

L. A. HAINES.
 METHOD OF PRODUCING TURBINE BLADE STRIPS OR SECTIONS.
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Patented Mar. 14, 1911.

Fig. 1.

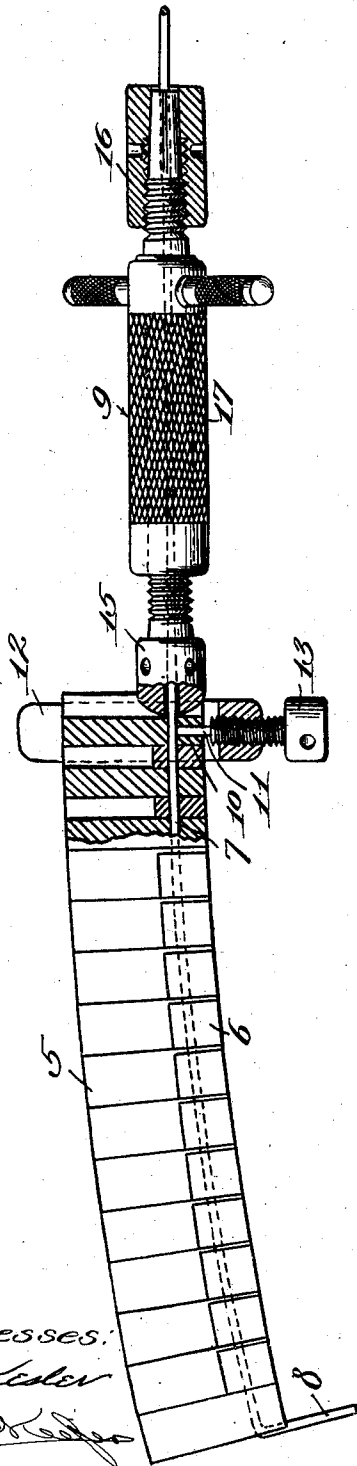
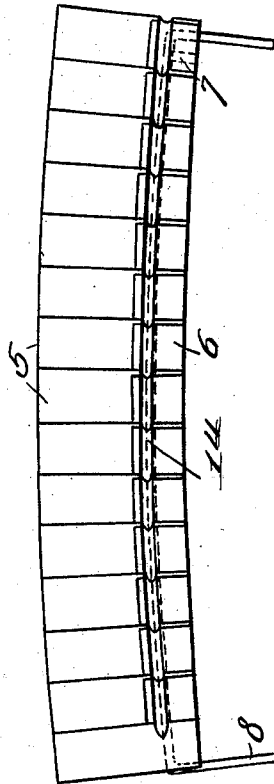


Fig. 2.



Witnesses:

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METHOD OF PRODUCING TURBINE-BLADE STRIPS OR SECTIONS.

986,974.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, LEWIS A. HAINES, a citizen of the United States, residing at Columbus, in the county of Franklin and State of Ohio, have invented new and useful Improvements in Methods of Producing Turbine-Blade Strips or Sections, of which the following is a specification.

This invention relates to a method of assembling a plurality of motive agent engaging means on a stringer or of producing turbine blade sections having the members thereof fixed in associated relation prior to application to a turbine carrying element.

The primary object of the invention is to produce a strip or section of motive agent engaging means of any desirable length for application to and removal from a carrying element so that the strips or sections may be replaced when found necessary without impairing the entire turbine or requiring a separation and replacement of all of the turbine engaging means.

A further object of the invention is to provide a strip or section of motive agent engaging means of definite proportions so that the same may be standardized and a number of the strips or sections kept in stock and supplied to the trade for immediate application and use similarly to other mechanical devices or organizations.

A still further object of the invention is to provide a turbine strip or section having a plurality of motive agent engaging means held in close assembled relation under tension and ready for application to a turbine carrying element without requiring tightening up of the motive agent engaging means after application to the turbine carrying element and thereby facilitating the assemblage of the said motive agent engaging means on the turbine carrying element in a positive and reliable manner.

The method consists in threading a plurality of motive agent engaging devices on a stringer having a terminal stop, exerting a tension on the stringer in the direction of length of the latter and a corresponding pressure on the motive agent means, temporarily securing the said motive agent engaging means against movement while the tension on the stringer and pressure against the means are maintained, and finally permanently securing the assembled engaging means on the stringer. For all practical intents and purposes the essential steps of

the method as thus explained if properly pursued will result in the production of a practicable turbine blade strip or section ready for immediate use or for storage, but other secondary steps incidental to the perfection of the turbine blade strip or section will be hereinafter more fully explained and claimed.

In the accompanying drawings a preferred apparatus is disclosed for assisting in carrying the method into effect, and also a particular form of turbine blade or motive agent engaging means is shown, but it will be understood that the invention is not in the least limited to this apparatus or specific form of turbine blade or motive agent engaging means nor to the particular dimensions and proportions of the turbine blade strip or section as illustrated.

In the drawing: Figure 1 is a side elevation of a turbine blade strip or section, partially broken away, and showing the apparatus used in pursuing a part of the steps of the method. Fig. 2 is a side elevation of a completed turbine blade strip or section produced in accordance with the steps of the method.

The turbine blade strip or section is made up of a plurality of blade members, space devices or blocks, and a stringer, the latter consisting of a steel rod or wire or any other analogous device. The method, however, is not limited to the precise form of blade members and space devices or blocks shown, nor to the exact construction of stringer 7 illustrated, and it will be understood that it is proposed to pursue the steps of the method in relation to any form of blade members or motive agent engaging means, whether they be provided with space devices alternately interposed between the same or not.

For the sake of illustration or to demonstrate the production of one practical form of turbine blade strip or section, the precise form of blade members, space devices and stringer will be particularly referred to.

In pursuing the first step of the method the blade members or motive agent engaging means and the space devices or blocks are alternately threaded on the stringer 7, the latter being preliminarily provided at one end with stop means or an angular bend 8. After the blade members or motive agent engaging devices are threaded on the stringer 7 in required or desired number, a

tension jack 9 is slipped over the projecting portion of the stringer and is adjusted to exert a tension on the said stringer and at the same time set up a corresponding pressure 5 against the blade members or motive agent engaging means to closely and positively assemble the latter, and after the tension required has been established the next step is pursued and consists in temporarily securing 10 the blade members or motive agent engaging means to the stringer in order to permit removal of the jack without slackening the tension of the stringer relatively to the blade members or motive agent engaging means and to prevent slipping or loosening of the said blade members or motive agent engaging means on the stringer. To accomplish this step an opening 10 is formed in the foot or inner end of the last 20 one of the series of blade members or motive agent engaging means, and a key pin 11 is inserted in said opening and engages the stringer. A yoke clamp 12 is then applied over the extremity of the strip or section 25 and has in one arm a set screw 13 which is brought into engagement with the said key pin, and by means of this screw the key pin is tightly forced against the stringer to lock the last of the series of blade members or motive agent engaging means against 30 the least movement on the stringer and thereby also secure the remaining blade members or motive agent engaging means and maintain the tension of the stringer 35 and the pressure exerted against the members or motive agent engaging means by the jack. After this temporary securing step has been effected the jack 9 may be readily removed from the stringer and while the 40 yoke clamp with its set screw is applied to force the key pin 11 into engagement with the stringer, the projecting portion of the latter is bent at an angle against the blade member or motive agent engaging means 45 over which the clamp is fitted and the tension on the stringer as well as the pressure on the blade members or motive agent engaging means is preserved and a permanent lock for the blade strip or section is thus insured. After the blade members or motive agent engaging means have been permanently secured, the clamp 12 is removed and the pin 11 withdrawn from the opening 10, and for practical service the blade strip or section is completed. An additional step, 55 however, is pursued in connection with the blade strip or section to facilitate a positive disposition of the said strip or section on the turbine carrying element, and this latter 60 step consists in placing the strip or section in a suitable jaw device or vise and straightening the same temporarily and forming in one side thereof a key groove 14 which extends full length thereof, as 65 clearly shown by Fig. 2. The resiliency of

the stringer permits the blade strip or section to flex, and hence the formation of the groove does not in the least affect the assemblage of the blade members or motive agent engaging means and stringer, and 70 after the strip or section is removed from the vise or other holding means it will immediately resume its normal contour. The blade strips or sections may be of any length 75 and may completely encircle a turbine carrying element or a certain predetermined number of shorter strips or sections may be used in encircling the turbine carrying element.

The jack 9 as shown has a pressure head 80 15 at one end and a gripping or holding head 16 at the opposite end and an intermediate body 17 carrying the said heads, and it will be understood that when the gripping head is secured on the stringer 85 the pressure head may be adjusted as desired to set up the necessary tension on the stringer by contact with one extremity of the strip or section or the last of the series of the blade members or motive agent engaging means, as clearly shown by Fig. 1. 90

What is claimed is:

1. The method of producing turbine blade sections, consisting in threading a plurality of motive agent engaging means and space 95 devices alternately on a stringer having an end stop, exerting a tension on the stringer to closely assemble the engaging means and space devices and temporarily securing the said means and devices against movement 100 while the tension on the stringer is maintained, and finally permanently securing the assembled engaging means and space devices.
2. The method of producing complete turbine blade sections, consisting in threading 105 a plurality of motive agent engaging means on a stringer, exerting a tension on the stringer in the direction of length of the latter to closely assemble said motive agent 110 engaging means, temporarily securing said means against movement while the tension on the stringer is maintained, permanently securing the assembled engaging means against movement on the stringer, and 115 finally simultaneously grooving all of the motive agent engaging means in the direction of length of the section.
3. The method of producing turbine blade strips or sections, consisting in disposing 120 motive agent engaging means on a stringer, exerting a tension longitudinally on the stringer to closely assemble the engaging means, temporarily securing the engaging means against movement while the tension 125 on the stringer is maintained, and permanently securing the assembled engaging means and stringer.
4. The method of producing turbine blade strips or sections, consisting in disposing 130

motive agent engaging means on a flexible stringer, exerting a tension on the stringer in the direction of the length of the latter to closely assemble the motive agent engaging means, and securing the motive agent engaging means and stringer against movement while the tension thereon is maintained.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

LEWIS A. HAINES.

Witnesses:

CHAS. S. HYER,
S. E. WHITE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."