

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO	
RAD: 13-234654- -2	FECHA: 2015-04-09 13:57:11
DEP: 2020 DIRECCION DE NUEVAS CREACIONES	EVE: 378 FASE NACIONAL INCLUIDO CAPITULO I
TRA: 11 PCT-PATENTE DE INVENCION CAPITULOS I Y II	FOLIOS: 7
ACT: 430 REQUERSOLICITA	

DIRECCIÓN DE NUEVAS CREACIONES

2020
Bogotá, D.C.,

Abogado(a)/Señor(a)
HUMBERTO RUBIO CAMACHO

Asunto: Radicación: 13-234654- -2
Trámite: 11
Evento: 378
Actuación: 430
Oficio: 3503
Folios: 7

Patente de Invención	X			Patente de Modelo de Utilidad	
Vía Nacional					
Vía PCT (Fase Nacional)	X	Capítulo I	X	Capítulo II	
No. Solicitud Internacional	PCT/EP2012/055062				
Fecha de Presentación Internacional	22/03/2012				

Como resultado del examen de fondo realizado, con fundamento en el Artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se comunica:

1. Documentos estudiados

Descripción:	Rad. N° 13-234654-00000-0000	03/octubre/2013
Reivindicaciones:	Rad. N° 13-234654-00000-0000	03/octubre/2013
Dibujos:	Rad. N° 13-234654-00000-0000	03/octubre/2013
Prioridad:	IT MI2011A000467	24/Marzo/2011

2. Análisis de la Prioridad

Se acepta la reivindicación de prioridad porque ésta solicitud fue presentada dentro del plazo establecido (Art. 9 D 486) y su contenido técnico corresponde con el de la prioridad reivindicada.

3. Objeto de la invención

De acuerdo con lo establecido en el numeral 1.2.2.2 del Capítulo Primero del Título X de la Circular Única para efectos del examen de patentabilidad, se tendrá en cuenta la tasa pagada por el solicitante al momento de comenzar el examen para las reivindicaciones adicionales; esto es que cuando la solicitud contenga más de diez (10) reivindicaciones y no se haya pagado la tasa complementaria, sólo se estudiarán las cubiertas por la tasa pagada. Por lo tanto, se estudiarán las reivindicaciones 1 a 6.

Título de la solicitud: “Husillo para embobinar rollos sin núcleo de una película de plástico” (Fl. 1).

El problema planteado en esta solicitud consiste en la necesidad de un husillo para el embobinado y desembobinado de rollos de películas de plástico, en el que se disminuya el alto consumo de aire comprimido utilizado para provocar la expansión radial de las vueltas interiores del rollo, cuando se realiza el desembobinado. Así como también, que permita la adhesión automática de la película de plástico en la superficie del husillo, al iniciar el embobinado.

Para resolver este problema técnico, la solicitud en estudio propone un husillo que comprende un cuerpo tubular provisto de una cámara interna que se extiende coaxialmente y una pluralidad de perforaciones que se extienden desde la cámara interna hasta la superficie externa del cuerpo tubular. La pared periférica del cuerpo tubular está provista de una capa de cromo duro con una rugosidad promedio (Ra) entre 6 y 6.5 µm.

El objeto de la presente solicitud se relaciona con la Clasificación Internacional de Patentes (CIP): B 65 H 19/28 // 75/28.

4. De la solicitud de patente

Título

El título no define en forma clara el objeto de la invención. Se sugiere al solicitante modificar el título por uno que exponga dicho objeto, refiriéndose a las características constructivas del producto reclamado, por ejemplo, “Husillo para embobinar rollos sin núcleo de una película de plástico con capa de cromo duro de superficie limpiada con chorro de arena”.

Reivindicaciones (Art 30 D 486, Art 22 PCT)

Las reivindicaciones no son claras porque:

- El término: “por lo menos” de la reivindicación 1, es impreciso, por lo cual no permite distinguir la invención del estado de la técnica. Se sugiere sustituirlo por un término preciso o un rango concreto.
- La expresión: “de manera preferente” de la reivindicación 2 precediendo una característica no es limitativo, porque hace opcional a la característica y no limita el alcance de la reivindicación. Se sugiere al solicitante eliminar la expresión citada.

- La reivindicación 4, al mencionar que: “...la capa de cromo duro tiene una dureza entre 1000 y 1200 HV.”, describe un resultado a alcanzar al incluir la capa de cromo en el husillo reclamado. Cabe aclarar, que los resultados a alcanzar no pueden definir la invención y son las características constructivas del producto las que se toman como base para realizar la comparación con el estado de la técnica. De acuerdo con lo anterior, se sugiere al solicitante eliminar la reivindicación 4 ya que no contiene materia que pueda ser susceptible de protección.
- Las reivindicaciones 1 y 4 al incluir las expresiones: “...limpiada con chorro de arena...” y “flash” respectivamente, están describiendo los procesos mediante los cuales se lograron las características constructivas del producto para el cual se solicita protección. Tal y como se mencionó anteriormente, el producto reclamada se define solamente mediante sus características constructivas, por ende, se sugiere al solicitante eliminar las expresiones citadas de las reivindicaciones.

5. Determinación del Estado de la Técnica

El estado de la técnica se determinó con base en la fecha de presentación de la solicitud de prioridad: marzo 24 de 2011, y se encontraron los siguientes documentos que anticipan el objeto de esta solicitud:

Ítem	Documento	Título	Fecha de Publicación
D1	US 7'641.141	'Method and apparatus for winding and removing coreless rolls from a spindle'	05/Enero/2010
D2	US 4'065.365	'Method for improving frictional surface in cylinders or sleeves of internal combustion engines'	27/Diciembre/1977

El documento D1¹ divulga un rollo sin núcleo de una película de plástico que es directamente enrollado en un husillo tubular. El husillo está provisto de una cámara de aire y consta de una pared periferia perforada que comunica con la fuente presurizada de aire (resumen).

El documento D2² divulga una invención relaciona con un nuevo método para obtener superficies con una capa de cromo con buenas propiedades anti-friccionales (Col. 1, líneas 8 a 9).

6. Examen de Patentabilidad (Art 14 D486)

Nivel inventivo (Art18 D486)

La reivindicación 1 consiste en: “Un husillo adecuado para embobinar rollos de una película de plástico estirable, el husillo que comprende...” (Ver página 13 del radicado N° 13-234654-00000-0000).

1 <https://www.google.ca/patents/US7641141?dq=7641141&hl=es&sa=X&ei=dVMAVaGfF9HtgwSUjoSgCQ&ved=0CB0Q6AEwAA>

2 <https://www.google.ca/patents/US4065365?dq=4065365&hl=es&sa=X&ei=bXcAVefWBo7EgwTlioHYCA&ved=0CB0Q6AEwAA>

Comparación de las características técnicas esenciales, con las del estado de la técnica:

Características esenciales	D1	D2
Husillo para embobinar rollos que comprende:	Método y aparato para embobinar y remover rollos sin núcleo de un husillo que comprende:	Método para mejorar la superficie friccional en cilindros o camisas que comprende:
Un cuerpo tubular que tiene una pared periférica provista de una superficie externa.	El husillo (11) comprende un cuerpo tubular elongado que tiene una pared perisferica (11W) (Figs. 2 y 3; Col. 3, líneas 49 a 53).	Cilindros o camisas con su correspondiente superficie de deslizamiento (Col. 1, líneas 8 a 12).
Una cámara interna que se extiende coaxialmente. La cámara interna conectable a una fuente de aire presurizado.	Una cámara tubular (11P) con conexión a una fuente de aire presurizado (27) (Figs. 2 y 3; Col. 3, líneas 53 a 56)	No menciona
Una pluralidad de perforaciones que se extienden desde la cámara interna hasta la superficie externa del cuerpo tubular.	La pared periférica (11W) esta provista de una pluralidad de perforaciones de salida de aire (34). Las perforaciones se extienden entre la pared exterior 11" a la pared interior 11' de la pared 11W (Figs. 2 y 3; Col. 4 líneas 4 a 8).	No menciona.
La pared periférica del cuerpo tubular del husillo esta provista de una capa de cromo duro.	No menciona.	La pared periférica de material base (14) está cubierta de una capa de cromo (Fig. 5; Col. 3, líneas 45 a 47).
La capa de cromo duro que tiene una superficie limpiada con chorro de arena para embobinar la película de plástico estirable. La superficie limpiada con chorro de arena que tiene una rugosidad promedio (Ra) entre 6 y 6.5 µm.	No menciona.	La figura 7 muestra los efectos resultantes del lapeado con arena abrasiva sobre la capa de cromo (Fig.7; Col. 3, líneas 45 a 50). La rugosidad final de la superficie de cromo lapeada dependerá del tamaño de la red de las microfisuras y no del tamaño del grano abrasivo. En consecuencia, para obtener determinada rugosidad es necesario el control del tamaño de la red de microfisuras (Col. 3, líneas 25 a 30).

Los documentos D1 y D2 se consideran el estado de la técnica cercano a la invención definida en la reivindicación 1 porque divulgan respectivamente un método y aparato para embobinar y remover rollos sin núcleo de un husillo y un método para mejorar la superficie friccional en cilindros o camisas.

La diferencia entre la invención, definida en la reivindicación 1 y el husillo de D1 consiste en que la pared periférica del cuerpo tubular del husillo esta provista de una capa de cromo duro, donde, la superficie limpiada con chorro de arena de la capa de cromo duro tiene una rugosidad promedio (Ra).

La diferencia entre la invención, definida en la reivindicación 1 y el método de D2 consiste en una cámara interna que se extiende coaxialmente, donde dicha cámara interna es conectable a una fuente de aire presurizado y una pluralidad de perforaciones que se extienden desde la cámara interna hasta la superficie externa del cuerpo tubular.

El efecto que logra el incluir la pared periférica del cuerpo tubular del husillo que esta provista de una capa de cromo duro, donde la superficie limpiada con chorro de arena de la capa de cromo duro tiene una rugosidad promedio, es aumentar las propiedades friccionales de la superficie de contacto.

Por lo tanto, el problema técnico objetivo que pretende resolver esta invención se puede formular así: “cómo modificar el husillo conocido en D1 para aumentar las propiedades friccionales de la superficie de contacto”.

Sin embargo, la pared periférica del cuerpo tubular que está provista de una capa de cromo duro, donde la superficie limpiada con chorro de arena de la capa de cromo duro tiene una rugosidad promedio que aumenta las propiedades friccionales de la superficie de contacto, ya está divulgada en el documento D2 que se refiere a una pared periférica de un material base que está cubierta de una capa de cromo (Fig. 5; Col. 3, líneas 45 a 47) y a los efectos resultantes del lapeado con arena abrasiva sobre la capa de cromo (Fig.7; Col. 3, líneas 45 a 50). Por su parte, también enseña que La rugosidad final de la superficie de cromo lapeada dependerá del tamaño de la red de las microfisuras y no del tamaño del grano abrasivo. En consecuencia, para obtener determinada rugosidad es necesario el control del tamaño de la red de microfisuras (Col. 3, líneas 25 a 30).

En consecuencia, la persona del oficio normalmente versada en la materia, incluiría la capa de cromo duro lapeada con arena abrasiva del documento D2 en el husillo divulgado en el documento D1 para llegar así al objeto de la reivindicación 1 de la solicitud. Por lo cual se considera obvia.

Conclusión:

La reivindicación 1 cumple el requisito de novedad (Art. 16), pero no cumple con el requisito de nivel inventivo (Art. 18).

Ahora bien, teniendo en cuenta que las reivindicaciones 1 y 2 especifiquen que la rugosidad esta ente 6 y 6.5 μm y entre 6.2 y 6.3 μm , cabe aclarar que en la técnica se conoce que con este tipo de procesos se puede obtener una rugosidad promedio de 3 a 10 μm^3 . Por otro lado, tal y como lo expone el documento D2, la rugosidad resultante puede determinarse mediante el control del tamaño de la red de microfisuras de la capa de cromo. En consecuencia, el técnico medianamente versado en la materia controlaría dicho tamaño para obtener la rugosidad deseada. De acuerdo con lo anterior, el hecho de que especifique la rugosidad promedio obtenida no puede dar nivel inventivo al husillo reclamado.

Por su parte, la reivindicación 3 reclama que la capa de cromo duro tiene un espesor entre 8 y 15 μm . De acuerdo con lo anterior, cabe mencionar que en la técnica es conocido que dicha capa de cromo puede tener un espesor entre este rango, por ejemplo de 10 μm^4 . Por lo tanto, esta reivindicación tampoco contiene características que puedan dar nivel inventivo al husillo reclamado.

Los documentos antecedentes también comprenden las características técnicas de las reivindicaciones dependientes así:

3 How to handle high modulus carbon fiber. Diapositiva 7. Disponible en:

http://www.mpi.co.jp/english/products/industrial_materials/pitch_based_carbon_fiber/pdf/2012091901.pdf

4 Effects of surface treatments on the fatigue strenght of AISI 4340 aeronautical Steel. Pág.609, Col. 1, Párr. 1. Disponible en:

http://www.google.com.co/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CBwQFjAA&url=http%3A%2F%2Fwww.researchgate.net%2Fprofile%2FMarcelino_Nascimento%2Fpublication%2F223284861_Effects_of_surface_treatments_on_the_fatigue_strength_of_AISI_4340_aeronautical_steel%2Flinks%2F00b7d51c1c43bc8c0d000000.pdf&ei=CnQAVYnZJMXSgwS464CIAQ&usq=AFQjCNF4HJLEdUIWyHlId20D61Y8Zb7BGw&sig2=AJTIUqXMiKUwog0wRd6FSg&bvm=bv.87611401.d.eXY

- Reivindicación 5 y 6: las perforaciones se extienden entre la superficie interior y la superficie superior 11” y 11’ (Col. 4, líneas 4 a 10). Las filas de perforaciones (34) pueden estar angularmente espaciadas una de la otra por 30º, 45º y/o por 90º (Col. 4, líneas 23 a 28).

Cabe agregar, que las reivindicaciones 1 a 4 también están afectadas en el numeral 4 de la presente comunicación.

7. Conclusión

Los requisitos de Patentabilidad de la presente solicitud están afectados así:

Ítem	Documento	Reivindicaciones afectadas	Requisito que afecta
D1	US 7'641.141	1 a 6	Nivel Inventivo
D2	US 4'065.365	1	Nivel inventivo

En cumplimiento del artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le indica que debe dar respuesta dentro del término de sesenta (60) días contados a partir del día siguiente de la fecha de notificación de la presente comunicación. En caso de no dar respuesta al presente requerimiento, o si a pesar de la respuesta subsistieran los impedimentos para la concesión, se denegará la patente.

Se invita al solicitante se sirva indicar, si así lo considera, su renuncia al término faltante de sesenta (60) días para dar respuesta a este requerimiento y presentarla por escrito.

Finalmente, se le recuerda al solicitante que si como respuesta a este requerimiento llegara a modificar el capítulo reivindicatorio y éste contenga más de diez (10) reivindicaciones, no pagará la tasa de modificación voluntaria pero sí la correspondiente al pago por reivindicación adicional.

Notifíquese el presente oficio conforme a lo dispuesto en el numeral 5.2, literal e), del capítulo quinto del título primero de la Circular Única No. 10 de 2001.



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El anterior requerimiento fue notificado por fijación en lista, de fecha 2015-04-14

Elaboró: Monica Andrea Gutierrez Almonacid
Revisó: Sonia Andrea Diaz Pirazan



US007641141B2

(12) **United States Patent**
Pellengo Gatti

(10) **Patent No.:** **US 7,641,141 B2**
(45) **Date of Patent:** **Jan. 5, 2010**

(54) **METHOD AND APPARATUS FOR WINDING AND REMOVING CORELESS ROLLS FROM A SPINDLE**

(58) **Field of Classification Search** 242/332.3, 242/532.2, 533.4, 571, 576, 576.1
See application file for complete search history.

(75) **Inventor:** **Roberto Pellengo Gatti**, Novara (IT)

(56) **References Cited**

(73) **Assignee:** **No. El. S.r.l.**, San Pietro Mosezo, Novara (IT)

U.S. PATENT DOCUMENTS

(*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 243 days.

2,575,631 A * 11/1951 Link 242/532.2
5,337,968 A 8/1994 De Bin et al.
5,797,559 A * 8/1998 Coffey 242/527.6
6,186,436 B1 * 2/2001 Selle et al. 242/532.2
6,270,034 B1 8/2001 Kury et al.
6,412,729 B2 * 7/2002 Kury et al. 242/533.4
6,595,458 B1 7/2003 Biagiotti

(21) **Appl. No.:** **11/632,659**

FOREIGN PATENT DOCUMENTS

(22) **PCT Filed:** **May 18, 2005**

EP 0 831 047 3/1998
EP 0 995 708 4/2000
WO WO 99/06312 2/1999

(86) **PCT No.:** **PCT/EP2005/005369**

* cited by examiner

§ 371 (c)(1),

(2), (4) **Date:** **Jan. 17, 2007**

Primary Examiner—Sang Kim

(74) *Attorney, Agent, or Firm*—Young & Thompson

(87) **PCT Pub. No.:** **WO2006/012933**

PCT Pub. Date: **Feb. 9, 2006**

(65) **Prior Publication Data**

US 2008/0035781 A1 Feb. 14, 2008

(30) **Foreign Application Priority Data**

Aug. 5, 2004 (IT) MI2004A1608

(51) **Int. Cl.**

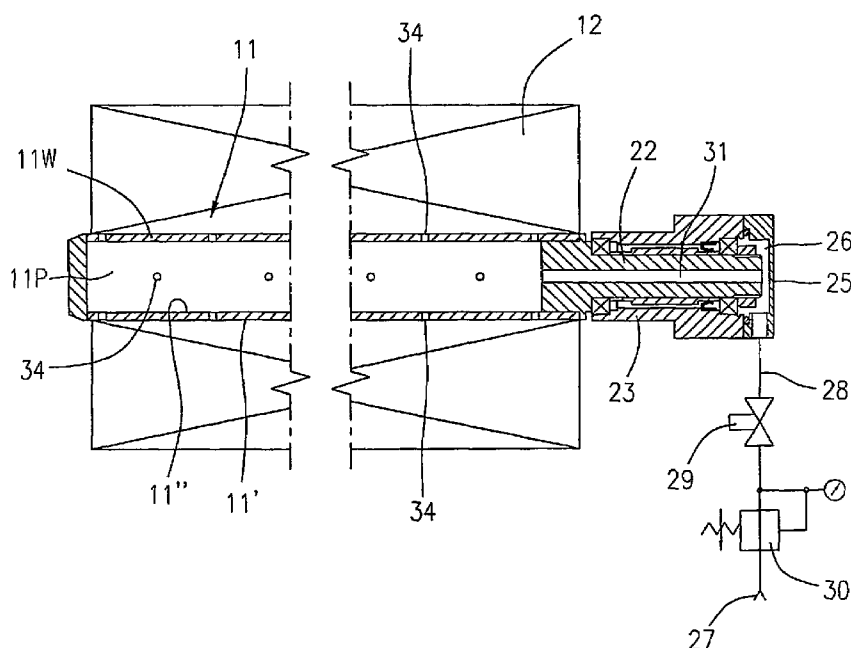
B65H 19/28 (2006.01)

(52) **U.S. Cl.** 242/532.2; 242/576.1

(57) **ABSTRACT**

A coreless roll (12) of a plastic film (10) is directly wound onto a tubular spindle (11); the spindle (11) is provided with an air chamber (11P) having a perforated side wall (11W), which communicate with a pressurised air source (27). At the removal of the roll (12), the inner turns of the roll (12) are radially expanded by feeding a pressurised airflow into the winding spindle (11) and the roll (12); the pressurised air is fed for a length of time required for the removal of the roll (12).

28 Claims, 4 Drawing Sheets



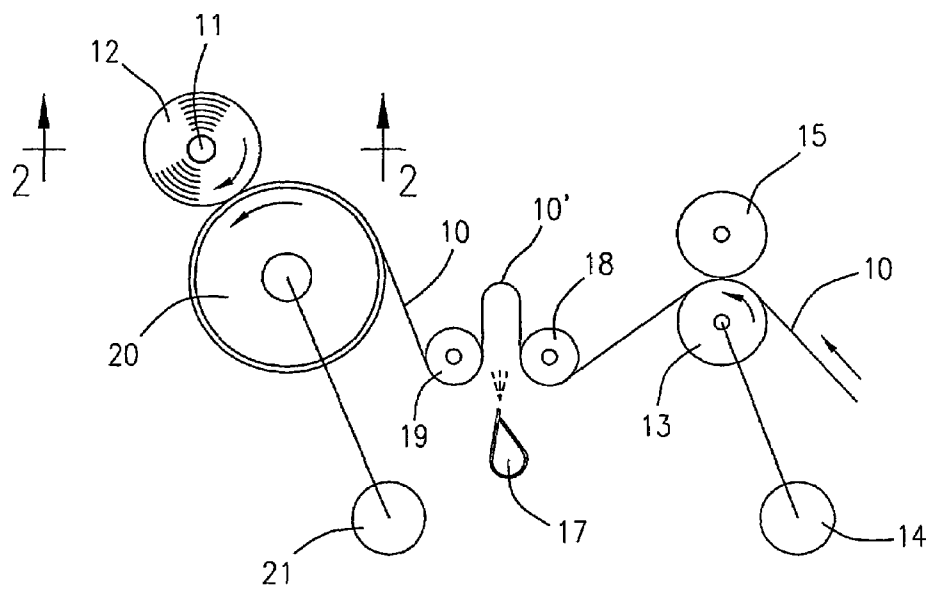


Fig. 1

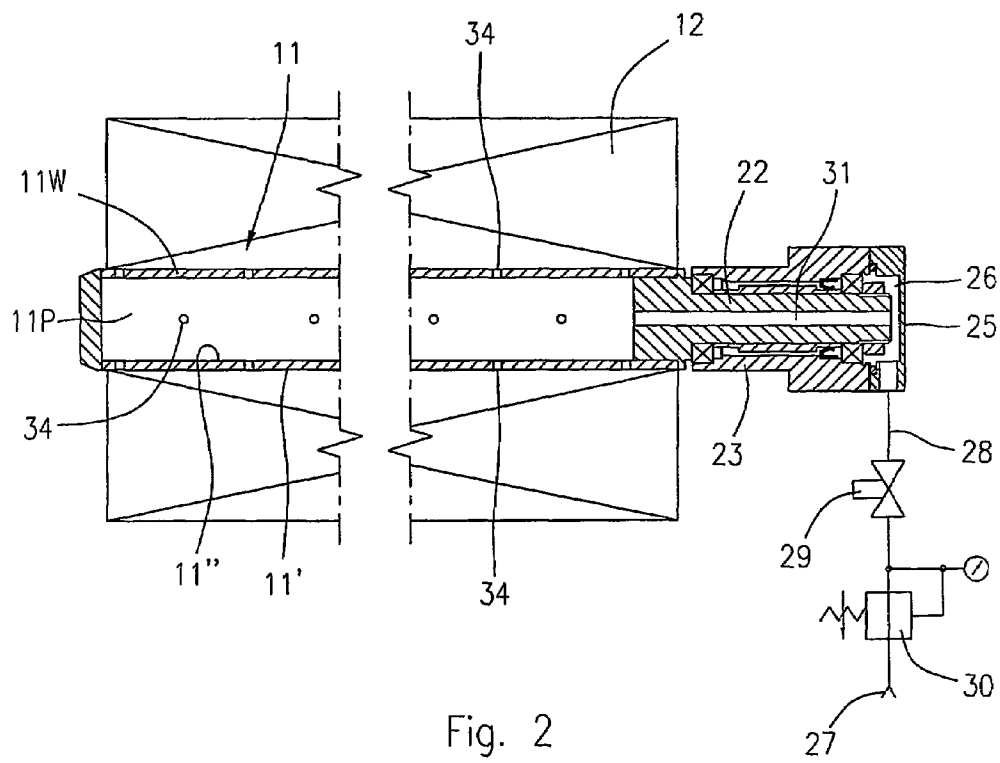
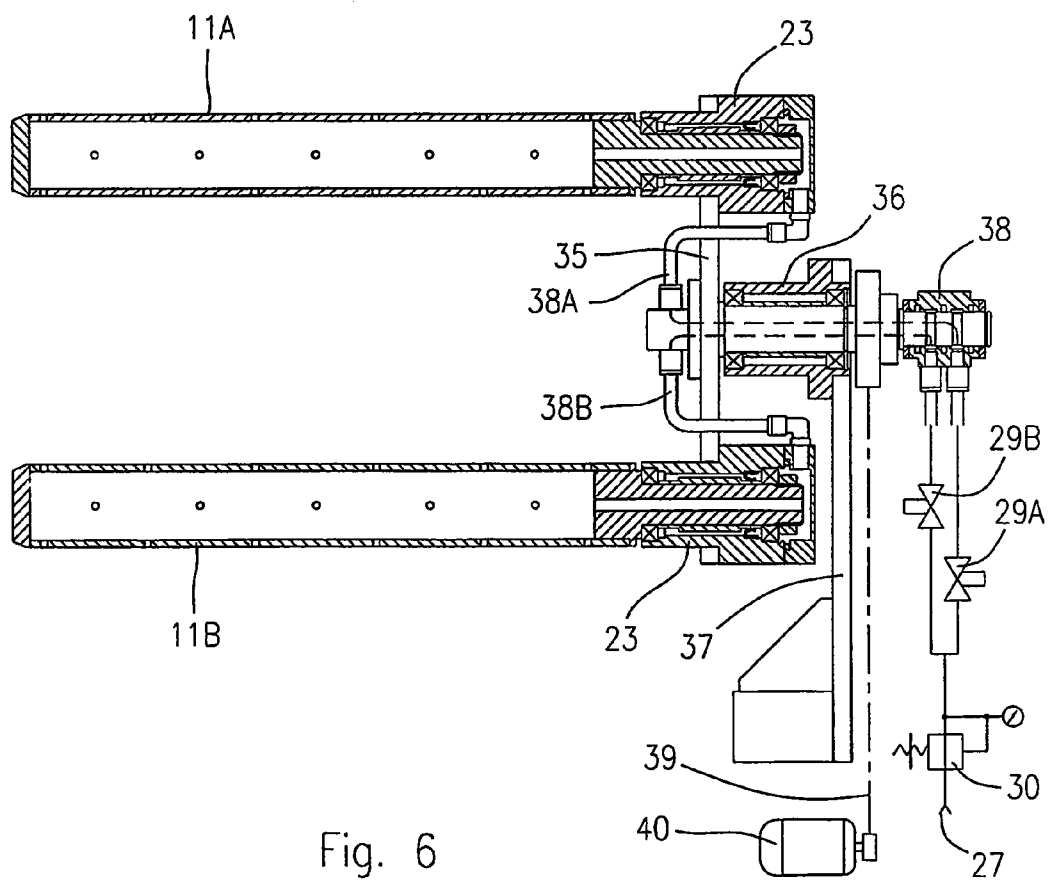
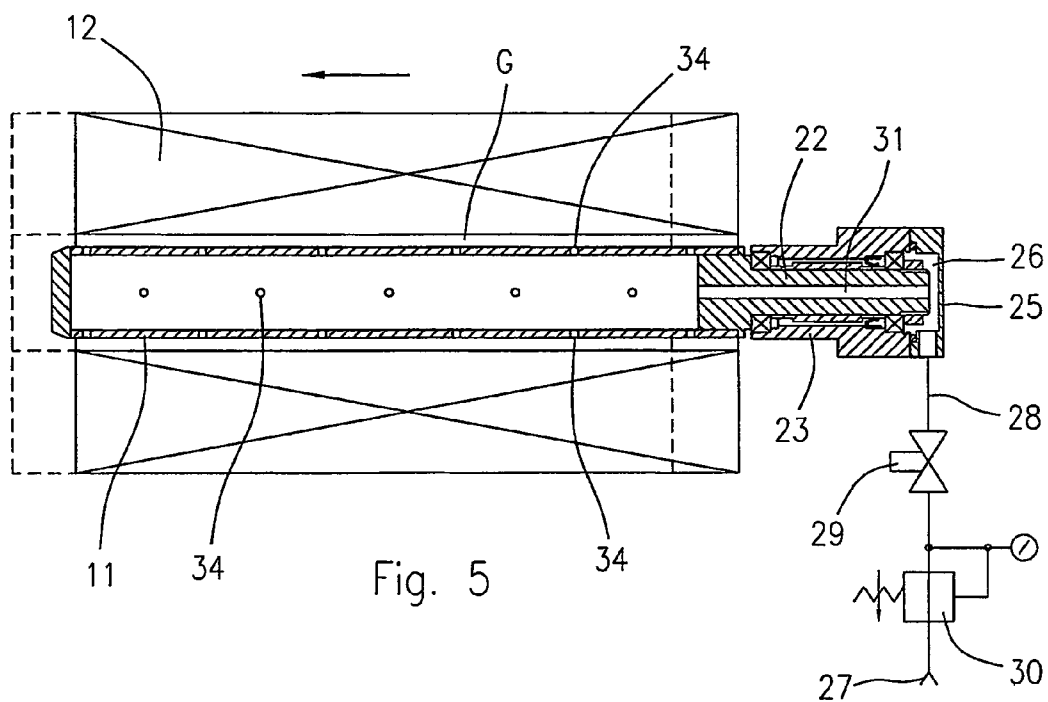


Fig. 2

Fig. 4



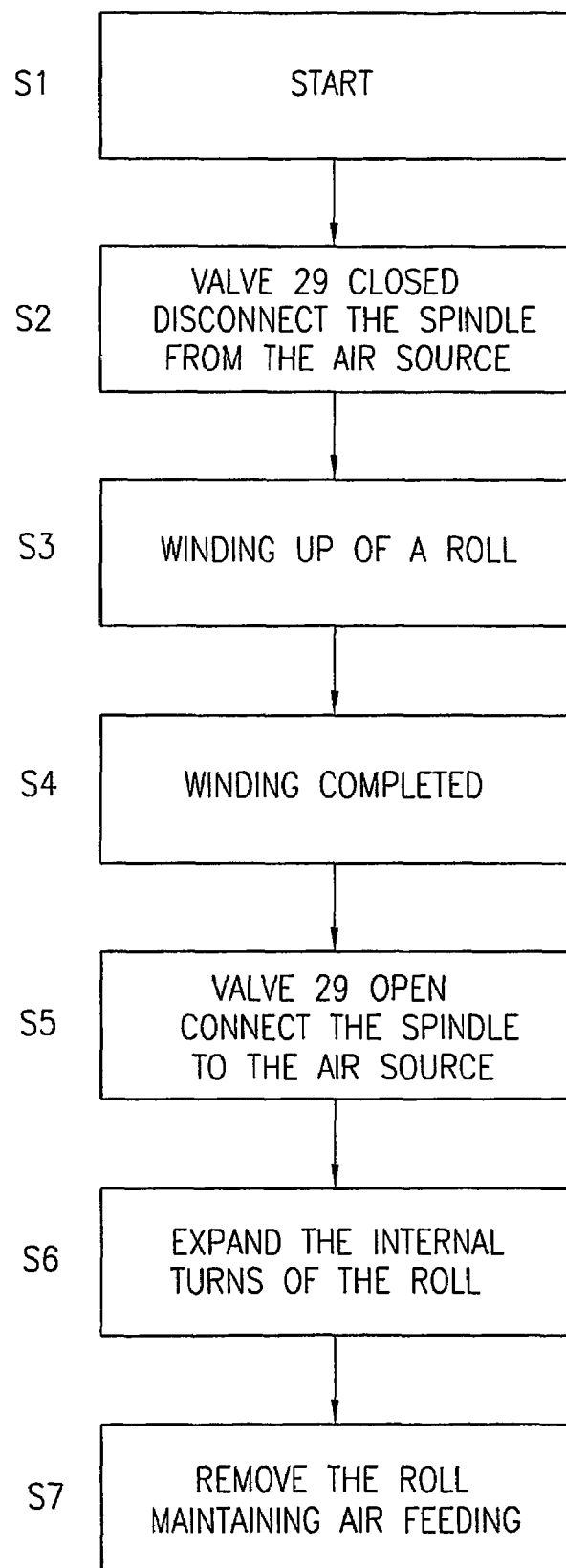


Fig. 7

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METHOD AND APPARATUS FOR WINDING AND REMOVING CORELESS ROLLS FROM A SPINDLE

BACKGROUND OF THE INVENTION

This invention refers to the production of coreless rolls, according to which a film of plastic material is directly wound up onto a spindle, and in particular the invention is directed to a method for winding up and removing a coreless roll from a winding spindle, to an air-pressure assisted spindle and to a pneumatic apparatus, designed to allow the winding and removal of coreless rolls from the spindle, in a very simple way.

STATE OF THE ART

Extensible and heat-shrinkable plastic films, wound in rolls, are normally used for packaging and for wrapping palletised loads or goods.

In forming the rolls, a plastic film directly from a production line, or from a large roll, is normally wound into rolls of small dimensions, supporting the rolls during winding by an appropriate tubular core of rigid material, previously fitted onto a rotating spindle; upon completion of a roll, the latter can be removed by simply withdrawing it, axially from the spindle, together with the tubular support core.

The use of tubular support cores of plastic material or cardboard is generally required since, in addition to facilitating the winding of the plastic film, it helps to maintain a stable shape of the roll and its easy withdrawal or removal from the spindle.

The current tendency however is to eliminate the use of cores for winding rolls of plastic film, both in order to reduce costs, and to eliminate several problems in terms of procurement, transport and storage in the warehouse of the tubular cores, prior to their use.

In this connection, it has been variously suggested to eliminate the use of the usual tubular cores and to form coreless rolls by winding up the plastic film directly onto an expandable spindle, as described for example in EP-A-1 001 908.

According to this document, use is made of an expandable spindle or mandrel, capable of assuming two different diameters or configurations. In particular the spindle comprises tubular body and an inflatable bladder, capable of protruding through longitudinal slots of the spindle body, during winding, to support the roll of the plastic film; upon completion of a roll the internal bladder is deflated and the diameter of the spindle is reduced to enable the roll to be removed; it has also been suggested to use mechanically-expandable spindles.

A solution of this kind proves to be somewhat complex and difficult to use with different types of spindles, especially with spindles of large dimensions in that it does not allow an adequate control of the diameter of the roll, owing to a possible elastic yielding of the internal bladder protruding from the longitudinal slots, due to the winding tension of the plastic film.

OBJECTS OF THE INVENTION

The main object of this invention is to provide a method for winding up and removing rolls of plastic film, of coreless type, which makes use of a pressure assisted spindle of special design, whereby it makes possible to wind up the plastic film directly on the outer cylindrical surface of a tubular body,

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to produce coreless rolls in an extremely controlled way, while ensuring constancy in the shape of the rolls, and its easy removal.

A further object of the invention is to provide a spindle for winding up coreless rolls, according to which use is made of a structurally simple solution, easily adaptable to any type of apparatus for winding up any type of plastic film into coreless rolls.

A still further object is to provide an apparatus suitable for implementing the method and use a pressure assisted spindle according to the invention.

BRIEF DESCRIPTION OF THE INVENTION

The method according to the invention comprises the steps of winding up a roll of plastic film directly onto a tubular body of a spindle having perforations on a peripheral wall, in the absence therefore of any support core and, at the removal, causing an expansion of some internal turns of the roll by feeding a pressurised air flow into the tubular body and through the perforated wall of the spindle to disengage the internal turns of the roll from said peripheral wall of the spindle allowing the withdrawal of the same roll.

The spindle according to the invention comprises:
an elongated hollow body, provided with a tubular chamber longitudinally extending to a peripheral wall, said wall having an outer winding surface;

a plurality of perforations opening out from the tubular chamber onto an outer surface of the peripheral wall; and
a pneumatic joint conformed to rotatably support the spindle and to connect the tubular chamber of the spindle to a pressurised air source.

The air-outlet holes or perforations can be disposed and oriented on the peripheral wall of the spindle body in any way with respect to a longitudinal axis of the spindle.

In particular, the air-outlet holes can be aligned in rows of holes parallelly arranged to the longitudinal axis of the spindle, or helically disposed, at a constant and/or variable pitch, according to the requirements.

The number of holes, their disposition on the peripheral wall, and their cross-sectional areas for the air flow, must be chosen such as to cause a controlled distribution of the pressurised air in the tubular chamber, of spindle, to avoid an excessive pressure drop in the final section of the chamber at the end opposite to the inlet side for the pressurised air. Therefore the number, and/or the distances between holes or perforations, and/or the dimensions of the holes themselves, may vary along the same spindle, and/or in spindles of different types, for winding rolls of different plastic films; for example the holes may be uniformly distributed on the body of the spindle, or grouped on one or more wall areas.

As alternative embodiments, the perforated wall of the spindle may consist of porous sintered ceramic or metal material, a microperforated plate or a fine meshed grid or net; as general rule, for the present invention, the total perforated area of the peripheral wall of the spindle, should be equal to or less than the cross-sectional area of a feeding duct for the pressurised air flow at one end of the tubular chamber of the spindle.

BRIEF DESCRIPTION OF THE DRAWINGS

These and further features of the claimed method, and some preferential embodiments of a spindle and an apparatus according to the invention, will be more clearly evident from the following description, with reference to the drawings, in which:

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FIG. 1 schematically shows an apparatus for winding up coreless rolls of plastic film, according to the invention;

FIG. 2 shows a longitudinal cross sectional view of a spindle, along the line 2-2 of FIG. 1, and a coreless roll during the winding of a plastic film;

FIG. 3 shows an enlarged detail of the pneumatic joint of FIG. 2;

FIG. 4 shows a preferential disposition of the air-outlet holes for a spindle according to the invention;

FIG. 5 shows a cross-sectional view similar to that of FIG. 2, during the removal of a roll;

FIG. 6 shows an apparatus according to the invention provided with a double spindle;

FIG. 7 is a flow chart describing the method according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

In FIG. 1, reference number 10 has been used to indicate a plastic film of any type, for example a heat-shrinkable or extensible film, if necessary prestretched, which must be wound onto a spindle 11 to form a roll 12 in a per se known way.

The apparatus of FIG. 1 comprises for example a feeding unit for a film 10, including a first drawing roller 13 operated by an electric motor 14, and a pressure roller 15 supported to idle rotate.

The plastic film 10, in FIG. 1 is moving towards two guide rollers 18, 19 to form a loop 10' floatingly sustained for example by an air flow generated by a nozzle 17, in a position between the two guide rollers 18, 19; the film 10 is drawn or pulled by a drum 20, operated by an electric motor 21, which is appropriately controlled with respect to the electric motor 14 of the drawing roller 13 of the feeding unit, by an electronic control unit, not shown.

The spindle 11 may be supported to idle rotate, by a movable arm, not shown, whereby the roll 12, during its winding, can be urged against the drawing drum 20, causing the same roll 12 to rotate with a constant peripheral speed.

The roll 12 of plastic film is directly wound up onto the outer surface of the spindle 11, without any supporting core; therefore, upon completion the winding of a roll 12, when it must be removed, the roll 12 is disengaged from the spindle 11 to enable it to be withdrawn.

For such purpose, the spindle 11 is conformed as shown in FIG. 2, 3 or 4, while the roll 12 is removed by the method described further on, with reference to FIGS. 5 and 7 of the drawings.

In particular, as shown in the example of FIGS. 2 and 3, the spindle 11 comprises an elongated tubular body having a peripheral wall 11W provided with an outer cylindrical surface 11' and an inner cylindrical surface 11'', defining a tubular chamber 11P, closed at both ends. The spindle 11 is rotatably supported at one end by a hollow shaft 22, forming part of a pneumatic joint for connection of the tubular chamber 11P of the spindle, to a pressurised air source 27.

More precisely, as shown in the detail in the enlarged view of FIG. 3, the shaft 22 of the spindle is supported to idle rotate by a sleeve 23 or other support element, by means of bearings 24. The support sleeve 23 for the spindle shaft 22 is closed at the rear end by a cover 25 defining an air chamber 26 which can be selectively connected to a pressurised air source 27, in FIG. 2, by means of a duct 28 comprising a solenoid valve 29 and a pressure regulator 30, to control the feeding of the pressurised air.

The air chamber 26 is also connected to the tubular chamber 11D of the spindle 11, by a flow passage consisting of a

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longitudinal hole 31 in the shaft 22; a lip seal 32 tightly closes the air chamber 26 from the outside, while allowing the spindle 11 to rotate.

The peripheral wall 11W of the spindle, is in turn provided with a plurality of air-outlet through holes or perforations 34, for discharging the air; the holes 34 extend between the inner and outer surface 11'' and 11' of the body wall 11W to communicate the internal chamber 11P with the outer surface 11' of the spindle body, onto which the plastic film 10 is directly wound during the formation of a roll 12.

Preferably, the air-outlet holes 34 are directed radially and differently spaced apart and/or disposed along the wall 11W of the spindle, as explained further on; however, different orientations and/or different dispositions of the holes 34, compared to that shown, are not excluded.

The diameter and the number of the holes 34, and their disposition along the wall 11W of the spindle, should be calculated and chosen so as to ensure a sufficient delivery of air, and an appropriate pressure drop along the tubular chamber 11P for causing a sufficient radial expansion of the internal turns of the roll 12, capable of maintaining the roll floating on an air cushioning during the removal.

In the example of FIG. 2, the holes 34 have been shown in an aligned condition, in which rows of holes are parallelly arranged to the longitudinal axis of the spindle 11; the rows of holes 34 can be angularly spaced apart from one another for example by 30°, 45° and/or by 90°, depending on the number of holes and rows contemplated for the spindle.

Moreover in FIG. 2 the holes 34 along each row are spaced apart from one another by a constant pitch, with the holes of each row axially staggered, for example by half a pitch, with respect to the holes of the adjacent rows.

Conversely, a different disposition of the holes 34 is shown in FIG. 4; in this case, the holes 34 are disposed along a helical line, with a variable pitch P. In particular, as shown in a position overlying the spindle 11, which refers to the disposition of the holes 34 in a certain number of cross sectional areas of the spindle, according to this example there are two diametrically opposed holes 34 in correspondence with a first set cross-sectional areas spaced apart by a first pitch P1, starting from the rear shaft 22. The first set of holes 34 is followed by an intermediate set of two diametrically opposed holes 34 in cross-sectional areas, spaced apart by a second pitch P2 smaller than the previous one P1, and then a third set of three holes at 120° in cross-sectional areas having a third pitch P3 smaller than the pitch P2.

This solution provide a holes disposition having variable pitches, decreasing from the rear end of the spindle in correspondence to the air inlet, to the opposite or fore end for the removal of roll 12; this disposition and spacing of the air-outlet holes 34, has been considered particularly advantageous in that the reduction in the pitch and the consequent shorter distance between holes 34 in the intermediate and fore position of spindle, makes it possible to achieve sufficient compensation for the pressure drops that occur inside the chamber 11P of the spindle, as the holes 34 are gradually uncovered by the progressive withdrawal of the roll 12.

The method for the winding and removal of coreless rolls, according to this invention, can be explained in greater detail with reference to the FIGS. 1, 2, 5 and 7 of the drawings.

As shown in FIGS. 1 and 2, the plastic film 10 is fed and made to advance towards the drum 20, and then wound up into a roll 12, directly onto the spindle 11, without any internal supporting core, in direct contact with outer surface 11' of the spindle, as clearly shown in FIG. 2.

At the start S1, the valve 23 is closed to disconnect the spindle 11 from the air source 27, step S2; during the winding

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of the roll 12, step S3, the solenoid valve 29 is maintained closed, thus preventing the feeding of the airflow.

After the winding of the roll 12 has been completed, step S4, having to move the roll 12 away from the drawing drum 20, the solenoid valve 29 is opened to connect the spindle to the air source 27, step S5, and to feed a flow of pressurised air into the tubular chamber 11P of the spindle 11.

The air under pressure, flowing out from the holes 34, causes the expansion of some internal turns of the roll, step S6, which become detached from the peripheral outer surface 11' of the spindle, as shown in FIG. 5, step S6, being sustained by the air cushioning, flowing along the annular gap G between the outer surface 11' of the spindle 11 and the inside turns of the roll 12.

At this point the roll 12 can be easily removed from the spindle 11, step S7, maintaining the feeding of the pressurised air for the time necessary to complete the withdrawal operation.

Since during the removal of the roll 12, all the holes 34 or perforated areas of the spindle are progressively uncovered, starting from the rear end, inside the spindle a variable pressure drop is generated which, if it were not controlled could cause the internal turns of the roll to collapse again against the spindle 11, thereby preventing or making the removal of the roll 12 more difficult.

In this case, it is possible prevent the collapsing of the internal turns of the roll by operating in different modes, while maintaining the airflow. For example it is possible to adopt a disposition of the perforations or holes having a variable pitch and/or variable cross dimensions of the holes or perforations, and/or more closely spaced apart, or a progressively larger number of holes or perforation at fore end of the spindle 11; it is also possible to operate on the flow regulator 30 to change or increase the flow-rate and/or the pressure of the air fed to the spindle 11.

In all the cases, a controlled winding of coreless rolls and their easy removal is achieved by means of a method, which makes use of an extremely simplified spindle and means.

After having completed the removal of the roll 12, the flow of air to the spindle 11 is interrupted again to allow the winding of a new roll and its subsequent removal as explained previously.

FIG. 6 of the drawings shows, by way of example, an apparatus provided with two pneumatic spindles according to the invention, parallelly arranged on a some support arm; therefore, in FIG. 6 the same reference numbers have been used to indicate parts similar or equivalent to those of the preceding figures.

The apparatus of FIG. 6 comprises a first spindle 11A and a second spindle 11B, wholly identical to each other and to the spindle 11 of FIG. 2.

The support sleeves 23 of the rotary air-feeding joints for the two spindles 11A, 11B are secured to a turntable arm 35, pivotally supported by an intermediate sleeve 36, secured to a bracket 37 or any other suitable supporting frame.

Each spindle 11A, 11B is pneumatically and selectively connectable to the air source 27, by means of respective ducts and solenoid valves 29A, 29B, through a rotary joint 38, having fluid connections 38A and 38B with the rotary air-feeding joints of the spindles 11A and 11B.

The intermediate rotary joint 38 is in turn connected, by means of a mechanical drive 39, to an electric motor 40 or control actuator capable of alternately causing a rotation of either one of the spindles 11A and 11B against a drawing drum 20 corresponding to the drum 20 of FIG. 1, to sequentially winding up separate rolls.

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In this way, while the plastic film 10 for one roll 12 is being wound onto one of the two spindles, the roll 12 previously wound onto the other spindle can be removed according to the method previously described.

From what has been described and shown with reference to the accompanying drawings, it will be clear that a method, a pneumatic spindle, and respective apparatus for winding and removing coreless rolls of a plastic film, have been provided as previously described.

It is understood however that what has been described and shown in the accompanying drawings, has been given purely by way of example in order to illustrate the general features of the invention and several of its embodiments. Other modifications or variations both to the method, to the spindle, as well as to the entire apparatus can however be made, without thereby departing from the scope of the claims.

The invention claimed is:

1. A method for winding up and removing a careless roll (12) of an extensible or stretch plastic film (10) for packaging wound onto a spindle (11), comprising:

providing said spindle (11) with an air chamber (11P) having perforations (34) on a peripheral wall (11W); winding up the plastic film (10) directly on the perforated wall (11W) of the spindle (11);

causing a radial expansion of internal turns of the roll (12); supporting the expanded roll (12) by a cushioning of pressurised air, during withdrawal of the roll (12);

at a removal of a wound up roll (12), causing an expansion of some internal turns of the roll (12) by feeding a pressurised air flow through the air-chamber (11P) of the perforated wall (11W) of the spindle (12), into the internal turns of the roll (12), to disengage the internal turns from said perforated peripheral wall (11W) of the spindle (11); and

during removal of the roll (12), controlling the air flow by changing an air-flow rate emerging from perforations (34), from a rear end to a fore end of the perforated wall (11W).

2. The method according to claim 1, further comprising maintaining the feeding of the pressurised air during at least part of the withdrawal step of the roll (12).

3. The method according to claim 2, further comprising maintaining the feeding of the pressurised air, throughout the entire withdrawal step of the roll (12).

4. The method according to claim 1, further comprising controlling the pressure of the air fed to the spindle (11), during the removal of the roll (12).

5. The method according to claim 1, further comprising increasing the air flow by increasing the number of perforations (34) from the rear end to the fore end of the peripheral wall (11W).

6. The method according to claim 1, further comprising increasing the flow of air by increasing the diameter of the perforations (34) from the rear end to the fore end of the peripheral wall (11W).

7. The method according to claim 1, further comprising reducing a space between the perforations (34), in a longitudinal direction of the spindle (11).

8. A spindle for winding and removal of coreless rolls (12) of an extensible or stretch plastic film (10) for packaging, comprising:

an elongated tubular body, provided with a tubular chamber (11P) longitudinally extending to a peripheral wall (11W), said wall (11W) having an outer winding surface;

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a plurality of perforations opening out from the tubular (11P) chamber onto an outer surface (11') of the peripheral wall (11W); and
 a pneumatic joint (22, 23) conformed to rotatably support the spindle (11) and to connect the tubular chamber (11P) to a pressurised air source (27),
 wherein the spindle is configured such that during removal of the roll (12), the air flow is controllable by changing an airflow rate emerging from air-outlet holes (34), from a rear end to a fore end of the perforated wall (11W).
 9. The spindle according to claim 8, wherein the peripheral wall (11W) of the spindle (11) comprises a number of parallel arranged rows of the air-outlet holes (34).
 10. The spindle according to claim 9, wherein the holes (34) in each row are circumferentially aligned with the holes (34) of adjacent rows.
 11. The spindle according to claim 9, wherein the holes (34) in each row are longitudinally staggered, with respect to the holes (34) of adjacent rows.
 12. The spindle according to claim 8, wherein the holes (34) are spaced apart by a constant pitch (P).
 13. The spindle according to claim 9, wherein the holes (34) are spaced apart by variable pitches (P1, P2, P3).
 14. The spindle according to claim 13, wherein the pitches of the holes (34) are decreasing from the rear end to the fore end of the perforated wall (11W).
 15. The spindle according to claim 8, wherein the holes (34) are arranged along at least one helicoidal path.
 16. The spindle according to claim 8, wherein in correspondence of some cross sections, the perforated wall (11W) comprises a same number of holes (34).
 17. The spindle according to claim 8, wherein in each cross section of the spindle (11), the perforated wall (11W) comprises an increasing number of the air-outlet holes (34).
 18. The spindle according to claim 8, wherein the holes (34) have a same diameter.
 19. The spindle according to claim 8, wherein the holes (34) are of different diameters.
 20. The spindle according to claim 8, wherein the perforated wall (11W) of the spindle (11) comprises a body of porous material.
 21. The spindle according to claim 8, wherein the perforated wall (11W) of the spindle (11) comprises a micro-perforated plate.
 22. The spindle according to claim 8, wherein the perforated wall (11W) of the spindle (11) comprises a fine meshed net.
 23. An apparatus for winding and removal of coreless rolls (12) of an extensible or stretch plastic film (10) for packaging, comprising:
 at least one winding spindle (11), rotatably supported by a movable arm;

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one film feeding unit (13, 15), and one film drawing unit (20) for winding up the extensible or stretch plastic film (10) for packaging onto the spindle (11),
 said spindle (11) being disengageably to the coreless roll (12) for the removal;
 wherein the spindle (11) comprises:
 an elongated body defining an air chamber (11P) having a perforated peripheral wall (11W), the perforated peripheral wall (11W) having perforations (34) configured such that during removal of the roll (12), an air flow is controllable by changing an airflow rate emerging from the perforations (34); and
 means for selectively connecting said air chamber (11P) of the spindle (11) to a pressurised air source (27).
 24. The apparatus according to claim 23, wherein said means for the selective connection of the air chamber (11P) to the air source (27), comprises an hollow rotary joint (22, 23) for rotatably supporting the spindle (11), and valve means (29) for selective connection of the rotary joint (22, 23) to the air source (27).
 25. The apparatus according to claim 23, further comprising:
 first and second film winding spindles (11A, 11B) rotatably supported by a turntable arm (37);
 control means (39, 40) to rotate said arm (37); and
 conduit and valve means (38A, 38B; 29A, 29B) for selective connection of the air chamber (11P) of each spindle (11A, 11B), to the air source (27).
 26. The apparatus as claimed in claim 25, wherein said valve means (29A, 29B) comprises a pressure adjusting valve device.
 27. The apparatus as claimed in claim 25, wherein said valve means (29A, 29B), comprises a flow-rate adjusting valve device.
 28. An apparatus for winding and removal of coreless rolls (12) of an extensible or stretch plastic film (10) for packaging, comprising:
 at least one mandrel, the mandrel having perforations configured such that during removal of the roll (12), an air flow is controllable by changing an air-flow rate emerging from perforations), from a rear end to a fore end of the mandrel;
 a rotary joint (23) on the mandrel;
 a valve (29) connected to the mandrel; and
 a pressure regulator (30) connected to the valve (29), the pressure regulator being configured to change at least one of a flow rate or pressure of pressurized air to cause radial expansion and compaction of internal turns of the rolls.

* * * * *

[54] **METHOD FOR IMPROVING FRICTIONAL SURFACE IN CYLINDERS OR SLEEVES OF INTERNAL COMBUSTION ENGINES**

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[21] Appl. No.: **755,602**

[22] Filed: **Dec. 29, 1976**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 559,649, March 18, 1975, abandoned.

[51] Int. Cl.² **C25D 7/04; C25D 5/36; C25D 5/50; C25D 5/52**

[52] U.S. Cl. **204/25; 204/29; 204/35 R; 204/36; 204/37 R; 51/323**

[58] Field of Search **204/25, 29, 35 R, 36, 204/37 R; 51/323**

[56]

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Assistant Examiner—William T. Leader

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[57]

ABSTRACT

Method of preparing chromium plated surfaces of improved anti-friction property, by machining the base material to a smooth finish, chromium plating the machined surface of the base material, heating the chromium plated surface at 150°–325° C for 1–3 hours, cooling and honing the surface, and lapping the surface with an abrasive to a surface finish such that the roughness of the surface measures 25–50 micro-inches center line average.

10 Claims, 9 Drawing Figures

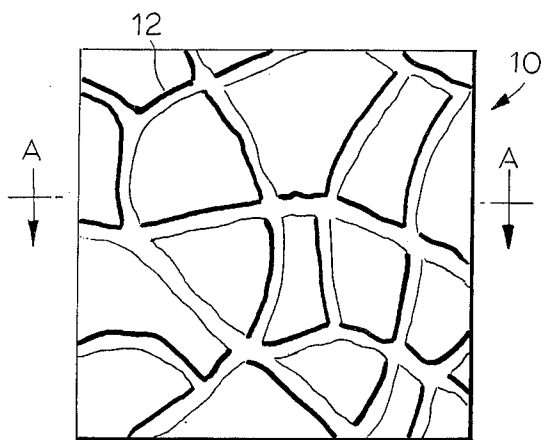


FIG. 1

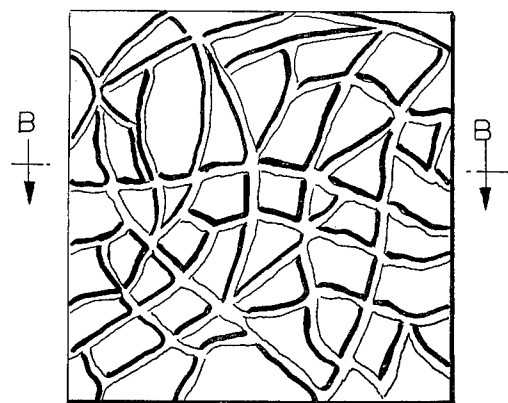


FIG. 3

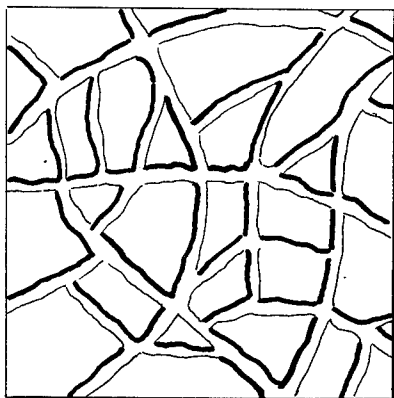


FIG. 2

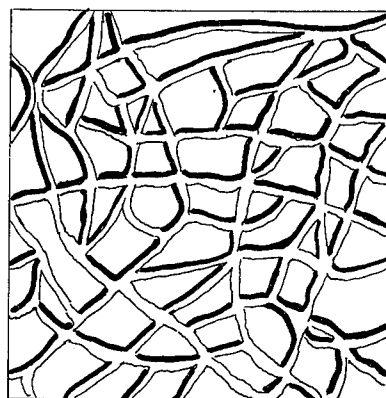


FIG. 4

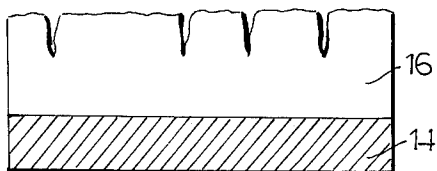


FIG. 5

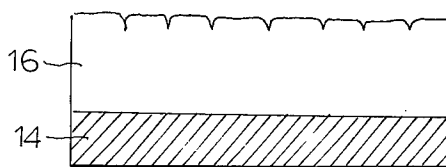


FIG. 6

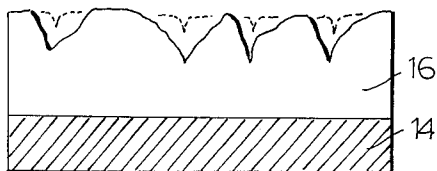


FIG. 7

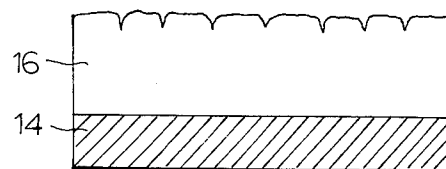


FIG. 8

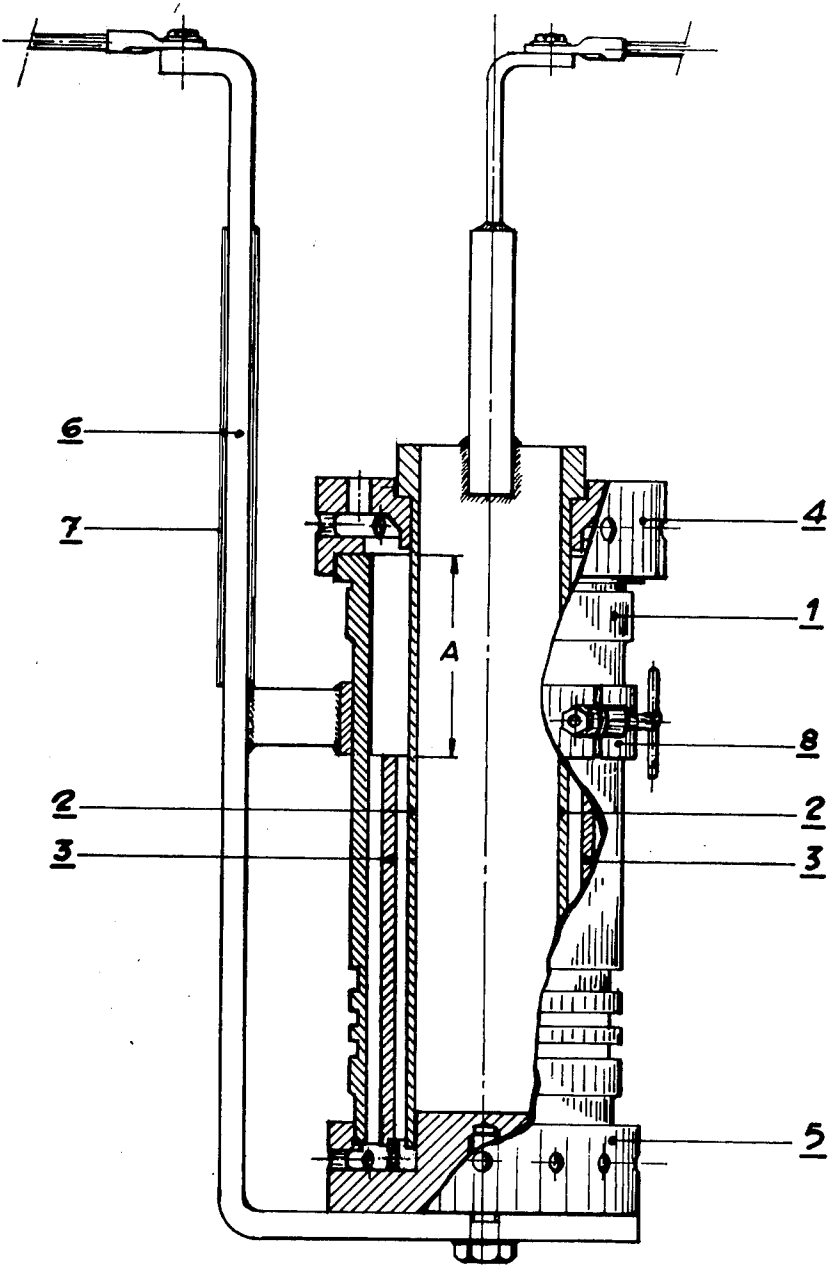


FIG. 9

METHOD FOR IMPROVING FRICTIONAL SURFACE IN CYLINDERS OR SLEEVES OF INTERNAL COMBUSTION ENGINES

This application is a continuation-in-part of Ser. No. 559,649, filed Mar. 18, 1975, now abandoned.

This invention relates to a new method for obtaining chromed surfaces with good anti-frictional properties. More particularly it relates to a method for improving the sliding surface of a chromium coating on a sleeve or cylinder, for example those used in reciprocating or rotary internal combustion engines, on which surface a piston, rotor or the like is slidable. The improvement gives a more rapid bedding-in of the said components during the running-in period and a greater endurance during service.

It is known that cylinders and engine sleeves which have a chromed surface have an improved resistance to wear and corrosion. It is also known that a smooth hard chromium plating per se does not provide a sliding surface most suitable for this purpose because of difficulty in its retaining lubricants. For this reason various kinds of chromium plated surfaces have been developed which have grooves, channels, pockets or pores in which the lubricant can be retained.

Chromed surfaces of this nature can be obtained by various known processes, consisting of etching the chromium coating by chemical or electrochemical methods, or by treating the iron or steel base material before chromium plating by scoring or engraving it, using mechanical means, as described in British Pat. Nos. 583,872 and 992,743.

Both processes have their disadvantages when being used in mass production. In the method of etching the chromium coating after plating by chemical and/or electrochemical methods, control is difficult during the operation, since the amount of etching depends not only on the conditions under which these methods are carried out, but also on the conditions of the chromium plating. In the case of the methods consisting of treating the base material before chromium plating by mechanical means, which may involve grooving the base material by turning it in a lathe, marking by knurling, sand blasting or scratching by lapping with loose abrasive grit or the like, the final surface, following chromium plating, exhibits the irregularities created by the grooving, knurling, sand blasting or scratching. The sleeve or cylinder must, after the chromium plating operation, be geometrically correct with the exact final dimensions required by the finished product, since any additional mechanical operation after the chromium plating will partially or completely remove the pattern previously formed on the surface. More particularly, when a small thickness, say below 0.002 inch, of chromium is plated onto a surface the plating follows very closely the contours of the original surface. If a particular surface is required after plating, this particular surface is prepared on the original surface so that by plating to the correct tolerance in thickness, the desired surface will be obtained. However, if the plating is not to the correct thickness and a mechanical machining operation has to be carried out, the finished surface, to the correct tolerance, will not look or be correct.

Another disadvantage of these processes is that the quality of surface finish of the chromium coating is very much dependent on the conditions of the chromium plating itself, which in general cannot remain ideal dur-

ing production runs, and therefore it is not always possible to obtain the best conditions necessary for the initial running-in and the rapid bedding-in of the piston and sleeve.

It is appreciated that the method of lapping with loose abrasive grit on the iron or steel base material should result in a chromium plated surface which has a suitable quality of surface finish and may avoid the problems set out in the previous paragraph, but in practice it does not succeed in this way. For example, by lapping a surface of iron or steel base material using an abrasive having a base of powdered silicon carbide of grain size 220 suspended in a mineral oil, and using an expanding mandrel in which the laps are of cast iron and operate by pressing against the walls of the cylinder, there results a lapped surface scored with scratches that cross one another, whose roughness, measured by the "Center line average" or "Arithmetic average" method rates between 45 and 75 micro-inches. This surface, after chromium plating, will read between 45 and 85 micro-inches, and this range is too wide. To achieve a smaller range is difficult in mass production because the abrasive grit breaks during use.

Another important point is that for a good antifrictional and sliding surface it is not only necessary to take into account the surface finish itself, but it is also necessary to take into account the actual bearing surface, that is to say the portion of the surface which stands out in the form of peaks with respect to the complete surface formed by peaks and valleys. In the methods considered above, it is practically impossible to control the bearing surface between the limits which are necessary in the motor industry today.

It is the object of this invention to provide mass production methods for producing a chromium plated surface with a smaller range of CLA (Center Line Average) readings than those which have previously been mentioned, and which also gives the required bearing surface.

It is another object of the present invention to provide a method of producing a chromium plated anti-friction surface having the required thickness on a cylinder or sleeve for use in an internal combustion engine.

These objects are achieved by a method which comprises machining (by fine turning or grinding) the base material to a smooth finish of up to 10 micro-inches CLA, chromium plating the machined surface and then heat treating the chromium plated surface at a temperature between 150° and 325° C for 1 to 3 hours, cooling the chromium plated surface in air to room temperature, honing the cooled surface (e.g. by conventional honing machines using abrasive stones) to remove any irregularities from the chromium plating, and lapping or blasting the honed surface by conventional methods with abrasive grit (e.g. silicon carbide or aluminum oxide) to result in a specified surface finish between the limits of 25 and 50 micro-inches CLA. This method is equally applicable whether the base material is iron, steel, aluminum, copper or any other metal.

The present invention can be more easily understood by reference to the drawings, wherein:

FIG. 1 is an enlarged view of a chromium coated surface;

FIGS. 2-4 are variations of the surface of FIG. 1, resulting from heat-treating the surface of FIG. 1 under varying conditions;

FIG. 5 is a cross-sectional view of FIG. 1 taken along the line A-A;

FIG. 6 is a cross-sectional view of FIG. 3 taken along line B—B;

FIG. 7 discloses the variation in rugosity of the surface of FIG. 1 before and after lapping; and

FIG. 8 is a cross-sectional view of FIG. 3 along B—B after the surface of FIG. 3 has been lapped.

FIG. 9 shows an apparatus for electrochemically attacking selected areas of a chromed surface to increase the porosity of those areas.

It is known that the surface of a coating of hard chromium is covered with a network of microfissures. The action of lapping with abrasive grit is that the grit works on the sharp edges of the microfissures by fragmenting and tearing. The continuous action of lapping gives a final surface finish which is microscopically rough and irregular.

If the network of microfissures is open, as illustrated in FIG. 1 of the accompanying drawings, wherein 10 is a chromium plated surface obtained by a standard plating process (which has then been subjected to a weak acid etch for the purpose of allowing the microfissures to be seen more clearly upon microscopic examination), and 12 is the network of microfissures, the action of the abrasive will be more violent than if the network is closed, as illustrated in FIG. 3. In this way the final roughness of the lapped chromed surface will depend on the size of the network of microfissures and not on the grain size of the abrasive. Consequently, to obtain a certain roughness it is necessary to control the size of the network of microfissures.

The nature of the network of microfissures fundamentally depends on the conditions of the chromium plating process, but also can be modified or altered by thermal treatment as described in British Pat. No. 601,065. The chromium plated surfaces which are to be subjected to treatment in accordance with the present invention can be obtained by following the plating process (and, optionally, thermal treatment) described in this British Patent.

A chromium plated surface produced under known conditions will have a network of microfissures similar to that shown in FIG. 1, when viewed at a magnification of 270 times, after it has been subjected to a weak acid etch to facilitate microscopic examination as indicated above. FIG. 5, wherein 14 is the base material, e.g. iron or steel, and 16 is the chromium coating, shows a section viewed at A—A in FIG. 1. This same section is shown in FIG. 7 by the dotted line, and the continuous line in FIG. 7 shows the effect after lapping with abrasive grit.

FIG. 3 shows the same chromium plated surface as FIG. 1 but after modification by heat treatment at a temperature of 250° C for 2 hours, and the microfissures now appear thinner and more numerous.

In FIG. 6, there is shown a cross section at B—B of FIG. 3, and FIG. 8 shows the same cross section after lapping with abrasive grit.

FIG. 2 shows the same chromium plated surface as in FIG. 1 but after it has been subjected to heat treatment at 150° C for 2 hours. FIG. 4 shows the same chromium plated surface as in FIG. 1 after heat treatment at a temperature of 325° C for 2 hours.

The invention is also concerned with controlled variations in the chromium coating after the blasting or lapping with abrasive grit.

A chromium surface obtained and treated similarly to that previously described can offer an adequate superficial surface but not the most convenient bearing surface,

since the profile of the coating can be extremely aggressive, i.e. abrasive, and give rise to undesirable premature wear. To overcome this, a final mechanical operation of smoothing out the peaks is carried out using an expanding mandrel, in which the parts of the mandrel that come into contact with the chromium surface are under pressure of 10–60 p.s.i. and are interspaced with a very fine abrasive mixed with an elastic carrier, such as CRA-TEX (Registered Trademark) rubberized abrasives. The mandrel is rotated at 30–100 r.p.m. and reciprocated at 40–60 strokes per minute at the same time with a stroke length equal to the length of the workpiece or shorter, using as lubricant a paraffinic oil with phosphor and chlorine based additives. An example of such a lubricant is FRAPOL C.P. from Houghton Co., USA, which has a viscosity of 1.3–1.5 degrees E. and a flash point of approximately 120° C. This operation of smoothing off the peaks means removing fractions of a thousandth of a millimeter which of course does not represent any appreciable change in the size of the finished component but improves the bearing area and surface, i.e. polishes the surface, without modifying the structure of the porous chromium plating perviously achieved.

By this method, the surface of a cylinder or sleeve for any internal combustion engine which is subject to contact or rubbing by a piston or the like will acquire a high resistance to wear and at the same time, acquire the necessary lubrication retention properties in the porous surface. The superficial roughness of the chromium surface can be varied and controlled, as can the proportion of the pores (valleys) and the smooth surface (peaks), as its use requires. The cylinders and sleeves obtained in accordance with the method of the present invention are suitable for application to any internal combustion engine, both reciprocating and rotary, independent of the nature of the base material of the sleeve or cylinder, as long as it can be chromium plated.

In certain cases in the application of chromium plating on sleeves or cylinders, there is required a greater degree of porosity in certain areas only, for the purpose of achieving more intensified lubrication in those areas. An example of this is the case of a supercharged four-stroke engine in which, as a consequence of the severe working conditions with high pressures, temperatures etc., it is difficult to obtain the correct lubrication of the upper part of the cylinder. A similar difficulty is experienced in a two-stroke engine but this area also extends around the exhaust ports. In these cases it is necessary to use a means of obtaining the correct lubrication pattern in these areas.

Increasing the porosity in the whole of the cylinder or sleeve to give the correct lubrication pattern in the areas mentioned above, would at the same time increase the consumption of lubricant to an unacceptable level overall and consequently create other problems and disadvantages. In fact it is necessary to increase the lubrication pattern only in the required areas, that is to say, produce an increase in the porosity level only in the required areas, maintaining the remainder with a reduced porosity level.

In such a cylinder, sleeve or rotor housing that requires this differing grade of porosity it is essential that the transition from one grade to another be gradual and not sudden. Therefore the increase in the porosity should be progressive. Nevertheless, it will be necessary to operate on the network of microfissures in such a

way as to produce two or more different networks in the same component.

To achieve this condition it is not practical to control the conditions of the plating, neither is it easy to control the thermal treatment in separate areas on one component. Therefore neither of these two variations offers the answer to this problem.

It has been proved that a practical solution can be obtained by a chemical or electrochemical attack, or a combination of both, on the area in which it is required to have a greater degree of porosity. Carrying out this operation prior to the lapping with abrasive grit produces a deepening of the channels of the network of microfissures. This operation can be controlled perfectly by limiting it to the chosen area, and its effect is to attack the treated area to the extent of the limits of said area, without going out of the area, resulting in a component with different networks of microfissures. In this condition, the grit lapping or blasting will produce areas of different roughness and porosity. There are many methods of attacking the selected areas. One such method involves the use of dilute hydrochloric acid, for example in concentrations of 10-30%. The component is dipped into the acid for a period of one-half to 3 minutes depending upon the amount of attack required. Another method is electrochemical, by attacking the selected areas cathodically or anodically, using an electrolytic acid solution such as oxalic acid, sulphuric acid or chromic acid, or an electrolytic alkaline solution such as hydroxides, in concentrations of 10-30%.

For example, the operation can be performed using the same apparatus as that used for the chromium plating, except that what was then cathode is now the anode.

Referring to FIG. 9, there is shown a central lead electrode 2 — which is the anode for plating and the cathode for etching — positioned at top and bottom by plastic material supports 4 and 5 respectively. Surrounding the electrode 2 is the cylinder liner 1 which is secured by means of a clamp 8 to an electrode in the form of a steel rack 6 which is also attached to the bottom support 5. The rack 6 has a plastic material protection sleeve 7 to prevent it from being plated. The lower part of the electrode 2, for etching operations only, is surrounded by a detachable plastic material (for example, polyvinyl chloride) tube 3 so that only the portion A of the cathode above the tube 3 will be active when the assembly is submitted to anodic attack, in this (etching) case with a current intensity of 10 to 15 amperes per sq. cm for 1 to 15 minutes. It is to be understood that the length of the plastic material tube 3 will depend upon the area of different porosity required on the cylinder line 1.

Lapping is done by using a conventional lapping machine with the laps rotating and reciprocating at the same time. The lapping medium is silicon carbide 180-220 grit size held in suspension in a liquid medium consisting of a fatty/mineral oil blend having a Redwood viscosity of 425-500 seconds at 20° C and an acid value of approximately 0.1. The proportions are 18 kg. of silicon carbide to 12 liters of the liquid medium.

The following working examples represent further detailed explanation of the invention, without limiting the invention thereto.

EXAMPLE 1

Cylinder liners used in a particular engine must be produced with an oil retentive bore of hard chrome and

a finished internal diameter of 4.000 to 4.001 inches with a constant surface finish reading of 25 to 50 micro-inches CLA. The method of producing this bore is as follows:

1. The bore is first internally ground on an internal grinder of a suitable size such as can be seen in any machine shop that carries out this type of work. The grinding wheel is of 280 grit size aluminum oxide, to give a surface finish of 10 micro-inches CLA maximum, at an internal diameter of 4.004 to 4.005 inches

2. The bore is then hard chromium plated to comply with U.S. Federal specification QQ-C-320A, to an internal diameter of 4.000 to 4.001 inches.

3. To adjust the depth of the microfissures in the chromium plating, the liner is placed in an oven and brought up to a temperature of 250° C where it remains for a period of 2 hours. The liner is then removed from the oven and allowed to cool in air down to room temperature.

4. The next operation is honing to remove any irregularities on the surface of the chromium. This is done on any conventional honing machine of a suitable size which can be fitted with an expanding mandrel. This expanding mandrel is of the taper cone type where the centre main shaft is tapered and operated by oil pressure. The tapered centre shaft is moved in a vertical direction and moves against the backs of the honing stone holders. As the two tapers, the centre shaft and the backs of the honing stone holders, are the same, the honing stones move out in a radial direction until contacting the liner bore. The honing stones used for this operation are of 240 grit size silicon carbide, operated with a pressure of 50 p.s.i. The mandrel is rotated at 70 r.p.m. and reciprocated at 50 strokes per minute.

5. Blasting of the bore is then carried out on a blasting machine manufactured by A.I. Crome Duro, S.A. of Bilbao, Spain, in which the grit, 180 to 220 grit size silicon carbide, is fed into a pressurised air stream and directed at the liner bore. At the same time, the liner is revolving at a speed of 100 r.p.m. and the time of this operation is 30 seconds. This blasting operation can be substituted by a lapping operation, where 180 to 220 silicon carbide grit is suspended in a fatty/mineral oil blend having a Redwood viscosity of 425 to 500 seconds at 20° C and an acid value of 0.1. Here, the laps, usually made from cast iron, are pressed against the liner bore with a constant spring pressure of 20 p.s.i. and the lapping medium allowed to circulate freely through the bore for a period of 2 minutes.

6. Finally, the bore of the liner is polished to remove the microscopic peaks of the hard chromium on a conventional type honing machine, similar to that described in step 4 above, but instead of using the 240 grit size stones, the machine is fitted with CRATEX rubber bonded abrasive honing sticks. A constant 50 p.s.i. pressure is applied and the mandrel is rotated at 50 r.p.m. and reciprocated at 50 strokes per minute for a period of 25 seconds.

EXAMPLE 2

Where a cylinder liner requires progressive porosity in the bore, an addition operation is carried out. This involves the use of the equipment as shown in FIG. 9, and this operation is carried out between steps 4 and 5 in Example 1. The liner is assembled in the jig as shown in FIG. 9 and the plastic tube positioned as required, so that the only portion of the bore surface which can be attacked is the portion that requires a porosity different

from that of the remainder of the liner bore. Instead of the central lead portion being used as an anode, as in the plating operation, the current is reversed and this lead portion then becomes the cathode. In this instance, the electrolyte is a 20% concentration of chromic acid in water. A current intensity of 10 amperes per square centimeter is applied for 12 minutes.

EXAMPLE 3

Instead of carrying out the additional operation of Example 2 to achieve progressive porosity in the bore, the portion of the liner for which increased porosity is desired can be immersed in a 20% aqueous solution of hydrochloric acid for 2 minutes. This operation is carried out between steps 4 and 5 of Example 1, after which the liner is washed with water to remove the acid.

I claim:

1. A method for preparing a chromium plated surface which comprises machining a metal base material to a smooth finish of up to 10 micro-inches CLA, chromium plating the machined surface, heat treating the chromium plated surface at a temperature between 150° and 325° C for 1 to 3 hours, cooling the heated surface in air, honing the cooled surface to remove irregularities from said surface, and lapping or blasting the honed surface with abrasive grit to obtain a surface finish between 25 and 50 micro-inches CLA.

2. A method according to claim 1, wherein the chromium plated surface is a chromium plated cylinder or sleeve suitable for use in an internal combustion engine.

3. A method according to claim 2, further comprising mechanically treating the lapped or blasted surface with an abrasive to polish said surface.

4. A method according to claim 3, wherein the mechanical treatment is carried out by means of an expanding mandrel in which the parts of the mandrel that come

into contact with the lapped or blasted surface are interspaced with an abrasive mixed with an elastic carrier, the lapped or blasted surface is lubricated during said mechanical treatment, and the mandrel is simultaneously rotated about its axis and subjected to a reciprocating movement.

5. A method according to claim 4, wherein the parts of the mandrel that come into contact with the lapped or blasted surface are under a pressure of 10 to 60 p.s.i., the rotation of the mandrel is at a rate of 30 to 100 r.p.m. and the reciprocating movement of the mandrel is at a rate of 40 to 60 strokes per minute.

6. A method according to claim 2, further comprising chemically treating a portion of the honed surface, prior to lapping or blasting, with hydrochloric acid having a concentration of 10 to 30%, thus providing said treated portion with a greater porosity than the untreated portion after carrying out the lapping or blasting.

7. A method according to claim 2, further comprising electrochemically treating a portion of the honed surface, prior to lapping or blasting, by subjecting said portion to cathodic or anodic attack in an electrolyte selected from the group consisting of oxalic acid, sulfuric acid, chromic acid and an alkaline hydroxide, the concentration of said electrolyte being 10 to 30%, thus providing said treated portion with a greater porosity than the untreated portion after carrying out lapping or blasting.

8. A method according to claim 7, wherein the electrochemical treatment is carried out at a current intensity of 10 to 15 amperes per sq. cm. for 1 to 15 minutes.

9. A method according to claim 2, wherein the abrasive grit is silicon carbide or aluminum oxide.

10. A method according to claim 1, wherein the metal base material is iron, steel, aluminum or copper.

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Search history

Search 1: TAC=(balanc* and (pole or post or tube or club) not (golf or lacrosse or basket) and game) (Results 345)

Search 2: TAC=(balanc* and (post or pole) and weight* not (golf or lacrosse)) (Results 4751)

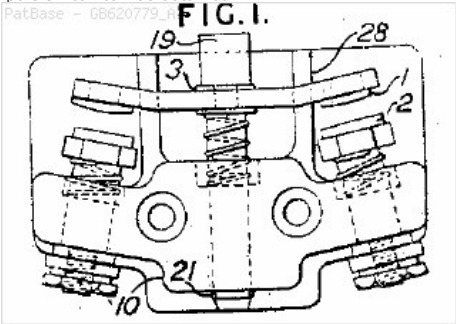
Search 3: TAC=(hard chrome and sand blasting) (Results 8)

Search 4: TAC=(spindle and hard chrome and sand blasting) (Results 1)

Title: Improvements in electrical switches having wiping contacts

Abstract: Source: GB620779A 620,779. Switch contacts. BRITISH INSULATED CALLENDER'S CABLES, Ltd., SWEETLAND. A. G.. and TYLER, L. H. G. Oct. 31, 1946, No. 32392. [Class 38(v)] A rectilinearly moving, spring biased, contact-carrier 3 is adapted to bridge spring-loaded plunger' contacts 2, inclined inwardly or outwardly at an angle less than 90 degrees to the path of the contactbridges whereby limited wiping of contact surfaces 1, 2 takes place after engagement. The contact members slide in passages in an insulating block 10 formed with ribs 28 to prevent the carrier 3 from rotating. The fixed contact surface may be plane and the movable surfaces part-spherical or cylindrical. The spindle carries an operating bush 19 and limit-stop 21. By making the carrier 3 of insulating material, a two-pole switch can be obtained.

Classifications:
International (IPC 8-9): A61C13/08 B29C43/00 H01H1/20 (Advanced/Invention); H01H1/12 (Core/Invention)
International (IPC 1-7): A61C13/08 H01H19/60
CPC: H01H1/2083 A61C13/08 B29C43/00
European: A61C13/08 B29C43/00 H01H1/20G



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