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Industria y Comercio

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Delegatura de Propiedad Industrial

División de Nuevas Creaciones

PCT

SOLICITUD

PATENTE DE INVENCION

21. **EXPEDIENTE No.** 04-39943

54. **TITULO** Paquete de Herramientas Internamente enfriado

51. **CLASIFICACION INTERNACIONAL** B21D 22/28

71. **SOLICITANTE** Sequa Can Machinery Inc

DOMICILIO New Jersey, Estados Unidos

74. **APODERADO** Dilia Maria Rodriguez D'Aleman

22. **BOGOTA, D.C.,** Abril 30, 2004

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1/83

PETITORIO

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Industria y Comercio
SUPERINTENDENCIA

FORMULARIO ÚNICO DE SOLICITUD DE PATENTE
PCT
ENTRADA EN FASE NACIONAL

1) SOLICITUD DE:

☒ Patente de invención ☐ Patente de Modelo de Utilidad

☐ Capitulo I. ☒ Capitulo II.

2) SOLICITANTE (71)	**Nombre: Sequa Can Machinery Inc.** **Dirección: 401 Central Avenue, East Rutherford NJ 07073, Estados Unidos** **Nacionalidad o domicilio: New Jersey, Estados Unidos** **Lugar de constitución: New Jersey, Estados Unidos**	**IDENTIFICACIÓN** **C.C.** ☐ **NIT:** ☐ **C.E.** ☐ **OTRO** ☐ **Cual** _____ **NÚMERO** _____
	Teléfono: **Fax:** **E. Mail:**	
3) REPRESENTANTE O APODERADO	**Nombre:** DILIA MARIA RODRIGUEZ D´ALEMAN **Dirección:** Carrera 11 N°. 93-43 Of. 404 Santafé de Bogotá D.C. **Teléfono:** 6350835 **Fax:** 6350824 **E. Mail:** clarkemodet@clarkemodet.com.co	**IDENTIFICACIÓN** **C.C.** ☒ **NIT:** ☐ **C.E.** ☐ **OTRO** ☐ **NÚMERO:** 41.654.882 **TP:** 20824 CSJ
4) INVENTOR (ES) **(72)**	**Nombre: BLUE, Rodney** **Dirección: 17421 Hillgate Lane, Huntington Beach, CA 92649, Estados Unidos** **Nacionalidad o Domicilio: Estadounidense**	

5) PCT (86)

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6)Título (54) PAQUETE DE HERRAMIENTAS INTERNAMENTE ENFRIADO

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9) C mprobante de pago N°. 04-20,331 Fecha: Marzo 11, 2004

Instrucciones para el diligenciamiento del presente formulario. Ver reverso de esta pagina

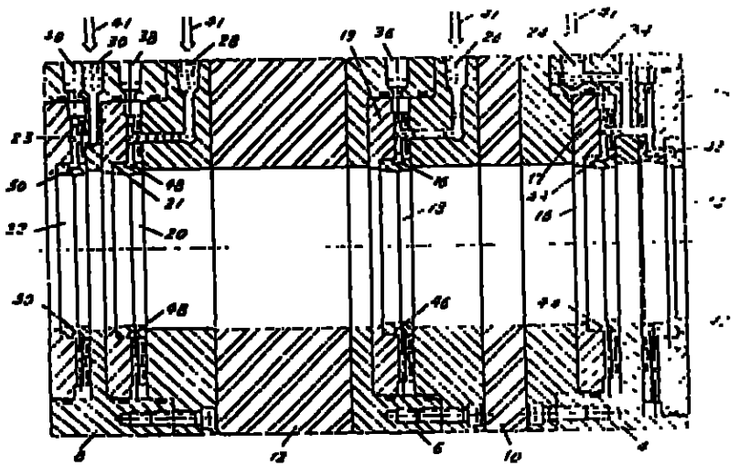
2

10) ANEXOS

- ☒ Comprobante de pago de la tasa de presentación de la solicitud
- ☐ Comprobante de pago por reivindicación de prioridad
- ☐ Documento que acredita la existencia y representación legal cuando el solicitante sea persona Jurídica
- ☐ Poderes, si fuera el caso
- ☐ Documento de cesión del inventor al solicitante o a su causante
- ☐ Declaraciones
- ☒ Copia de la solicitud Internacional. (Resumen, descripción, reivindicación, Dibujos).
- ☒ Traducción de la solicitud internacional al castellano. (Resumen, descripción, reivindicación, Dibujos)
- ☒ Copia del examen preliminar efectuado por la IPEA
- ☐ De ser el caso, copia del contrato de acceso
- ☐ De ser el caso, documento que acredite la licencia o autorización de uso de conocimientos tradicionales de las comunidades indígenas
- ☐ De ser el caso, certificado de depósito del material biológico
- ☒ Arte final 12 x 12 y 6 x 6 cm
- ☐ De ser el caso, información sobre otras solicitudes de patente o títulos obtenidos en el extranjero por el mismo titular o su causante, relacionados parcial o totalmente con la invención de esta solicitud.
- ☐ Otros

1, Reporte internacional de búsqueda
2. Notificación de la transmisión del examen preliminar
3. Solicitud de patente PCT
4. Notificación de oficinas designada

11) FIGURA CARACTERÍSTICA:



12) Solicitud concesión de la patente,

NOMBRE: DILIA RODRÍGUEZ D´ALEMAN

FIRMA:

C.C. 41.654.882 de Bogotá TP 20824 CSJ

Instrucciones para el diligenciamiento del presente formulario. Ver reverso de esta pagina

3

SUPERINDUSTRIA Y COMERCIO
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RECIBO OFICIAL DE CAJA : 04 - 20,331
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$$$$$ C O N S I G N A C I O N $$$$$

DEPOSITANTE	TIPO PAGO	BANCO	CUENTA	No. PAGO	FECHA PGO	Vr. PAGO
CLARKE MODET Y CO. COLOMBIA	CONSIGNACION	BANCO POPULAR	050-00110-6	15584526	11/03/2004	1,585,000.00

$$$$$ C O N C E P T O $$$$$

CANT.	RENTISTICO	CONCEPTO	TOTAL CONCEPTO
1	50003-01-01 SOLICITUDES	1 TRAMITES DE SOL. DE PATENTE DE IN	422,000.00
		TOTAL : $	422,000.00

SON: CUATROCIENTOS VEINTIDOS MIL PESOS

RESPONSABLE : _____

RECIBO DE CAJA APLICADO AL EXPEDIENTE No._____

P0054

PAQUETE DE HERRAMIENTAS INTERNAMENTE ENFRIADO

CAMPO DE LA INVENCION

La presente invención se refiere generalmente a ensambles de paquete de herramientas para manufacturar latas que tienen dados de estirado y planchado para reconformar una copa dentro de un cuerpo de recipiente, y muy específicamente a dicho ensamble de paquete de herramientas que es enfriado internamente.

ANTECEDENTES DE LA INVENCION

Los dados de conformación de latas se utilizan para formar cuerpos de latas o recipientes metálicos. La descripción en la presente invención está particularmente relacionada con la formación de recipientes metálicos de dos piezas. Una copa metálica hueca es impulsada dentro de los dados por medio de un troquel para formar el cuerpo de la lata. Generalmente, los dados son provistos en paquetes de herramientas en donde, una serie de extremidades de dados progresivamente más angostas están colocadas para estirar y planchar

progresivamente la copa metálica dentro de un recipiente de la forma y grosor deseado. Un ejemplo de un conjunto convencional de dados de estirado y planchado en un paquete de herramientas se muestra en la Patente EUA número 4,173,882 expedida a Lee, Jr. el 13 de noviembre de 1979, cuya descripción detallada se incorpora en la presente invención por referencia. Cada dado está incluido en un módulo de dado respectivo.

Los paquetes de herramientas de dado que se utilizan en la manufactura de latas comerciales convencionalmente utilizan refrigerantes que se aplican al exterior del paquete de dados para mantener o reducir las temperaturas operativas de los dados. Sin embargo, en ciertas aplicaciones de formación de latas, es conveniente evitar el uso de fluidos refrigerantes externos. Por ejemplo, los refrigerantes externos pueden contaminar las superficies del recipiente, lo que requiere procesos de limpieza posteriores a la formación que son costosos y que pueden resultar ambientalmente indeseables.

SUMARIO DE LA INVENCION

La presente invención supera las desventajas de la técnica anterior, tal como aquellas que se observaron anteriormente, proveyendo un ensamble de paquete de herramientas de dados modulares internamente enfriados que no requiere el uso de refrigerante aplicado al exterior del paquete de herramientas. En lugar de eso, la temperatura del paquete de herramientas es controlada forzando un fluido, particularmente un líquido, con las propiedades de transferencia de calor deseables alrededor de las extremidades del dado a través de cavidades de dado especiales y el calor se transfiere por conducción. La temperatura exterior de cada extremidad de dado se puede monitorear continuamente en el módulo de dado respectivo, y la temperatura del medio de fluido se puede ajustar automáticamente para mantener temperaturas de dado aceptables.

El medio de fluido es suministrado al paquete de herramientas por medio de una unidad de control de temperatura, y se administra a los módulos de dado a través de una serie de tuberías, accesorios, y mangueras. El medio de fluido fluye a

través de una abertura en cada módulo y de su dado, en donde el fluido es dirigido circunferencialmente alrededor de la superficie exterior de las extremidades de dado. Preferentemente, las aberturas múltiples en cada dado son circunferencialmente simétricas, con puertos de entrada y salida que alternan para distribuir el medio de fluido uniformemente alrededor de cada extremidad de dado. El diseño múltiple de entrada y salida de fluido con aberturas simétricas asegura que todas las temperaturas de las extremidades de dado permanezcan sustancialmente uniformes, y también reduce al mínimo los gradientes de temperatura alrededor del dado. En una modalidad preferida, cuatro puertos de entrada y cuatro puertos de salida son provistos con puertos de entrada y salida que alternan a 45° de distancia entre sí. Pero el número y colocaciones de los puertos se puede alterar para satisfacer los requerimientos de control de temperatura específicos.

Otras características y ventajas de la presente invención serán aparentes a partir de la siguiente descripción detallada que se refiere a las figuras anexas.

BREVE DESCRIPCION DE LAS FIGURAS

La figura 1 es una sección transversal axial de un ensamble de paquete de herramientas modular internamente enfriado de acuerdo con la presente invención.

La figura 2 es la sección transversal axial de la figura 1 que muestra las trayectorias del medio de refrigerante que fluyen al interior del ensamble.

La figura 3 es la sección transversal axial de la figura 1 que muestra las trayectorias del medio de refrigerante que fluyen fuera del ensamble.

La figura 4 es una sección transversal de un dado de estirado y planchado que muestra las trayectorias del refrigerante en el dado de acuerdo con la presente invención.

La figura 5 es una vista cortada del dado de estirado y planchado que se toma a lo largo de la línea V-V de la figura 4.

DESCRIPCION DE UNA MODALIDAD PREFERIDA

La figura 1 muestra un ensamble de paquete

de herramientas de dado modular internamente enfriado 2 de acuerdo con la presente invención en una sección transversal axial. El ensamble incluye tres módulos de dado anulares 4, 6 y 8 en secuencia, con módulos adyacentes separados mediante separadores 10 y 12. El primer módulo de dado 4 incluye una extremidad de dado de reembutición anular 14 seguida de una primera extremidad de dado de planchado anular 16. El siguiente módulo de dado 6 incluye una segunda extremidad de dado de planchado anular 18. El módulo de dado final 8 incluye extremidades de dado anulares 20 y 22. Las extremidades de dado 14, 16, 18, 20 y 22 se sostienen en las cajas de dado 15, 17, 19, 21 y 23, respectivamente.

Refiriéndose también a las figuras 2-5, cada uno de los módulos de dado 4, 6 y 8 tiene por lo menos un puerto de entrada y por lo menos un puerto de salida para el medio refrigerante. Cuando se utilizan múltiples puertos de entrada y de salida, preferentemente los puertos están colocados alternativa y simétricamente alrededor de cada módulo de dado.

Refiriéndose muy específicamente a la figura 2, el primer módulo de dado 4 es provisto

con un puerto de entrada 24, el segundo módulo 6 es provisto con un puerto de entrada 26, y el tercer módulo 8 tiene puertos de entrada 28 y 30. Similarmente, como se muestra en la figura 3, el módulo de dado 4 es provisto con un puerto de salida 34, el módulo 6 es provisto con un puerto de salida 36 y el módulo 8 tiene puertos de salida 38 y 40, desde los cuales el medio refrigerante sale del ensamble de paquete de herramientas.

El medio de refrigerante provisto por una unidad de control de temperatura convencional 39 fluye a través de los conductos 43 (figura 1) dentro de los módulos de dado a través de los puertos de entrada, tal como se muestra mediante las flechas direccionales 41 de la figura 2. Los pasos maquinados dentro de cada módulo de dado y a través de las cajas dirigen el medio refrigerante a los canales 42, 44, 46, 48 y 50 formados en las paredes exteriores de las extremidades de dado 14, 16, 18, 20 y 22 respectivamente.

La unidad de control de temperatura 39 puede controlar tanto la velocidad de flujo para cada conducto 43 y puerto de entrada en 41 como la temperatura respectiva en cada conducto y puerto de entrada, independientemente de los otros conductos

y puertos de entrada para dar cabida y controlar las temperaturas en los diversos módulos de dado, debido a que cada módulo puede estar sujeto a una carga de calor respectiva diferente. Después de circular parcial y circunferencialmente alrededor de cada dado, el medio refrigerante fluye fuera de los módulos de dado, tal como se muestra mediante las flechas direccionales 43 de la figura 3.

Por lo tanto, el medio refrigerante fluye a través de los canales en contacto directo con una superficie radialmente exterior de cada una de las extremidades de dado, extrayendo el calor que es generado en las extremidades de dado durante el estirado y planchado de la lata. Generalmente, el medio refrigerante que pasa alrededor de las extremidades de dado absorbe el calor y enfría la extremidad de dado para mantener una temperatura deseada en cada extremidad de dado. El fluido también se puede calentar para elevar la temperatura de las extremidades de dado, por ejemplo, en el arranque de la máquina. Esto puede ser deseable para reducir al mínimo los efectos de la expansión térmica y mejorar los procesos de estirado, planchado y desmonte de la lata.

Refiriéndose a las figuras 4 y 5, la

extremidad de dado 16 y la caja de dado 17 se muestran para ilustrar las entradas y salidas simétricamente separadas para proveer medios refrigerantes a la extremidad de dado 16. El medio refrigerante ingresa a las entradas de caja 52, 54, 56 y 58, fluye radialmente hacia dentro y a través de la caja 17, y circunferencialmente a lo largo del canal 44 formado alrededor de un cuarto de la circunferencia exterior del dado 17. El medio refrigerante sale del módulo de dado a través de las salidas 60, 62, 64 y 66. Los obturadores 68, 70, 72 y 74 cierran los extremos exteriores maquinados de las entradas 52, 54, 56 y 58, respectivamente. Sólo se ilustra un paso de medio refrigerante de la entrada 52 circunferencialmente en ambas direcciones para las salidas 60, 66. Las otras entradas y salidas para ese módulo de dado están dispuestas de la misma manera. Como resultado, una entrada y la salida adyacente están a 45° de separación entre sí. Las extremidades de dado 14, 18, 20 y 22 son enfriadas por una disposición similar de entradas y salidas simétricamente separadas.

Convenientemente, la separación simétrica de las entradas y salidas de caja proveen un

enfriamiento uniforme de las extremidades de dado, asegurando así que las temperaturas de las extremidades de dado permanezcan uniformes, y reduciendo al mínimo los gradientes de temperatura circunferenciales. La temperatura exterior de cada extremidad de dado se puede monitorear, ya sea mediante termómetros de medición de temperatura en cada módulo o mediante el monitoreo de la temperatura del medio refrigerante que sale, y se pueden hacer los ajustes de temperatura según sea necesario.

Aunque la presente invención ha sido descrita en relación con una modalidad particular de la misma, para aquellos expertos en la técnica se pueden volver aparentes muchas otras variaciones y modificaciones así como otros usos. Por lo tanto, se prefiere que la presente invención esté limitada no por la descripción específica de la misma, sino únicamente por las reivindicaciones anexas.

NOVEDAD DE LA INVENCION

Habiendo descrito el presente invento, se considera como una novedad y, por lo tanto, se reclama como prioridad lo contenido en las siguientes:

REIVINDICACIONES

1.- Un módulo de dado para estirar y planchar un objeto, el módulo comprende: una extremidad de dado que tiene una superficie interior que define un orificio que recibe un objeto que tiene una periferia, la superficie interior de la extremidad de dado está configurada para recibir el objeto a través del orificio que recibe el objeto para uno de estirar y planchar el objeto, la extremidad de dado además incluye una pluralidad de trayectorias de fluido completamente encerradas dentro de la extremidad de dado y colocadas adyacentes a las porciones respectivas de la periferia del orificio que recibe el objeto; y una caja que rodea la extremidad de dado, la caja incluye una pluralidad de entradas simétricamente separadas alrededor de la caja, las entradas están

configuradas para recibir un medio de refrigerante y para suministrar el medio refrigerante a trayectorias de fluido respectivas de la extremidad de dado, la caja además incluye una pluralidad de salidas, por lo menos una de las salidas está asignada a cada una de las trayectorias de fluido, las salidas están configuradas para permitir que el medio de refrigerante fluya fuera de la caja desde las trayectorias de fluido de la extremidad de dado; en donde las trayectorias de fluido están configuradas para evitar que el medio refrigerante entre en contacto con la superficie interior de la extremidad de dado, y las entradas simétricamente separadas permiten que el medio de refrigerante enfríe de manera uniforme la extremidad de dado.

2.- El módulo de dado de conformidad con la reivindicación 1, caracterizado porque la periferia del orificio está cilíndricamente configurada, y la pluralidad de las trayectorias de fluido están colocadas alrededor de la periferia cilíndricamente configurada del orificio que recibe el objeto.

3.- El módulo de dado de conformidad con la reivindicación 2, caracterizado porque una de las salidas está asignada a cada trayectoria de fluido, y cada una de las trayectorias de fluido está

dispuesta adyacente a porciones respectivas de la periferia cilíndricamente configurada del orificio que recibe el objeto.

4.- El módulo de dado de conformidad con la reivindicación 1, caracterizado porque la pluralidad de salidas está colocada simétricamente alrededor de la caja.

5.- Un ensamble de dado de conformación de latas, que comprende: una pluralidad de módulos de dado colocados de una manera lineal para permitir que un troquel pase a través de los módulos de dado respectivos, cada uno de los módulos incluye una extremidad de dado que tiene una superficie interior que define un orificio que recibe un objeto que tiene una periferia, la superficie interior de la extremidad de dado está configurada para recibir un objeto a través del orificio que recibe un objeto para uno de estirar y planchar el objeto, la extremidad de dado además incluye una pluralidad de trayectorias de fluido totalmente encerradas dentro de la extremidad de dado y colocadas adyacentes a porciones respectivas de la periferia del orificio que recibe el objeto; y una caja que rodea la extremidad de dado, la caja incluye una pluralidad de entradas simétricamente

separadas alrededor de la caja, las entradas están configuradas para recibir un medio de refrigerante y para suministrar el medio refrigerante a las trayectorias de fluido respectivas de la extremidad de dado, la caja además incluye una pluralidad de salidas, por lo menos una de las salidas está asignada a cada una de las trayectorias de fluido, las salidas están configuradas para permitir que el medio de refrigerante fluya fuera de la caja desde las trayectorias de fluido de la extremidad de dado; en donde las trayectorias de fluido están configuradas para evitar que el medio refrigerante entre en contacto con la superficie interior de la extremidad de dado, y las entradas simétricamente separadas permiten que el medio de refrigerante enfríe de manera uniforme la extremidad de dado.

6.- El ensamble de dado de conformación de latas de conformidad con la reivindicación 5, caracterizado porque la periferia del orificio está cilíndricamente configurada, y la pluralidad de las trayectorias de fluido están colocadas alrededor de la periferia cilíndricamente configurada del orificio que recibe el objeto.

7.- El ensamble de dado de conformación de latas de conformidad con la reivindicación 6,

caracterizado porque una de las salidas está asignada a cada una de las trayectorias de fluido, y cada una de las trayectorias de fluido está dispuesta adyacente a las porciones respectivas de la periferia cilíndricamente configurada del orificio que recibe el objeto.

8.- El ensamble de dado de conformación de latas de conformidad con la reivindicación 5, caracterizado porque la pluralidad de salidas está dispuesta simétricamente alrededor de la caja.

9.- Una disposición de módulo de dado para estirar y planchar un objeto, el módulo comprende: un medio de calentamiento de fluido; una extremidad de dado que tiene una superficie interior que define un orificio que recibe un objeto que tiene una periferia, la superficie interior de la extremidad de dado está configurada para recibir el objeto a través del orificio que recibe el objeto para uno de estirar y planchar el objeto, la extremidad de dado además incluye una pluralidad de trayectorias de fluido completamente encerradas dentro de la extremidad de dado y colocadas adyacentes a la periferia del orificio que recibe el objeto; y una caja que rodea la extremidad de dado, la caja incluye una pluralidad de entradas

simétricamente separadas alrededor de la caja, las entradas están configuradas para recibir un medio de calentamiento de fluido y para suministrar el medio de calentamiento a las trayectorias de fluido respectivas de la extremidad de dado, la caja además incluye una pluralidad de salidas, por lo menos una de las salidas está asignada a cada una de las trayectorias de fluido, las salidas están configuradas para permitir que el medio de calentamiento de fluido fluya fuera de la caja desde las trayectorias de fluido de la extremidad de dado; en donde las trayectorias de fluido están configuradas para evitar que el medio de calentamiento entre en contacto con la superficie interior de la extremidad de dado, y las entradas simétricamente separadas permiten que el medio de calentamiento de fluido caliente de manera uniforme la extremidad de dado.

10.- El módulo de dado de conformidad con la reivindicación 9, caracterizado porque la periferia del orificio está cilíndricamente configurada, y la trayectoria de fluido está dispuesta alrededor de la periferia cilíndricamente configurada del orificio que recibe el objeto.

11.- El módulo de dado de conformidad con

la reivindicación 10, caracterizado porque por lo menos una trayectoria de fluido incluye una pluralidad de trayectorias de fluido, y por lo menos esa salida incluye una pluralidad de salidas, una de las salidas está asignada a cada trayectoria de fluido, y cada una de las trayectorias de fluido está colocada adyacente a las porciones respectivas de la periferia cilíndricamente configurada del orificio que recibe el objeto.

12.- El módulo de dado de conformidad con la reivindicación 9, caracterizado porque la pluralidad de salidas está colocada simétricamente alrededor de la caja.

13.- El módulo de dado de conformidad con la reivindicación 9, caracterizado porque por lo menos una entrada incluye una pluralidad de entradas colocadas simétricamente alrededor de la caja.

RESUMEN DE LA INVENCION

Un paquete de herramientas de conformación de latas (2) incluye módulos de dado internamente enfriados (4, 6, 8); cada módulo de dado incluye por lo menos una extremidad de dado (14, 16, 18, 20, 22) que se mantiene en una caja; el medio de refrigerante es suministrado a múltiples entradas (24, 26, 28, 30) provistas circunferencialmente en cada caja; el refrigerante es canalizado desde las entradas a través de los espacios (42, 44, 46, 48, 50) entre una superficie exterior de la extremidad de dado y la caja para enfriar la extremidad de dado; las salidas (34, 36, 38, 40) están separadas circunferencialmente alrededor de la caja para regresar el refrigerante al suministro del medio.

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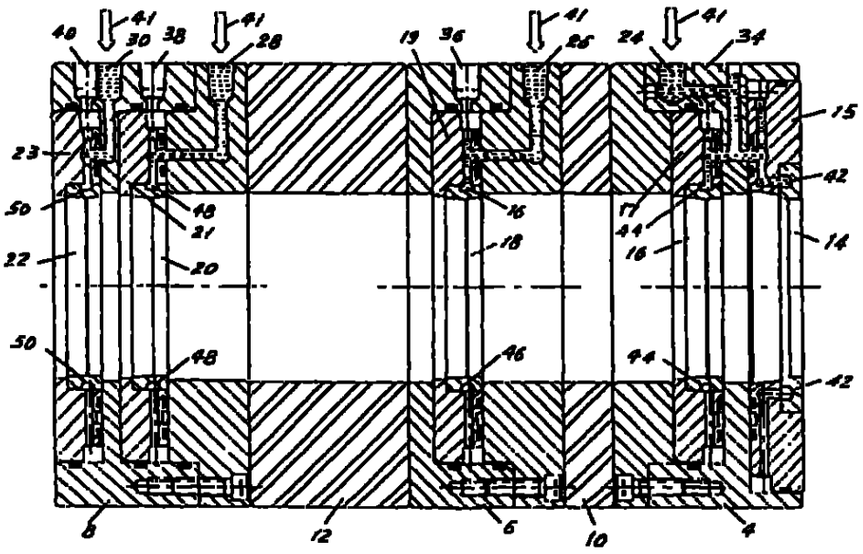
(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW

(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette

(54) Title: INTERNALLY COOLED TOOL PACK



(57) Abstract: A can forming tool pack (2) includes internally cooled die modules (4, 6, 8). Each die module includes at least one die nib (14, 16, 18, 20, 22) held in a case. Fluid cooling medium is supplied to multiple inlets (24, 26, 28, 30) provided circumferentially in each case. The cooling fluid is channeled from the inlets through clearances (42, 44, 46, 48, 50) between an outer surface of the die nib and the case to cool the die nib. Outlets (34, 36, 38, 40) are spaced circumferentially around the case to return the cooling fluid to the medium supply.

WO 03/039780 A1

INTERNALLY COOLED TOOL PACK

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates generally to can manufacturing tool pack assemblies that have drawing and ironing dies for reforming a cup into a container body, and more specifically to such a tool pack assembly that is internally cooled.

2. Brief Description of the Related Art:

Can forming dies are used to form the bodies of metal cans or containers. The description herein is particularly concerned with forming two piece metal containers. A shallow metal cup is driven into the dies by a punch to form the body of the can. The dies generally are provided in tool packs in which a series of progressively narrower die nibs are arranged to progressively draw and iron the metal cup into a container of the desired shape and thickness. An example of a conventional set of drawing and ironing dies in a tool pack is shown in U.S. Patent No. 4,173,882 issued to Lee, Jr. on November 13, 1979, the entire disclosure of which is incorporated herein by reference. Each die is included in a respective die module.

Die tool packs used in commercial can manufacturing conventionally use cooling fluids applied to the exterior of the die pack to maintain or reduce operational temperatures of the dies. In certain can forming applications, however, it is desirable to avoid the use of external cooling fluids. For example, external cooling fluids may contaminate the container surfaces, which requires costly and environmentally undesirable post-formation cleaning processes.

assembly according to the present invention.

Fig. 2 is the axial cross section of Fig. 1 showing fluid cooling medium pathways flowing into the assembly.

Fig. 3 is the axial cross section of Fig. 1 showing fluid cooling medium pathways flowing out of the assembly.

Fig. 4 is a transverse cross section of a drawing and ironing die showing cooling fluid pathways in the die according to the present invention.

Fig. 5 is a cut away view of the drawing and ironing die taken along the line V-V of Fig. 4 .

DETAILED DESCRIPTION OF AN EMBODIMENT OF THE INVENTION

Fig. 1 shows an internally cooled modular die tool pack assembly 2 according to the present invention in an axial cross section. The assembly includes three annular die modules 4, 6, and 8 in sequence, with adjacent modules separated by spacers 10 and 12. The first die module 4 includes an annular redraw die nib 14 followed by a first annular ironing die nib 16. The next die module 6 includes a second annular ironing die nib 18. The final die module 8 includes annular die nibs 20 and 22. Die nibs 14, 16, 18, 20, and 22 are held in die cases 15, 17, 19, 21, and 23, respectively.

Referring also to Figs. 2-5, each of the die modules 4, 6, and 8 has at least one inlet port and at least one outlet port for cooling medium. When multiple inlet and outlet ports are utilized, the ports preferably are arranged alternately and symmetrically around each die module.

Referring more specifically to Fig. 2, the first die module 4 is provided with an inlet port 24, the second module 6 is provided with inlet port 26, and the third module 8 has inlet ports 28 and 30. Similarly, as shown in Fig. 3, die module 4 is provided with an outlet port 34, module 6 is provided with outlet port 36, and module 8 has outlet ports 38 and 40, from which cooling medium exits

passage of cooling medium from inlet 52 circumferentially in both directions to outlets 60, 66 is illustrated. The other inlets and outlets for that die module are arranged in the same manner. As a result, an inlet and the adjacent outlet are 45° apart. Die nibs 14, 18, 20, and 22 are cooled by a similar arrangement of symmetrically spaced inlets and outlets.

Advantageously, the symmetrical spacing of the case inlets and outlets provides for even cooling of the die nibs, thereby insuring that die nib temperatures remain uniform, and minimizing circumferential temperature gradients. The external temperature of each die nib can be monitored, either by temperature measurement thermometers 80 at each module or by monitoring the temperature of the exiting cooling medium, and temperature adjustments can be made as necessary.

Although the present invention has been described in relation to a particular embodiment thereof, many other variations and modifications and other uses will become apparent to those skilled in the art. It is preferred, therefore, that the present invention be limited not by the specific disclosure herein, but only by the appended claims.

7. The die module of claim 6, wherein each inlet is connected by the respective path with one outlet and each path extends over a respective part of the circumference of the nib.

8. A can forming die assembly including a plurality of the die modules of claim 1, wherein the modules are arrayed in a linear sequence for enabling a punch to pass through the respective dies in the modules in sequence.

9. The assembly of claim 8, wherein each fluid path comprises a clearance between the case and the respective die nib.

10. The assembly of claim 9, wherein the clearance is a circumferential channel formed on the outer side of the die nib.

11. The assembly of claim 8, wherein the inlets are spaced symmetrically around the case.

12. The assembly of claim 8, wherein the outlets are spaced symmetrically around the case.

13. The assembly of claim 12, wherein the inlets are spaced symmetrically around the case.

14. The assembly of claim 13, wherein each inlet is connected by the respective path with one outlet and each path extends over a respective part of the circumference of the nib.

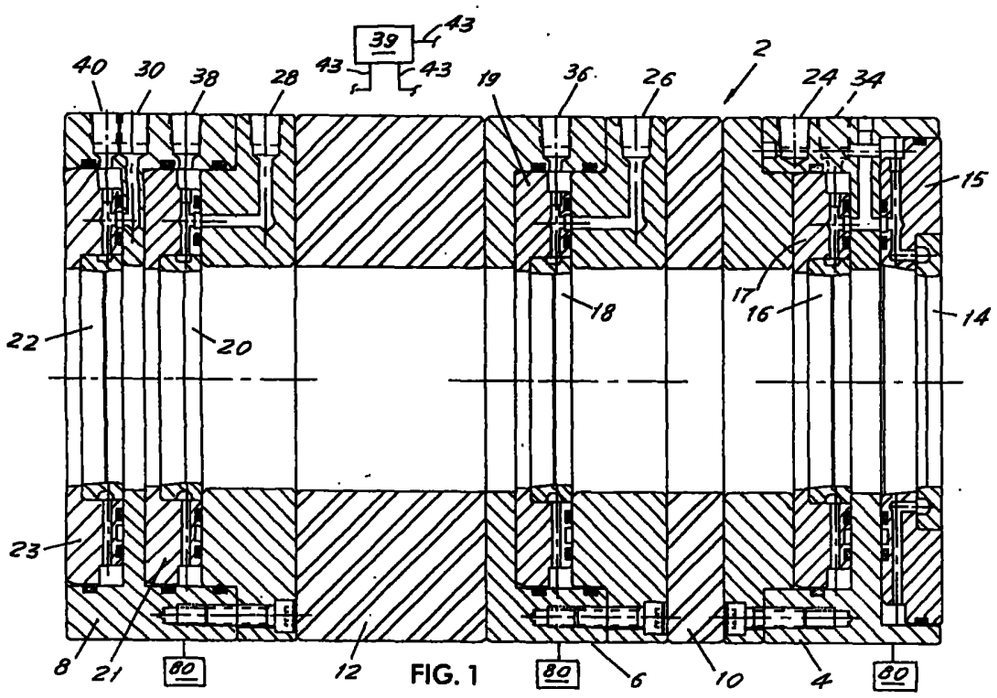

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FIG. 1

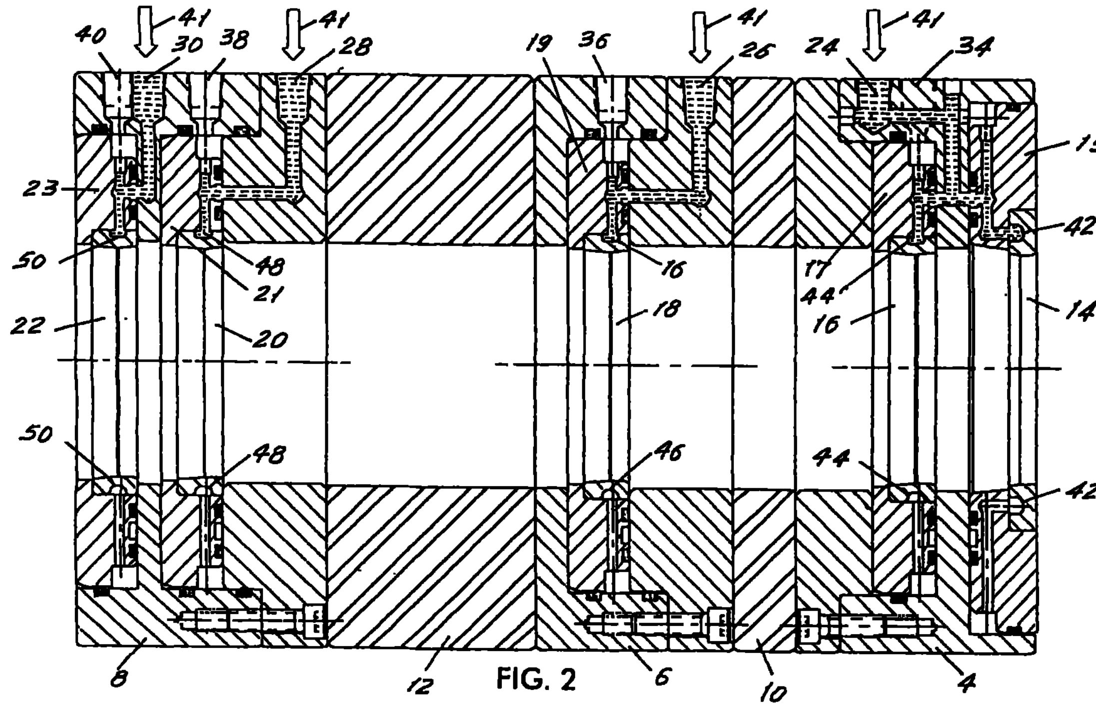
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FIG. 2

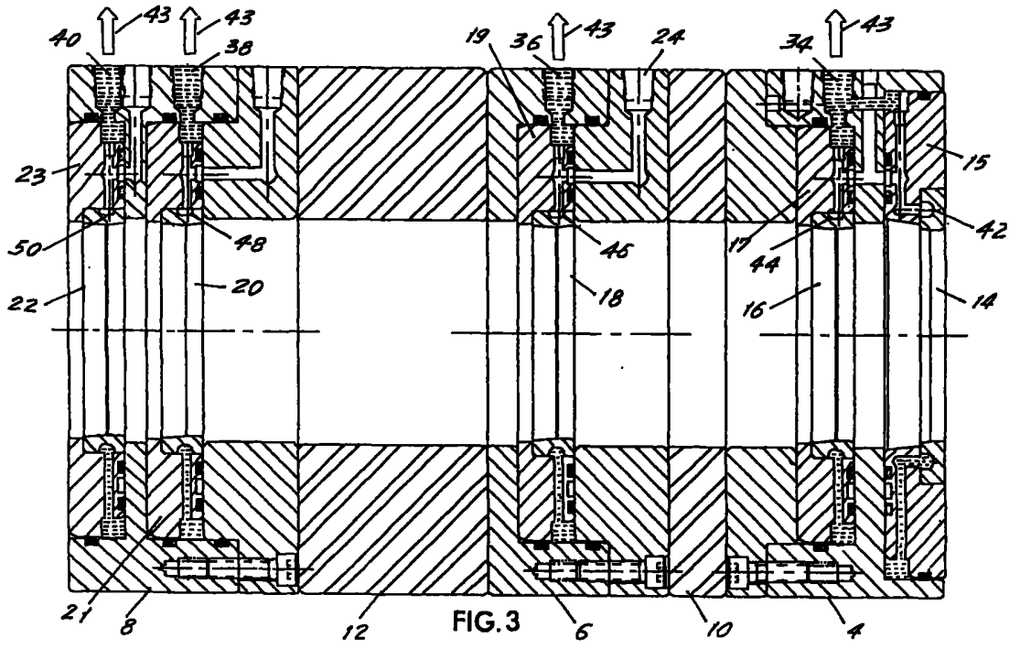
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FIG.3

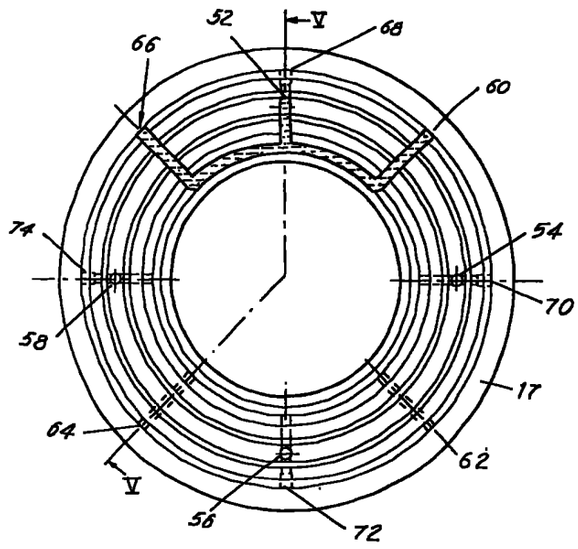

FIG. 4

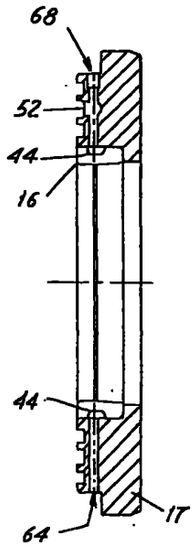

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US02/34896

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : B21D 22/28
US CL : 72/342.3
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 72/342.3, 342.4, 349

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 883,695 A (CANDA) 07 April 1908 (07.04.1908), whole doc.	
Y	US 4,502,313 A (PHALIN et al.) 05 March 1985 (05.03.1985), Figure 3, col.7, line 48 to col. 8, line 47	1-14
A	US 6,263,718 B1 (BUSE et al.) 24 July 2001 (24.07.2001) Figure 11, col. 2, lines 65-67	1-14

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 December 2002 (20.12.2002)	16 JAN 2003
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)305-3230	Authorized officer Lowell A. Larson Telephone No. (703)308-1148

Sheila Veney
Paralegal Specialist
Group 3700

Form PCT/ISA/210 (second sheet) (July 1998)

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:
MITCHELL D. BITTMAN
SEQUA CORPORATION
THREE UNIVERSITY PLAZA
HACKENSACK, NJ 07601

PCT

NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of Mailing (*day/month/year*)	10 OCT 2003

Applicant's or agent's file reference	IMPORTANT NOTIFICATION
RM-106(PCT)	

International application No.	International filing date (*day/month/year*)	Priority date (*day/month/year*)
PCT/US02/34896	31 October 2002 (31.10.2002)	02 November 2001 (02.11.2001)

Applicant

SEQUA CAN MACHINERY, INC.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/US	Authorized officer
Mail Stop PCT, Attn: IPEA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450	Lowell A Larson Sheila H. Veney Paralegal Specialist Tech. Center 3700
Facsimile No. (703)305-3230	Telephone No. 703 308-1148

Form PCT/IPEA/416 (July 1992)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference RM-106(PCT)	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/US02/34896	International filing date *(day/month/year)* 31 October 2002 (31.10.2002)	Priority date *(day/month/year)* 02 November 2001 (02.11.2001)
International Patent Classification (IPC) or national classification and IPC IPC(7): B21D 22/28 and US Cl.: 72/342.3		
Applicant SEQUA CAN MACHINERY, INC.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 6 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of report with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
19 May 2003 (19.05.2003)	16 September 2003 (16.09.2003)
Name and mailing address of the IPEA/US Mail Stop PCT, Attn: IPEA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703)305-3230	Authorized officer Lowell A Larson Telephone No. 703 308-1148

Sheila H. Veney
Paralegal Specialist
Tech. Center 3700

Form PCT/IPEA/409 (cover sheet)(July 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/US02/34896

I. Basis of the report

1. With regard to the elements of the international application:*

☐ the international application as originally filed.

☒ the description:
pages 1-5 as originally filed
pages NONE, filed with the demand
pages NONE, filed with the letter of _____.

☒ the claims:
pages NONE, as originally filed
pages NONE, as amended (together with any statement) under Article 19
pages NONE, filed with the demand
pages 6, 7, 7a, 7b, filed with the letter of 04 August 2003 (04.08.2003)

☒ the drawings
pages 1-4, as originally filed
pages NONE, filed with the demand
pages NONE, filed with the letter of _____.

☐ the sequence listing part of the description:
pages NONE, as originally filed
pages NONE, filed with the demand
pages NONE, filed with the letter of _____.

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination(under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in printed form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of

☐ the description, pages NONE

☐ the claims, Nos. 14

☐ the drawings, sheets/fig NONE

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

** Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*
*** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.*

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/US02/34896

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. STATEMENT

Novelty (N)	Claims 1-13	YES
	Claims NONE	NO
Inventive Step (IS)	Claims 1-13	YES
	Claims NONE	NO
Industrial Applicability (IA)	Claims 1-13	YES
	Claims NONE	NO

2. CITATIONS AND EXPLANATIONS

Claims 1-13 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest a drawing and ironing die having a plurality of fluid paths with symmetrically spaced inlets and corresponding outlets as recited in the claims.

Claims 1-13 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

------NEW CITATIONS------

1. A die module to draw and iron an object, the module comprising:

a die nib having an inner surface defining an object receiving orifice having a periphery, the inner surface of the die nib being configured to receive the object via the object receiving orifice to one of draw and iron the object, the die nib further including a plurality of fluid paths fully enclosed within the die nib and arranged adjacent to respective portions of the periphery of the object receiving orifice; and

a case surrounding the die nib, the case including a plurality of inlets symmetrically spaced around the case, the inlets being configured to receive a fluid cooling medium and to supply the cooling medium to respective ones of the fluid paths of the die nib, the case further including a plurality of outlets, at least one of the outlets being assigned to each of the fluid paths, the outlets being configured to permit the fluid cooling medium to flow out of the case from the fluid paths of the die nib;

wherein the fluid paths are configured to prevent the cooling medium from contacting the inner surface of the die nib, and the symmetrically spaced inlets permit the fluid cooling medium to evenly cool the die nib.

2. The die module according to claim 1, wherein the periphery of the orifice is cylindrically shaped, and the plurality of fluid paths are arranged around the cylindrically shaped periphery of the object receiving orifice.

3. The die module according to claim 2, wherein one of the outlets is assigned to each fluid path, and each of the fluid paths is arranged adjacent to respective portions of the cylindrically shaped periphery of the object receiving orifice.

4. The die module according to claim 1, wherein the plurality of outlets are arranged symmetrically around the case.

5. A can forming die assembly, comprising:

a plurality of the die modules arranged in a linearly to enable a punch to pass through the respective die modules, each of the modules including a die nib having an inner surface defining an object receiving orifice having a periphery, the inner surface of the die nib being configured to receive an object via the object receiving orifice to one of draw and iron the object, the die nib further including a plurality of fluid paths fully enclosed within the die nib and arranged adjacent to respective portions of the periphery of the object receiving orifice; and a case surrounding the die nib, the case including a plurality of inlets symmetrically spaced around the case, the inlets being configured to receive a fluid cooling medium and to supply the cooling medium to respective ones of the fluid paths of the die nib, the case further including a plurality of outlets, at least one of the outlets being assigned to each of the fluid paths, the outlets being configured to permit the fluid cooling medium to flow out of the case from the fluid paths of the die nib;

wherein the fluid paths are configured to prevent the cooling medium from contacting the inner surface of the die nib, and the symmetrically spaced inlets permit the fluid cooling medium to evenly cool the die nib.

6. The can forming die assembly according to claim 5, wherein the periphery of the orifice is cylindrically shaped, and the plurality of fluid paths are arranged around the cylindrically shaped periphery of the object receiving orifice.

7. The can forming die assembly according to claim 6, wherein one of the outlets is assigned to each fluid path, and each of the fluid paths is arranged adjacent to respective portions of the cylindrically shaped periphery of the object receiving orifice.

8. The can forming die assembly according to claim 5, wherein the plurality of outlets are arranged symmetrically around the case.

9. A die module arrangement to draw and iron an object, the module comprising:

a fluid warming medium

a die nib having an inner surface defining an object receiving orifice having a periphery, the inner surface of the die nib being configured to receive the object via the object receiving orifice to one of draw and iron the object, the die nib further including a plurality of fluid paths fully enclosed within the die nib and arranged adjacent to the periphery of the object receiving orifice; and

a case surrounding the die nib, the case including a plurality of inlets symmetrically spaced around the case, the inlets being configured to receive a fluid warming medium and to supply the warming medium to respective ones of the fluid paths of the die nib, the case further including a plurality of outlets, at least one of the outlets being assigned to each of the fluid paths, the outlets being configured to permit the fluid warming medium to flow out of the case from the fluid paths of the die nib;

wherein the fluid paths are configured to prevent the warming medium from contacting the inner surface of the die nib, and the symmetrically spaced inlets permit the fluid warming medium to evenly warm the die nib.

10. The die module according to claim 9, wherein the periphery of the orifice is cylindrically shaped, and the fluid path is arranged around the cylindrically shaped periphery of the object receiving orifice.

11. The die module according to claim 10, wherein the at least one fluid path includes a plurality of fluid paths, and the at least one outlet includes a plurality of outlets, one of the outlets being assigned to each fluid path, and each of the fluid paths being arranged adjacent to respective portions of the cylindrically shaped periphery of the object receiving orifice.

12. The die module according to claim 9, wherein the plurality of outlets are arranged symmetrically around the case.

13. The die module according to claim 9, wherein the at least one inlet includes a plurality of inlets arranged symmetrically around the case.

US006263718B1

(12) **United States Patent**
Buse et al.

(10) **Patent No.: US 6,263,718 B1**
(45) **Date of Patent: Jul. 24, 2001**

(54) **TEMPERATURE CONTROL DURING CAN BODY IRONING**

(75) Inventors: **Dieter Buse, Swisttal-Odendorf; Willi Grandmann, Wolferbuettel, both of (DE)**

(73) Assignee: **Schmalbac Lubeca AG, Ratingen (DE)**

(*) Notice: **Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 483 days.**

(21) Appl. No.: **08/945,138**

(22) PCT Filed: **Apr. 9, 1996**

(86) PCT No.: **PCT/DE96/00623**

§ 371 Date: **Jun. 2, 1998**

§ 102(e) Date: **Jun. 2, 1998**

(87) PCT Pub. No.: **WO96/32213**

PCT Pub. Date: **Oct. 17, 1996**

(30) **Foreign Application Priority Data**

Apr. 13, 1995 (DE) 195 14 076

(51) Int. Cl.[7] B21D 22/28
(52) U.S. Cl. 72/342.92; 72/349
(58) Field of Search 72/342.3, 342.7, 72/342.8, 342.92, 349

(56) **References Cited**

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4-100639 *	4/1992	(JP)	72/342.92
5-212485 *	8/1993	(JP)	72/342.7
6055230 *	3/1994	(JP)	72/342.92

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Hoffmann,: Herstellung von Konserven– und Getrankedosen, Handbuch der fertigungstechnik, Bd. 2/3, S. 1224, 1225.

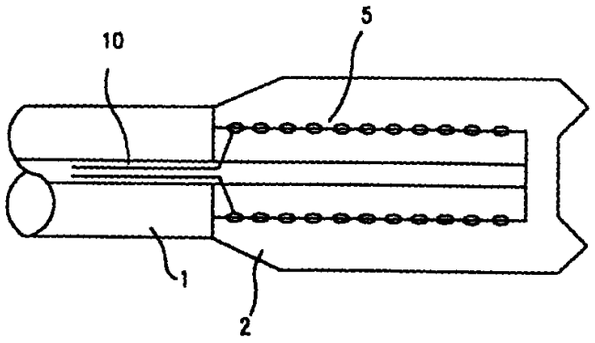
* cited by examiner

Primary Examiner—Lowell A Larson
(74) *Attorney, Agent, or Firm*—Duane, Morris & Heckscher LLP

(57) **ABSTRACT**

A method is provided for ironing a cup to a selected wall thickness, using a mandrel that pushes the cup through several ironing rings that are axially aligned with the central axis of the mandrel. The method includes selecting a wall thickness, providing a resistive heater associated with at least one of the punch, the ram and the ironing rings, and controlling a gap between the punch and the ironing rings, and thus the wall thickness of the ironed can body, by setting a temperature of at least one of the punch, the ram and the ironing rings. The temperature is set by controlling electrical current in the resistive heater to provide a controlled gap between the mandrel and ironing rings, to produce a wall thickness of the ironed can body equal to the selected wall thickness when the can body is pushed through the ironing rings by the mandrel.

6 Claims, 4 Drawing Sheets



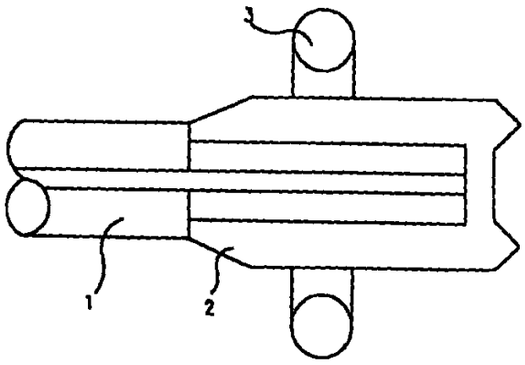


FIG. 1

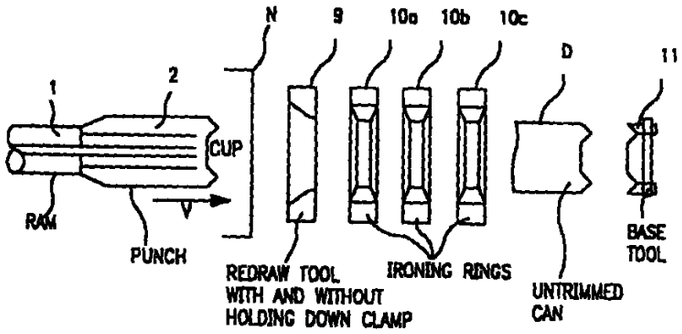


FIG. 2

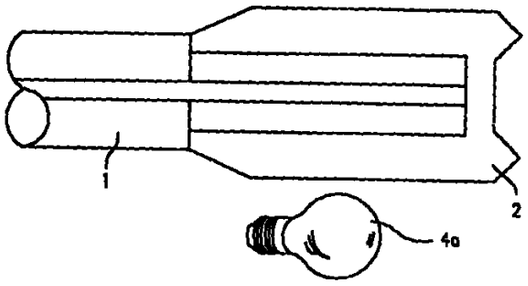


FIG. 3

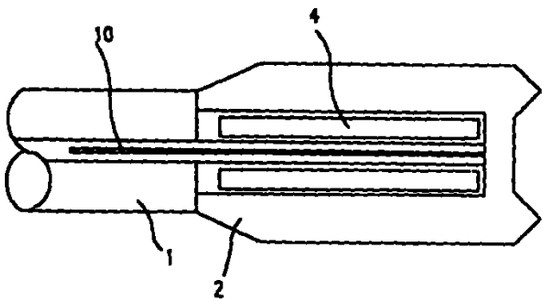


FIG. 4

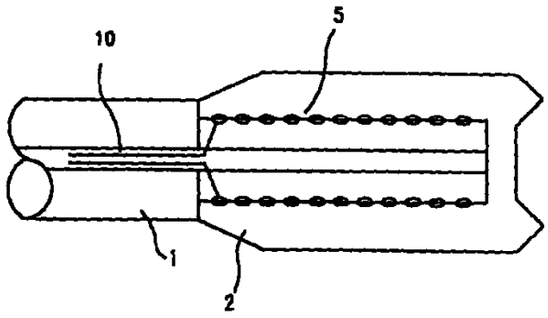


FIG. 5

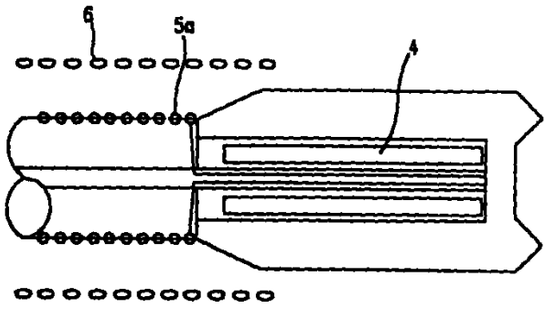


FIG. 6

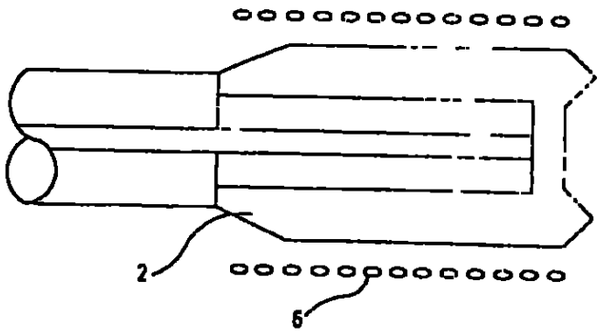


FIG. 7

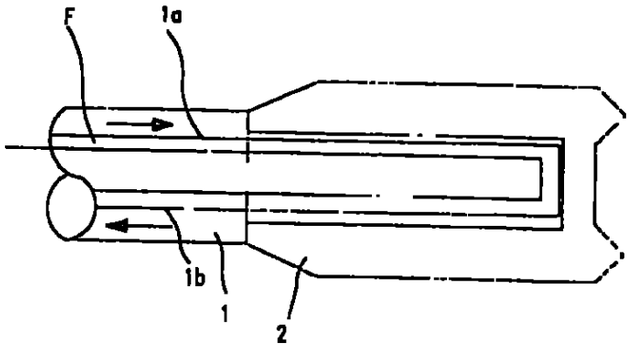


FIG. 8

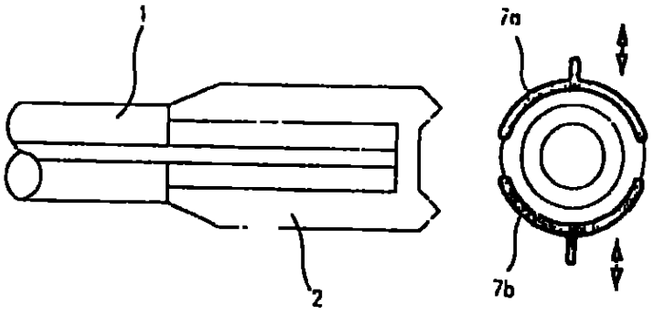


FIG. 9

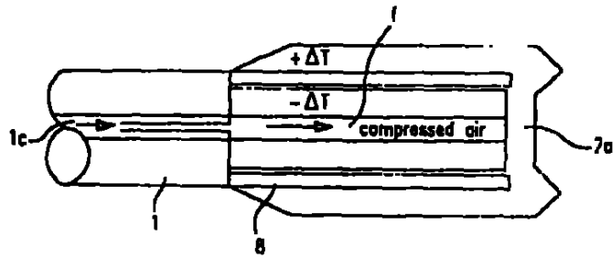


FIG. 10

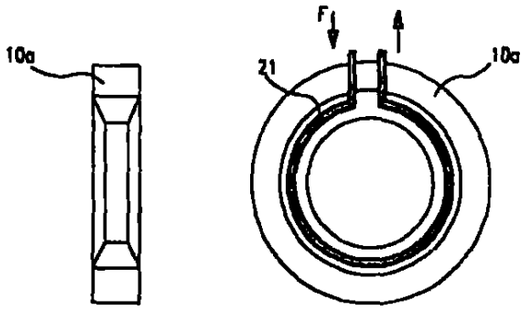


FIG. 11

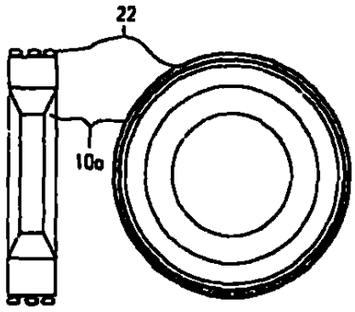


FIG. 12

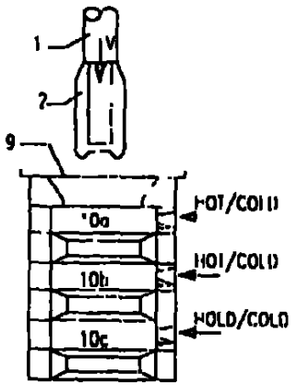


FIG. 13

TEMPERATURE CONTROL DURING CAN BODY IRONING

BACKGROUND OF THE INVENTION

1 *Field of the Invention*

The technical field of the invention is a forming method for sheet metal cans made from aluminum or steel sheet or a combination of said both materials, said method being called "ironing". Said sheets may as well be provided with an additional functional coating (e.g. lamination or coat of varnish). In this technical field, ironed can bodies are obtained which in a closing process may be provided with can ends to obtain closed cans.

In said technical field, it is an object of the invention to reduce tool wear and to simultaneously save material.

SUMMARY OF THE INVENTION

According to the invention, this object is achieved by using at least one of a heated or a cooled punch and a heated or a cooled ram and heated or cooled ironing rings and heated or cooled process and supporting agents. Cooling or heating of said punch, ram, ironing rings and process and supporting agents may be controlled externally as well as by providing the ram, punch or ironing rings with an integrated heating or cooling means (claim 1, 4). The dimensions of the ironing tool are alterable by its temperature.

With a *known* tool temperature $THETA_a$ *and a defined* (i.e., selected) tool configuration (given clearance between ironing mandrel and ring), the ironed can *presents a defined* distribution of the wall thickness. A defined (controlled) heating or cooling of the tools results in an expansion or shrinkage, respectively, of the ironing mandrel and ring and a defined change of said clearance, thus achieving a controllable wall thickness or a change in the wall thickness distribution depending on the selected controlled temperature. Thus, according to the invention, the tool geometry is altered by influencing the temperature, which influence is *principally* avoided by prior art using a substantially constant cooling agent.

The present *invention* succeeds in compensating temperature influences and tool wear occurring during operation of an ironing press. Without said compensation, raising the cycle numbers of ironing machines would not be possible. Besides, the service life of each ironing tool is markedly prolonged, since tool wear may be compensated without being forced to use new tools. Said compensation permits longer term usability of the same tool and, despite wearing of the tool material (mostly hard metal), production of an ironed can with constant wall thicknesses remaining the same for a long term.

According to the invention, both, the forming behavior during forming of a seam and the forming behaviour during reducing the upper can edge diameter ("reduced neck" or "necking") are improved.

During trimming, material waste may be reduced. Also, the trimming process of the upper can edge may be improved with regard to accuracy.

By an additionally possible diminution (tightening) of the window of dimensional tolerance, which can be effected for each reduction of the sheet thickness of a basic metal sheet, the thickness of the remaining wall portion of the can may—if using the invention—be reduced during necking of the upper can portion. According to prior art, diameter variation *during reduction of the upper can portion from a* main diameter to a reduced upper diameter ("necking") impedes a *further* reduction of the wall *thickness*.

The invention permits such an improvement in favor of material savings.

For compensating tool wear by using temperature influences, the invention uses a physical effect which, *according to prior art, was undesired and avoided. In fact,* prior art also uses cooling agents and lubricants which, with respect to the environment, present an elevated or reduced temperature; however, said temperature being at a *constant* level in order to avoid a change of a tool geometry as now intended by the invention. The can wall thickness is measured in contact or contactless and may be controlled by tracking or adjustment or may be "feedback-controlled" to remain at constant values, by altering the temperature of the tools (claim 9).

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following embodiments of the invention are intended to give a more detailed and complete comprehension of the invention.

FIG. 1 *In the first embodiment according to the invention* a punch 2 or ram 1 is provided with heating nozzles. *The same arrangement may serve, for heating or cooling with* a fluid.

FIG. 2 FIG. 2 shows a punch 2 being fixed on a ram 1 by a so-called punch screw. The ironing principle shown here corresponds to prior art.

FIG. 3 The heating of a punch 2 or a ram is also possible by external influence of radiation. In FIG. 3, for example, illustrates an external infrared radiator 4*a*.

FIGS. 4, 5, 6 Heating is effected with the help of heating cartridges or heating resistors 4 (FIG. 4) according to the physical principle of a resistance heating. Heating can also be be made with helical pipe cartridges or spiral heating elements 5, also being a resistance heating principle (FIG. 5). The heating cartridges according to FIG. 6 are inserted in said ram 1, an integration of the heating cartridges in a punch 2 also being possible.

Cables 10 *are* used for electric power supply.

Using an induction method (coil arrangement 6) for an electric power supply is possible to spare the conductors. In this embodiment, said helix 5 in the tool would have to be shorted then.

Coils 6 may be arranged between said ironing rings 10*a*, 10*b*, 10*c* (instead of spacers), they may as well be arranged in front of and/or behind said ironing arrangement (compare FIG. 1).

FIG. 7 Heating of said punches 2 is also possible by an external coil arrangement 6, said punch or ram being heated by induction.

FIG. 8 Said punch or ram may as well be cooled or heated by leading fluids through them. FIG. 8 shows a ram 1 with integrated conduits 1*a*, 1*b* through which said cooling or heating fluid may be led.

FIG. 9 Said punch or ram is cooled or heated by external contact plates 7*a*, 7*b*.

FIG. 10 Said forming tools are heated by means of Peltier cooled or heated by means of Peltier effect with Peltier element 8. The temperature is effected by a reversed direction of a current or by alternating flows medium I inside said ram in a central conduit 2*a*, 1*a*.

FIG. 11 A heat sink with FIG. 11 shows normal or through at least one ring 10*a*, 10*b*, 10*c*. For this purpose, [illegible] conduits are provided in or at said ironing ring (e.g. 10*b*).

FIG. 12 At least one ring 10a, 10b, 10c is heated by helical pipe resistors 22 or the heat is carried off by cooling spirals 22

FIG. 13 Process and supporting agents ("ironing fluids") of an "ironing press system" are cooled or heated to benefit from different expansion coefficients of ironing rings and punches

Heating or cooling of said ram 1 or punch 2 and of said ironing rings by at least one venturi cartridge is disclosed without Figures, a temperature change being achieved by a defined alteration of the cross sections of a gas flow (Thomson Joule effect)

The temperature range suitable for use to control the tool dimensions (e.g. diameter) is between −20° to 250° C. (said temperature range being limited by previous tool fatigue and tool rupture).

1° C. changes the diameter of the ironing mandrel by 0.8 μm, e.g. in case of hard metal being the tool material. This gives the corresponding alteration of the wall thickness of the ironed sheet metal can or corresponds to the extent of diameter compensation

If the amount of wear is known during a longer term tool use—in case of known tool-temperature behaviour—, the temperature of the forming tools may be long-term altered by characteristic lenses (to read correctly characteristic curves). Thus, a continuous tool wear is compensated on a long term continuous basis.

Besides said compensation, short-term tool dimensions (ring diameter, mandrel diameter, corresponding diameter steps or different diameters of successive rings) may be altered without removal or change of the tools

A temperature control of tools for altering their dimensions is helpful for production as well as for research and development.

What is claimed is

1. Method for ironing a cup with a mandrel having a central axis and comprising

a punch and a ram, during said ironing pushing the cup with the mandrel through several ironing rings, axially aligned with respect to the central axis of the mandrel to form an ironed can body having a wall thickness, the method comprising

selecting a selected wall thickness of said ironed can body,

providing a resistive heating means associated with at least one of the punch, the ram and the ironing rings,

controlling a gap between the punch and the ironing rings by setting a temperature of at least one of the punch, the ram and the ironing rings, said temperature being set by setting an electrical current in said resistive heating means, said controlled gap corresponding to said selected wall thickness so that the wall thickness of the ironed can body formed by pushing the mandrel through ironing rings corresponds to said selected wall thickness

2. The method according to claim 1, wherein the can wall thickness is measured for controlling at least one of alteration of the can wall thickness and maintaining constant can wall thickness

3. The method of claim 2 wherein by a controlled alteration of the tool temperature the can wall thickness is altered or maintained constant

4. The method of claim 2, wherein the measurement of the thickness is oriented in radial direction

5. The method of claim 1 wherein the electrical current in said resistive heating means is induced by an induction coil

6. Ironing tool for ironing a cup, the tool having a mandrel having a central axis and comprising a punch and a ram for pushing the cup with the mandrel through several ironing rings, axially aligned with respect to the central axis of the mandrel to form an ironed can body having a wall thickness, wherein

(a) at least one of said ironing rings is electrically heatable by heating means controlled electrically through cables, and

(b) the mandrel of said ironing tool is electrically controllable in a temperature of said ironing tool, whereby heating of said at least one of said ironing rings and control of the temperature of the mandrel influences dimensioning of said tool without mechanical engagement

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,263,718 B1
DATED : July 24, 2001
INVENTOR(S) : Buse et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title page,
Item [73], Assignee, delete "Schmalbac" and insert therefor -- Schmalbach --

Signed and Sealed this

Twenty-sixth Day of February, 2002

Attest

Attesting Officer

JAMES E. ROGAN
Director of the United States Patent and Trademark Office

No. 883,695 PATENTED APR. 7, 1908.

F. E. CANDA.

DIE.

APPLICATION FILED MAR. 19, 1908.

Fig. 1

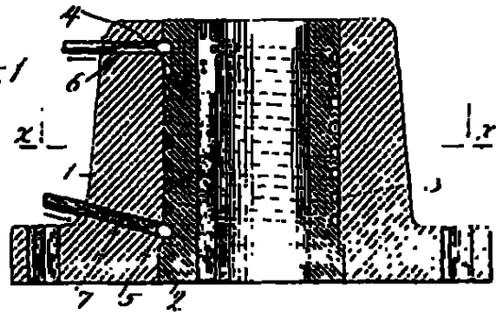


Fig. 2

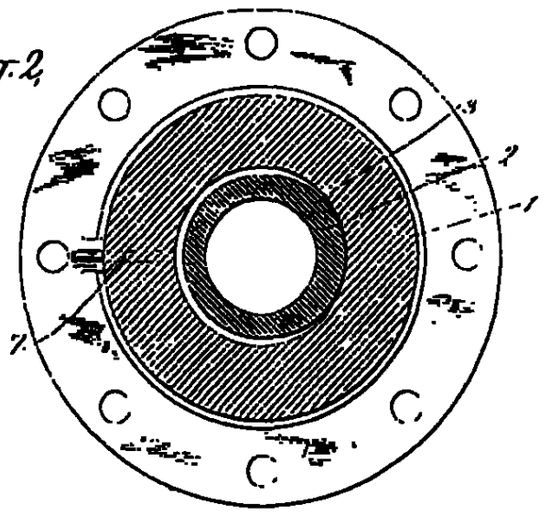


Fig. 3

WITNESSES:

Harry Goss.

Mary A. Warren

INVENTOR

Ferdinand E. Canda

BY

Marks & Mathews

ATTORNEYS

UNITED STATES PATENT OFFICE.

FERDINAND E. CANDA, OF NEW YORK, N. Y., ASSIGNOR TO CHROME STEEL WORKS, OF CHROME, NEW JERSEY, A CORPORATION OF NEW JERSEY

DIE.

No. 883,695. Specification of Letters Patent. Patented April 7, 1908

Application filed March 19, 1906. Serial No. 306,805.

To all whom it may concern:

Be it known that I, FERDINAND E. CANDA, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Dies; and I do hereby declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to means for cooling dies of presses and the like and consists in means for circulating cooling fluid through or around such dies, all as more fully hereinafter described and particularly pointed out in the claims.

The objects of my invention are to avoid over-heating of press dies and the like and to provide simple, inexpensive and reliable means for cooling the same.

I shall particularly describe my invention with reference to dies for forging presses such as are used for extremely heavy work, the particular die illustrated, being one intended for a hydraulic forging press of the type illustrated in my Patent No. 751,430, dated February 2nd, 1904, but it will be understood that the invention is applicable to various other and smaller types of dies, as well as to dies for many different kinds of machines and presses.

In the accompanying drawings: Figure 1 shows a central vertical section of the die of the forging press such as referred to, with the liner of said die in place; Fig. 2 shows a horizontal transverse section of said parts on the line x x of Fig. 1; and Fig. 3 shows an elevation of the liner removed from the die, and particularly shows the exterior spiral groove of such liner, through which cooling fluid circulates.

In the said drawings: 1 designates an anvil die for a forging press, such as above referred to, and 2 a liner bushing therefor. This bushing fits closely within the bore of the die, being in fact usually forced in place under great pressure. It may, however, be removed by the application of pressure, and such bushings are from time to time removed and replaced by others as they become worn or as the size or style of the work to be done in the press is changed, a number of bushings of different sizes being frequently provided for the same die. When in place in the press, there is a hydraulic plunger immediately beneath the bore of the die and another hydraulic plunger above the same. The heated ingot to be pressed is placed within the bore of the bushing, resting upon the lower of said plungers and then by the action of the upper plunger, the ingot is compressed within the die and finally is forced outward, usually by the action of the lower plunger. I do not illustrate these plungers, as their location with respect to the anvil die and the method of operation of the press is well known to those acquainted with hydraulic forging presses. It will be readily apparent that much heat will be communicated from the highly heated ingot to the die, and that in order to avoid delay in the operation of the press it is highly desirable to provide means for carrying off the heat thus communicated to the die. This I do, in the construction shown, by providing in the side of the removable bushing 2 a spiral groove 3 and by providing in the inner wall of the die 1 grooves 4 and 5 adapted to register respectively with the upper and lower convolutions of the groove 3 when the bushing is in place. Ducts 6 and 7 lead from these grooves 4 and 5 to the outside, and there may be connected to pipes for supplying and carrying off cooling water or other cooling fluid.

Owing to the close fit of the bushing to the die proper, it is not usually necessary to pack or lute the joints between the die and bushings at the top and bottom.

In the operation of the press, water or other cooling fluid is circulated from duct 7 and through the spiral groove 3 in the bushing to duct 6 and thence outward, the water so circulated absorbing the heat communicated to the bushing from the heated ingot and keeping the bushing and die relatively cool and at practically a uniform temperature.

What I claim is:—

1. A die for forging presses and the like, comprising a die proper and a liner bushing fitting therein, said bushing having in the face adjacent to the die proper a channel for the circulation of cooling fluid, said die provided with means for supplying cooling fluid to said channel.

2. A die for forging presses and the like, comprising a die proper and a liner bushing therefor, said bushing provided in the . . .

adjacent to the die proper with a spiral groove for the circulation of cooling fluid, said die provided with supply and discharge ducts communicating with said groove.

3. A die for forging presses and the like, comprising a die proper and a liner bushing therefor, said liner bushing having in its outer surface a spiral groove for the circulation of cooling fluid, the die proper having supply and discharge ducts and grooves connected therewith and extending around the inner surface of said die proper, said grooves adapted to register with the spiral groove of the bushing when said bushing is in place.

In testimony whereof I affix my signature, in the presence of two witnesses.

FERDINAND E. CANDA

Witnesses:

ALPHONSE KLOH,
H. M. MARBLE.

United States Patent [19]

Phalin et al.

[11] **Patent Number: 4,502,313**

[45] **Date of Patent: Mar. 5, 1985**

[54] **TOOLING ADJUSTMENT**

[75] Inventors: Thomas L. Phalin, Cary; James J. Ulmer, Palatine, both of Ill.

[73] Assignee: American Can Company, Greenwich, Conn.

[21] Appl. No.: 377,331

[22] Filed: May 12, 1982

[51] Int. Cl.³ B21B 22/00

[52] U.S. Cl. 72/342; 72/349; 72/364

[58] Field of Search 72/342, 364, 347, 348, 72/349

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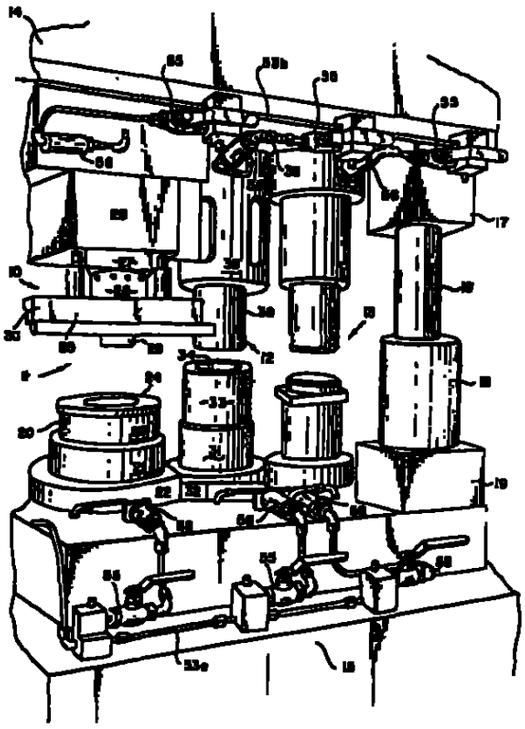
Primary Examiner—Leon Gilden

Attorney, Agent, or Firm—Paul R. Audet

[57] **ABSTRACT**

An apparatus for drawing and ironing a cup with a peripheral flange from relatively thin material into an elongated container also having a flange by moving a die and punch relative to one another and draw clamping and centering sleeve coaxial therewith and thereafter applying a bottom forming member axially relative to the die against the punch to profile shape said container bottom without the benefit of coolant flooding of said material during drawing and ironing, the improvement comprising; a die of a predetermined shape and size carried in the apparatus, a punch of a predetermined shape and size for cooperating with said die and each having surfaces which define a clearance therebetween during forming of said material; separate passages through said die means and said punch means to permit flow of coolant; valving in line with die and punch passages for independent control of the coolant flow from a supply means to said die and punch to permit regulation of the operating temperature of said die means with respect to said punch means to increase or decrease said clearance therebetween by moving said surfaces toward or away from one another during the drawing and ironing of said material into an elongated container.

7 Claims, 7 Drawing Figures



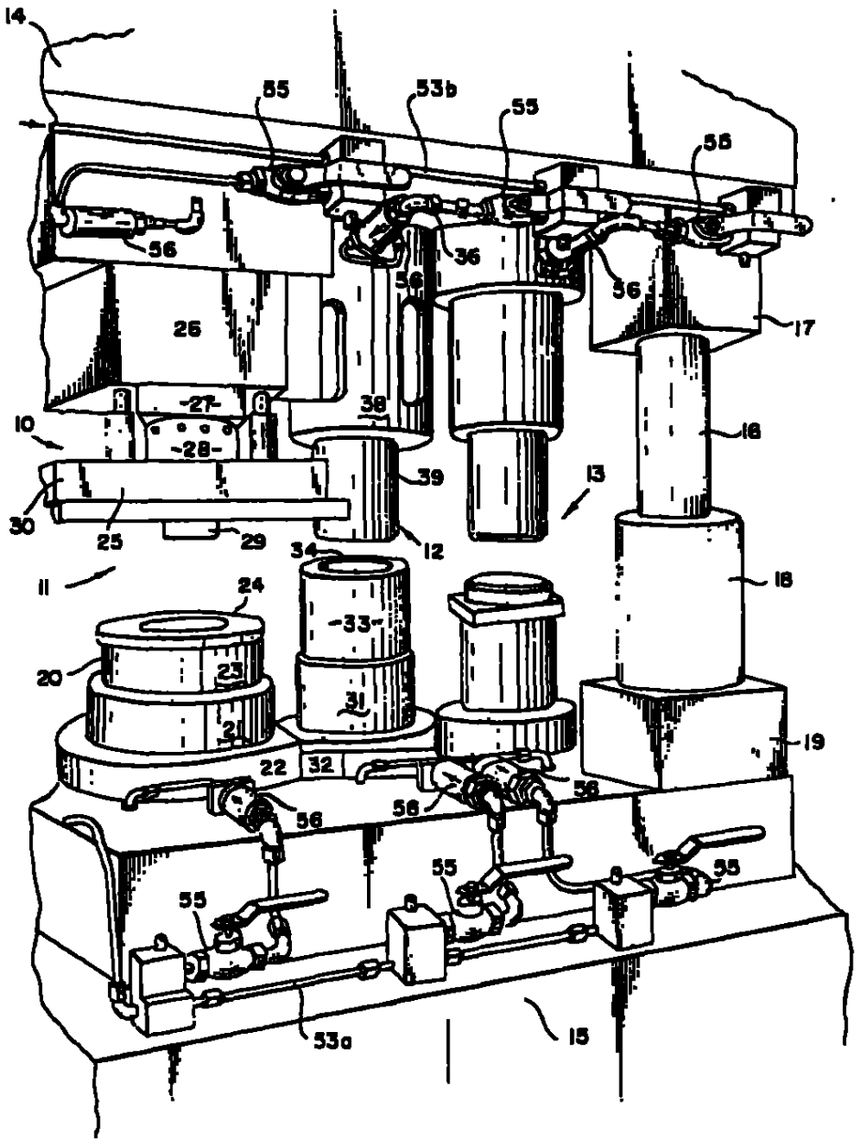

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Fig. 1

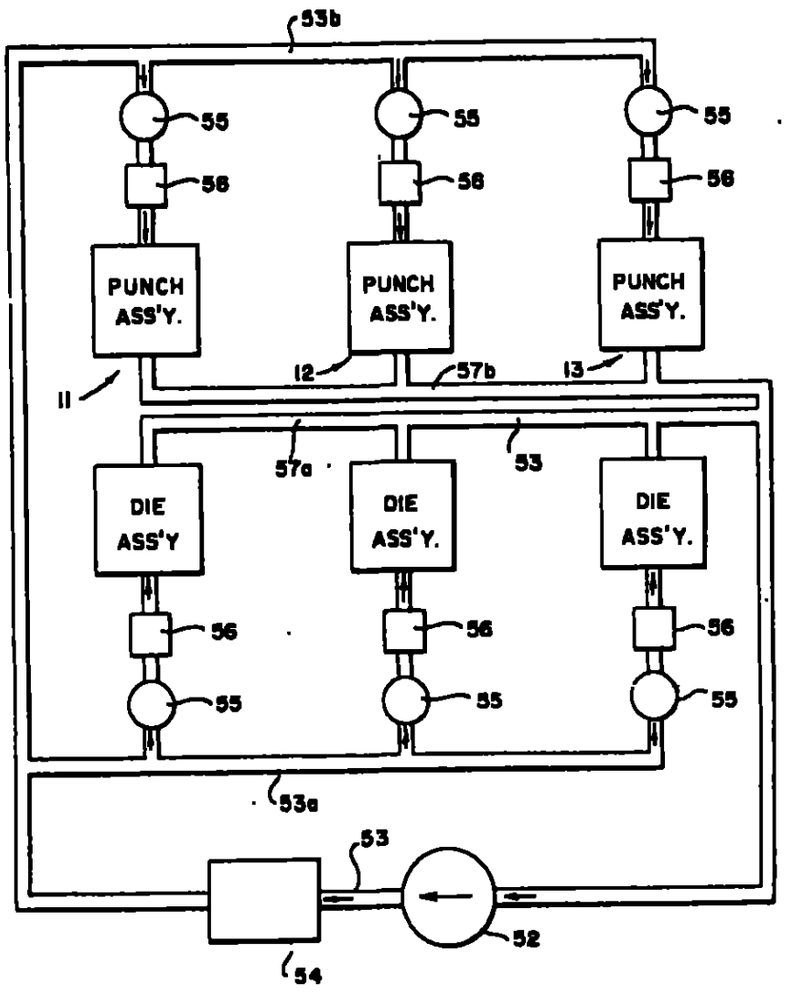

Fig. 2

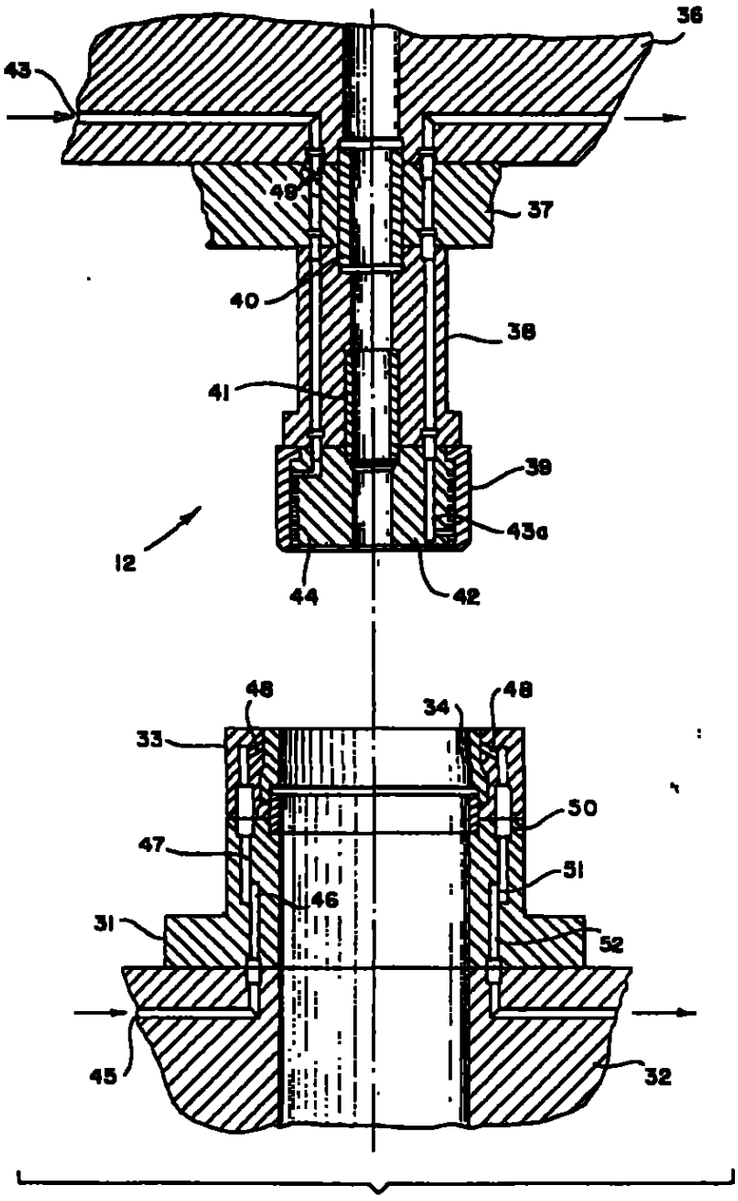

Fig. 3

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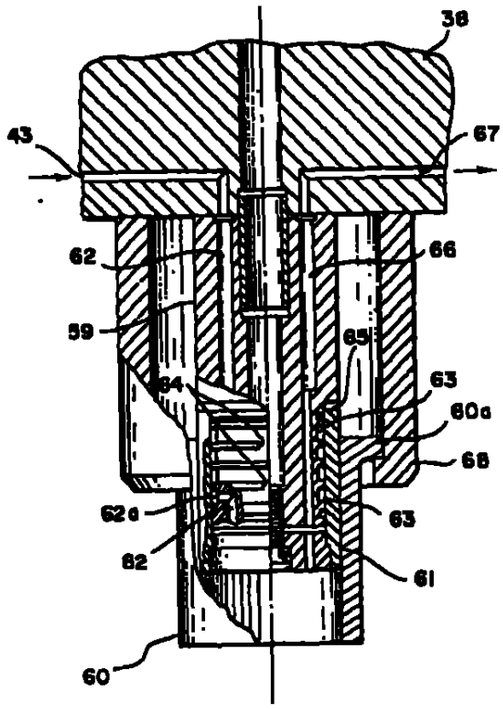

Fig. 4

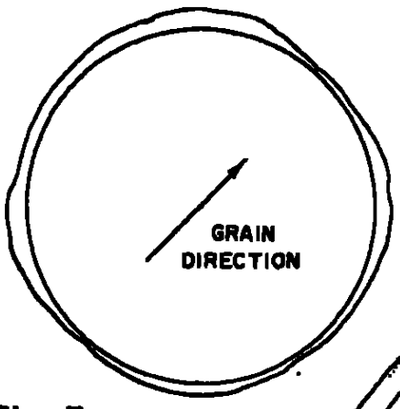

Fig. 5

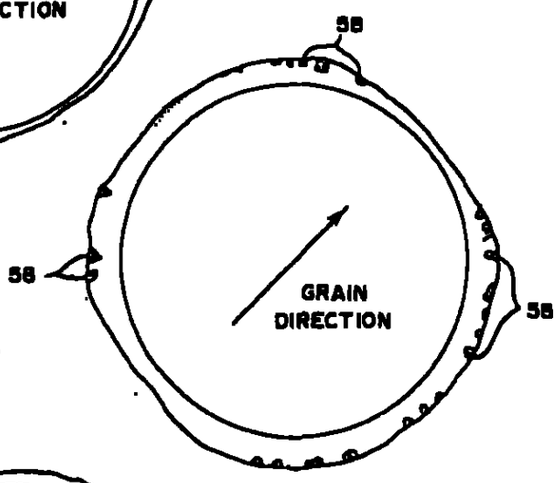

Fig. 6

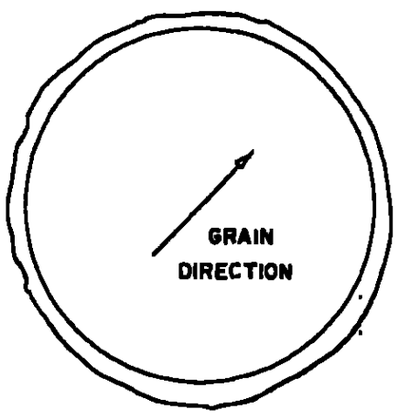

Fig. 7

TOOLING ADJUSTMENT

BACKGROUND OF THE DISCLOSURE

For the last 25 years, work has progressed on manufacturing drawn cans for food product. These containers were made of materials such as aluminum and low temper steels in order to facilitate the drawing operation. In addition to this the containers usually had a height about equal to or less than the diameter of the container and were fashioned in one or two drawing operations.

Only recently has it been possible to make multiple drawn two piece food containers which were fashioned from organically precoated tin free steel such that postcoating or post treatment operations were not necessary. More particularly, a 24 oz. 404×307 tin free steel container was made in a two draw operation. (The can makers convention gives the diameter across the completed doubleseam in inches plus sixteenths of an inch then the height in inches plus sixteenths of an inch. Therefore, the foregoing container is 4 4/16" in diameter by 3 7/16" in height). It is desired to be able to make a container whose height is appreciably greater than the diameter, using precoated starting material in a multiple draw process. It is also desired to make such a container in the popular 16 oz. 303×406 size or the 15 oz. 300×407 size or the 11 oz. 211×400 size.

A triple draw process is required to make the foregoing containers, and that process tends to thicken the area of the container side wall near the open end. The amount of thickening increases from the bottom of the container to the top and all the way to the tip of the flange. This thickening is a consequence of the drawing of the material from a flat disc-shape and the variable circumferential compression of the material as a function of its distance from the bottom of the ultimately formed cup. The additional material thickness at the top of the container serves no useful purpose, and is a waste of material increasing the weight and cost of the container.

The preferred container is fashioned from double reduced plate and more specifically from plate of DR9 temper and about 65# per base box base weight. DR9 is a tin mill product specification which relates to the process by which the metal is cold reduced in two stages with an anneal preformed between the two cold rolling operations. The steel is reduced approximately 89% in the first reduction, is annealed, and then is reduced about 25 to 40% in the second and final cold reduction. The base box terminology for base weight is standard in the can making industry; it originally referred to the amount of steel in a base box of tinplate consisting of 112 sheets of steel 14"×20", or 31,360 square inches plate. Today the base box as related to base weight refers to the amount of steel in 31,360 square inches of steel, whether in the form of coil or cut sheets. The preferred embodiment can be made from tin free steel (TFS), tinplate, nickel plated steel, or steel base material.

This material may be coated on what ultimately will be the outside surface by an epoxide-resin-type or an organosol coating. The inside may be coated with a coating consisting of a combination of resins of the organosol type. Inside and outside coatings are capable of withstanding the drawing and ironing stresses typical of can-making operations. Consequently, the container can be made from a relatively high temper material and

should not require a postcoating. Of course, tinplate which is not organically cated will require at least an internal postcoating operation.

The outside coating is applied by roller coating or coil coating and cured in an oven. For sheet coating operations, this coating is baked in a temperature range of 300° to 400° for about 6 to 10 minutes. It is usually applied to the metal substrate at a film weight of 8 to 15 mg per 4 square inches of plate area. The outside coating can be of several chemical types such as a vinyl organosol, an epoxide resin, an amine resin, a phenolic resin or suitably formulated blends of these resins. The inside coating is generally applied at a film weight of 15 to 35 mg per 4 square inches of plate area; that coating can be either sheet coated or coil coated. A baking temperature of 300° to 400° F. for 8 to 10 minutes is generally used in sheet coating. Inside coatings contain mixtures of phenolic resin, epoxy resin, vinyl solution resins of the vinyl acetate-vinyl chloride copolymer type and high molecular weight polyvinyl chloride dispersion resins.

The preferred method used in order to produce such a desired container having a minimum amount of the high temper DR9 steel, includes three drawing operations which may take place in a press such as that disclosed in U.S. Pat. No. 4,262,510 which is assigned to the same Company as the present invention. For a triple drawn and ironed can the diameter of the container and the wall thickness are concurrently reduced in each forming operation. More specifically, the first operation blanks and forms the sheet of precoated material into a shallow cup wherein the diameter is in excess of the height. During this operation the wall thickness is reduced by ironing while drawing such that part of the wall is reduced to less than the thickness of an unironed container. The second operation redraws the container and reduces the diameter and again concurrently irons the wall to similarly reduce thickness from the top to the bottom. In this second operation the diameter is reduced and the height increased so that they are about equal. The final operation reduces the diameter still further and once again concurrently irons the side wall to produce a preferred thinness and uniformity such that the container achieves its final configuration with a sidewall which is about 0.001" less than the starting gauge before bottom profile and sidewall beading.

In any of the multiple operations where the diameter is reduced and the side wall is thinned the ironing operation may be stopped before it reaches the flange. Consequently, the flange thickness as well as the side wall area next adjacent the flange can be left thicker. It should be appreciated that a complete container can be manufactured from precoated stock without having the need for any washing, repair postcoating or additional energy-intensive operations.

The addition of ironing to the multiple-draw process permits the original cutedge or circular blank to have a smaller diameter than that necessary for an unironed similar size container. Therefore, the amount of steel used for this container is less than that needed for drawn containers of the same size. This reduction in steel saves material and reduces the ultimate container weight.

During forming at high levels of pressure, heat is generated. Lubrication topically applied to the coating is a critical aspect for forming multiple drawn and ironed containers. The lubricant provides the needed slip properties when precoated plate is formed in the

press tooling. Without proper lubrication, the coatings will be scraped off by the press tools resulting in scuffing, drawing failures and possible damage to the punches and dies in the press. Lubricants such as Boker wax, lanolin or petrolatum can be used. For multiple drawn containers, petrolatum is the best with regard to tool lubrication, good flavor performance, price and stability. The lubricant can be topically applied by spraying from standard spray guns, fogging by special electrostatic machines over the coated plate or by mixing the lubricant into the coating.

The lubricant must be able to work under both the heat and pressure in order to protect the coating and metal combination from destruction. The mechanical working of the precoated metal in the dies of the press causes a rise in temperature of the precoating and metal as they are formed into containers. Temperatures in the press tooling and consequently in the containers at least at the interface rise to 150° F. in the first redraw station and reach as high as 200° F. in the second redraw station, but temperatures as high as 280° F. have been measured. In addition to or instead of topical lubricants dry film type lubricants can be dispersed in solvent and incorporated in the coating. During the forming operations, the dry film lubricant becomes available at the heated interface as a hard, solid protective layer. It is essential that the melting point of the solid lubricant be adjusted to cooperate with the levels of heat existing during the multiple forming steps whereby the lubricant first becomes available in a flowable form at the time when the temperature exceeds a predetermined level.

A working temperature is ultimately arrived at during the multiple forming operations and contrary to drawing and ironing of beverage containers there is no coolant/lubricant flood of the containers and tooling used to form sanitary food cans. The flooding of the containers and tooling requires that the containers be cleaned by washing and drying after forming. Here, there is disclosed an essentially clean dry process which provides a container which is ready to be packed and processed. Of course, the foregoing relates primarily to organically precoated stock and not necessarily to unorganically coated tinplate. The working temperature is a result of the process parameters, the tooling design, material used and other factors that influence the pressure applied during forming.

Traditionally, any variation in plate gauge, hardness or temper which affected the drawability had to be overcome by different punch and die dimensions. In particular, a few 0.0001" in the clearance between the punch and die (for a drawn and ironed container diameter in the range of 2¼ to 5") could substantially affect the outcome of a drawing and ironing process. Metal tends to be a resistant to thinning during the plastic deformation resulting from drawing. In a multiple draw/redraw process with ironing, the resistance to thinning will affect the ultimate container volume because as the metal is thinned it elongates resulting in greater side wall height. Similarly, the plate gauge varies throughout a coil thus affecting the ultimately container size. In a two-piece container the height and volume are critical in that each container must be of uniform size in order to properly pass through existing conveyors, processing and labeling equipment.

From the foregoing it is clear that the process used to multiple form drawn and ironed food containers generates a sufficient amount of heat and working pressure to cause uncontrolled dimensional changes in the tooling. These changes are critical to the overall container shape and more specifically, to the variations in ultimate height, volume, side wall condition, bottom profile integrity and flange length before trimming from one container to another. The untrimmed flange length at any given circumferential portion thereof is also a function of the original material gauge and the grain direction established during the rolling of the sheet. Consequently, if the metal is high earing the flange will be extended radially at all points which are about 45° to the grain direction to an extent which is wasteful of material and harmful to the process. Conversely, low earing metal will not extend as far. Light gauge metal will tend to have a short or narrow flange in a radial direction normal to the direction of the grain. This minimum radial extent could result in incomplete trimmed rings such that they will be unmanageable and/or the flange too short.

Also, low temper steel and/or a heavy plate gauge and/or plate with low levels of lubricants produce large flanges causing wrinkling about the circumferential flange periphery. That wrinkling has difficulty in flowing past the clamping sleeve through the tooling between the punch and die. More particularly, the uncontrolled wrinkling of the flange periphery locks against the clamping sleeve which is designed to control the feed of the metal to a prescribed rate. Locking puts excessive stress on the side wall during drawing and/or on the bottom during profiling. That stress causes tearouts in the side wall and breakouts in the bottom wall. More specifically, the feeding of the material into the die as a result of being drawn by the punch is not uniform and not controlled because of the locking due to wrinkling about the extended flange periphery.

In a high speed draw/redraw food container multiple forming operation at speeds of 100 containers per minute or higher the variables which will determine the quality of the container produced are many and are changing with respect to time. It is therefore essential to such a commercial operation to be able to accurately control the process and consequently the results by some means. It is the object of the disclosure to present the technique, method and apparatus discovered which permits the stated problems to be resolved.

OBJECTS OF THE DISCLOSURE

It is an object of this invention to radially adjust the tooling dimensions during operation to overcome running material and operational changes which will affect the container and trim size and quality.

It is another object of the present invention to overcome the difficulties of having gauge tolerances which affect the length of the untrimmed flange and container volume.

It is still a further object of the present invention to disclose a method by which the amount of flange wrinkling can be controlled.

It is yet another feature of the present invention to show an inexpensive, expedient and practical means by which the container volume and flange length can be adjusted in a high speed commercial drawing and ironing food can manufacturing process.

SUMMARY OF THE DISCLOSURE

The present inventions deals with thin metal plate having a thickness or gauge tolerances of ±5% from the ideal or aim gauge necessary for reliable continuous multiple forming operations. In the past the maximum

gauge tolerance feasible for producing acceptable containers without excessive flange, incorrect volume, clip-offs, breakouts, tearouts and the like was about ±3% from the ideal gauge. The ±3% tolerance is necessitated by the recognition that in a high speed commercial operation the eccentricity of the tooling relative to its axis varies such that the trim rings become offset or eccentric with respect to the trimmed containers. Similarly, uneven clamping affects the control of the metal drawn through the die giving eccentric trim rings. During normal startup the normalization of tooling temperature results in a decrease in the amount of trim. This contricity problem coupled with the plate gauge tolerance means that the ±3% is critical unless other measures are taken. The present disclosure deals with those other measures which permit the plate gauge tolerances to be raised to at least as high as ±5%.

The ideal gauge of 65# plate is 0.00715 inches and with a ±5% tolerance gives a gauge variation from 0.0068" to 0.0075". The difference between precoated plate and plain plate gauge is about 0.0004" so that the thickness with ±5% gauge tolerance for precoated plate is 0.0072" to 0.0079". More specifically, selective water cooling of the punches and/or dies can be used to control the dimensions of the punches with respect to the dies. Water passages provided to permit cooling water to flow through the tooling will help control the clearance between the punch and die sufficiently to handle the ±5% gauge tolerance.

The flange length is also a function of the temperature of the tooling since the dimensions of the tooling vary with temperatuer resulting in fluctuations in the loading applied to the metal. Temperature increases in the punch, or decreased in die result in greater untrimmed flange size length and larger container volume. Similarly, minimum trim length correlates with decreasing punch temperature and increased die temperature with lighter plate gauge, and specifically as the gauge decreases so does the amount of trim. When the tooling is cool or at room temperature, the cans which are drawn and ironed have large or excessive trim rings. If the tools are allowed to heat up by restriction of the flow of the cooling water or increasing the temperature of the cooling water, the trim rings diminish in size. This results because the metal flow or drawability improves permitting more metal to flow into the side and bottom of the container. This improved flow decreases stress induced in the container during forming thus minimizing the potential for breakouts or tearouts. Of course, the metal consumption can be reduced by increasing the amount of cooling but at the risk of greatr stress in the can side and bottom. It becomes a balance as to obtaining the maximum use of material at the minimum stress while keeping the trim a container size within the range which is considered normal.

The preferred embodiment in a typical press of the type described for making ironed cans in a multiple drawing and ironing process, has chilled water of about 40° F. flowing through the dies from one supply connection and through the punches from another separate supply connection. Consequently, the temperature of either the punches or the dies or both can be controlled. For example, restriction of the water flow through the punches will increase the amount of ironing as the punches heat up and expand. Similarly, increasing the flow of coolant through the punches will prevent them from expanding in a radial direction and cut down the amount of ironing which takes place as the dies warm up and expand. Similarly, increasing the flow of coolant through the die decreases the temperatures of the die which increases the amount of ironing, obviously increasing the temperature of the water used for cooling will have the same affect as decreasing the flow and alternatively lowering the temperature has the same effect as increasing the flow because the tooling tends to warm up as a result of the operation. Tooling temperature adjustments are made by valving the flow, changing the temperature of the coolant, or a combination of both. Of course, adjusting the flow with valves is simpler and tends to give a quicker response.

The effect of being able to adjust the clearance between the punches and dies is best appreciated when one understands that running changes can be made which will permit the tooling to be adjusted for plate gauge tolerances, drawability, die allignment plate, temper and lubrication effects. Another factor arising from the effects of temperature control of the die is the variation of the preload on the carbide die insert. With temperature increase the steel portion of the tool is expanded radially and the preload decreases. This has a direct affect on increasing clearance between the punch and die.

Lubrication level also effects the trim ring dimensions. With high levels of lubricants either topically applied or in the coating, small trim rings are obtained since the metal flow or drawability is improved. Conversely, low lubrication levels produce large trim rings as the stress of the process is increased and the flow of metal is inhibited. The preferred lubrication rate is 17 to 21 mg per square foot ±7 mg per square foot on the inside and outside of the container when petrolatum is used as lubricant. Similarly, temper will affect the trim ring dimensions. Low temper steel has a low tensile strength and thus gives long trim rings as the metal elongation is greater. High temper metal produces short trim rings since the tensile strength is high and the stress elongation is low.

The preferred drawing and ironing process seeks to produce containers with uniform height having a tolerance of ±0.0001". It is, therefore, important to be able to quickly and easily adjust the process to meet the parameters of the material so that the resulting containers are uniform.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial perspective view of the apparatus of the invention in a press having three stations in which a thin sheet of metal is first blanked and cupped, then redrawn and finally redrawn again and bottom profiled;

FIG. 2 is a schematic flow diagram illustrating the cooling circuits and water flow in the apparatus of FIG. 1;

FIG. 3 is a partial side elevational view in cross section of the punch and die of the first redraw station of the apparatus of FIG. 1;

FIG. 4 is a partial side elevational view in cross section of an alternate punch design for the apparatus of FIG. 1;

FIG. 5 is a plan view of a trim ring which is almost too thin or fragile for handling;

FIG. 6 is a plan view of a trim ring which has excess material such that it is uneconomical and difficult to handle;

FIG. 7 is a plan view of a trim ring wherein the amount of material and distribution of same is considered normal.

DETAILED DESCRIPTION OF THE DRAWINGS AND DISCLOSURE OF THE INVENTION

FIG. 1 is a partial perspective view of the tooling 10 is a press wherein multiple operations take place in converting a blank sheet of a thin metallic strip into a container having a height greater than its diameter. The tooling 10 includes a blanking and cupping tool 11, a first redraw punch and die 12, and a second redraw and bottom profile tool 13. The tooling 10 is held between the crown 14 of the press and the ram 15 of the press. To support the ram 15 relative to the crown 14, there is a shown in FIG. 1 just one of several guide posts 16 which in a conventional manner is supported from the crown 14 by guide post retainers 17 so as to depend perpendicularly from the crown 14 into a lower guide bushing 18 which is affixed to the ram 15 by a bushing retainer 19. The ram 15 is thus carried within the press for guided reciprocatory movement towards and away from the crown 14 as shown by the arrow in FIG. 1.

The blanking and cupping tooling 11 consists of a blanking punch draw die assembly 20 mounted to the ram 15 by a die retainer 21 which is attached to the die shoe 22 that is directly carried on the ram 15. The die assembly 20 includes a blanking punch cutedge 23 carried atop the die retainer and designed to support and generate a blank over draw die 24. Similarly, a punch assembly 25 for the blanking and cupping tooling 11 includes a punch shoe 26, a punch retainer 27, a punch spacer 28 and a punch 29 mounted in axial relation in descending order from the crown 14. The punch 29 is surrounded by a hold down clamp 30, see FIG. 1.

The tooling for blanking and cupping 11 and the second redraw and bottom profiling 13 are substantially identical to the first redraw tooling and as for as the present disclosure is concerned the cooling passages are substantially as shown in FIG. 3 in the other stations and only the dimensions are different with respect to the tools whereby order a different size container are formed. The numbering applied in FIG. 3 is in connection with the first redraw station 12 and the parts which compose the punch and die members for each of the tools 11, 12, or 13 are similar in name and operation. They will only be described in detail in connection with the first redraw section shown in cross section in FIG. 3, and the alternate punch assembly of FIG. 4.

Turning to FIG. 3 which is the partial side elevational view in cross section of the first redraw tool 12 and it shows in detail the cooling passages. Specifically, there is a die retainer 31 mounted on die shoe 32 carried on a ram 15 for supporting the hollow cylindrical die ring holder 33 which holds therein the carbide draw die ring 34 in concentric coaxial alignment. The first redraw tooling 12 includes a punch assembly having a punch shoe 36, a punch retainer 37, a punch spacer 38 and, of course, the punch 39. There are a pair of cylindrical centering locating sleeves upper 40 and lower 41 which are coaxially centered within the punch portion of the first redraw operation operation 12. The lower locating sleeve 41 is held within the punch by a punch center 42 being a ring-like member disposed within the hollow confines of the punch 39. A cooling passage 43 starts in the upper left side of the punch tooling in FIG. 3 and permits coolant to flow across and down through the punch retainer 37, the punch spacer 38 and into the punch center 42. About the punch center 42 there is a series of spiral grooves in the periphery thereof labelled generally 44. The incoming coolant passage 43 supplies the spiral grooves 44 which are against the inside of the draw die 34 thus allowing the coolant to flow about the periphery of the punch center 42 and in heat conductive contact with the inside wall of the punch 39. The coolant enters the spiral groove 44 at a high elevation and in circulating the coolant progresses to the bottom of the punch center 42 where an exit passage 43a is provided to permit the coolant to flow upwardly through the punch center 42, punch spacer 38, punch retainer 37 and out across the punch shoe 36.

An inlet passage 45 is provided at the left side of the die shoe 32 in FIG. 3 and passage 45 which permits the coolant flow across and then upwardly through the die shoe 32 and into the die retainer 31. The passage 45 in the die retainer 31 includes an offset portion 46 at the juncture where the passage 45 from the bottom of the die retainer 31 joins another passage 47 from the top of the die retainer 31. This offseting is needed in order to align the passage 46 and 47 so they run through the portions of the die retainer 31 with the maximum amount of material thickness. More specifically, the offset 46 for passages 45 and 47 permit the die retainer 31 to have maximum strength notwithstanding the fact that coolant passages are drilled therethrough. The passage 47 continues up through the die ring holder 33 wherein a transverse passage and inner wall groove 48 are provided to permit circumferential circulation of coolant between the inner wall of the die ring holder 33 and the mating part of draw die ring 34.

As those skilled in the art will no doubt appreciate, O-rings such as, for example, those noted at the mating surfaces between the punch shoe 36 and the punch retainer 37 and labelled 49 are included at all of the junctures between all of the components of the tooling in order to provide the fluid tight seal necessary for coolant flow without leakage of the coolant. The coolant in the punch of FIG. 3 and, in particular at the groove 48 is allowed to exit through the die ring holder 33, die retainer 31 and the die shoe 32 through a set of passages 50, 51 (again being the offset) and 52 in a manner similar to that arrangement through which of coolant was allowed to enter. This technique is used in order to maintain the strength of retainer 31. Passages 50 and 52 are apart from passages 45 and 47 to permit circulation of the coolant about the circumference of the draw ring 34.

Turning to FIG. 2 which is a schematic view to show the flow of coolant in a parallel type system. While the preferred embodiment incorporates a parallel type system, those skilled in the art will no doubt appreciate that in specific instances other arrangements would be feasible where the coolant flow is more important during certain stages of the forming operations than others due to increased heat buildup, for example, the second redraw operation. In FIG. 2, from left to right there is shown the tooling 11, 12 and 13 in schematic fashion. The top blocks are labelled punch assembly and represent the respective punch assemblies for the cupping and blanking tool 11, first redraw tool 12 and second redraw and bottom profiling tool 13. Similarly, the lower blocks immediately below the punch assemblies are the die assemblies for the cupping and blanking tool 11, the first redraw tool 12 and the second redraw and bottom profiling tool 13.

The coolant flow begins at a pump labelled 52 which by the piping generally labelled 53, throughout, is connected to a chiller 54 used to control the temperature of

the coolant being pumped through the piping 53. In the preferred embodiment the coolant is water and the temperature 40° F. The pump 52 and the chiller 54 act to supply coolant to the respective punch and die assemblies by the respective manifold assemblies 53a and 53b for the dies and punches. As can easily be seen schematically in FIG. 2 and as can be seen pictorially in FIG. 1, the manifolding is for parallel flow. Manifolding assemblies 53a and 53b have independent connections to each of the die assemblies and each of the punch assemblies. The connections include flow control means being valves designated 55 (one for each assembly) and flow control meters 56 (one for each assembly). The valves 55 are shown pictorially in FIG. 1 and schematically in FIG. 2, and similarly, the flow meters 56 are shown pictorially in FIG. 1 and schematically in FIG. 2. Flow meters 56 are Hedland brand in-line type which are designed to measure the flow in a range of zero to two gallons per minute. Thus, it can be seen that the quantity of coolant fluid available to flow to any of the die assemblies or punch assemblies can be independently determined and regulated. Exit manifolds 57a and 57b are connected to the respective dies and punches to permit collection of the coolant fluid flow therethrough and the return of same by piping 53 to the inlet of the pump 52.

FIG. 4 shows an alternate view of punch cooling passages. More specifically, the second redraw punch assembly is shown and the view is partially in section to disclose the details of the cooling passages through that assembly. In a manner similar to that described in FIG. 3, the coolant enters the punch shoe 36 through an inlet passage 43 moving thereacross and down into a punch base 59 being a cylindrical member disposed within a redraw sleeve 60 a continuing device for the can and pressure clamp. Redraw sleeve 60 is hollow and cylindrical and fits about the outer periphery of a carbide punch shell 61 which rides about a punch core 63 attached to the lower periphery of the cylindrical punch base 59. Redraw sleeve 60 has a retainer flange 60a which cooperates with a redraw sleeve retainer 68 carried on punch shoe 36. There are coolant passages in punch core 63 against the inside of carbide punch shell 61.

More specifically a passage 62 extends downwardly from inlet passage 43 into the punch base 59 and communicates by cross passage 62a with a series of spaced parallel circumferentially positioned grooves in punch core 63. Cross passage 62a permits coolant to flow into grooves of punch core 63. In order to establish a circuitous path about the outer periphery of punch core 63. There are a series of inner connections 64 between adjacent grooves of punch core 63 to permit the coolant to migrate from one groove to the next. As can be seen in FIG. 4, these interconnections 64 are alternately spaced on opposite sides of the punch base 59 such that the coolant must flow about the punch core 63 before it can reach another level and thus in a maze fashion coolant flow passes through the spaces formed by the grooves in punch core 63 and the inner connections 64 adjacent the inside wall of the carbide shell 61. An exit passage 65 interconnects the grooves with an outlet passage 66 which extends up through the punch base 59 to the punch shoe 36 and through an exit passage 67.

In operation, the apparatus shown in FIG. 1 can be used as an experimental tool to determine the best method for producing containers having the ideal trim ring as shown and described with respect to FIG. 7, notwithstanding the fact that the material dimension i.e., thickness or specifications, i.e. temper will vary. For example, the following Example A discloses an arrangement wherein the die temperatures were checked with a contact pyrometer probe with and without cooling as c...n be seen. The temperatures varied and could be controlled by the flow of coolant.

EXAMPLE A

PARALLEL PATH COOLING

	TEST 1	TEST 2
Exiting Can Temperature	150–160° F.	140–150° F.
Capping Die Temperature	115–120° F.	75° F.
First Redraw Die Temperature	95° F.	85° F.
Second Redraw Die Temperature	150° F.	95° F.
First Redraw Sleeve (Clamp Sleeve) Temperature	150° F.	110° F.
Second Redraw Sleeve (Clamp Sleeve) Temperature	150° F.	100° F.

Test 1 involved cooling of the second station (the first redraw) tooling only. The press ran at 80 strokes/minute and made cans from 75# T-4 plate.

Test 2 was a more representative experiment; all stations were cooled by tap water @ 55° F. and 35–40 psig supply pressure. (The supply pressure was also the total pressure drop across the system.) The press operated at 100 strokes/minute and made cans from 75# T-4 plate.

Similarly, an experiment wherein the water was run in series (not specifically shown and disclosed herein where the temperatures of the stations cannot be independently controlled) the coolant flows through one set of tooling after another before it is rechilled. For such an experiment inferior cooling was found.

Draw punch temperatures are unavailable because the clamp sleeve covered the punch surface and made it impossible to get the contact pyrometer probe to directly touch the punch.

SERIES PATH COOLING

Capping Die Temperature	110° F.
First Redraw Die Temperature	165° F.
Second Redraw Clamp Sleeve Temperature	170° F.
First Redraw Sleeve Clamp Sleeve Temperature	150° F.
Second Redraw Sleeve Clamp Sleeve Temperature	200° F.

All press conditions were not recorded, but the speed was 85 strokes/minute. The cooling was a series arrangement fed by tap water at the temperature and pressure mentioned previously.

It is clear that parallel feed is superior for minimizing operating temperature of the tooling. Tests 1 and 2 involved parallel-path cooling channels in which water from the supply cooled only one tool before being discharged from the press. The material used was also 75# T-4. No die temperature exceeded 170° F. and that no clamp sleeve exceeded 200° F.

Calculations as to the amount of heat which is removed can easily be made by measurement of the coolant temperatures before and after it has passed through the tooling provided that a steady state condition has been achieved. That is to say that, the tooling is running at an operating speed for a sufficient time to equalize the operating temperatures of all of the components and all

of the piece parts. This was done in connection with the following Example B

The amount of heat being removed from each tool by the coolant water was determined during a continuous run of the press. The coolant temperatures in each coolant passage reached a steady state, and the water flow rates and the water temperatures were measured so that the heat removal rates could be calculated. The results are as follows:

	RATE OF HEAT REMOVAL (BTU/MIN)	WATER FLOW RATE (GAL/MIN)
Cupper Punch	23	0.51
First Redraw Punch	34	0.37
Second Redraw Punch	36	0.27
Cupper Die	78	0.83
First Redraw Die	42	0.66
Second Redraw Die	37	0.89

SPEED OF PRESS: 90 STROKES/MINUTE
MATERIAL RUN: 75# T-4

The cupper die was found to have the greatest amount of heat removed from it by the coolant, perhaps because heat transfer is superior in that particular piece of tooling or because there is more heat being generated there. The amount of heat removed from each of the punches is roughly the same as that removed from its respective dies.

Once the concept was evolved as to how the independent cooling of the tooling for the various stations could best be applied, it was necessary to see what the commercial advantage would be and more specifically, how the adjustment to the flow of coolant could be used to accommodate plate variations, specifically plate gauge and temper variations and to adjust trim rings. The following Examples C, D and E show the results of a test made in connection with determining the effect of controlled cooling on adjusting the trim ring size and accommodating wide ranging gauge variations.

EXAMPLE C

The difference in flow rates between the punches and the dies should be noted. The flow path through the punches (see FIG. 3) presents much more resistance to flow than that through the dies.

The following test conditions have been tried on the press with the objective of determining the effect that various water cooling arrangements have on the amount of metal in the trim ring:

DRAW DIE COOLED (STATIONS)	DRAW PUNCHES COOLED (STATIONS)
None	None
1,2,3	1,2,3

In each test the press speed in strokes per minute was 80 and, marked panels of stock were inserted into the feed stock at set intervals. Matched cans and trim rings were saved and weighed to determine the percent of metal from the original blank which was used in the trim ring. The flow path was parallel such that the tooling 11, 12 and 13 could be independently cooled.

FIG. 5 shows a trim ring which is difficult to handle without jamming. That is to say that, the trim ring shown in FIG. 5 is narrowest in the area normal to the direction of grain established during mill rolling of the metal into a sheet form to make it thin enough to be used for drawing into cans. Similarly, the trim ring shown in FIG. 5 is widest at all points which are at angles which are at 45° relative to the grain direction. This widening is called earing. In the most severe case, the narrow areas shown in FIG. 5 could consist of no metal at all and thus represent a broken trim ring which is particularly difficult to handle in that the broken edges are sharp and do not cooperate with the equipment designed to help remove the trim ring from the press or because slivers or shards of metal from the broken portion jam the press and damage the tools.

In FIG. 6 a trim ring with excessive material is shown. This trim ring includes puckers at 58 which extend about the periphery of the trim ring. These puckered portions interfere with the drawing of the metal into the container wall during the cupping, first redraw, and second redraw with bottom profiling operations. The puckers tend to lock between the die and clamping portion of the tooling thus preventing metal flow into the container body. It is therefore important to minimize the radial extent of the trim ring such that the flow of metal is not inhibited by puckers. These puckers result from the circumferential contraction of metal as it is converted from a flat sheet or from a larger diameter container into a smaller diameter container when the metal is insufficiently clamped. Once again the trim ring even though excessive tends to be wider along lines at 45° to the direction of the grain as established during the rolling of the metal at the mill.

Finally, FIG. 7 shows a normal trim ring and while not circular about its outer circumferential periphery it is more nearly so than the trim rings of FIGS. 5 and 6. Here again, there is some narrowing in the areas normal to the direction of grain. This preferred trim ring has sufficient material to be easily handled without difficulties due to its size or fragilness. Again, the preferred trim ring of FIG. 7 does not have the puckers 58 shown in connection with the excessive trim ring in FIG. 6. Consequently, there is no inhibition to the flow of material during drawing or redrawing, and in particular, to the movement or flow of metal during the bottom profile operation wherein material has to be shifted into the bottom from the flange and side wall of the container. The trim rings from the test where water was supplied to all punches and rings had 27% more material than those of the test where there was no cooling. The exact values were:

	RATIO OF TRIM RING WEIGHT TO ORIGINAL BLANK WEIGHT*	STANDARD DEVIATION
TEST WITH NO COOLING	.037	.004
TEST WITH COOLING OF ALL PUNCHES AND DIES	.047	.004

(*Note Original Blank Weight = weight of trim ring + weight of corresponding can body)

% Increase in trim ring material = $\frac{.047 - .037}{.037} = 27\%$

EXAMPLE D

Results of can making tests of 65# DR9 gauge-temper for:

1. Process Set for Ideal Plate Thickness

Safe operating gauge range for coated plate: 0.0073" (−3.3%) to 0.0078" (+3.3%)

Water cooling flow rates (40° to 50° F. supply), gpm:

Station	Punch	Die
Cupping	0.4	1.0
Second	0.2	0.73
Third	0.25	0.20

2. Process Set for Heavy Gauge Plate

Safe operating limit for coated plate: Up to 0.0080" (+6.0%).

Water cooling flow rates (40° to 50° F. supply), gpm:

Station	Punch	Die
Cupping	0.60	.57
Second	0.17	.37
Third	0.35	None

The criticality of the trim ring control has been discussed in connection with FIGS. 5, 6 and 7. Data which exceeds the variation in trim ring material by weight in grams is disclosed in connection with some experiments used with coolant flow for varying conditions with varying types of plate i.e., light, ideal and heavy. It can be seen that the trim ring weights can be controlled to some extent notwithstanding the fact that the plate varies considerably.

EXAMPLE E

CONDITIONS TO INCREASE IRONING—LIGHT PLATE

	PUNCHES			DIES		
	1	2	3	1	2	3
TOOLING SURFACE TEMPERATURE °F.	100	130	160	70	80	90
WATER FLOW RATE (GPM)	.30	.18	.17	1.0	7.3	.20
CAN SURFACE TEMPERATURE (DEGREES F.)			145			
TRIM RING WEIGHT (GRS.)			1.7			

INLET WATER TEMP. 45° F. AVG.

NORMAL CONDITIONS FOR IDEAL PLATE

	PUNCHES			DIES		
	1	2	3	1	2	3
TOOLING SURFACE TEMPERATURE °F.	80	105	130	70	80	90
WATER FLOW RATE (GPM)	.60	.37	.39	1.00	.73	.20
CAN SURFACE TEMPERATURE (DEGREES F.)			130			
TRIM RING WEIGHT (GRS.)			1.7			

INLET WATER TEMP. 45° AVG.

CONDITIONS TO DECREASE IRONING—HEAVY PLATE

	PUNCHES			DIES		
	1	2	3	1	2	3
TOOLING SURFACE TEMPERATURE °F.	80	105	130	90	105	120
WATER FLOW RATE (GPM)	.60	.37	.35	.50	.36	.10
CAN SURFACE TEMPERATURE (DEGREES F)			133			
TRIM RING WEIGHT (GRS.)			1.7			

INLET WATER TEMP 45° F. AVG.

Those skilled in the art will no doubt appreciate that variations on the specific coolant passage configurations could be applied to a variety of tooling in order to make a system wherein the tooling dimensions could be controlled in accordance with the desired results of the fabricating process.

The claims which follow are fashioned to cover those arrangements which skilled artisan would develope through the knowledge of the teachings of the present disclosure even though the exact configurations or the particular operation to which it has been adapted are not followed.

What is claimed is:

1. In an apparatus for drawing and ironing a container from material without coolant being applied directly to said material including a press frame for supporting tooling for reciprocating movement where said tooling includes punch means and die means for drawing and ironing said material captured therebetween into a thin walled hollow container having a cup-shape, the improvement comprising:

adjacent surfaces on said punch and die means for defining a space therebetween through which said material must pass during forming;

coolant passages provided in said die means for permitting coolant to flow therethrough without said coolant contacting said material;

flow regulating means associated with said die means coolant passages for adjusting the rate of said coolant allowed to pass through said die means in accordance with variations in said material and to effect said space, between said adjacent surfaces by increasing or decreasing said die means surface position toward or away from said punch means surface; and

temperature control means connected to said die means passages to change the temperature of said coolant in accordance with variations in said material and to effect said space, between said adjacent surfaces by increasing or decreasing said die means surface position toward or away from said punch means surface.

2. The apparatus of claim 1 wherein said punch means has coolant passages connected independently of said die means passages and another flow regulating means being connected to said punch means passages.

3. The apparatus of claim 1 wherein said punch means has coolant passages independent of said die means passages and another temperature control means being connected to said punch means passages.

4. In an apparatus for drawing and ironing a cup with a peripheral flange from relatively thin material into an

elongated container also having a flange by moving a die and punch relative to one another and draw clamping and centering sleeve coaxial therewith and thereafter applying a bottom forming member axially relative to the die against the punch to profile shape said container bottom without the benefit of coolant flooding of said material during drawing and ironing, the improvement comprising:

a die means of a predetermined shape and size carried in the apparatus,

a punch means of a predetermined shape and size for cooperating with said die means and each having surfaces which define a clearance therebetween during forming of said material;

separate passages through said die means and said punch means to permit flow of coolant;

a coolant supply means independently connected to said die means and said punch means passages;

valving in line with said die means and said punch means passages for independent control of the coolant flow from said supply means to said die means and said punch means to permit regulation of the operating temperature of said die means with respect to said punch means to increase or decrease said clearance therebetween by moving said surfaces toward or away from one another during the drawing and ironing of said material into an elongated container.

5. The apparatus of claim 4 wherein said die and punch passages each have independent temperature controlling means for varying the operating temperature of the coolant flowing through said passages to said die and punch means with respect to one another.

6. The apparatus of claim 5 wherein said temperature controlling means is between said valving and said passages for said die to change the temperature of said coolant for said die.

7. The apparatus of claim 5 wherein said temperature controlling means is between said valving and said passages for said punch to change the temperature of said coolant for said punch.

* * * * *

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PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

To:

BITTMAN, Mitchell, D.
Sequa Corporation
3 University Plaza
Hackensack, NJ 07601
ETATS-UNIS D'AMERIQUE

Date of mailing (day/month/year)	
15 May 2003 (15.05.03)	
Applicant's or agent's file reference	IMPORTANT NOTICE
RM-106 (PCT)	
International application No.	International filing date (day/month/year)	Priority date (day/month/year)
PCT/US02/34896	31 October 2002 (31.10.02)	02 November 2001 (02.11.01)
Applicant	
SEQUA CAN MACHINERY, INC.	

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this notice:

   KP, KR

   In accordance with Rule 47.1(c), third sentence, these Offices will accept the present notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:

   AE, AG, AL, AM, AP, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EA, EC, EE, EP, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OA, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW

   The communication will be made to these Offices only upon their request. Furthermore, these Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-*bis*)).

3. Enclosed with this notice is a copy of the international application as published by the International Bureau on 15 May 2003 (15.05.03) under No. 03/039780

4. **TIME LIMITS for filing a demand for international preliminary examination and for entry into the national phase**

   The applicable time limit for entering the national phase will, subject to what is said in the following paragraph, be 30 MONTHS from the priority date, not only in respect of any elected Office if a demand for international preliminary examination is filed before the expiration of 19 months from the priority date, but also in respect of any designated Office, in the absence of filing of such demand, where Article 22(1) as modified with effect from 1 April 2002 applies in respect of that designated Office. For further details, see *PCT Gazette* No. 44/2001 of 1 November 2001, pages 19926, 19932 and 19934, as well as the *PCT Newsletter*, October and November 2001 and February 2002 issues.

   In practice, time limits other than the 30-month time limit will continue to apply, for various periods of time, in respect of certain designated or elected Offices. For regular updates on the applicable time limits (20, 21, 30 or 31 months, or other time limit), Office by Office, refer to the *PCT Gazette*, the *PCT Newsletter* and the *PCT Applicant's Guide*, Volume II, National Chapters, all available from WIPO's Internet site, at http://www.wipo.int/pct/en/index.html.

   For filing a demand for international preliminary examination, see the *PCT Applicant's Guide*, Volume I/A, Chapter IX. Only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination (at present, all PCT Contracting States are bound by Chapter II).

   It is the applicant's sole responsibility to monitor all these time limits.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Judith Zahra
Facsimile No.(41-22) 740.14.35	Telephone No.(41-22) 338.91.11

Form PCT/IB/308 (April 2002)

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PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION CONCERNING SUBMISSION OR TRANSMITTAL OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

To:

BITTMAN, Mitchell, D.
Sequa Corporation
3 University Plaza
Hackensack, NJ 07601
United States of America

Date of mailing (day/month/year) 29 January 2003 (29.01.03)	
Applicant's or agent's file reference RM-106 (PCT)	**IMPORTANT NOTIFICATION**
International application No. PCT/US02/34896	International filing date (day/month/year) 31 October 2002 (31.10.02)
International publication date (day/month/year) Not yet published	Priority date (day/month/year) 02 November 2001 (02.11.01)
Applicant SEQUA CAN MACHINERY, INC.	

1. The applicant is hereby notified of the date of receipt (except where the letters "NR" appear in the right-hand column) by the International Bureau of the priority document(s) relating to the earlier application(s) indicated below. Unless otherwise indicated by an asterisk appearing next to a date of receipt, or by the letters "NR", in the right-hand column, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).

2. This updates and replaces any previously issued notification concerning submission or transmittal of priority documents.

3. An asterisk(*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b). In such a case, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

4. The letters "NR" appearing in the right-hand column denote a priority document which was not received by the International Bureau or which the applicant did not request the receiving Office to prepare and transmit to the International Bureau, as provided by Rule 17.1(a) or (b), respectively. In such a case, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

Priority date	Priority application No.	Country or regional Office or PCT receiving Office	Date of receipt of priority document
02 Nove 2001 (02.11.01)	10/003,652	US	10 Dece 2002 (10.12.02)

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer PETRESKA, Gorica
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338 9999

Form PCT/IB/304 (July 1998)

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PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

INFORMATION CONCERNING ELECTED OFFICES NOTIFIED OF THEIR ELECTION

(PCT Rule 61.3)

To:

BITTMAN, Mitchell, D.
Sequa Corporation
3 University Plaza
Hackensack, NJ 07601
United States of America

Date of mailing (day/month/year)	
17 June 2003 (17.06.03)	
Applicant's or agent's file reference	**IMPORTANT INFORMATION**
RM-106 (PCT)	

International application No.	International filing date (day/month/year)	Priority date (day/month/year)
PCT/US02/34896	31 October 2002 (31.10.02)	02 November 2001 (02.11.01)

Applicant
SEQUA CAN MACHINERY, INC.

1. The applicant is hereby informed that the International Bureau has, according to Article 31(7), notified each of the following Offices of its election:

   EP :AT,BE,BG,CH,CY,CZ,DE,DK,EE,ES,FI,FR,GB,GR,IE,IT,LU,MC,NL,PT,SE,SK,TR
   National :AU,BG,CA,CN,DE,GB,IL,JP,KP,KR,MN,NO,PL,RO,RU,SK

2. The following Offices have waived the requirement for the notification of their election; the notification will be sent to them by the International Bureau only upon their request:

   AP :GH,GM,KE,LS,MW,MZ,SD,SL,SZ,TZ,UG,ZM,ZW
   EA :AM,AZ,BY,KG,KZ,MD,RU,TJ,TM
   OA :BF,BJ,CF,CG,CI,CM,GA,GN,GQ,GW,ML,MR,NE,SN,TD,TG
   National :AE,AG,AL,AM,AT,AZ,BA,BB,BR,BY,BZ,CH,CO,CR,CU,CZ,DK,DM,DZ,EC,EE,
   ES,FI,GD,GE,GH,GM,HR,HU,ID,IN,IS,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MA,MD,MG,
   MK,MW,MX,MZ,NZ,OM,PH,PT,SD,SE,SG,SI,SL,TJ,TM,TN,TR,TT,TZ,UA,UG,UZ,VN,YU,
   ZA,ZM,ZW

3. The applicant is reminded that he must enter the "national phase" before the expiration of 30 months from the priority date before each of the Offices listed above. This must be done by paying the national fee(s) and furnishing , if prescribed, a translation of the international application (Article 39(1)(a)), as well as, where applicable, by furnishing a translation of any annexes of the international preliminary examination report (Article 36(3)(b) and Rule 74.1).

   Some offices have fixed time limits expiring later than the above-mentioned time limit. For detailed information about the applicable time limits and the acts to be performed upon entry into the national phase before a particular Office, see Volume II of the PCT Applicant's Guide.

   The entry into the European regional phase is postponed until 31 months from the priority date for all States designated for the purposes of obtaining a European patent.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 338-70-90

Authorized officer:
David MALEK

Telephone No. (41-22) 338 8886

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF RECEIPT OF RECORD COPY

(PCT Rule 24.2(a))

To:

BITTMAN, Mitchell, D.
Sequa Corporation
3 University Plaza
Hackensack, NJ 07601
United States of America

Date of mailing (day/month/year)	IMPORTANT NOTIFICATION
21 January 2003 (21.01.03)	
Applicant's or agent's file reference	**International application No.**
RM-106 (PCT)	PCT/US02/34896

The applicant is hereby notified that the International Bureau has received the record copy of the international application as detailed below.

Name(s) of the applicant(s) and State(s) for which they are applicants:

SEQUA CAN MACHINERY, INC.(all designated States)

International filing date	:	31 October 2002 (31.10.02)
Priority date(s) claimed	:	02 November 2001 (02.11.01)
Date of receipt of the record copy by the International Bureau	:	26 November 2002 (26.11.02)
List of designated Offices	:	

AP :GH,GM,KE,LS,MW,MZ,SD,SL,SZ,TZ,UG,ZM,ZW
EA :AM,AZ,BY,KG,KZ,MD,RU,TJ,TM
EP :AT,BE,BG,CH,CY,CZ,DE,DK,EE,ES,FI,FR,GB,GR,IE,IT,LU,MC,NL,PT,SE,SK,TR
OA :BF,BJ,CF,CG,CI,CM,GA,GN,GQ,GW,ML,MR,NE,SN,TD,TG
National :AE,AG,AL,AM,AT,AU,AZ,BA,BB,BG,BR,BY,BZ,CA,CH,CN,CO,CR,CU,CZ,DE,DK,DM,DZ,EC,EE,ES,FI,GB,GD,GE,GH,GM,HR,HU,ID,IL,IN,IS,JP,KE,KG,KP,KR,KZ,LC,LK,LR,LS,LT,LU,LV,MA,MD,MG,MK,MN,MW,MX,MZ,NO,NZ,OM,PH,PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TN,TR,TT,TZ,UA,UG,UZ,VN,YU,ZA,ZM,ZW

ATTENTION

The applicant should carefully check the data appearing in this Notification. In case of any discrepancy between these data and the indications in the international application, the applicant should immediately inform the International Bureau.

In addition, the applicant's attention is drawn to the information contained in the Annex, relating to:

- [X] time limits for entry into the national phase - see updated important information (as of April 2002)
- [X] confirmation of precautionary designations (if applicable)
- [X] requirements regarding priority documents (if applicable)

A copy of this Notification is being sent to the receiving Office and to the International Searching Authority.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer: Carlos NARANJO
Facsimile No. (41-22) 338-8998	Telephone No. (41-22) 338 8349

Form PCT/IB/301 (April 2002)

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ US

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only	
Identification of IPEA	Date of receipt of DEMAND

Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION		Applicant's or agent's file reference: RM-106(PCT)
International application No.: PCT/US02/34898	International filing date (day/month/year): 31 OCTOBER 2002 (31.10.02)	(Earliest) Priority date (day/month/year): 02 NOVEMBER 2001 (02.11.01)

Title of invention: INTERNALLY COOLED TOOL PACK

Box No. II APPLICANT(S)

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)	Telephone No.: 201-933-1200 Facsimile No.: 201-438-7801 Teleprinter No.: Applicant's registration No. with the Office:
SEQUA CAN MACHINERY, INC. 401 CENTRAL AVENUE EAST RUTHERFORD, NJ 07073 US	

State (that is, country) of nationality:	State (that is, country) of residence:

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

State (that is, country) of nationality:	State (that is, country) of residence:

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

State (that is, country) of nationality:	State (that is, country) of residence:

☐ Further applicants are indicated on a continuation sheet.

Sheet No. 2

International application No.
PCT/US02/34896

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The following person is ☒ agent ☐ common representative

and ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.

☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.

☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

BITTMAN, MITCHELL D.
SEQUA CORPORATION
THREE UNIVERSITY PLAZA
HACKENSACK, NJ 07601
US

Telephone No.
201-343-1122

Facsimile No.
201-488-2014

Teleprinter No.

Agent's registration No. with the Office

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION

Statement concerning amendments:*

1. The applicant wishes the international preliminary examination to start on the basis of:

☒ the international application as originally filed

the description ☒ as originally filed
☐ as amended under Article 34

the claims ☒ as originally filed
☐ as amended under Article 19 (together with any accompanying statement)
☐ as amended under Article 34

the drawings ☒ as originally filed
☐ as amended under Article 34

2. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.

3. ☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *(This check-box may be marked only where the time limit under Article 19 has not yet expired.)*

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English

☒ which is the language in which the international application was filed.
☐ which is the language of a translation furnished for the purposes of international search.
☐ which is the language of publication of the international application.
☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

Box No. V ELECTION OF STATES

The applicant hereby elects all eligible States *(that is, all States which have been designated and which are bound by Chapter II of the PCT)*

excluding the following States which the applicant wishes not to elect:

Sheet No. 3

International application No.
PCT/US02/34896

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

			For International Preliminary Examining Authority use only: received	not received
1. translation of international application	:	sheets	☐	☐
2. amendments under Article 34	:	sheets	☐	☐
3. copy (or, where required, translation) of amendments under Article 19	:	sheets	☐	☐
4. copy (or, where required, translation) of statement under Article 19	:	sheets	☐	☐
5. letter	:	sheets	☐	☐
6. other *(specify)*	:	sheets	☐	☐

The demand is also accompanied by the item(s) marked below:

1. ☒ fee calculation sheet
2. ☐ original separate power of attorney
3. ☐ original general power of attorney
4. ☐ copy of general power of attorney; reference number, if any:
5. ☐ statement explaining lack of signature
6. ☐ sequence listings in computer readable form
7. ☐ tables in computer readable form related to sequence listings
8. ☐ other *(specify)*:

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

Sequa Can Machinery, Inc

Mitchell D Bittman

Assistant Secretary

19/05/03

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:
2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):
3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply. ☐ The applicant has been informed accordingly.
4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.
5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

CHAPTER II

PCT

FEE CALCULATION SHEET

Annex to the Demand

International application No. PCT/US02/34896	For International Preliminary Examining Authority use only
Applicant's or agent's file reference RM-106	Date stamp of the IPEA

Applicant

SEQUA CAN MACHINERY, INC.

CALCULATION OF PRESCRIBED FEES

1. Preliminary examination fee	490.00	P	
2. Handling fee *(Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.)*	146.00	H	
3. Total of prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box	636.00 TOTAL		

MODE OF PAYMENT

- ☐ authorization to charge deposit account with the IPEA (see below)
- ☒ cheque
- ☐ postal money order
- ☐ bank draft
- ☐ cash
- ☐ revenue stamps
- ☐ coupons
- ☐ other *(specify)*:

AUTHORIZATION TO CHARGE (OR CREDIT) DEPOSIT ACCOUNT
(This mode of payment may not be available at all IPEAs)

IPEA/ US

☐ Authorization to charge the total fees indicated above.

☒ *(This check-box may be marked only if the conditions for deposit accounts of the IPEA so permit)* Authorization to charge any deficiency or credit any overpayment in the total fees indicated above.

Deposit Account No.: 19-4970

Date: 19/05/03

Name: Mitchell D. Bittman

Signature: Mitchell D Bittman

Form PCT/IPEA/401 (Annex) (March 2001; reprint January 2003) *See Notes to the fee calculation sheet*

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference RM-106(PCT)	**FOR FURTHER ACTION**	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
International application No. PCT/US02/34896	International filing date (*day/month/year*) 31 October 2002 (31.10.2002)	(Earliest) Priority Date (*day/month/year*) 02 November 2001 (02.11.2001)
Applicant SEQUA CAN MACHINERY, INC.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the Report**
   a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
   ☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).
   b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing:
   ☐ contained in the international application in written form.
   ☐ filed together with the international application in computer readable form.
   ☐ furnished subsequently to this Authority in written form.
   ☐ furnished subsequently to this Authority in computer readable form.
   ☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   ☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.
2. ☐ Certain claims were found unsearchable (See Box I).
3. ☐ Unity of invention is lacking (See Box II).
4. With regard to the title,
   ☒ the text is approved as submitted by the applicant.
   ☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,
   ☐ the text is approved as submitted by the applicant.
   ☒ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No. 2
   ☐ as suggested by the applicant.
   ☐ because the applicant failed to suggest a figure.
   ☒ because this figure better characterizes the invention.
   ☐ None of the figures

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US02/34896

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : B21D 22/28
US CL : 72/342.3
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 72/342.3, 342.4, 349

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 883,695 A (CANDA) 07 April 1908 (07.04.1908), whole doc.	
Y	US 4,502,313 A (PHALIN et al.) 05 March 1985 (05.03.1985), Figure 3, col.7, line 48 to col. 8, line 47	1-14
A	US 6,263,718 B1 (BUSE et al.) 24 July 2001 (24.07.2001) Figure 11, col. 2, lines 65-67	1-14

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
20 December 2002 (20.12.2002)

Date of mailing of the international search report
16 JAN 2003

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231
Facsimile No. (703)305-3230

Authorized officer
Lowell A. Larson
Telephone No. (703)308-1148

Sheila Veney
Paralegal Specialist
Group 3700

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US02/34896

Box III TEXT OF THE ABSTRACT (Continuation of Item 5 of the first sheet)

The technical features mentioned in the abstract do not include a reference sign between parentheses (PCT Rule 8.1(d)).

NEW ABSTRACT

A can forming tool pack (2) includes internally cooled die modules (4,6,8). Each die module includes at least one die nib (14,16,18,20,22) held in a case. Fluid cooling medium is supplied to multiple inlets (24,26,28,30) provided circumferentially in each case, spaced symmetrically around the case. The cooling fluid is channeled from the inlets through clearances (42,44,46,48,50) between an outer surface of the die nib and the case to cool the die nib. Outlets (34,36,38,40) are spaced circumferentially around the case to return the cooling fluid to the medium supply.

Box No. VI PRIORITY CLAIM

The priority of the following earlier application(s) is hereby claimed:

Filing date of earlier application *(day/month/year)*	Number of earlier application	Where earlier application is:		
		national application: country or Member of WTO	regional application:* regional Office	international application. receiving Office
item (1) 02 November 2001 (02.11.01)	10/003,652	US		
item (2)				
item (3)				
item (4)				
item (5)				

☐ Further priority claims are indicated in the Supplemental Box.

The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) *(only if the earlier application was filed with the Office which for the purposes of this international application is the receiving Office)* identified above as:

☐ all items ☒ item (1) ☐ item (2) ☐ item (3) ☐ item (4) ☐ item (5) ☐ other, see Supplemental Box

** Where the earlier application is an ARIPO application, indicate at least one country party to the Paris Convention for the Protection of Industrial Property or one Member of the World Trade Organization for which that earlier application was filed (Rule 4.10(b)(ii)):* ....

.....

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) *(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used)*:

ISA / US .....

Request to use results of earlier search; reference to that search *(if an earlier search has been carried out by or requested from the International Searching Authority)*:

Date *(day/month/year)*	Number	Country *(or regional Office)*
02 November 2001 (02.11.01)	10/003,652	US

Box No. VIII DECLARATIONS

The following declarations are contained in Boxes Nos. VIII (i) to (v) *(mark the applicable check-boxes below and indicate in the right column the number of each type of declaration)*:		Number of declarations
☐ Box No. VIII (i)	Declaration as to the identity of the inventor	:
☐ Box No. VIII (ii)	Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent	:
☐ Box No. VIII (iii)	Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application	:
☐ Box No. VIII (iv)	Declaration of inventorship (only for the purposes of the designation of the United States of America)	:
☐ Box No. VIII (v)	Declaration as to non-prejudicial disclosures or exceptions to lack of novelty	:

Box No. IX CHECK LIST; LANGUAGE OF FILING

This international application contains:		This international application is accompanied by the following item(s) *(mark the applicable check-boxes below and indicate in right column the number of each item)*:	Number of items
(a) the following number of sheets in paper form:			
request (including declaration sheets)	: 3	1. ☒ fee calculation sheet	:
description (excluding sequence listing part)	: 6	2. ☐ original separate power of attorney	:
claims	: 2	3. ☐ original general power of attorney	:
abstract	: 1	4. ☐ copy of general power of attorney; reference number, if any:	:
drawings	: 4	5. ☐ statement explaining lack of signature	:
Sub-total number of sheets	: 16	6. ☐ priority document(s) identified in Box No. VI as item(s):	:
sequence listing part of description *(actual number of sheets if filed in paper form, whether or not also filed in computer readable form; see (b) below)*	:	7. ☐ translation of international application into *(language)*:	:
Total number of sheets	: 16	8. ☐ separate indications concerning deposited microorganism or other biological material	:
(b) sequence listing part of description filed in computer readable form		9. ☐ sequence listing in computer readable form (indicate also type and number of carriers (diskette, CD-ROM, CD-R or other))	
(i) ☐ only (under Section 801(a)(i))		(i) ☐ copy submitted for the purposes of international search under Rule 13*ter* only (and not as part of the international application)	:
(ii) ☐ in addition to being filed in paper form (under Section 801(a)(ii))		(ii) ☐ *(only where check-box (b)(i) or (b)(ii) is marked in left column)* additional copies including, where applicable, the copy for the purposes of international search under Rule 13*ter*	:
Type and number of carriers (diskette, CD-ROM, CD-R or other) on which the sequence listing part is contained *(additional copies to be indicated under item 9(ii), in right column)*:		(iii) ☐ together with relevant statement as to the identity of the copy or copies with the sequence listing part mentioned in left column	:
		10. ☐ other *(specify)*:	:

Figure of the drawings which should accompany the abstract:	Fig. 1	Language of filing of the international application:	English

Box No. X SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

Sequa Can Machinery, Inc.
By Mitchell D. Bittman
Mitchell D. Bittman, Assistant Secretary

Date 30/10/2002

For receiving Office use only

1. Date of actual receipt of the purported international application:	2. Drawings: ☐ received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:	
4. Date of timely receipt of the required corrections under PCT Article 11(2):	☐ not received:
5. International Searching Authority (if two or more are competent): ISA /	6. ☐ Transmittal of search copy delayed until search fee is paid

For International Bureau use only

Date of receipt of the record copy by the International Bureau:

02
78

This sheet is not part of and does not count as a sheet of the international application.

PCT

FEE CALCULATI N SHEET

Annex to the Request

For receiving Office use only

International Application No.

Date stamp of the receiving Office

Applicant's or agent's file reference: RM-106(PCT)

Applicant: SEQUA CAN MACHINERY, INC.

CALCULATION OF PRESCRIBED FEES

1. TRANSMITTAL FEE . . . . . 240.00 [T]

2. SEARCH FEE . . . . . 450.00 [S]

International search to be carried out by US

(If two or more International Searching Authorities are competent to carry out the international search, indicate the name of the Authority which is chosen to carry out the international search.)

3. INTERNATIONAL FEE

Basic Fee

Where item (b) of Box No. IX applies, enter Sub-total number of sheets / Where item (b) of Box No. IX does not apply, enter Total number of sheets: ____

[b1] first 30 sheets . . . . . 407.00 [b1]

[b2] ____ (number of sheets in excess of 30) x ____ (fee per sheet) = ____ [b2]

[b3] additional component (only if sequence listing part of description is filed in computer readable form under Section 801(a)(i), or both in that form and on paper, under Section 801(a)(ii)):

400 x ____ (fee per sheet) = ____ [b3]

Add amounts entered at b1, b2 and b3 and enter total at B . . . . 407.00 [B]

Designation Fees

The international application contains 91 designations.

5 (number of designation fees payable *(maximum 5)*) x 88 (amount of designation fee) = 440.00 [D]

Add amounts entered at B and D and enter total at I . . . . . 847.00 [I]

(Applicants from certain States are entitled to a reduction of 75% of the international fee. Where the applicant is (or all applicants are) so entitled, the total to be entered at I is 25% of the sum of the amounts entered at B and D.)

4. FEE FOR PRIORITY DOCUMENT *(if applicable)* . . . . . 15.00 [P]

5. TOTAL FEES PAYABLE . . . . . 1552.00 TOTAL

Add amounts entered at T, S, I and P, and enter total in the TOTAL box

☐ The designation fees are not paid at this time.

MODE OF PAYMENT

☐ authorization to charge deposit account (see below) ☐ postal money order ☐ cash ☐ coupons

☒ cheque ☐ bank draft ☐ revenue stamps ☐ other *(specify)*:

AUTHORIZATION TO CHARGE (OR CREDIT) DEPOSIT ACCOUNT

(This mode of payment may not be available at all receiving Offices)

☐ Authorization to charge the total fees indicated above.

☒ *(This check-box may be marked only if the conditions for deposit accounts of the receiving Office so permit)* Authorization to charge any deficiency or credit any overpayment in the total fees indicated above.

☐ Authorization to charge the fee for priority document.

Receiving Office: RO/ US

Deposit Account No.: 19/4970

Date: 30/10/2002

Name: Mitchell Bittman

Signature: Mitchell Bittman

Form PCT/RO/101 (Annex) (January 2002; reprint July 2002)

See Notes to the fee calculation sheet

FORMATO DE DIGITALIZACION
RELACION DE ANEXOS

Royal Technologies S.A.

Item	Expediente No	64039943	No de Folio
		No de unidades	√
1	CD		
2	DVD		
3	REVISTA		
4	LIBRO		
5	PERIODICO		
6	DISQUETES		
7	SOBRE DE MANILA	1	
8	SOBRE BLANCO TAMAÑO CARTA		
9	SOBRE BLANCO TAMAÑO OFICIO		
10	OTROS:		

Observaciones: Arte final

84
80

SUPERINDUSTRIA Y COMERCIO
Radicacion : 04039943 00000000 Folios: 43
Fecha (AMD): 2004-04-30 16:45:57
Tramite : 011 PCT-PATENT 379 FASE NACI 411 PRESENTAC
Dependencia: 0000 DIVISION DE NUEVAS CREACIONES

REQUISITOS NECESARIOS PARA PRESENTACION Y AGILIZACION DEL TRAMITE

	USUARIO	RADICADOR
PATENTE DE INVENCIÓN / MODELO DE UTILIDAD	( )	( )
Indicación de que se solicita la concesión de una patente.	( )	( )
Datos de identificación del solicitante o de la persona que se presenta la solicitud.	( )	( )
Descripción de la invención.	( )	( )
Dibujos de ser estos pertinentes.	( )	( )
Comprobante de Pago de las tasas establecidas.		
COMPLETA ( )	INCOMPLETA ( )	( )
DISEÑO INDUSTRIAL. ( )		
Indicación de que se solicita el registro de Diseño Industrial	( )	( )
Datos de identificación del solicitante o de la persona que presenta la solicitud.	( )	( )
Representación gráfica o fotográfica del Diseño Industrial o muestra del Material que incorpora el diseño.	( )	( )
Comprobante de pago de las tasas establecidas	( )	( )
COMPLETA ( )	INCOMPLETA ( )	( )
ESQUEMA DE TRAZADO ( )		
Indicación de que solicita el registro de un Esquema de trazado.	( )	( )
Datos de identificacion del solicitante o de la persona que presenta La solicitud.	( )	( )
Representación gráfica del esquema de trazado	( )	( )
Comprobante de pago de las tasas establecidas.	( )	( )
COMPLETA ( )	INCOMPLETA ( )	( )

Firma Responsable:

Fecha:

Industria y Comercio
SUPERINTENDENCIA

85
01

2020
Bogotá, D.C.,

Doctor:
DILIA MARIA RODRIGUEZ D'ALEMAN
Apoderado

Oficio N°
05214

ASUNTO:

Radicación N°	04-39943
Solicitud Internacional	PCT/US02/34896
Fecha inicio fase nacional	02/06/2004
Trámite	011
Evento	379
Actuación	430
Folios	001

Como resultado del examen de forma, realizado con fundamento el el artículo 38 de la Decisión 486 de la Comisión de la Comunidad Andina, artículo 27 del Tratado de Cooperación en Materia de Patentes (PCT), regla 51 bis del Reglamento y Circular Única de la Superintendencia de Industria y Comercio, se le comunica que:

- La solicitud no contiene la traducción de los anexos del reporte de examen preliminar internacional (Art. 36.2.b) del tratado PCT).
- La solicitud no contiene la copia del documento en que consta la cesión del derecho a la patente del inventor al solicitante o a su causante. (Art. 26-k) Decisión 486).
- La solicitud no contiene el poder debidamente otorgado, con el lleno de los requisitos exigidos por los artículos 63 y subsiguientes del Código de Procedimiento Civil. Adicionalmente, deberá presentar el documento que acredita la existencia y representación legal de la sociedad solicitante, cuando ésta fuere persona jurídica.
-

En cumplimiento de lo dispuesto por el artículo 39 de la Decisión 486, se le requiere para que dentro del término de dos meses siguientes a la fecha de notificación del presente oficio, complete los requisitos anteriormente enunciados. En caso de no dar cumplimiento al presente requerimiento, la solicitud se considerará abandonada y perderá su prelación.

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 N° 10 de 2001.

ALIX CARMENZA CESPEDES DE VERGEL
Jefe de la División de Nuevas Creaciones.

El anterior requerimiento fue notificado por fijación en lista de fecha 21 MAYO 2004.

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