

COMMISSIONER'S DECISION

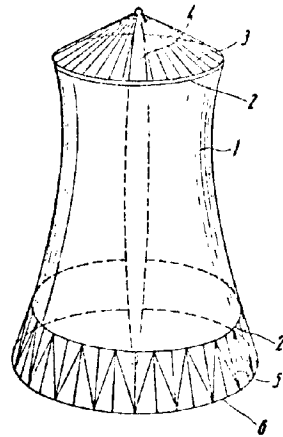
Obviousness: Industrial Cooling Tower

The applicant claimed a highly stressed waisted tubular envelope as the main component of the tower. The applicant has made a patentable advance in the art over the cited reference. The reference cited required a pre-stressed cable structure which supported an envelope type housing.

Final Action: Reversed

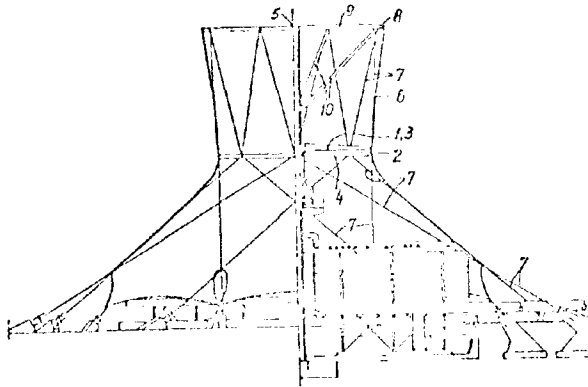
This decision deals with a request for review by the Commissioner of Patents of the Examiner's Final Action dated September 10, 1976, on application 180,985 (Class 62-115). The application was filed on September 14, 1973, in the name of Fritz Leonhardt, and is entitled "Industrial Cooling Tower",

The application relates to an industrial cooling tower, comprising a waisted tubular envelope, the envelope is tensioned and suspended by its upper end from a support which carries the vertical component of the tensioning. The envelope consists of a membrane the material of which is capable of supporting tension in all directions in its plane. Figure 1, shown below, illustrates that arrangement.



In the Final Action the examiner refused the application in view of Belgian patent 752877 - December 16, 1970 - Kugler. This patent

corresponds to United States patent 3,637,193. The patent discloses a cooling tower for cooling gases and liquids in which the supporting framework comprises a cable construction in which the bearing means are connected to a common shaft or support. An envelope covers the framework. The envelope is made from material such as reinforced synthetic material]. Figure 1, shown below, is illustrative of that invention:



In the Final Action the examiner stated his position (in part) as follows:

The reference shows a mantle or housing 6 made of reinforced synthetic material or the like and held at an upper end by a ring 2 on post 5 and attached at a lower end to foundations by tensioning cable means (shown in figures 1 and 2, but not labelled). It is noted that cables 7 serve to support rigid structure 2, 8, 10, 4, 9 and 5.

No invention can be ascertained in this application over Kugler in light of expected skill. Nothing in applicant's response of July 8, 1976 convinces the examiner that this rejection is not well founded. It is clear from Kugler that his envelope 6 is tensioned by the cable-anchors attached to its lower rim. Further cables 7 (in addition to those holding down the lower envelope circumference) locate and anchor rings 2 and 8 in concentric relation to vertical support post 5. The waist of the envelope 6 appears at ring 2.

The applicant in his response to the Final Action had this to say (in part):

...

Applicants invention constitutes a unique innovation in the construction of cooling towers, whereby the conventional

concrete shell is replaced by a waisted or hyperbolic membrane which is relatively flexible and is pre-stressed in a vertical direction sufficiently to create tensile forces in all directions in the plane of the membrane shell, which tensile forces are greater than the compression forces created externally by the wind. The tower is of the natural-draft or air cooled type.

...

Because of the waisted shape of the tubular membrane, the stretching of the membrane in a vertical and axial direction provides the vertical component of the pre-tensioning, whereby the tensioned membrane becomes a self-supporting membrane shell which is rendered wind-resistant by the pre-tensioning creating tensile forces in all directions in the plane of the shell. The pre-tensioning is made sufficient to create such tensile forces which are greater than the compression forces created by the wind externally to the shell. The use of the central mast 4 is not essential to the invention since there may be substituted several internal masts or any supporting structure located exteriorly to the membrane and overhanging the latter, provided that the supporting structure is capable of supporting the vertical component of all forces created by the pre-tensioning and sufficient to withstand external wind forces.

...

The construction of the cooling tower of the present invention from a pre-stressed membrane shell, rather than from concrete, enables the tower to be erected at much larger heights than conventional cooling towers and still be capable of withstanding wind compression forces encountered at these heights, so that the tower may be made of a sufficient size to be used for dry cooling by air in areas where a water supply is not available to provide water cooling. Thus, applicants' structure is capable of being erected in heights of 900 feet and over. At the same time, the shell wall is of relatively small thickness and of relatively light weight so that it can be easily erected.

...

To be more explicit it should be noted that the tower of the applied United States patent No. 3,637,193 to Kugler comprises a cable construction (column 1, line 61). Another feature of the tower of the applied patent is the fact that the airtight housing of the cooling tower consists of a material which is suitable to be held by a cable construction (column 1, lines 68 to 70). Therefore, from the outset of the description of the cooling tower of the applied patent to Kugler it is apparent that the housing or the mantle 6 thereof has not the same property and is not put into the same working conditions as the envelope of the present invention. It is evident that the housing of the applied patent is held by a cable construction contrary to the present invention wherein the envelope itself between the two ring elements 2 is not supported by any cable construction.

...

We have carefully considered the prosecution of this application and the points and arguments made by the applicant. The issue to be considered is whether or not the applicant has made a patentable advance in the art.

We note that the applicant agrees that the United States patent 3,637,193 (Kugler) corresponds with the Belgian cited patent. The following discussion will therefore refer to that patent (United States) for the sake of facility.

We find that Kugler is concerned with the construction of a cooling tower. Spoked rings 2 and 8 are fastened to a supporting central shaft or column 5 resting on a foundation 20. The rings serve for holding or guiding a cable construction. The cable construction is pretensioned - "two cable parts diametrically crossing each other are simultaneously pretensioned...."

The mantle or housing 6 is made of reinforced synthetic material or impregnated canvas, wood or asbestos cement. The mantle is held at the upper end by a stiffening ring 8 on support 5 and is connected to and supported by the pretensioned cable construction. Guide cables are also used to support the structure at a central portion of the mantle (see Figure 1 of the patent supra). Claim 1 of that patent reads:

A ventilator-cooling tower of the round type for cooling gases and liquids, which includes: central shaft means forming a supporting member of said cooling tower, ventilator means comprising ventilator blades, bearing means journalling said ventilator means and supported by said shaft means, spacer ring means extending around said ventilator means and connected to said shaft means, said spacer ring means having outer annular means, substantially airtight envelope means extending around said spacer ring means and being connected thereto, and cable means connected to and supporting said envelope means.

We agree with the examiner that the general basic concept of having a centrally supported cooling tower is taught by the cited patent. Therefore in order for the present applicant to obtain a patent he must show that he has a new

and practical combination in a cooling tower construction which required a degree of inventive ingenuity for fruition.

The tower structure disclosed in the present application comprises a waisted or hyperbolic tubular membrane 1 (see Figure 1 of the application supra), which is open at the top and bottom ends and is made of a continuous membrane of relatively flexible material. This material may be made from laminated fabric, plastic, thin sheet aluminum, steel or the like and which upon tensioning, "is capable of supporting tension in all directions in its plane." A stiffening ring 2 is attached to the upper end of the tubular envelope or membrane 1, by means of which the envelope is suspended in a vertical position from a central mast 4 through connecting cables 3. At its lower end, the envelope 1 is provided with another stiffening ring 2' which is connected by an open latticework 5 to a ground support 6. In erecting the tower, the envelope is anchored to the foundation 6 by means of the latticework 5 and is stretched in a vertical direction to provide the stressing thereof. Thus we see that the envelope is stretched between the foundation and the upper end of the central mast in a highly tensioned condition. The purpose of this is so that it will withstand external wind forces.

We agree with the applicant that Kugler discloses a skin-clad cable construction in which the main purpose of the mantle or housing is to serve as an airtight wall. In that patent we find: "...The airtight housing of the cooling tower consists of a material which is suitable to be held by a cable construction..." (see Kugler column 1 lines 68 ff.). Kugler also states at column 2, lines 12 ff.: "The mantle or housing 6 is made of a material which is strong enough to be held by a pretensioned cable construction and may be of a reinforced synthetic material..." (emphasis added). Claim 1 of that patent also reads (in part): "... substantially airtight envelope means extending around said spacer ring means and being connected thereto, and cable means connected to and supporting said envelope means" (emphasis added). It is clear from the above that the housing or mantle in Kruger is connected to and supported by a pretensioned cable

construction and is not used for the same function or working condition as the envelope in the present application. The present envelope is unsupported between the two ring elements 2, by any cable construction whatsoever, other than at the top and bottom.

We find therefore, that the mantle (envelope) of Kugler basically serves only one purpose, namely, for building up the airtight outer wall. The mantle is basically not highly tensioned, and does not serve as the main structural component of the tower. In other words in Kugler the cable construction undertakes the supporting and bearing function, whereas the housing or mantle serves the sealing function; this in contrast to the present arrangement where the membrane of the envelope is highly tensioned and in a sense is a self-supporting housing between the two ring elements 2. This feature, of course, is totally absent from the reference. On the face of it this may not appear to be an important feature. We must remember however, that these towers can be erected to reach substantial heights.

In attempting to understand the position of the examiner however, we do find in the drawings of the patent that the mantle or housing is secured to the foundation by some means, not labelled, other than by the pretensioned cable means 7. There is no discussion whatsoever of this in the disclosure and it may be that it is just another means to secure the mantle to the foundation to prevent such things as "wind flapping." We are however, more inclined to think it is really the "flare" of the draftsman concerned, because in Figure 2 it does not seem to make much sense. In any event there is absolutely no teaching, when taking the reference as a whole, that the mantle (envelope) is highly tensioned, or what this applicant refers to as "pre-tensioned." The elimination of the prestressed cable framework and the use of a high tension waisted envelope is basically the essence of the present invention.

Some of the advantages, according to the applicant, are that "the shell [envelope] wall is of relatively small thickness and of relatively light weight so that it can be easily erected." In the present arrangement there are generally no deformation caused by the wind forces in the tensioned membrane shell. It is simpler and more economical to construct, because it is formed of a light-weight membrane which is easily installed by anchoring it at the bottom and suspending it at the top of a supporting structure.

In summary, Kugler discloses a structure having a supporting framework (to a center support) of pre-stressed cable construction which supports a mantle (envelope) to form a cooling tower and which is supported intermediate its ends. In other words the pre-stressed cable construction essentially undertakes the supporting and bearing function, whereas the mantle essentially serves the sealing or housing function. By contrast the present application discloses a cooling tower comprising a support resting on a ground surface and a waisted tubular envelope consisting of a continuous highly tensioned membrane having an unbroken surface. The envelope is secured by support rings 2 to the top of a supporting mast and to the foundation. No support cables are used intermediate the two ends.

We have no hesitation in concluding that the applicant has disclosed a new combination. Furthermore, we are satisfied that there was a degree of inventive ingenuity involved in producing a new or improved result in a more expeditious manner. There is no teaching in Kugler of a "free standing" structure of the type disclosed in this application. This notwithstanding that we agree with the examiner that Kugler does show the center-supported type of structure. We recommend that the decision in the Final Action to refuse the application be withdrawn.

We now turn to the claims which were amended in response to the Final Action. Amended claim 1 reads as follows:


An industrial cooling tower comprising a support structure resting on a ground surface and a waisted tubular envelope consisting of a continuous membrane having an unbroken surface of saddle shape and made of a material which is capable of supporting tension in all directions in its plane, said membrane being pre-tensioned and carried with its tubular axis upright from said support structure, an open latticework anchoring the lower border of said membrane to the ground surface and providing an inlet for entry of cooling air into the interior of said membrane, said membrane having an open upper end serving as an air outlet opening and a ring connected to the upper border of said membrane and to said support structure with said envelope stretched in an axial direction between its upper and lower borders, and with said support structure providing the vertical component of said pre-tensioning, said support structure being of sufficient strength to support said membrane in a sufficiently stretched condition to cause said pretensioning to create tensile forces in said membrane in all directions in the plane of said waisted envelope, with said tensile forces being greater than the compression forces created by the wind externally to said shell, whereby said tensioned membrane becomes a self-supporting membrane shell.

Before considering the allowability of this claim we are concerned with two points. The first concerns the term "pre-tensioned;" which is also used in the disclosure. It is our understanding that the tubular envelope is not "pre-tensioned" before use in the tower, but has high tension applied during the tower construction. We believe the term should be amended, possibly to "tensioned" or "post-tensioned," to more correctly depict the facts. The second point concerns the "self-supporting membrane shell" (the last line in the claim). The membrane is simply not self supporting. An amendment to correct this should also be made.

In considering the allowability of claim 1 we clearly find in the claim the essence of the invention, as discussed above, over the Kugler patent. The claim does not go beyond the invention made and restricts the monopoly in an appropriate manner. This claim should be allowable when amended

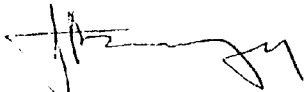
according to the suggestions made above. Claims 2 to 10, which depend directly or indirectly on claim 1, are also found to be allowable.

We are satisfied that the applicant has made a patentable advance in the art and recommend that the decision in the Final Action to refuse the application be withdrawn. It is also recommended that the claims be amended to improve the form for clarity purposes.



J.F. Hughes
Assistant Chairman
Patent Appeal Board, Canada

I have studied the prosecution of this application and have carefully reviewed the recommendation of the Patent Appeal Board. In the circumstances I have decided to withdraw the Final Action and will accept the claims when amended as suggested by the Board. The application is returned to the examiner for resumption of prosecution.



J.H.A. Gariépy
Commissioner of Patents

Dated at Hull, Quebec

this 15th. day of September, 1977

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