The present invention relates to an improved type of locking device for retaining a turbine blade member against axial movement relative to the turbine wheel on which it is mounted.

It is common practice in constructing a turbine wheel to provide a base or wheel member having a plurality of axially extending peripheral recesses formed in the wheel and within which recesses the individual turbine blades are adapted to be mounted. In cross section the turbine wheel recesses have the appearance of an inverted Christmas tree or more properly a tapered dovetail construction with a wheelock similarly shaped base on the turbine blades to retain the turbine blades against radial movement relative to the turbine wheel. With this standard type turbine wheel assembly, it has also been the practice to utilize pin members to lock the turbine blades against axial movement relative to the wheel. Such pins have been relatively unsatisfactory from several points of view. First of all, in utilizing such turbine pin locks it is necessary to drill holes through both the turbine wheel rim adjacent the dovetail recesses as well as providing a corresponding hole in the base of each turbine blade member. There has been a high rejection rate of the turbine wheel rim dovetail lock device due to cracks or fractures which have developed around the pin holes. In addition, once the pins have been inserted and the turbine wheels operated for a period of time, corrosion around the pin and pin holes has made the removal of the pin and the disassembly of the turbine wheels very difficult.

The present invention relates to a new and improved turbine blade lock device which substantially eliminates turbine wheel rejects due to failures caused by providing a seat for the turbine blade locks. In addition, the subject blade lock device is very simply disengaged permitting ready disassembly of the turbine wheel.

More specifically, the subject turbine lock device includes a spring clip type member which is adapted to be disposed within a small recess formed in the turbine wheel rim intermediate adjacent dovetail recesses and which clip includes a radially extending portion adapted to coact with a correspondingly shaped notch formed in one edge of the turbine blade base.

The details as well as other objects and advantages of the present invention will be apparent from a study of the detailed description which follows.

In the drawings:
FIGURE 1 is a partially sectioned portion of a turbine wheel embodying the present invention;
FIGURE 2 is a view along line 2--2 of FIGURE 1;
FIGURE 3 is a plan view showing a pair of adjacent turbine blades removed from the wheel;
FIGURE 4 is a perspective view of the preferred form of locking clip; and
FIGURES 5--7 are modified forms of locking clips.

Referring to FIGURE 1, a turbine wheel is shown at 10 and includes a rim portion 12. A plurality of axially extending tapered dovetailed recesses 14 are formed in the periphery of wheel rim 12. Each recess 14 is adapted to receive the correspondingly shaped base or platform portion 16 of a turbine blade 18. Each turbine blade or bucket member 18 is attached to the wheel rim by axially sliding the member into one of the peripheral recesses 14. The dovetail construction of the recesses and turbine bucket platforms retains the buckets against radial movement relative to the wheel under the considerable centrifugal forces that are developed as the rotor assembly rotates. This is typical turbine rotor construction and does not, per se, constitute a part of the present invention.

It has been the practice in the past to drill a hole through the thinnest portion 20 of the wheel rim and provide a corresponding hole in the turbine blade platform to permit a pin member to be inserted through the wheel rim and into engagement with the bucket platform and in this way to retain the bucket against axial movement relative the wheel rim. As already noted, this type of turbine blade lock construction has been unsatisfactory due to wheel rim fractures developing about the holes as well as the difficulty experienced in removing the buckets after the rotor has been in use.

In the present invention, as best seen in FIGURES 1 and 3, a recess 22 is formed in the periphery of each of the wheel rim portions 24 intermediate adjacent wheel rim recesses 14. In general, recesses 22 are of a rectangular shape. A corresponding notch 26 is formed in each turbine bucket platform so as to be adequately aligned with the corresponding turbine wheel recesses 22 when the buckets are in proper axial position on wheel rim 12.

A spring clip type locking member 28, as best seen in FIGURE 4, is adapted to be disposed within each wheel rim recess 22. Spring locking clips 28 are made from a suitable temperature and corrosion resistant strip steel stock. Each clip includes a base portion 30 and a substantially flat portion adapted to seat within the wheel rim recess 22, a short curved end portion 32 and a longer end portion which terminates in a flat tongue or tab 34. From the construction of clip 28 it is apparent that the latter will be capable of flexing for the purpose to be better understood subsequently.

Referring to FIGURES 1 and 2, it will be seen that the clip member is positioned within the turbine wheel rim recess 22 such that the clip tongue 34 is disposed within the turbine bucket notch 26. Since the turbine rim recess 22, clip 28 and turbine bucket notch 26 are of substantially the same length it is apparent that with the clip in position, as shown in FIGURES 1 and 2, that the buckets will be restrained against axial movement.

To assemble the turbine buckets 18 upon the turbine wheel rim, each clip 28 is disposed within a rim recess 22 at which time, through a suitable tool such as a screwdriver, the clip tongue 34 is flexed into the space between adjacent bucket platforms permitting a turbine bucket to be axially moved into position within a dovetailed recess 14 until the bucket is in proper axial position at which time the platform notch 26 and wheel rim recesses 22 are aligned. When the alignment has taken place the clip tongue is released and allowed to flex into the platform notch locking the bucket in position. The short curved section 32 of clip 28 is disposed in subadjacently abutting relation to the overhanging platform portion 35 of the turbine bucket adjacent the one being locked by the clip. This provides support for the clip and prevents possible undesired movement thereof.

Overhanging platform portions 35 of adjacent turbine buckets terminate to provide a space 37 slightly wider than the thickness of clip 28 so as to permit proper engagement and disassembly of the buckets on rim 12.

The turbine rotor buckets may be removed from the wheel by simply reversing the process which includes engaging the clip tongue with a suitable tool, moving the same out of the appropriate bucket platform notch and thereafter sliding the bucket axially off the wheel rim.

As seen in FIGURE 6, it is possible to construct a
clip member 36 so as to have a pair of tongues 38 and 40 permitting the locking of adjacent buckets. It is apparent that various structural modifications may be made in the subject spring clip construction within the scope of the teachings of the present invention. In addition to the one of FIGURE 6, other possible modifications of spring clip construction are shown in FIGURES 5 and 7. Clip 41 of the modification of FIGURE 5 is substantially the same as the modification of FIGURE 4. In both the modifications of FIGURES 5 and 6, as well as that of FIGURE 4, the tongue portion of these clips which coact with the bucket platform notches are engaged by a suitable tool and moved circumferentially to permit assembly and disassembly of the buckets on the wheel. However, in the modification of FIGURE 7 the locking portion or tongue 42 of clip 44 would be engaged by a suitable tool and depressed radially relative to the wheel to permit turbine bucket assembly and disassembly.

We claim:

A turbine rotor assembly comprising a wheel member having a rim, a plurality of circumferentially spaced tapered dovetailed recesses formed in said rim, said recesses extending axially of said wheel and opening into the periphery of said rim, a plurality of turbine buckets adapted to be supported within said recesses, each of said buckets including a platform having a tapered dovetailed cross section corresponding to the cross section of said wheel rim recesses, said recesses and platform coacting to retain the turbine buckets against radial movement relative to said wheel, a second set of recesses formed in the periphery of said rim intermediate the turbine bucket receiving recesses, each platform includ