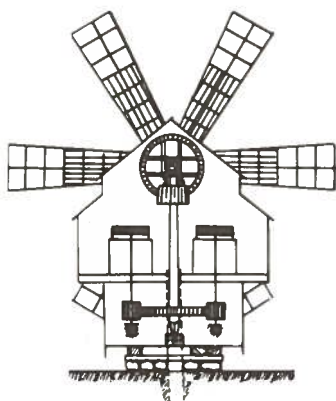


Fig. 34.24 Two storied pivot mill with board sails, 2-step gear, and two pairs of stones.

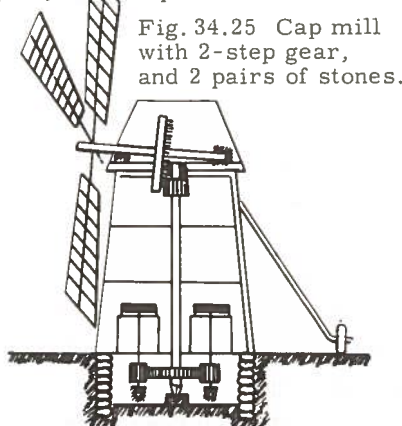


Fig. 34.25 Cap mill with 2-step gear, and 2 pairs of stones.

mills of Western Europe. The sails of the Dobrogea mills normally turn clockwise when viewed in the direction of the wind.

Besides the mills with boarded sails, which are found throughout the area investigated, we find in the Southern part of Dobrogea some examples of the jib sails so characteristic of the Mediterranean windmill <sup>7) 8) 9)</sup>.

These jib sails or lateen sails are found only on mills with one pair of stones; particularly the small mills on stone socles (Fig. 34.20-.22-.26). This system, using 8 or 12 cloth sails, could only be studied on the two such mills which have survived to the present day. Of the 12 sail poles of these mills, only 4 were fastened at a stock (nadă) morticed through the windshaft; the other 8 being mounted on an iron ring fitted round the shaft. About 1 m from the shaft, the sail poles are braced by a square wooden frame. The windshaft extends about 3 m to the windward of the sails, and from its end, ropes run to the tips of the sail poles to relieve them of the backward thrust from the sails. Finally, a tie-rope runs round the perimeter of this "wind wheel".

In spite of local differences in building tradition, these small mills with jib sails and stone socles are reminiscent of the Portuguese windmills with central posts found in the Azores (Terceira) 10

#### Gearing

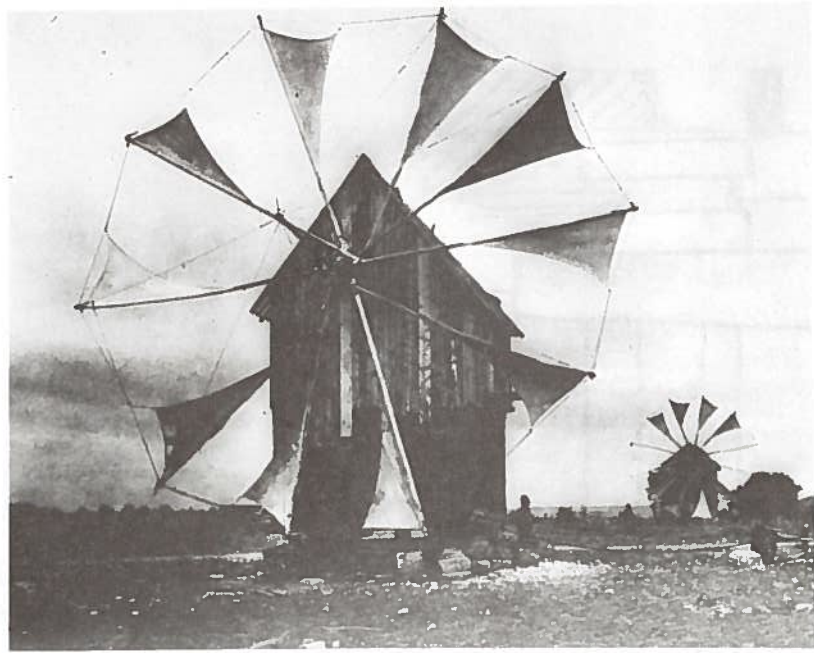
The gearing systems of the Dobrogea windmills are not significantly different from those of other windmills (Figs. 34.05-.06-.07). The windshaft is placed at an angle to the horizontal for statical reasons, with the head end with the sails raised 15 - 25 cm above the tail. The windshaft carried a brakewheel (ischidar or roată măselată) of ca. 2 m diameter, with 32 - 64 beechwood cogs. These mesh with the felinar: a lantern pinion with 7 - 12 rungs made of cornel cherry wood. The felinar is fixed on the upper end of a vertical iron spindle (fusul pietrei) which drives the runner stone (piatra rotitoare or piatra alergătoare) (Fig. 34.08). The stones in Dobrogea windmills are generally driven from above, and no further gear stages are used. The gear ratio ranges from 1:4.5 to 1:6.

This gearing can serve one pair of stones, or in the case of the two-storey mills, two pairs (often of different sizes), in which case the windshaft carries a brakewheel and a tailwheel, each driving one pair of stones (Fig. 34.05-.06-.07). In some of the two-storied pivot mills with two pairs of stones, two-stage under-drive gear was used (Fig. 34.24-.27-.28-.29-.30-.31-.32) a system which we will describe in detail under the cap mill. The two pairs of stones are frequently of different material, and were named after their place of origin - often far away. The French burr stones were hardly known.



Fig. 34.26 Windmills from Mangalia, a part of Southern Dobrogea which passed from R to BG in 1944. The numbering is thence R-50 011 — BG-50 011 and R-50 012 — BG-50 012-Ghiaur Suiuciu Mills. UTMn 35/610/4810. Here cloth spread sails were used in stead of boards.

From Kurt Hielscher: Rumänien Landschaft, Bauten, Volksleben. Leipzig, F. A. Brockhaus, 1933, P. 123.



Notes:

- 7) Jespersen, Anders: Report on Watermills, Volume 3: Scale Drawings (29 contributors), Virum, København, 1957.

Jespersen, Anders: Mills and their Preservation, Excerpt CN Post, Bording, København, 1963.

- 8) Dias, Jorge: Moulins Portugais, Revista de Etnografia Nr. 6, Museo de Etnografia e Historia, Junta Distrital do Porto, (page 39-59).

- 9) Dias, Jorge - de Oliveira, Ernesto Veiga - Galhano, Fernando: Sistemas primitivos de moagem em Portugal, Moinhos, Azenhas e Atafonas, Moinhos de Vento, Instituto de Alta Cultura, Centro de Estudos de Etnologia Peninsular, Porto, 1959.

- 10) de Oliveira, Ernesto Veiga - Galhano, Fernando - Pereira, Benjamin: Moinhos de Vento, Acores e Porto Santo, Centrol de Estudos de Etnologia Peninsular, Lisboa, 1965 (loc. cit.)

- 11) Ionescu, Grigore: Arhitectura populara romaneasca (The Romanian Popular Architecture) Editura Technica, Bucuresti, 1957 (page 99).

The millstones are thrown out of gear by moving the lantern pinion sideways, out of mesh with the brakewheel. To stop the mill altogether, two wooden brake-blocks are forced against the sides of the brakewheel by two horizontal levers drawn together by a rope and pulley blocks (Fig. 34.11).

## 2. The Cap Mill ("Moara Căciulată")

In this so-called Dutch Windmill type (Fig. 34.33-.34-.35), the tower-shaped mill body is fixed, and only the cap is turned to bring the sails into the wind. This type of mill was restricted to a limited area in North Dobrogea, and it was uncommon even there. It was quite unknown in the Southern part of the province. These mills were also built exclusively of wood. The brick or stone tower mill, so widespread in other parts of Europe, was not found in Dobrogea, although ample supplies of building stone were available, and used in other types of building.

Unfortunately, not a single specimen of these windmills has survived; the last having perished in 1963. The type could, however, be reconstructed from written documentation 11)(two drawings and a short description of a cap mill from the village of Beștepe, Județ Tulcea), and above all, from actual parts of the gearing and grinding equipment which have been recovered from the former millowners. Further, important information has been collected as statements from the Dobrogea millwrights who once built this type of mill.

The 8- or 10-sided all-wooden body rested on a 1 m deep stone foundation which also formed the walls of the basement, while the

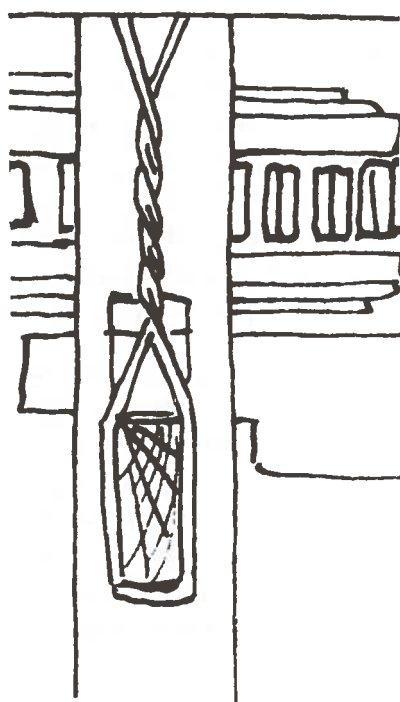
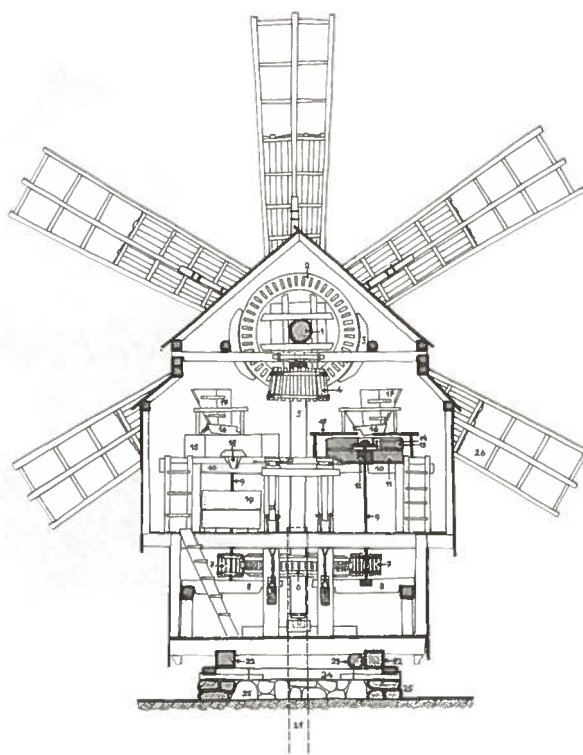
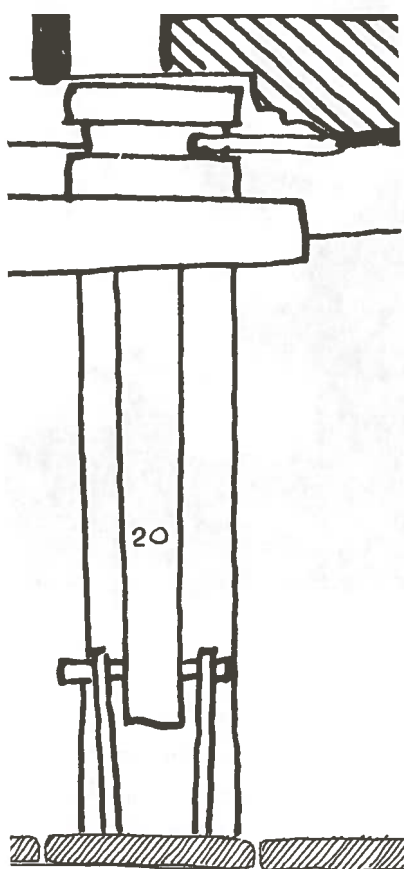


Fig. 34.27 R-50 003-Caraibil Mill, Judetul Tulcea. UTMn 35/652/4990. Cross section of a double storied post mill with two-step gearing, looking into the wind. Scale *ca.* 1/100 (partly diagrammatic). Part of the tentering mechanism repeated in the left hand margin to scale *ca.* 1/10 as fig. 34.28.

- 1) Wind shaft ~ val.
- 2) Brake wheel ~ ishidar or roata măselată.
- 3) Brake.
- 4) Wallower ~ roata de sus.
- 5) Upright shaft ~ dăul.
- 6) Lower spurwheel ~ sturceac.
- 7) Lantern pinions (stone nuts) ~ felinar.
- 8) Bridge trees ~ masa fusului.
- 9) Stone spindle ~ fusul pietrelor.
- 10) Stone ledge ~ postamentul pietrelor.
- 11) Bed stone ~ piatra stătătoare.
- 12) Boss ~ buhaz.
- 13) Runner stone ~ piatra alergătoare.
- 14) Rhynd ~ pârărița.
- 15) Vat ~ veșca.
- 16) Shoe ~ tigăița.
- 17) Hopper ~ coș.
- 18) Spout ~ scoc.
- 19) Flour box ~
- 20) Tentering windlass ~ virtej. See also fig. 34.28 and .32
- 21) Post ~ babalîc.
- 22) Saddle frame ~ sania.
- 23) Tail pole ~ proțap.
- 24) Curb frame ~
- 25) Row of stones supporting the curb frame.

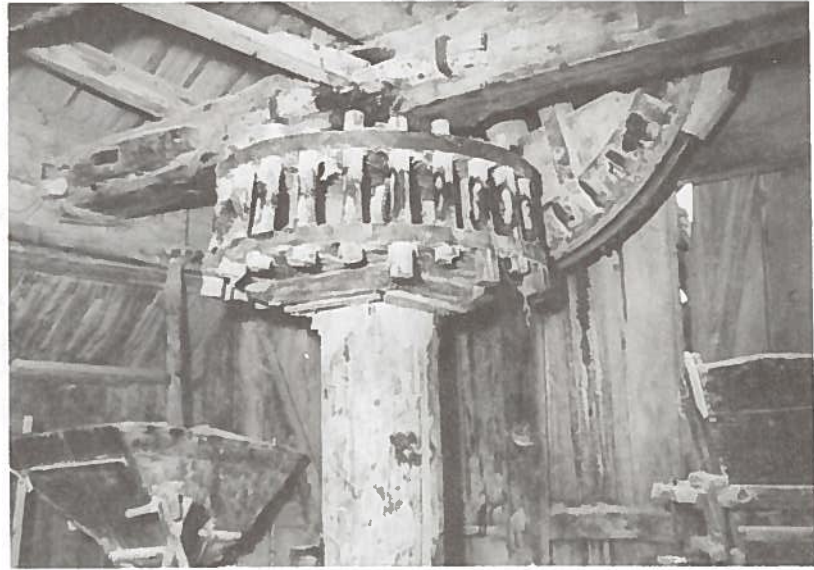


Fig. 34.29 R-50 010-Sabangia Mill, Județul Tulcea. UTMn 35/647/4987. Post mill with two stories and two pairs of stones - of the same type as R-50 003, pictured to left and right.

Fig. 34.30 R-50 003 (as opposite). First gear step: brake-wheel-wallower. The stone hoppers are seen on either side of the upright shaft.

Fig. 34.31 (below, right) R-50 003. The second gear-step below the stone hurst. Note the slip-sticks being removed from the stone nut, thus disengaging this stone for the moment. Both views looking into the wind.

Fig. 34.32 (below) A blow-up of .31, showing the twist-rope tentering system, see also the detail drawing opposite, fig. 34.28.

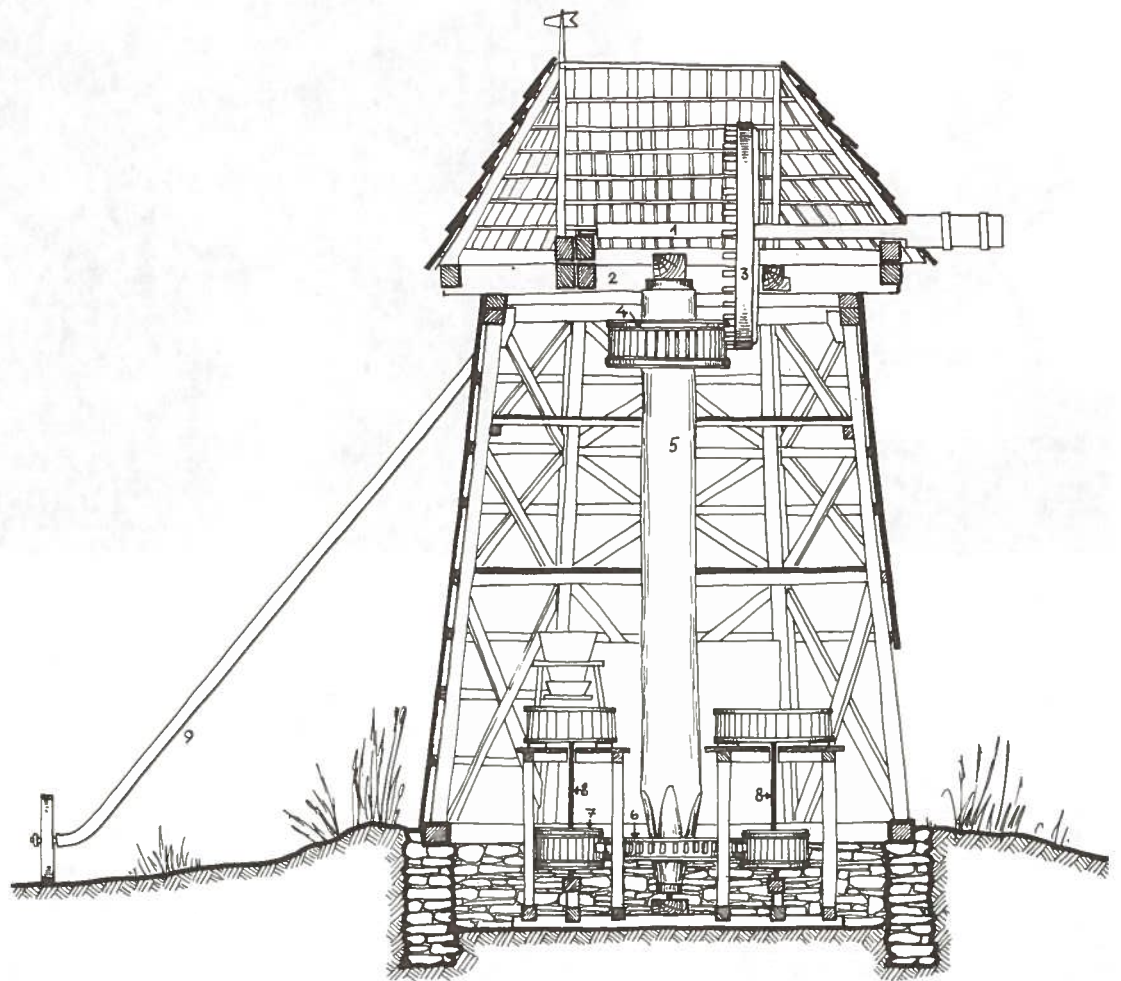


top of the body ended in a ring of wooden beams forming the curb (Fig. 34.33-.34). The cap framing was based on two sheers (sanie ~ sleigh) which slid on this curb.

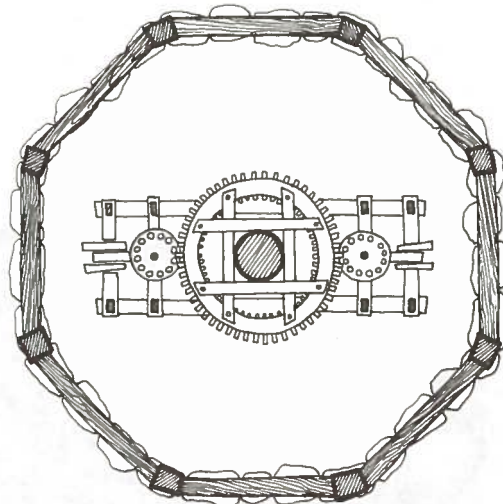
For winding the cap, two long (15 m) tailpoles were fixed to the ends of a crossbeam joining the sheers and protruding beyond the cap sides. At ground level the lower ends of the tailpoles (proțap) were joined together and fitted with a wheel.

The mill body had a shallow basement (ca. 1 m deep) containing the second gearing stage, and above this a floor carrying two hursts; one for each pair of stones. Above this again was another storey, through which access was provided to the upper gearing and the cap.





- 1) Wind shaft ~ val.
- 2) Shear and curb ~ sania.
- 3) Brake wheel ~ ishidar.
- 4) Wallower ~ roata de sus.
- 5) Upright shaft ~ daul.
- 6) (Lower) spurwheel ~ sturceac.
- 7) Lantern pinions (stone nuts) ~ felina.
- 8) Stone spindles ~ fusul pietrelor.
- 9) Tail pole ~ protap.



The smock mill ~ moara caciulata:

Fig. 34.33 (top) R-50 009-Bestepe Mill, Județul Tulcea. UTMn 35/652/4995. From Ionescu, Grigore: *Arhitectura Populara Romaneasca*, Editura Tehnica, București, 1957, P. 99. Scale ca. 1/100, section.

Fig. 34.34 (below) Same mill, plan of lower stone ledge frame, and second gear-step. Also showing main house framing and cant posts.

The walls of the mill body, together with the pyramid-shaped cap roof, were covered with pine weatherboarding. To allow access to the mill with the sails facing in any direction, the two ground-level doors were placed on opposite sides of the mill body.

The four fairly large sails were of the same construction as those of the pivot mills, including the board covering (Fig. 34.35).

The gearing was always two-stage underdrive. The windshaft carried a brakewheel (usually with 44 or 48 cogs), which drove a slightly conical 25 rung lantern pinion on the massive upright shaft (dăul). The dăul extended the full height of the building, including the basement where the second gear stage was placed. This consisted of a spurwheel (sturceac) with 64 cogs mounted on the dăul, which engaged two symmetrically-placed stone nuts (felinar) with 16 rungs (citori). The stone nuts were mounted on the vertical stone-spindles which passed through the bedstones and turned the runner stones. We must emphasise that this underdrive system, which was fairly rare in the "Dutch Mills" in other countries, is advantageous in these mills, as space is restricted by the narrow body. By placing the second stage in the basement, the millwright achieved the optimal utilisation of the available space in the mill body. Each pair of stones was placed on a hurst, on opposite sides of the upright shaft, and thus raised half a storey above ground level. The two-stage gear allowed a higher stone speed than the single-stage gear, due to a higher total gear ratio of about 1:7 to 1:9. This increased the grinding capacity considerably 12).

12) Jespersen, Anders: Gearing in Watermills (Gangtøjet i Vandmøller), Virum, København, 1953.

When only one pair of stones was in use the other pair was thrown out of gear by removing four rungs from the stone nut, and turning it to allow the gap so formed to clear the spurwheel cogs (Fig. 34.31).

The brake mechanism for these mills could not be made in the same way as in the pivot mills, due to the central position of the brakewheel and the restricted space in the cap. The brake was therefore made as a semicircular strap encircling the upper half of the brakewheel.

The cap mill was technically more advanced than the pivot mill, in that it had two-stage gearing, and an easier means of winding. The restricted use of this mill was due to the fact that it came into use so much later than the pivot mill.

As we have already mentioned under the description of the pivot mills, two-stage gearing with underdrift stones was also found in some of the taller pivot mills, but only in those areas where both types of mill were used. This fact, together with statements from millwrights who remodelled some pivot mills by fitting them with two-stage gearing, allows us to assume that this system was taken over from the cap mill. The body of the pivot mill remained unchanged, with the pivot retaining its central position.

Below is a list of Romanian windmills mentioned in this paper. Two mills, R-50 011 and R-50 012 are now situated in Bulgaria, and should therefore be named BG-50 011 and BG-50 012 respectively.

VINDMØLLE ROMÂNIA NUMBER LIST		PAGE
		CHIEF LIST
		R-50 000
		NR R-50 021
number	name of mill	grid reference
R-50 000		
50 001	Dundărești	35/875/4986
50 002	Pogia	35/824/5003
50 003	Carabii	35/832/4990
50 004	Constanța	35/831/4894
50 005	Tulcea	43/841/5005
50 006	Preștea	35/829/4989
50 007	(Rădila)	35/816/5013
50 008	Curceni	35/801/4870
50 009	Beștepe	35/832/4995
50 010	Sabangia	35/847/4987
BG-50 011	Chisau Suietuc (1)	35/810/4810
BG-50 012	Chisau Suietuc (2)	35/810/4810
R-50 013	Enicula	35/845/4972
14		
15		
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24		

The upright shaft is therefore not central, but in the front half of the mill body, together with both pairs of stones. The lower gearing is at ground floor level (Fig. 34.27-.28-.29-.30-.31-.32).

Conclusions

Finally, we will summarise and draw conclusions from that part of our research described in this paper; the description of the windmills of one region of our country, of which the survivors are now objects of preservation projects, both in the museum and in the field.

Even this short description allows us to draw certain conclusions. One fact is obvious: the technique of building windmills, no matter how it was introduced into our country, underwent more or less important development which gave it its special local characteristics. This was especially pronounced in the Dobrogea area. It applies even where it may only be a question of a choice between one or another system, or the combination of elements borrowed from various types and different influences. This development undoubtedly occurred under the influence of historical, geographical, social, and economic conditions. The complex interaction of these factors caused the formation of two parent types and several subtypes within the comparatively small area of Dobrogea, and resulted in an uneven distribution of these variations.

While the pivoted windmill is known over the whole of Dobrogea, the subtypes with two storeys and two pairs of stones (both one- and two-stage geared) are only found in the north of the province. Similarly, the cap mill was only found in a particular zone within North Dobrogea.

In the South, the small pivoted mills with a stone socle and a single pair of stones were in the majority. In some cases they had jib sails; a trend which was entirely confined to South Dobrogea. In this type of mill we find a mixture of North European features (the wooden body and the central post, with the quoted differences) and Mediterranean features (the jib sails and the stone socle).

Although this paper is concerned exclusively with the technical side of the windmill, our current research is concerned with many other aspects of traditional milling in our country; such as their history, origin, foreign influences and indigenous features, together with the social and economic aspects of the milling trade. This research is paralleled by strenuous efforts to save the last surviving specimens of these mills.

Fig. 34.35 R-50 009-Bestepe  
Mill, see also fig. 34.33 & .34.  
Elevation, looking with the wind.  
Scale ca. 1/100.

