

Title : Multi-locking Pulley

Technical Field

This invention relates to a method of manufacturing Multi-locking Pulley.

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BACKGROUND ART

Principles of the present invention will be discussed in relation to a method of manufacturing Multi-locking Pulley such as used in the industrial

10. manufacturing, construction, agriculture, oil and gas, automotive and general industries. Some of the example can be referred to figure 11 & 12.

It should be appreciated however that the principles of the present invention can apply to manufacture of a wide range of Multi-locking Pulleys; offering
15 combinations of various pulley sizes to various sizes of sleeve to various numbers of sleeves. Some example can be referred to figure 6.

Present method of manufacturing a pulley is either by sand casting, die cast, investment cast iron or metal stamping; of which, sand cast iron is the
20 preferred method of manufacturing pulley in the present time before this invention of Multi-locking Pulley

These processes are complicated, expensive, labour intensive and places limitation on the design of the pulley.

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Sand casting of iron pulley involves the placement of a particular pulley
patent (generally aluminium mould) into casting sand, which is packed
around the aluminium pulley mould. The mould, and hence the pulley
eventually manufactured, must be tapered ready removal of the mould from
5 the packed sand. It should be noted that the sand might include inserts for
the pulleys.

Once the mould is removed, the hot iron is then poured into the sand mould.
Once the metal has cooled sufficiently, the sand mould is broken and the
10 rough pulley cast removed.

Next, the pulley has to be machined to the desired pulley sleeve size.

Next, the pulley is sent to apply putty filling up the holes caused by bubble
15 during the casting. The putty also requires sanding down manually by
sandpaper before sending to the next process; which is painting with a coat
of paint.

The cast iron pulleys are also heavy because they are generally cast in full
20 form with the core and pillar and sleeves all in one piece. An example of this
can be referred to figure 13.

A typical cast iron pulley through casting process is extremely heavy due to
the limitation of casting process requiring thicker wall all round of the
25 entire pulley.

The destruction of the mould insert every time a pulley is manufactured is expensive. Also expensive is the labour to provide the extra machining of the pulley one piece by one piece.

- 5 Another problem is the huge range of pulley requires for these method means that manufacturers are slow to cast the pulley one by one in accordance to the desired model of the pulley required by his customer.

- 10 It would be desirable if there could be provided a method of pulley manufacture that overcomes these problems.

It is an object of the present invention to address the foregoing problems or at least to provide the public with a useful choice.

- 15 Further aspect and advantages of the present invention will become apparent from the ensuing description, which is given by way of example only.

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DISCLOSURE OF INVENTIONS

According to one aspect of the present invention there is provided a method of manufacturing pulley characterized by the steps of:

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A extruding a length to form as part of the Multi-locking Pulley, and

B cutting the length of the material when it reaches the desired length for the said Multi-locking Pulley

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C the components are then slot-in to inter-lock to make into a full Multi-locking Pulley.

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D bolts such as Alan Keys are used to tighten up the components to make it into a fully assembled Multi-locking Pulley.

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The process of extrusion is one not normally thought of when looking at the pulley manufacturing. This is because design of the pulley is such that it would be difficult to apply the extrusion process. Existing designs do not have the substantially constant diameter of pulley and width of pulley for extrusion.

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The inventor recognized that a new Multi-locking Pulley could be produced by extrusion process with all its advantages.

It is envisaged that standard extrusion process can be used with the present invention.

In preferred embodiments of the present invention the extrusion process is applied to the Multi-locking Pulley of: -

- 1 different sizes of pulley ,
- 2 different sizes of Pulley Disc as shown in figure 7 item no. 1
- 5 3 different sizes (of the width) of pulley sleeve as shown in figure 7 & 8 item no. 2
- 4 different number of sleeves as shown in figure 8 item no. 3
- 5 different sizes of Pillar Joint as shown in figure 9 and
- 6 having a small number of common Pulley Cores as shown in figure 10

10 An example of this Multi-locking Pulley system is shown in figure 6

It is also apparent here that the Multi-locking Pulley can be extruded are categorized into 2 categories. That is: -

15 1 In a pulley of smaller sizes, a single Pulley Disc inter-locking one piece of Pulley Core to make one complete assembled Multi-locking Pulley. Example of this is shown in figure 4.

2 In a pulley of medium and large sizes, many components of the Multi-locking Pulley inter-locking each other with 1 piece of Pulley
20 Core to make into 1 complete assembled Multi-locking Pulley. Example of this is shown in figure 1, 2 & 3.

It should be appreciated however that the present invention could apply to pulley having alternate sizes of the pulley and different number of sleeves

and different sizes of sleeve without having to change the Pulley Core or visa-versa.

5 This Multi-locking Pulley system also provides wide selection of combinations one can achieve by selecting different Pulley Core to different size of pulley and different number of sleeves as well as different sizes of sleeves. An example of this Pulley Core is shown in figure 10

10 A multiple sleeve pulley may be manufactured by extrusion process, or in alternative embodiments of the whole range of pulley with multiple Disc and sleeves and sleeve sizes may be extruded at one time. An example of this multi sleeves are shown in figure 7 & 8. Herewith showing the varieties of Pulley Disc and Pulley Sleeves respectively.

15 One advantage of extrusion Multi-locking Pulley as opposed to the whole pulley casting is that the extrusion process is considerably easier. For example, the extrusion has less mass thus is easier to handle in terms of sheer size and weight.

20 Further, the less mass there is, the less restriction there has to be made on the extrusion design to ensure that there is minimal distortion of the extrusion during the cooling process.

25 Even so with the extrusion process, considerably tighter tolerance can be obtained with extrusion than the casting.

Obviously, if the Multi-locking pulley is extruded into a few components, then there must be provided a means by which they can be joined together to

form a single pulley.

Means an attachment may be through a conventional method such as Alan Key Screw, Bolts, Bracket and so forth. Such attachment are illustrated in
5 figure 1, 3 & 4 item no. 1

However, in preferred embodiments the extrusion components is made so that it has complimentary teethes and indentations, readily allowing the individual components to slot in to one another.

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In particular, it is envisaged that a few choices of inter-locking connection can be employed. Such examples are as that: -

- 1 Dove Tail arrangement as shown in figure 5 item no. 1
- 15 2 Tongue and groove arrangement as shown in figure 5 item no. 2
- 3 Star arrangement as shown in figure 5 item no. 3

These arrangements have the advantages in that they can be readily incorporated into an extrusion and that the Multi-locking Pulley is secured
20 over the whole depth of the Multi-locking Pulley.

The Multi-locking Pulley may be made of variety of material such as aluminium & plastic.

25 Composite and ceramic may also be used. But however it may also have inferior material strength, which is not good for such pulley applications.

It should be appreciated with the conventional cast iron pulley manufacturing method limits to each pulley, which are of different models with different sizes of pulley and different number of sleeves and different sizes of sleeves. The present invention ensure that there is uniformity of design and sizes and thus efficiency in the manufacturing and management process.

Another advantage of the present invention is that the core of the pulley (Pulley Core shown in figure 10) is extruded as one component. This provide an enormous advantage over conventional cast iron pulley because in the event the Multi-locking Pulley needs to be replaced. One need to just replace the Pulley Disc or Pulley Sleeve or the Pulley Core, which ever that is worn out. This ensure the customer almost immediate replacement unlike the conventional pulley which requires to replace the entire pulley. The conventional pulley too need to be re-bore and this is normally done in another workshop, which is a slow process.

It should be appreciated that aluminium will reduce the Multi-locking Pulley by approximately 50% as compare to cast iron pulley.

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It should be apparent that the present invention has a number of advantages over prior art. This advantage includes;

A Cheaper start up cost

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The extrusion manufacturing process requires only a small number of die (press mould) to extrude a large selection of Multi-locking Pulley. Thus

cheaper start up cost. Where else the conventional cast iron pulley requires one mould each for every model they so desire to manufacture.

B Faster start up time

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The extrusion manufacturing process can be start up much faster with only a handful of die to be made for the large selection of Multi-locking Pulley.

These dies can be machined by Computerized Machine Center. Whereas the conventional cast iron pulley will take a far much longer time to start up
10 a factory due to the fact that each mould is hand crafted out of wood than they are cast into aluminium moulds. And this mould must be made for each and every model. And to provide the full range of pulley, they must take a long time to complete this task.

15 **C Mass manufacturing process**

The extrusion manufacturing process provides the Multi-locking Pulley to be produced in mass quantity. This genuine concept of inter-locking the components allows the repetition of similar components to be used. Thus, a
20 possibility to extrude components in large quantity which is fast and cheap. Whereas the conventional cast iron pulley manufacturing is limited to produce the pulley one by one, which is slow and expensive.

D Uses less manpower

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The extrusion manufacturing process is done in mass production and hence requires very small number of manpower. Whereas the conventional cast

iron pulleys are manufactured piece by piece and thus uses a very large workforce.

E Less floor space

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The extrusion manufacturing process is made in mass production. And also due to the Multi-locking system, the components are small and these all lead to a requirement of a much smaller factory floor space. This is a vast different comparing to the cast iron pulley manufacturing where by each and every Pulleys are cast in full form occupying a large floor space to do sand casting.

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F Clean manufacturing process

15 The extrusion is manufactured without any toxic fumes, no smelting and all waste are recyclable, thus it is friendly to the environment. Whereas the iron casting furnaces need cocking coal of which there will be a world shortage. Burning of the coal produces " cupola emissions " which is an environmentally disastrous gas.

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G Factory easy to manage

The extrusion manufacturing process provide mass production, good component tolerances and small manpower has made it all easier to manage comparing to cast iron pulley where the manufacturing process is slow, Pulleys are cast out in rough and having a large workforce has contributed to a complex and difficult factory to manage.

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H Require to have less inventory

The Multi-locking Pulley system has this great advantage of using common parts. Therefore the require inventory is very much smaller to carry if you
5 compare to the conventional cast iron pulley where the manufacturer
required to carry a very large selection of pulley of different model to
satisfy his customer.

I High turn over low overhead

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The extrusion manufacturing process provides mass production with minimal manpower thus it provides a high turnover and low overhead. This ensures the manufacturer to gain bigger profit. Unlike the conventional cast iron pulley manufacturer, which provides the opposite, that is low turnover
15 and high overhead and making only small profit.

J No putty is required

The extrusion manufacturing process provides excellent Multi-locking
20 Pulley finish and do not require further touch up. Whereas the conventional cast iron pulley requires further touch up by applying putty into the holes left behind by poor sand casting. Cast iron pulley also requires sanding down the putty by sandpaper.

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K No painting required

The extrusion manufacturing process produces excellent components of the Multi-locking Pulley and does not require further surface coating or
5 painting, whereas the conventional cast iron pulley requires a coat of paint.

L Less waste of labour force

Less waste of labour force as separate mould and inserts are not destroyed
10 every time a pulley is produced.

N Less number of die (mould)

A single extrusion tool die may be used to make variable models of Multi
15 -locking Pulley of different sizes.

O Lighter material

The ability to use alternate material to cast iron means that the pulley can be
20 much lighter in weight which amongst other things gives better fuel and electric efficiency to the prime mover that uses Multi-locking Pulley.

P A more balanced pulley

25 The extruded Multi-locking Pulley provides a more balanced pulley. Unlike the conventional cast iron pulley which is subject to potholes caused during the process of gravity casting.

A balanced Multi-locking Pulley will give better efficiency to the prime mover and equipment.

Q Saves Storage and Shipping Space

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All the components of the Multi-locking Pulley are small and can be packed in a small box, which provides a great advantage to save storage and shipping space.

10 Unlike the conventional cast iron pulley, which is a full form pulley. It cannot be knocked down into components and thus takes a very large storage and shipping space.

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BRIEF DESCRIPTION OF DRAWINGS

Further aspect of the present invention will become apparent from the following description, which is given by way of example only and with
5 reference to the accompanying drawings in which:

Figure 1 illustrate a preferred example of a Multi-locking Pulley constructed in accordance with the invention for larger range of pulleys good for the normal pulley application.

- 10 Item no. 1 shows the Alan Key Screw
Item no. 2 shows an example of a Pulley Sleeve
Item no. 3 shows an example of the Pillar Joint
Item no. 4 shows an example of Pulley Core

15 Figure 2 illustrate the complete assembly of a Multi-locking Pulley after all the components are held together.

Figure 3 illustrate a preferred example of Multi-locking Pulley constructed in accordance with the invention for the medium
20 size pulleys good for the normal pulley application

Picture A, illustrate 3 piece of Pulley Sleeve item no. 2 and 3 pieces of Pillar Joint item no. 3 are about to slot in together to make the shape of a pulley.

25 Picture B, illustrate the Pulley Core item no. 4 also about to slot into the center of the Multi-locking Pulley.

Picture C, illustrate the 15 pieces of Alan key Screw item no. 1 used for tightening up all the components.

Picture D, illustrate an example of a complete assembly of Multi-locking Pulley.

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Figure 4 illustrate a preferred example of Multi-locking Pulley constructed in accordance with the invention for the smaller pulleys good for the normal pulley application.

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Picture A & B, illustrate 1 piece of Pulley Disc item no. 1. And 2 pieces of Alan Key screw item no. 2. And 1 piece of Pulley Core item no. 3 are placed together to make the shape of a pulley.

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Picture C, illustrate an example of a complete assembly of a Multi-locking Pulley

Figure 5 illustrate some example of the teeth arrangement that is used for inter-locking the components found the Multi-locking Pulley system.

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Picture no. 1 shows the Dove Tail teeth arrangement

Picture no. 2 shows the Tongue and groove arrangement

Picture no. 3 shows the Star teeth arrangement

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These teeth arrangement can be found in: -

1 Pulley Core as shown in figure 10

- 2 Pulley Disc as shown in figure 7
- 3 Pulley Sleeves as shown in figure 8
- 4 Pillar Joints as shown in figure 9

5 **Figure 6** illustrate that in the Multi-locking Pulley system, a common Pulley Core item no. 1 can be used to suit multiple choice of Multi-locking Pulleys of various pulley sizes, various pulley sleeve sizes and various number of pulley sleeves shown here item no. 2

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Figure 7 is the perspective view of some example of the Pulley Disc item no. 1. In the Multi-locking Pulley system, Pulley Disc are made

- 1 in various pulley sizes as shown in item no. 1 and
- 2 in various sleeve sizes as shown item no. 2 and
- 3 in various numbers of sleeves as shown in item no. 3.

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To assemble into a complete Multi-locking Pulley, you need only to use 1 piece of Pulley Disc.

20 **Figure 8** is the perspective view of some example of the Pulley Sleeve used in various pulley sizes in the range of Multi-locking Pulley item no. 1. In the Multi-locking Pulley system, Pulley Sleeve are made: -

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- 1 in various pulley sizes and length as shown in item no. 4
- 2 in various sleeve sizes as shown in item no. 2 and
- 3 in various numbers of sleeves as shown in item no. 3.

To assemble into a complete Multi-locking Pulley, you are required to use more than one piece of Pulley Sleeve

5 **Figure 9** is the perspective view of some of the Pillar Joints used the Multi-locking Pulley system. In this system the Pulley Joints are made: -

1 in various sizes as shown in item no. 1 and

2 also in various thicknesses to suit various numbers of sleeves as shown in item no. 2.

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To assemble into a complete Multi-locking Pulley, you are required to use more than one piece of Pillar Joint.

15 **Figure 10** is the perspective view of some example of the Pulley Core used in the Multi-locking Pulley system. In this system the Pulley Core are made of various sizes suitable for different pulley sizes as well as suitable for various sleeves sizes and various number of sleeves.

20 To assemble into a complete Multi-locking Pulley, you may require one piece or more than one piece of Pulley Core.

25 **Figure 11** show some of the example of the application of the Multi-locking Pulley.

Picture A illustrates a Multi-locking Pulley item no. 1 can be fitted to a prime mover item no. 2, which is an electrical motor.

Picture B illustrate a Multi-locking Pulley item no. 1 can be fitted to a prime mover item no. 2, which is a diesel engine

5 Figure 12 Shows some of the common example of the application of the Multi-locking Pulley. They are: -

Picture	A	Generator
Picture	B	Mini Concrete Mixer
Picture	C	Air Compressor
Picture	D	Water Pump
10 Picture	E	Chemical Sprayer
Picture	F	Road Cutter
Picture	G	Cultivator
Picture	H	Palm Oil Screw Press

15 Figure 13 Show some example of the conventional cast iron pulleys.

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BEST MODES FOR CARRYING OUT THE INVENTIONS

The Multi-locking Pulley has been designed to have a substantially constant cross section to readily allow the component to be extruded.

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The extrusion provides the flexibility to cut to any desired length. This process can be carried out by using a circular or hack saw.

It can be seen that the multi-locking Pulley has minimal additional
10 machining, namely, the groove on the sleeve of the Pulley Sleeve. This process can be carried out on a CNC lathe machine

The Multi-locking Pulley has been constructed to provide a number of inter-
locking joints, which enable the components to be slot in together with
15 teethes arrangement. These components are tighten (held) up by mean of Alan Key Screw.

Aspect of the present invention have been described by way of example only
and it should be appreciated that modification and additions may be made
20 thereto without departing from the scope as define in the appended claims.

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THE CLAIMS DEFINING THE INVENTION ARE: -

- 1 A method of manufacturing multi-locking Pulley characterized by the steps of :-
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- A extrusion a length of material as component of the Multi-locking Pulley, and
- 10 B cutting the length of the material when it reaches the desired length for the said Multi-locking Pulley.
- 2 A method as claimed in claim 1 wherein the Multi-locking Pulley includes a slot in Pulley Core as illustrated in figure 10
- 15 3 A method as claimed in claim 1 wherein the Multi-locking Pulley includes a Pulley Disc as illustrated in figure 7
- 4 A method as claimed in claim 1 wherein the Multi-locking Pulley includes a few pieces of Pulley Sleeve as illustrated in figure 8.
- 20 5 A method as claimed in claim 1 wherein the Multi-locking Pulley includes a few pieces of Pillar Joint as illustrated in figure 9.
- 6 A method as claimed in claim 1 wherein the Multi-locking Pulley are extruded with slot in arrangement for inter-locking the
- 25 components claimed in claim 2 to 5.



- 7 A method as claimed in claim 1 wherein the whole Multi-locking
Pulley is extruded out as illustrated in figure 1,2, 3 & 4.
- 8 A method as claimed in claim 2 to 6 wherein the whole or part of the
5 components are used in the Multi-locking Pulley system.
- 9 A method as claimed in claim 1 which includes the additional step of
extruding means to ensure that all the components in claim 2 to 6 can
be connected by a single locking system.
- 10 10 A method as claimed in claim 1 which includes the additional step of
treating the Multi-locking Pulley to provide colored anodized coating.
- 15 11 That a Multi-locking Pulley component made in accordance with the
method as claimed in claim 1
- 12 12 A Multi-locking Pulley incorporate any of the componentry as
claimed in any one of claims 9 to 12.
- 20 13 A method as claimed in claim 1 wherein the components of the Multi-
locking Pulley provides inter-locking slot (teeth) arrangement to
inter lock one component to another.
- 25 14 That in the Multi-locking system all the components are tighten up
together by mean of bolts to form a complete pulley.

