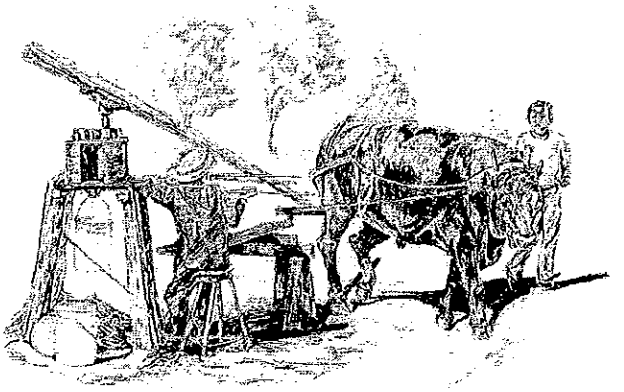
TILLERS INTERNATIONAL

TechGuide



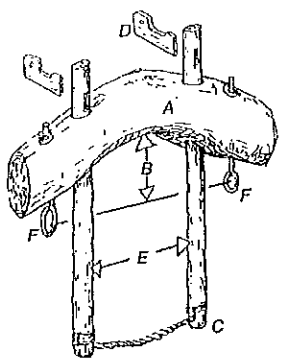
Pressing Sorghum with a Single Yoke & Brichen
drawn by Marcia Keith, 1990

Yoking and Harnessing Single Cattle

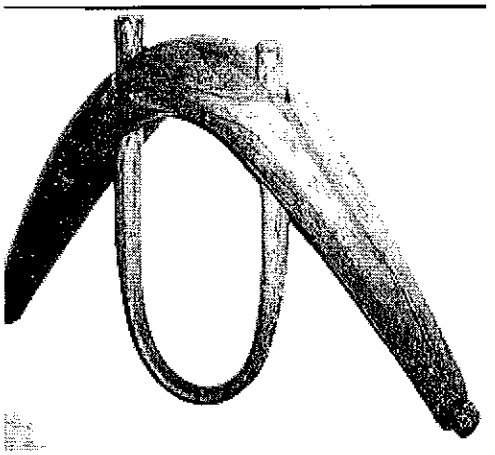
by Richard Roosenberg

A single ox or cow can do many tasks. Being able to yoke individual animals effectively is particularly important when a person has only one working animal for whatever reason -- accident, disease, poverty, or prudence. It should be remembered, however, that animals have a limited amount of energy. A single animal can only do about half the work of a pair. And being gregarious herd animals, some cattle will have a hard time adjusting to working alone. They distrust being isolated.

The objective of this paper is to describe the basics of single yokes, to review design considerations, and to list a number of options for yoking single animals. Some of these yoke arrangements will approach the complexity of horse harness. Without the second animal at the other end of a yoke for two, there are extra challenges of stability. Harnessing acheives this through starping the collar in place. Also, lines or traces must be run back from each end of the yoke since there is no clear center point for hitching an implement. Then, the traces are attached to a singletree behind the animal to rejoin the force at the implement. The traces should be held far enough apart so they do not rub too hard on the body of the ox. The extra ropes and straps add opportunity for entanglements.



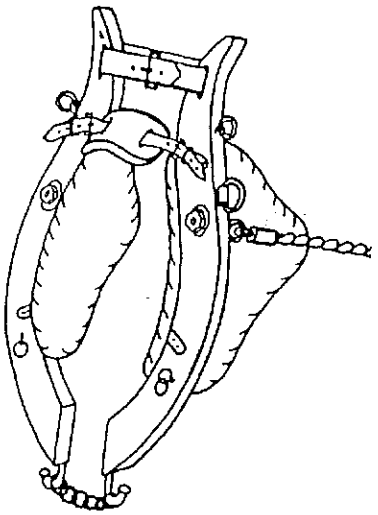
A simple single yoke A, crooked beam; B, Drop; C, Staves or bow; D, bow keeper pins; E, bow width; F, dropped hitch points.
Drawn by R Roosenberg



Single ox yoke with marked drop to trace attachment, 1870. Block Island Historical Society. Considered rare.
Photo by Donn & Margallen Ficther

A few years ago, one of Tillers' interns Renee Kivikko, tested a couple single yoke designs to help us understand them better. Of the available options Renee chose the old crook and the late European three-pad collar. Farmers have traditionally used simple crooked branches with bows, staves (skeins), or ropes to hold animals in place (Figures 1 &2). Renee did the

tests 1987. As a traditional design, she used a naturally bent branch, known as a crook, as the beam. She provided for lower hitch points on each side with the use of eye pins at the ends of the beam into which tugs were fastened (Kivikko; 1987, 8). This is a very simple design that maintains most of the dynamics of the traditional North American and English neck yokes (Roosenberg, TechGuide). It has narrow bows or staves to fit into the pockets between the neck and shoulder points. And it has lowered hitch points which function to rotate the bows back into the shoulders of the oxen. This helps hold the yoke in place once a load is on the hitching system.



The three-pad collar of Central Europe

by Barwell & Ayre, 38

The three-pad collar from Germany, Switzerland, and other central European countries was getting considerable press, so Renee made one to test against the traditional yoke. It is essentially two padded wooden hames with a third pad over the top of the neck. It was of interest since it provides much more potential surface area against which the animal can push -- and any added comfort should convert to a greater willingness to work.

To our surprise in 1987, Kivikko's tests of this traditional single yoke against the three-pad collar no significant difference. This pointed out a need to look beyond the theory of added surface area to find what was most important to the ox.

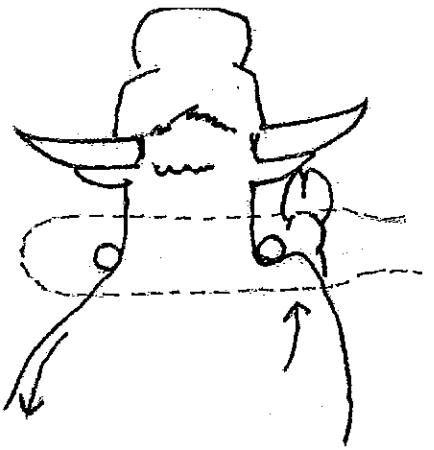


Figure 6 *As an ox steps forward, its shoulders should pass outside the bow.*

By Marica Keith

First, we must remember that oxen are physiologically different from horses. The great successes with horse collars may not be easily transfered. We know that farmers occasionally used horse collars on oxen during the 19th century. Since the ox pulls more from the top of its neck and the horse from the breast, they inverted the collar to the ox. Indeed, we have used upside down horse collars with reasonable success at Tillers with moderate loads. The greatest problem with the horse collar was that it moved from side to side with every step of the animals. The points of the shoulders pushed it forward several inches with each step -- first on one side, then the other. American farmers must have seen this or other problems for they generally stayed with the bow yoke. On the otherhand, literature suggests that many central European farmers switched to modified collars for their oxen at the end of the 19th Century. Perhaps in their later use of the ox, they discovered designs superior to any tried in North America.

Before pursuing the European adaptations, it is important to understand the difference between the shoulder phsyiology of the equine and the bovine. This difference may explain the hesitancy of farmers to use collars on oxen. The ox has substantial movement in its shoulders compared to the beautifully stationary seat for a collar at the lower neck and breast of the horse. Traditional bow yokes and head yokes avoid the problem of shoulder movement. Head yokes avoid the area. Neck, wither, yoke take advantage of a niche in the shoulder of limited movement. The shafts of a bow are each narrow enough to fit between the neck and the points of the shoulders. When well fitted,

bows permit the movement of the shoulders outside of the bows. Indeed, watch an ox pulling a plow or other heavy load, and note how -- from a side view -- the the bow is partially obscured by the shoulder at every forward step. The bow seats itself in the relatively stable soft tissue between the shoulder and the neck. This keeps the pressure off the hard point of the shoulder bone. While the bow has less surface area it appears to be more comfortable for the animal, expecially under heavy load.

Research, including ours, is far from adequate to answer the questions. Most of the international literature suggests that the three pad collar would have the advantage given its greater surface area. It seems they may not have given sufficient consideration to the dynamics of the ox in motion. But if more than surface area is at play, that should be seen in research data.

The interest in adapting collars for the ox goes back several years. Noel Vietmeyer with his most infleuntial 1981article in Ceres, *The Untapped Potential of Animal Power*, argued that adaptation of the collar to the ox would greatly increase its productivity. He did not test the theory with any of his own research and did not address questions of physiological differences from equines. Waclaw Micuta followed in 1985 with several articles urging the use of the Swiss three-pad collar in adapted form as the answer for oxen (Micuta, 1993). He claims that oxen pull twice as hard with this collar. But he does not desrcibe the comparison yoke used in his tests. If it was the rustic Kenyan yoke, a pole with widely placed staves, or skeins, that does not use a lowered hitch point, it would be easy to find improvement.

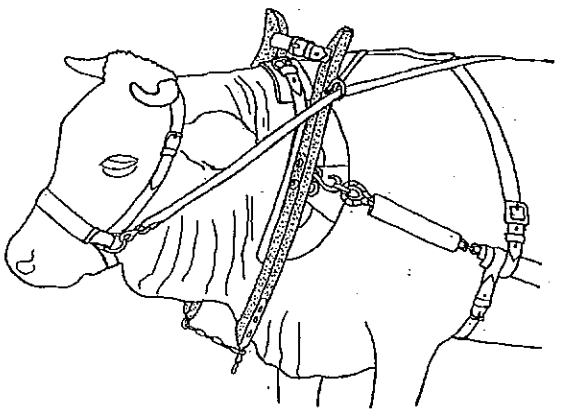


Figure 7 *Adjustable three-pad collar designed by the germans, Steinmetz and Boss, in 1934.*
from Minhorst, 1991, page 26

In 1991, Rolf Minhorst wrote an extensive paper on the German development of ox harnessing systems and the three-pad collar for oxen. He documents the Central European history with impressive detail. Minhorst goes beyond Micuta in that he clearly recognizes the physiological differences between ox and horse. And from the German ox collar designs, it is apparent that they were working to accommodate shoulder movement.

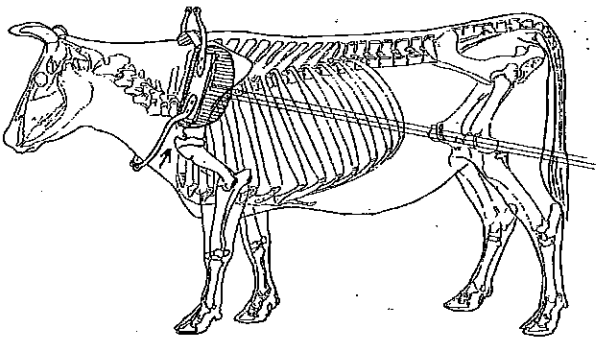


Figure 8 *A well-fitted three-pad collar should seat above the points of the shoulder. This collar includes a bend in the hames to offer clearance of movement for the shoulders.*
From Minhorst, 1991, page 29

Rolf Minhorst visited Tillers and we were most interested in his ideas since they made efforts to accommodate shoulder mobility. He helped us build a prototype with extra adjustability for testing. The animal seemed to work well with the prototype under moderate loads again. But we found it impossible to keep it in place for heavy loads with out extensive strapping. The collar with its large surface area on the outside of the shoulder would quickly climb up the neck until the animal was being choked.

As a result of these experiences, we have continued to recommend use of the traditional crook beam (or a more carved version of it), Figures 1 & 2. We suspect that some of the great reports of success with the collar must have compared it to very poorly fitted or designed yokes. We continue to look for better systems or ways to improve the old traditions, but have not yet found that improvement. We recognize that we are but a small part of an argument that has swirled around the yoke and the collar for a couple hundred years (Powell, 1989). The collar and harness certainly have advantages with the single ox in adding stability to the over all system. Although the cost is to be considered.

Historically, American farmers may have favored the ox yoke and the Germans the collar because of differing use patterns. In America late use of the ox was largely for heavy tasks -- such as logging and plowing new land -- which took advantage of their superior abilities to move heavy loads at low speeds. In Central Europe, it seems that small farms frequently did not have both horses and oxen, and so they were using oxen for lighter cart and plowing work. In these circumstances, the three-pad collar may have worked

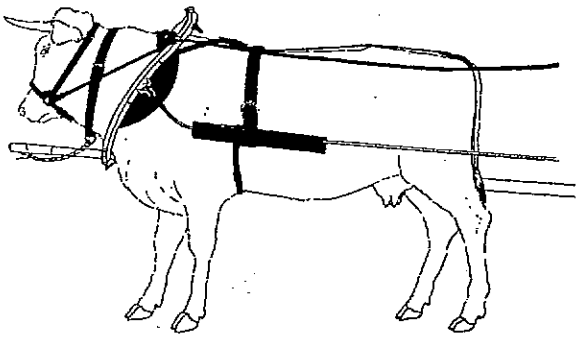
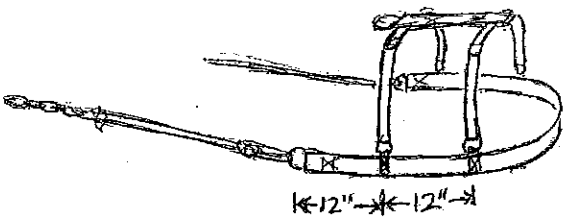


Figure 9 *A cow hitched in the Steinmetz-Boss 1934 adjustable three-pad ox collar.*
from Minhorst, 1991, page 28

well. Central Europe certainly used more single draft cattle than were used on the larger North American farms. It would be a mistake to dismiss their experience.

Even with the fine testing facilities of CTVM at the University of Edinburgh we have not had conclusive answers to these age old questions. Their tests have reportedly not shown significant differences among yoke and collar types. Perhaps each system has differing strong points with regard to heavy pulls versus endurance pulls. Since we cannot understand the detail and criteria of historical judgements, we need to re-test to more specific conditions. We need to develop endurance and injury tests as well as maximum short pull tests.

Supplementary Harnessing

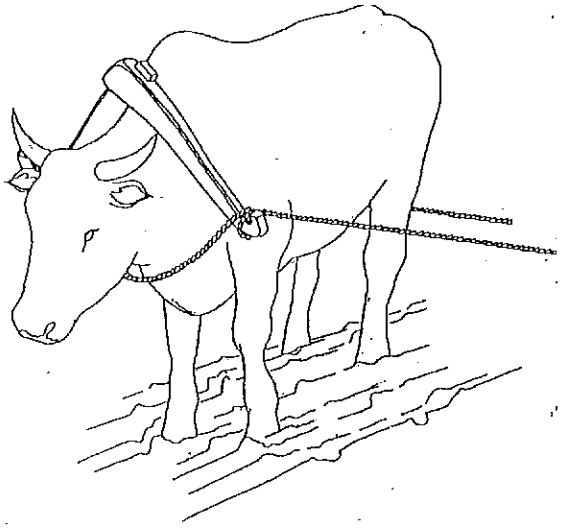


Brichen adapted for oxen from US Army mule harness
by R Roosenberg

Holding the single yoke in place is most difficult, even with a good yoke, when there is no load to hold it into the shoulders. A brichen is helpful if available. (See TechGuide on Brichen.) Essential to a brichen is a wide strap that circles the hind quarters and extends with smaller straps or ropes to the yoke or collar. It serves to resists forward movement of the yoke. The design we use at Tillers is adapted from US Army mule harness. The hip drops that hold the brichen strap in place are separated by a strap of 8-12 inches on top of the hips. They are in turn anchored to the brichen so they will fall in front and behind the hip bone. This greatly helps them stay in place under the lumbering locomotion of the cattle. Brichen are, nonetheless, much more of a problem on cattle than on horses. Cattle will drop their more moist manure right into the brichen and will then spread it along the brichen strap as the strap moves back and forth with each step. Some of the European documentation uses either a surcingle around the chest or a cruper around the base of the tail as an optional means of retaining the yoke or collar in position.

Some writers have urged the use of padding on yokes and collars (Micuta, 1985). We have become wary of soft padding on cattle. The easy slidding movement of parts seems very important on their lumbering bodies. Fabrics such as burlap for padding can cause chaffing and develop sores. Horse collars are firmly padded and covered with hard, slick leather. They move fairly easily. Wood yokes when carefully smoothed at friction points will also slide easily with movement.

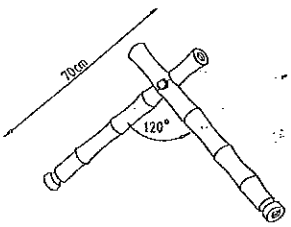
Other Design Options



Light Chinese Yoke

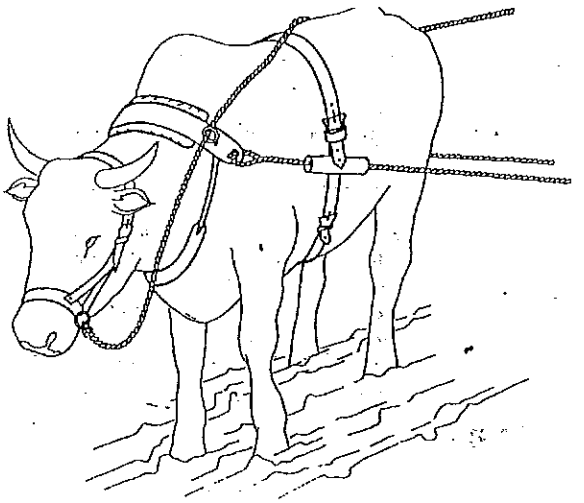
by Barwell & Ayre

A number of international designs were drawn and described by Barwell and Ayre (IT Publications, 1982). These give options of varying effectiveness and frequently nominal cost. They found the time tested light Chinese yoke with its lowered hitch points to be stable on the shoulders. The bamboo version was tested in Tanzania. When the angle of the intersection of the two pieces was less than 110 degrees the bamboos rubbed on the shoulders. These obviously have limited surface area and could be painful to the ox with heavy loads.



Bamboo version of the Chinese yoke used in Tanzania

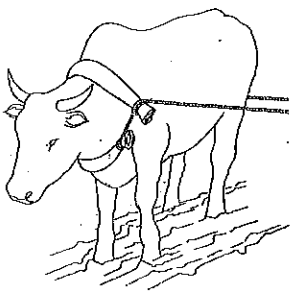
by Barwell & Ayre, p30.



The Swiss withers yoke

Barwell & Ayres, 32

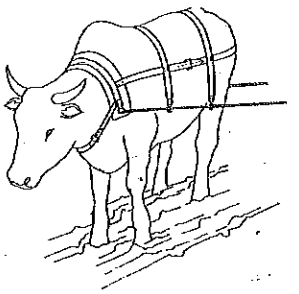
They described the Swiss withers yoke as being made of a padded steel plate curved to the top of the neck, or withers. This was a historically popular design but without test data. They saw the major advantages to be padding and the stability given by the belly and hip straps.



Zimbabwe flexible yoke

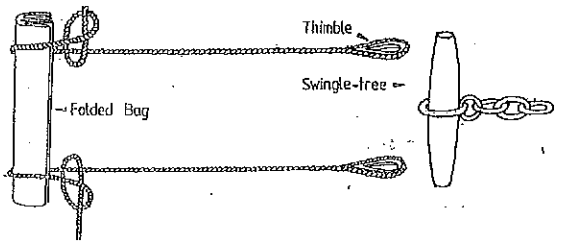
by Barwell & Ayre, 36

The flexible harness version uses the inverse of an equine breast strap -- placing the broad strap over the withers rather than below the neck. This requires more leather work than the Swiss withers yoke. It works best on cattle with humps. In Zimbabwe where considerable experimentation in animal power has been occurring, they developed an extremely low cost version of the flexible harness. It consists of two rolled up burlap bags, trace ropes, and a singletree. It is also more effective with humped withers to keep it in position. Yet, its cost factor recommends it, at least, for temporary single yoking.



Flexible harness

by Barwell & Ayre, 34



Detail of Zimbabwe flexible yoke system
by Barwell & Ayre, 36

Single Head Yokes

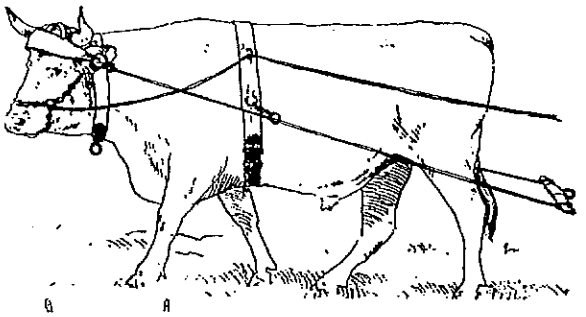


Figure 17 *A German head yoke with traces and singletree leaves shoulders free.*
from Minhorst, 1991, page 15

The use of single head yokes avoids the shoulder area and its challenges. Although bulls use their heads and necks to considerable advantage in herd battles, supporting a heavy cart tongue or vertical force for long period should be monitored carefully. Minhorst documents several of these designs for Germany. He describes two types of head yokes. Those that fasten from behind the horns, he calls head yokes. The forehead yoke attaches in front of the horns. Head yokes also need to have an appropriate amount of drop to the hitch points. Without some drop the resistance of the load will be to far above the spine and will pull the head back and the nose up. This is uncomfortable for the animal and is frequently reflected by a compensating sway in the back. The forehead yoke, reduces this potential by placing the beam on the forehead in front of and below the horns.

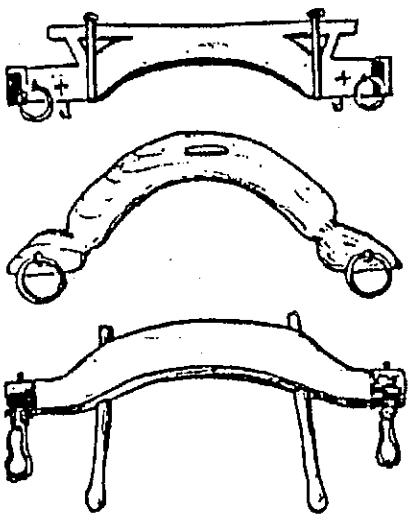


Figure *18 German Single Head Yokes*
from Rolf Minhorst, 1991, page 7

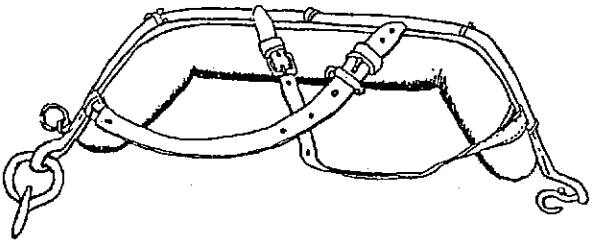


Figure 19 *The most common forehead yoke in use in Germany in 1960.*
from Minhorst, 1991, page 15

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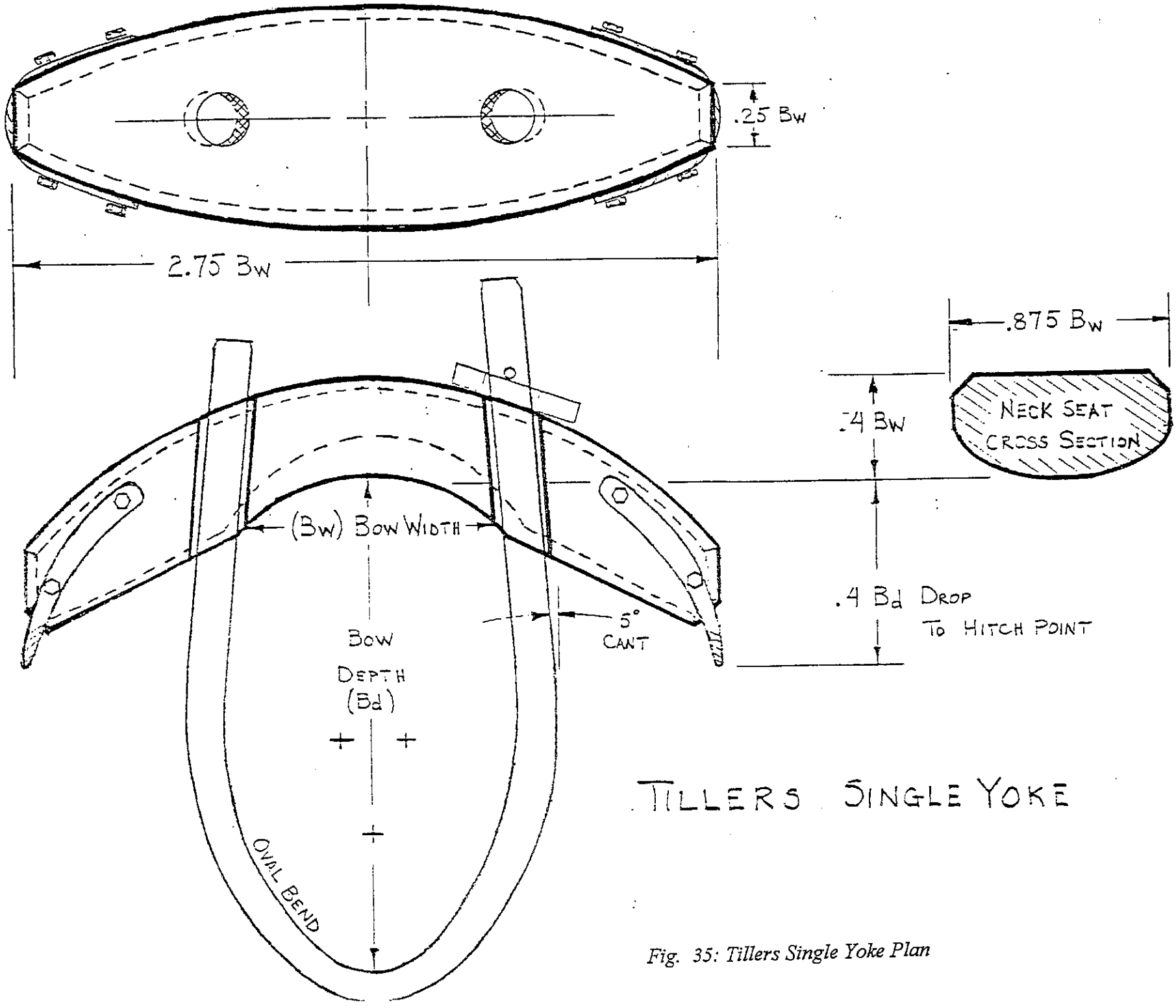

Fig. 35: Tillers Single Yoke Plan