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Industria y Comercio
SUPERINTENDENCIA

AS: 81.877

SUPERINTENDENCIA Y COMERCIO
Radicacion : 00007585 00000003 Folios: 6
Fecha (AMD): 2004-01-16 16:30:11
Tramite : 002 PATENTES D 1 REGISTRO/ 329 COMPLEME
Dependencia: 2020 DIVISION DE NUEVAS CREACIONES

FORMULARIO ÚNICO DE CORRECCIONES Y MODIFICACIONES

1 SOLICITUD DE:

☐ Corrección de Error Material. ☒ Modificación a una Solicitud.

2 SOLICITANTE

Nombre: **OWENS – BROCKWAY GLASS CONTAINER INC.**

Dirección: One Sea Gate, Toledo, Ohio 43666
Nacionalidad o Domicilio: Estados Unidos

Lugar de Constitución: Estados Unidos

Teléfono: Fax:
E-mail:

IDENTIFICACION

C.C. ☐ NIT ☐
C.E. ☐ Otro ☐

Cual _____

Número _____

3 REPRESENTANTE O APODERADO

Nombre: RAMIRO CASTRO DUQUE

Dirección: Cra. 7 No. 16-56 Piso 9

Teléfono: 3-802200 Fax: 3-802700

E-mail:

IDENTIFICACION

C.C. ☒ NIT ☐
C.E. ☐ Otro ☐

Número 170.322 TP 1003

4 Número de expediente: 00 007.585

5 Descripción de la corrección o modificación solicitada

Estamos presentando nuevo capítulo reivindicatorio, donde se han realizado algunas correcciones las cuales precisan el objetivo de la invención y no afectan en ningún sentido el alcance de la invención.

6 Comprobante de pago No. 03-79.311 y 04-1595 **Fecha** Enero 16, 2004

7 Anexos:

☒ Comprobante de pago de la tasa. $87.000
☐ Poderes, si fuere el caso.
☐ Documento que acredita la existencia y representación legal de las partes, cuando sean personas jurídicas.
☒ Nuevo capítulo reivindicatorio.

8

NOMBRE: RAMIRO CASTRO DUQUE **FIRMA:**

C.C. 170.322 de Bogotá T.P. 1003 del C.S.J.

Instrucciones para el diligenciamiento del presente formulario, ver reverso de esta página.

2000-F03

SUPERINDUSTRIA Y COMERCIO
Radicacion : 03007585 00000003 Folios: 6
Fecha (AMD): 2004-01-16 16:30:11
Tramite : 002 PATENTES D 1 REGISTRO/ 329 COMPLEME
Dependencia: 2020 DIVISION DE NUEVAS CREACIONES

NIT : 800176089-2

RECIBO OFICIAL DE CAJA : 3 - 79,311
FECHA : OCTUBRE 29 DE 2003

***** C O N S I G N A C I O N *****

DEPOSITANTE	TIPO PAGO	BANCO	CUENTA	No. PAGO	FECHA PGO	Vr. PAGO
BRIGARD & CASTRO LTDA	CONSIGNACION	BANCO POPULAR	050-00110-6	16391115	29/10/2003	30,070,000.00

***** C O N C E P T O *****

CANT.	RENTISTICO	CONCEPTO	TOTAL CONCEPTO
1	50005-01-03 CAMBIO DE MODALIDAD Y MODIFICA	12 MARCAS Y LEMAS COMERCIALES	82,000.00
		TOTAL : $	82,000.00

SON: OCHENTA Y DOS MIL PESOS

RESPONSABLE : _____

RECIBO DE CAJA APLICADO AL ASUNTO No.

112

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
Radicación : 03007585 00000003 Folios:
Fecha (AMD): 2004-01-16 16:30:11
Tramite : 002 PATENTES D 1 REGISTRO/ 329 COMPL
Dependencia: 2020 DIVISION DE NUEVAS CREACIONES

NIT : 800176089-2

RECIBO OFICIAL DE CAJA : 04 - 1,595
FECHA : ENERO 9 DE 2004

***** C O N S I G N A C I O N *****

DEPOSITANTE	TIPO PAGO	BANCO	CUENTA	No. PAGO	FECHA PGO	Vr. PAGO
BRIGARD & CASTRO LTDA	CONSIGNACION	BANCO POPULAR	050-00110-6	21589519	09/01/2004	30,000.00

***** C O N C E P T O *****

CANT.	RENTISTICO	CONCEPTO		TOTAL CONCEPTO
1	50005-01-01 SOLICITUDES	998	VALOR COMPLEMENTO TARIFA A#O ANTR	5,000.00
			TOTAL : $	5,000.00

SON: CINCO MIL PESOS

RESPONSABLE : _____

RECIBO DE CAJA APLICADO AL EXPEDIENTE No._____

113 426

REIVINDICACIONES

1. Un sistema de formación de artículos de vidrio (10) de una máquina (IS) de secciones individuales que incluye una máquina de secciones individuales (20) con una pluralidad de secciones individuales (20a, 20b, 20c, 20d, 20e, 20f, 20g, 20h, 20i, 20j, 20k, 201, 20m, 20n) para recibir pequeñas masas de vidrio fundido y formar las pequeñas masas en artículos de vidrio, un alimentador de pequeñas masas (12, 14, 16) para presentar pequeñas masas de vidrio fundido, y un distribuidor de pequeñas masas (18) para alimentar las pequeñas masas a dichas secciones individuales en secuencia y un medio para sincronizar la operación de dichas secciones con respecto a dicho alimentador de pequeñas masas,

caracterizado en que dicho medio para sincronizar incluye:

medios (40) operativamente acoplados a dicho alimentador de pequeñas masas para proporcionar una señal de indicio del alimentador indicativa de la presentación de una pequeña masa de vidrio para una primera de dichas secciones,

medios de temporización electrónica (42) de la máquina que incluye medios para generar una señal de indicio de la máquina para sincronizar la operación de dichas secciones unas con respecto a las otras,

medios (58, 61) para determinar la separación en tiempo real entre dicha señal de indicio del alimentador y dicha señal de indicio de la máquina, y almacenar dicha separación en unidades de tiempo,

medios (60) operables ante el inicio de la operación de dicho sistema para recuperar automáticamente dicho tiempo de separación almacenado, y

medios (60) para ajustar la temporización de dichas señales de indicio de las máquinas en relación con dicha señal de indicio del alimentador para igualar dicho tiempo almacenado.

2. El sistema tal como se estableció en la reivindicación 1 donde dichos medios de temporización electrónico de la máquina incluye adicionalmente medios (58) operable durante la operación de dicho sistema para vigilar la separación en tiempo entre dicha señal de indicio del alimentador y dicha señal de indicio de la máquina para ajustar la temporización de dicha señal de indicio de la máquina hasta que dicha separación a su vez iguala dicho tiempo almacenado.

3. El sistema tal como se estableció en la reivindicación 2 donde dichos medios para ajustar la temporización de dicha señal de indicio de la máquina comprende un serpentín de bloqueo de fases (62, 64, 66) que recibe una señal de frecuencia de entrada y proporciona dicha señal de indicio de la máquina como una salida, y medios (60) que responden a dichos medios de monitoreo para ajustar la operación de dicho serpentín de bloqueo de fases.

4. El sistema establecido en la reivindicación 3 donde dichos medios (60) para ajustar la operación de dicho serpentín de bloqueo de fases comprende medios para ajustar la operación en incrementos fijos que responden a cada una de dichas señales de indicio del alimentador.

5. Un método de iniciar la operación de un sistema de formación de artículos de vidrio de secciones individuales (10) que incluye una máquina de secciones individuales (20) que tiene una pluralidad de secciones individuales de la máquina (20a, 20b, 20c, 20d, 20e, 20f, 20g, 20h, 20i, 20j, 20k, 20l, 20m, 20n) para recibir pequeñas

masas de vidrio fundido y formar las pequeñas masas en artículos de vidrio, un alimentador de pequeñas masas (12, 14, 16) para presentar pequeñas masas de vidrio fundido, y un distribuidor de pequeñas masas (18) para alimentar las pequeñas masas desde dicho alimentador de pequeñas masas a cada una de las secciones de la máquina en secuencia,

caracterizado en que dicho método incluye los pasos de:

(a) generar una señal de indicio del alimentador indicativa de la presentación en el alimentador de pequeñas masas de una pequeña masa de vidrio para una primera de las secciones de la máquina,

(b) generar una señal de indicio de la máquina,

(c) sincronizar la operación de la primera sección de la máquina y todas las otras secciones de la máquina con respecto a dicha señal de indicio de la máquina,

(d) durante la operación de la máquina de secciones individuales, medir la separación entre dicha señal de indicio del alimentador y dicha señal de indicio de la máquina en unidades de tiempo,

(e) almacenar dicho tiempo en memoria, y

(f) ante la iniciación de la máquina subsecuente a dicho paso (e), recuperar dicho tiempo almacenado en la memoria y ajustar dicho paso (b) mientras se lleva a cabo dicho paso (d) hasta que la separación en tiempo entre dichas señales de indicio del alimentador y la máquina igualen dicho tiempo almacenado en dicho paso (e).

6. El método establecido en la reivindicación 5 que comprende el paso adicional de:

(g) llevar a cabo periódicamente dichos pasos (d) y (f) durante la operación de dicho sistema para mantener dicha separación en tiempo igual a dicho tiempo almacenado.

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2004-07-08
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SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

DIVISIÓN DE NUEVAS CREACIONES

2020
Bogotá D.C.

06361

Doctor:
Ramiro Castro Duque
Apoderado

REFERENCIA:	**Radicación**	**00-7.585**
	Trámite	**002**
	Evento	**001**
	Actuación	**430**
	Oficio No	
	Folios	**066**

Como resultado del examen de fondo, realizado conforme a lo establecido por el artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le comunica:

1. Documentos estudiados:

Para el presente estudio se tuvo en cuenta la descripción de los folios 42 a 56, los dibujos 1 a 6B de los folios 62 a 67 que son los allegados en respuesta a las observaciones del primer examen, y las reivindicaciones 1 a 6 de los folios 126 a 128, presentadas en el memorial del 16 de enero de 2004, apartes que se aceptan y califican aquí.

El artículo 9 de la Decisión 486 de la Comisión del Acuerdo de Cartagena establece que, "La primera solicitud de patente de invención... conferirá al solicitante o su causahabiente el derecho de prioridad para solicitar... misma materia. El alcance y los efectos del derecho de prioridad serán los previstos por el Convenio de Paris... a) doce meses para las patentes de invención y modelos de utilidad...".

La solicitud en estudio fue radicada el 07 de febrero de 2000, en ese momento se reclamó prioridad para la solicitud americana 09/247.797 del 08 de febrero de 1999; luego del estudio correspondiente, se determinó que acorde a lo estipulado por los artículos 9 a 11 de la Decisión 486, la prioridad reivindicada, es válida.

2. Objeto de la invención

Según la descripción, el objeto de la solicitud consiste en suministrar un método y un sistema para sincronizar el tiempo de operación de una máquina de secciones individuales IS y el suministro de pedazos de vidrio fundido a la máquina IS.

De otra parte, el pliego reclama: un sistema de formación de artículos de vidrio (10) de una máquina (IS) de secciones individuales (20) que incluye una máquina..., relacionado en las reivindicaciones 1 a 4; y un método de iniciar la operación de un sistema de formación de artículos de vidrio de secciones individuales (10)..., relacionado en las reivindicaciones 5 y 6.

La solución propuesta consiste en suministrar una técnica para sincronizar la operación de las secciones de una máquina IS a la operación del alimentador de vidrio, por generación de una señal del alimentador, indicativa de la presencia de los pedazos de

vidrio fundido en el alimentador, por medio de un soporte lógico, redactado en la forma de sistema y método.

Según la IPC la clasificación del objeto reclamado es G05B 19/00 // C03B 9/41.

3. Claridad de la solicitud:

El artículo 28 de la Decisión 486 de la Comisión de la Comunidad Andina señala que: "la descripción deberá divulgar la invención de manera suficientemente clara y completa para su comprensión y para que una persona capacitada en la materia técnica correspondiente pueda ejecutarla".

Aunque después del segundo examen se aceptó la descripción allegada, luego del presente estudio se encontró que esta presenta errores de redacción y traducción, que inciden en la claridad de la exposición.

Para ilustrar nuestras anteriores afirmaciones, a continuación, se suministraremos un par ejemplos de los defectos detectados, pero no se hará una lista detallada porque no se pretende que se hagan nuevas correcciones, que no van a incidir en el resultado final.

Página 8 primer párrafo, se afirma que "... las piezas... a través de etapas secuenciales... mecanismo de cizallado o desprendimiento de pequeñas... dentro de cada sección... para movimiento de entrada... cabezales... hasta el transportador 22 de la máquina".

La prioridad, en realidad, afirma en ese aparte que, "... mover la pieza de vidrio que se trabaja en una secuencia de etapas de operación o, de otro modo, realizar las funciones por el sistema. Tales mecanismos de operación incluyen, por ejemplo, un mecanismo de aguja 14, un mecanismo de corte en trozos (de vidrio fundido, obviamente) 16, un distribuidor de trozos 18 y el cargador de un horno de túnel 24. Además, hay una multiplicidad de mecanismos de operación en cada una de las secciones de la máquina IS 20, como los mecanismo de apertura y cierre de los moldes, los mecanismos de movimiento para entrada y salida de los túneles, los cabezales de desviación y soplado... para mover los artículos al transportador 22 de la máquina".

Al comparar, los apartes cuestionados con los ejemplos de la oficina, de inmediato, se detectan diferencias significativas no solo de estilo sino de la relación clara entre los componentes.

En todo el documento se hace mal uso de las preposiciones desde, hacia, a través de, etc. que muchas veces no corresponden a las relaciones que se quieren establecer. También se detectó un continuo abuso con los gerundios, propios de otros idiomas pero no del castellano.

De otro lado, el artículo 30 de la citada Decisión indica que: "las reivindicaciones definirán la materia que se desea proteger mediante la patente. Deben ser claras y concisas y estar enteramente sustentadas por la descripción".

Las reivindicaciones 1, 5 incluyen explicaciones ajenas a la definición que se busca, por ejemplo en, "un sistema de formación... que incluye una máquina...pequeñas masa", "un método... que incluye una máquina...en secuencia". Además, dichas reivindicaciones 1, 5 de un lado, se relacionaron respectivamente como un sistema de formación de artículos de vidrio y como método de iniciar la operación de dicho sistema, pero en realidad la 1 pretende definir unos medios (aparato) para sincronizar la temporización de operación de una máquina IS al suministrarle trozos de vidrio fundido y un método de sincronización para dicha máquina; de otro lado, se relaciona en términos del resultado a obtener y no

por las características de estructura o función del sistema y las de método se relacionaron como etapas la secuencia lógica de operación del sistema, es decir, lo presentado como pasos de un método, en realidad, corresponde a la secuencia de procesamiento de señales que realiza el controlador (procesador) 42.

Las reivindicaciones 2 a 4 y 6 no presentan la estructura estándar requerida de preámbulo y caracterización, expresiones tales como: "donde" "que comprende el paso adicional de", no son sinónimas de "caracterizado por".

De proseguir la tramitación las objeciones de este punto se deben solucionar en conjunción con las del punto 5 de adelante.

De otro lado, como se informa en el folio 120, no se presentaron oposiciones por parte de terceros.

4. Evaluación de la unidad de invención:

El artículo 25 de la Decisión 486 establece que, "La solicitud de patente sólo podrá comprender una invención o un grupo de invenciones relacionadas entre sí, de manera que conformen un único concepto inventivo".

El pliego estudiado se refiere a un único objeto, en consecuencia, cumple el requisito establecido.

5. No cumplimiento de los requisitos de patentabilidad

Por una parte, el artículo 14 de la Decisión 486 establece que: **"**Los países miembros otorgarán patentes para las invenciones, sean de **producto o** de **procedimiento** (...) Industrial**"**, (resaltado fuera de texto).

Para dar cumplimiento a tal requisito, y teniendo en cuenta que ni la Decisión ni el reglamentario establecen, taxativamente, cómo se debe definir cada concepto, la oficina, acude a la *Guía sobre el examen de las solicitudes de patentes,* publicada por la OMPI en 1982 para ayudar a los examinadores de la oficinas nacionales en sus estudios; en el párrafo 57 (de dicha guía) se especifica que existen dos tipos de reivindicaciones: de **producto** y de **procedimiento** (método).

Adicionalmente, el citado párrafo indica que las reivindicaciones de **producto** deben definir, el objeto que se desea proteger, mediante las características estructurales **ó** de función y, las de **procedimiento**, mediante las características de una secuencia de etapas a seguir, para lograr un resultado, sin incluir o hacer referencia a los elementos que lleven a cabo dichas etapas.

De allí se concluye que la combinación de características estructurales y de función **NO** se **admite** en la redacción de reivindicaciones de **producto**.

Al estudiar el pliego salta a la vista que incluye mezclas de características no permitidas, como se evidencia de su redacción:

"1. un sistema de formación para recibir... un alimentador... para presentar... un medio para sincronizar... medios (40) ... para proporcionar... medios de temporización... para generar una señal... medios... para determinar... medios... para recuperar...".

"2. el sistema... medios... para vigilar la separación...".

"3. el sistema... para ajustar la temporización...".

De lo anterior es evidente que la parte no subrayada son características estructurales, y la subrayada, características de uso.

Por otra parte, el artículo 15 de la Decisión 486 señala que, "No se considerarán invenciones: ...

e) los programas de ordenadores o el soporte lógico como tales y".

Del estudio de la solicitud, de un lado, se deduce que la máquina de secciones individuales incluye un computador (ver figura 3, componentes 42, 46 y 48) al cual, se le carga el soporte lógico necesario para sincronizar el inicio de operación de los mecanismos de una máquina de secciones individuales IS, que en este expediente, se ilustra con los diagramas de flujo (rutinas) de las figuras 6A, 6B y el entramado de la temporización usada, por ello, se considera que no se cumple lo dispuesto por el artículo 15 e).

Por último, también se afecta lo dispuesto por el artículo 21 debido a que solo se hace otro (segundo) uso de componentes convencionales de un sistema de formación de artículos de vidrio.

En este punto, es necesario recordar al interesado que la oficina **no** puede aceptar como sustento de patentabilidad el uso de componentes convencionales o parte de ellos, ni la redacción del documento con mezclas de características no permitidas.

Por las anteriores razones, consideramos que lo reivindicado en el presente caso, no cumple lo dispuesto por los artículos 14, 15 e) y 21.

6. Determinación del estado de la técnica:

La fecha para determinar el estado de la técnica es 08 de febrero de 1999.

Consultadas las fuentes de información con que cuenta este despacho se encontraron los siguientes documentos anteriores a la fecha de prioridad invocada 08 de febrero de 1999, relacionados con la materia de la solicitud:

No	Documento	Título	Fecha de publicación
1	**US 4 108 623**	Electronic control system for glassware and other thermoplastic articles forming machines	22 08 1978
2	**US 4 141 711**	Automatic parison freeze for a glassware forming machine	27 02 1979
3	**US 4 145 204**	Timing pulse generator for a glassware forming machine	20 03 1979
4	**US 4 357 157**	Electronic gob distributor for glassware forming machines and the like	02 11 1982
5	**GB 2 114 302**	Indicating the relative degree positioning between and/or the frequency of mechanisms in a glassware forming machine	17 08 1983

7. Evaluación de los requisitos de patentabilidad:

En cumplimiento del artículo 14 de la Decisión 486, el cual, dispone que: "Los países miembros otorgarán patentes para las invenciones, sean de producto o de procedimiento, en todos los campos de la tecnología, siempre que sean nuevas, tengan nivel inventivo y sean susceptibles de aplicación industrial"; se procedió a evaluar los requisitos de fondo con el objeto de establecer la patentabilidad de las reivindicaciones de la solicitud presentadas para tal efecto.

Evaluación del nivel inventivo

Conforme al artículo 18 de la decisión 486 que establece "Se considerará que una invención tiene nivel inventivo, si para una persona del oficio normalmente versada en la materia técnica correspondiente, esa invención no hubiese resultado obvia ni se hubiese derivado de manera evidente del estado de la técnica".

La persona del oficio, normalmente versada en la materia técnica correspondiente, que se puede encargar de solucionar el problema planteado en la presente solicitud, es un ingeniero de electrónico con experiencia en disposiciones de sincronización y en programación de máquinas de secciones individuales que forman artículos de vidrio, que conozca la composición y los principios básicos de funcionamiento de dichos aparatos o, por lo menos, que cuente con las condiciones necesarias para informarse acerca de esos principios al consultar la literatura técnica respectiva.

El objeto de la reivindicación 1 se plantea como un sistema de formación de artículos de vidrio, pero en si pretende definir una disposición de sincronización donde los "medios" son independientes de la forma en que las señales se usan para el procesamiento. De allí, es evidente que el control del proceso de formación de artículos de vidrio, mediante medios electrónicos y medios de procesamiento de señales (datos), caben más en el campo del control automático que en el campo de la formación de envases.

La primera anterioridad divulga un sistema de control de limitación de intervalos de tiempo (temporización) electrónico para máquinas que formen artículos de vidrio u otros artículos termoplásticos que tengan una pluralidad de secciones unitarias de formación y únicos medios de alimentación y distribución de trozos de vidrio fundido.

Como se aprecia en la figura 1, dicho sistema de control, incluye un único alimentador y distribuidor 8 acoplado operativamente a él hay un sensor 9 y medios de sincronización electrónica 1 conectada por medio de los amplificadores 2 y las válvulas 3 a las diferentes secciones de la máquina que cuentan con una pluralidad de sensores 5 para generar las señales de indicio de dicha máquina. La operación del sistema coincide con la relacionada en a) hasta f).

Al comparar el resumen anterior con lo revindicado en 1 y 5 de esta solicitud, se advierte su coincidencia, la única diferencia consiste en que no se discriminan en forma separada los "medios" para determinar la separación en tiempo real y los ajustes de fase, que forman parte del procesador de señales, como cualquier técnico en el arte conoce.

Adicionalmente, como se reconoce en la página 9 de la descripción de este expediente, el sistema de formación de artículos de vidrio es convencional e incluye una disposición de sincronización que solo debe ser programada de acuerdo a las rutinas de las figuras 6A, 6B para lograr el resultado reclamado, lo que está al alcance de un técnico en programación para máquinas IS.

Consecuentemente, un técnico en la materia, a partir de las enseñanzas del documento 1

pudo derivar, de forma evidente, lo reivindicado en 1 a 6, por ello, el pliego no tiene **nivel inventivo**.

Otra forma de desvirtuar el **nivel inventivo** sería a partir de la última referencia, pues como ya se señaló antes el sistema de formación de artículos de vidrio es bien conocido en el arte y la función de la disposición de sincronización se explica dicho documento, en términos de indicar la posición relativa, en grados, entre los mecanismos de una máquina de formación de artículos de vidrio.

En conclusión los requisitos de patentabilidad de la presente solicitud se encuentran afectados así:

No.	Documento	Reivindicación(es) Afectada(s)	Requisito que afecta
1	**US 4 108 623**; ver todo el documento.	1 a 6	Nivel inventivo
2	**US 4 141 711**; ver todo el documento.	1 a 6	Estado del arte
3	**US 4 145 204**; ver de línea 26 col 3 a línea 51 col 9; figuras 1 a 6.	1 a 6	Nivel inventivo
4	**US 4 357 187**; ver todo el documento.	1 a 6	Nivel inventivo
5	**GB 2 114 302**; ver de línea 9 página 1 a 35 página 6; figuras 1 a 3.	1 a 6	Nivel inventivo

122 135

En cumplimiento del artículo 45 de la decisión 486 de la Comisión de la Comunidad Andina, se le indica que debe dar respuesta dentro del término de sesenta días contados a partir de la fecha de la notificación de la presente comunicación. En el caso de no dar respuesta al presente requerimiento, o si a pesar de la respuesta subsisten impedimentos para la concesión, se denegará la patente.

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

ALIX CÉSPEDES DE VERGEL
Jefe de la División de Nuevas creaciones

El anterior requerimiento fue notificado por fijación en lista, de fecha 08 JUL. 2004

Concepto Técnico Número: 807	Examinador Técnico IE Código: 202004	Examinador jurídico Código:

United States Patent [19]

Cárdenas-Franco

[11] **4,108,623**

[45] **Aug. 22, 1978**

[54] **ELECTRONIC CONTROL SYSTEM FOR GLASSWARE AND OTHER THERMOPLASTIC ARTICLES FORMING MACHINES**

[75] Inventor: **Luis Cárdenas-Franco**, Monterrey, N. L., Mexico

[73] Assignee: **Investigacion Fic Fideicomiso**, Monterrey, N.L., Mexico

[21] Appl. No.: **843,200**

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[30] **Foreign Application Priority Data**

Jun. 6, 1977 [MX] Mexico 169360

[51] **Int. Cl.**[2] **C03B 9/40**

[52] **U.S. Cl.** **65/163**; 65/29; 65/158; 65/159; 65/164; 65/DIG. 13; 364/473

[58] **Field of Search** ..... 65/160, 163, 164, 158, 65/159, DIG. 13, 29; 364/473, 476

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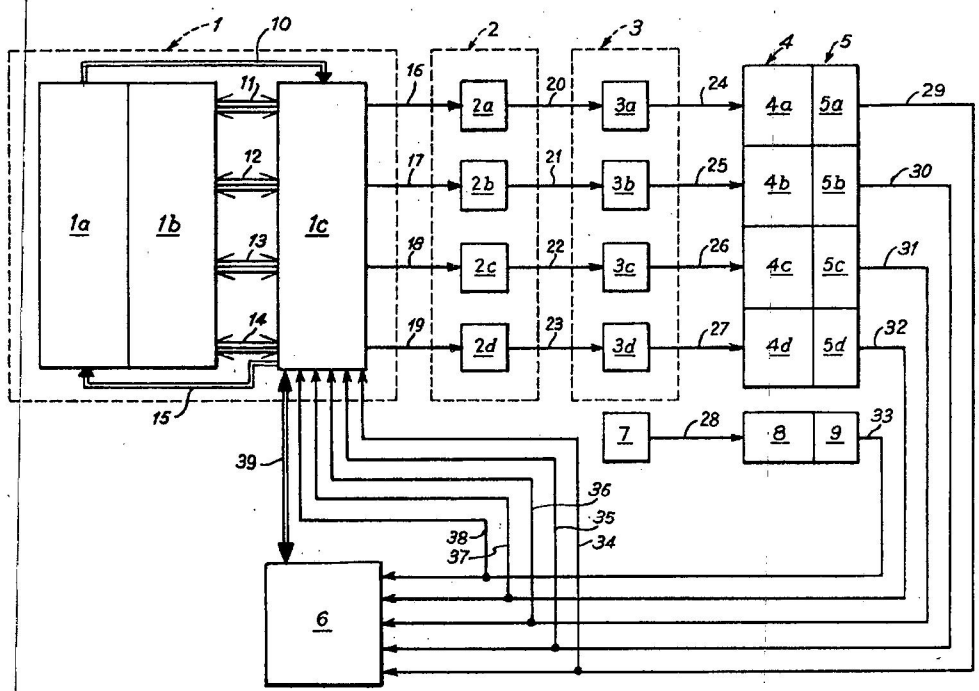
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Primary Examiner—Arthur D. Kellogg
Attorney, Agent, or Firm—Sughrue, Rothwell, Mion, Zinn and Macpeak

[57] **ABSTRACT**

An electronic timing control system for glassware and other thermoplastic articles forming machines of the kind having a plurality of unitary forming sections and a single molten glass gob feeding and distribution means, each forming section comprising glass gob guiding channels, a blank forming station, a blow molding station and/or a take out station, and finished ware take out means, comprises a preprogrammed controller capable of sequentially controlling all the ware forming operations, a constant frequency pulse generator to operate as a real time clock to measure the timing and duration of each operation sequentially controlled by said controller, a glass gob release sensor to detect the instant when a glass gob is cut and released from said glass gob feeding and distribution means and feed back a signal to said controller to indicate the end of a prior cycle and the initiation of a new cycle of operations, a temperature sensor to detect the passage of a glass gob from said guiding channels into said blank forming station and feed back a signal to said controller to trigger the operation of the parison forming means, and a pressure sensor to detect the instant when said parison forming means commence to work on a glass gob and feed back a signal in accordance with the pressure to said controller to initiate the time count and to thereby secure an accurate duration of the parison forming operation, said controller also having mode of operation selector switches to enable selection of manual operation of the different main mechanisms of the machine without the need of inhibiting the remaining mechanisms, unloaded test operation of the machine to sequentially work the mechanisms without a load of glass, and fully automatic operation with a load of glass, and a variable frequency oscillator to simulate the signal of the gob release sensor, whereby when the unloaded test operation is selected, the simulated time signals are given by said oscillator and by the operator, whereas when automatic operation is selected, the real time signals are back fed to the controller by said sensors.

15 Claims, 6 Drawing Figures



group selecting means to enable reuse of said digital switches for marking additional time signals to be exhibited by said display means and fed to said memory of the controller means.

13. An electronic control system according to claim 1 wherein said mode of operation selector switch means comprise emergency stop switch means to inhibit any remaining portion of the ware forming cycle and to immediately stop the machine when actuated.

14. An electronic control system according to claim 13 wherein said mode of operation selector switch means comprise preprogrammed stop switch means to carry out any remaining portion of the ware forming cycle when actuated and to thereafter stop the machine in a reset or starting condition.

15. An electronic control system according to claim 11 wherein timetable subprogram reject means are included to immediately inhibit operation of any mechanism of the machine, said reject means comprising a comparator circuit to detect when a predetermined timetable subprogram fed to said floating memory does not match with the cycle sequence stored in said fixed memory, and alarm means to warn the operator of said fact.

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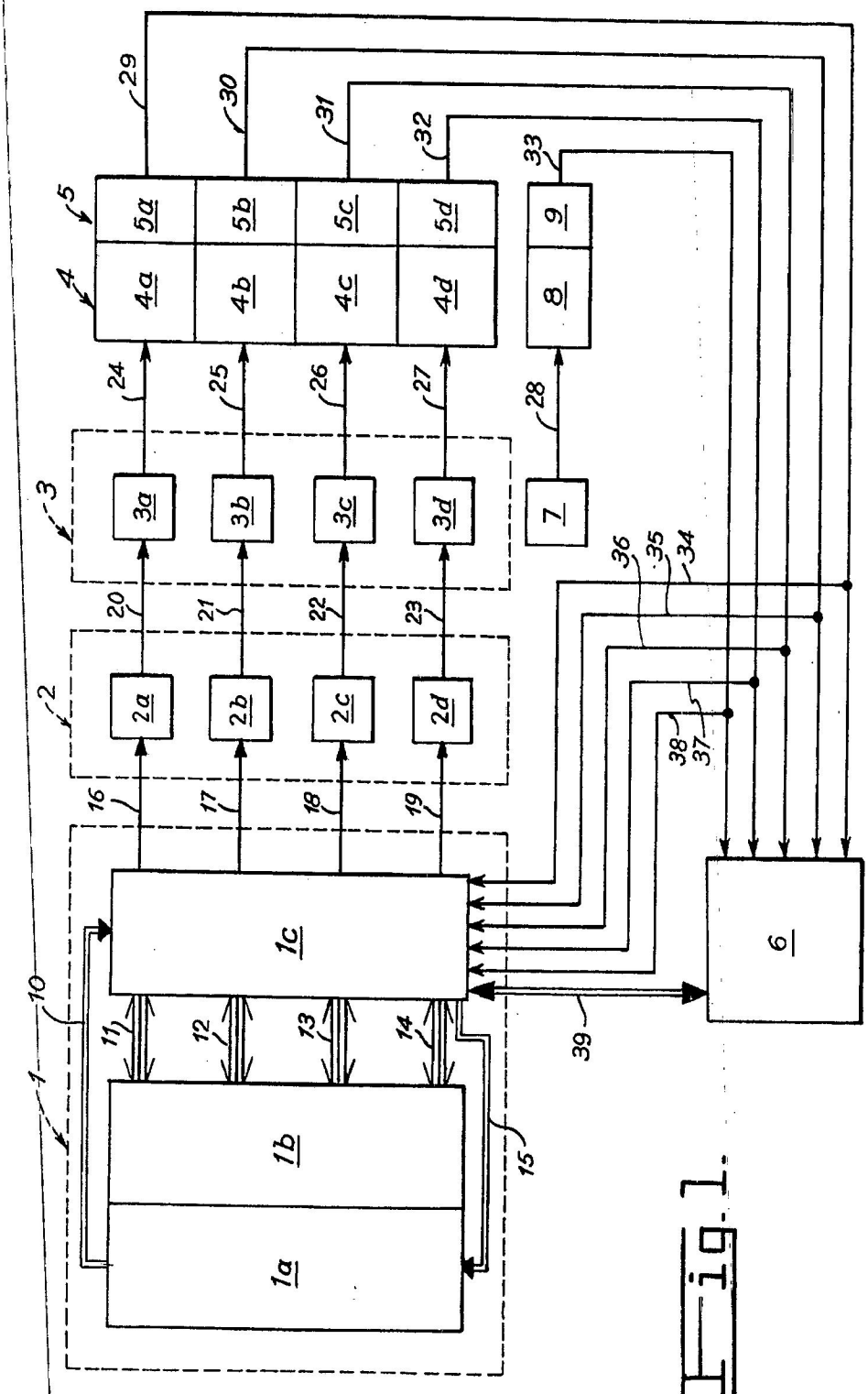

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Fig. 1.

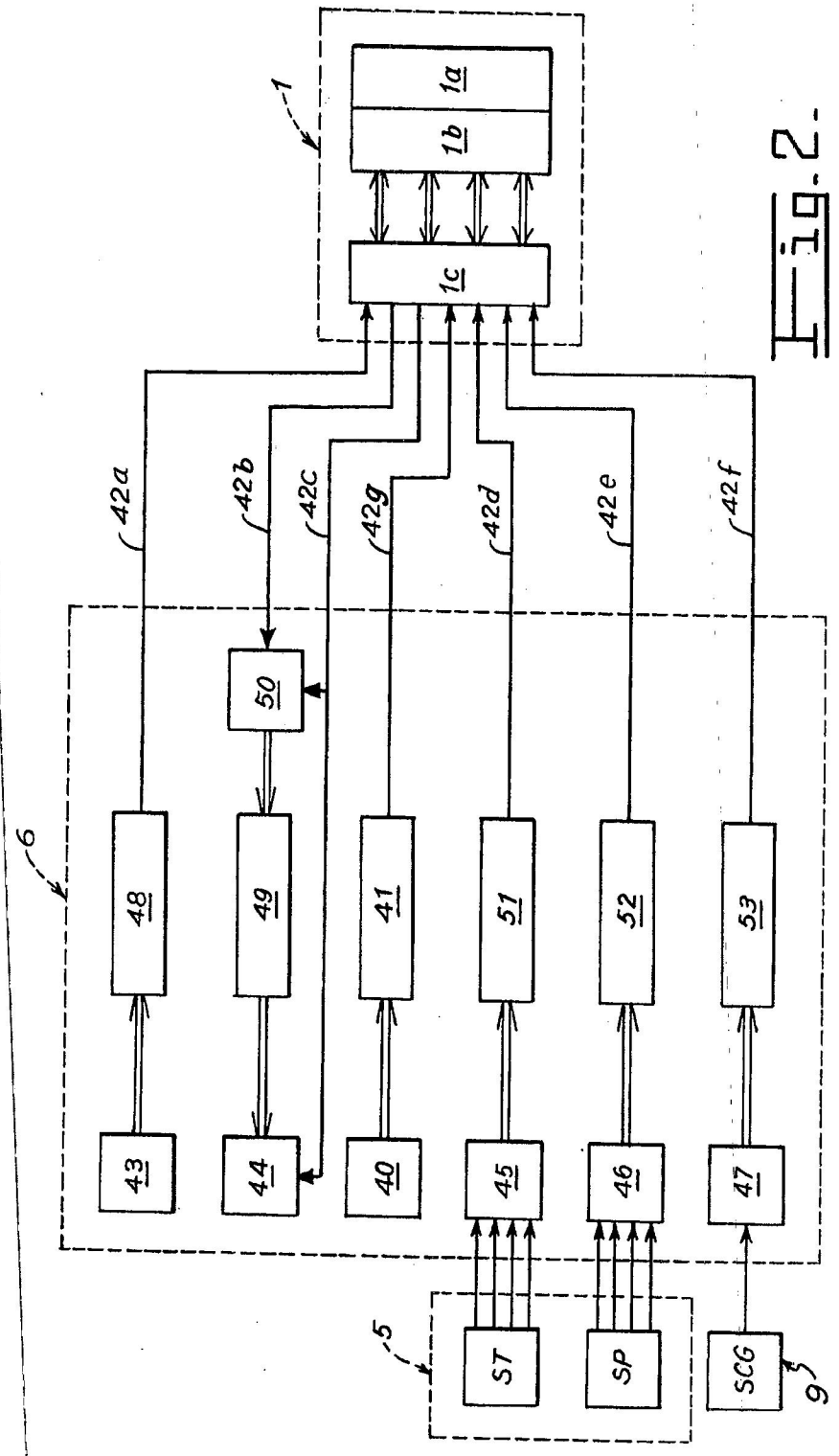

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Fig. 2.

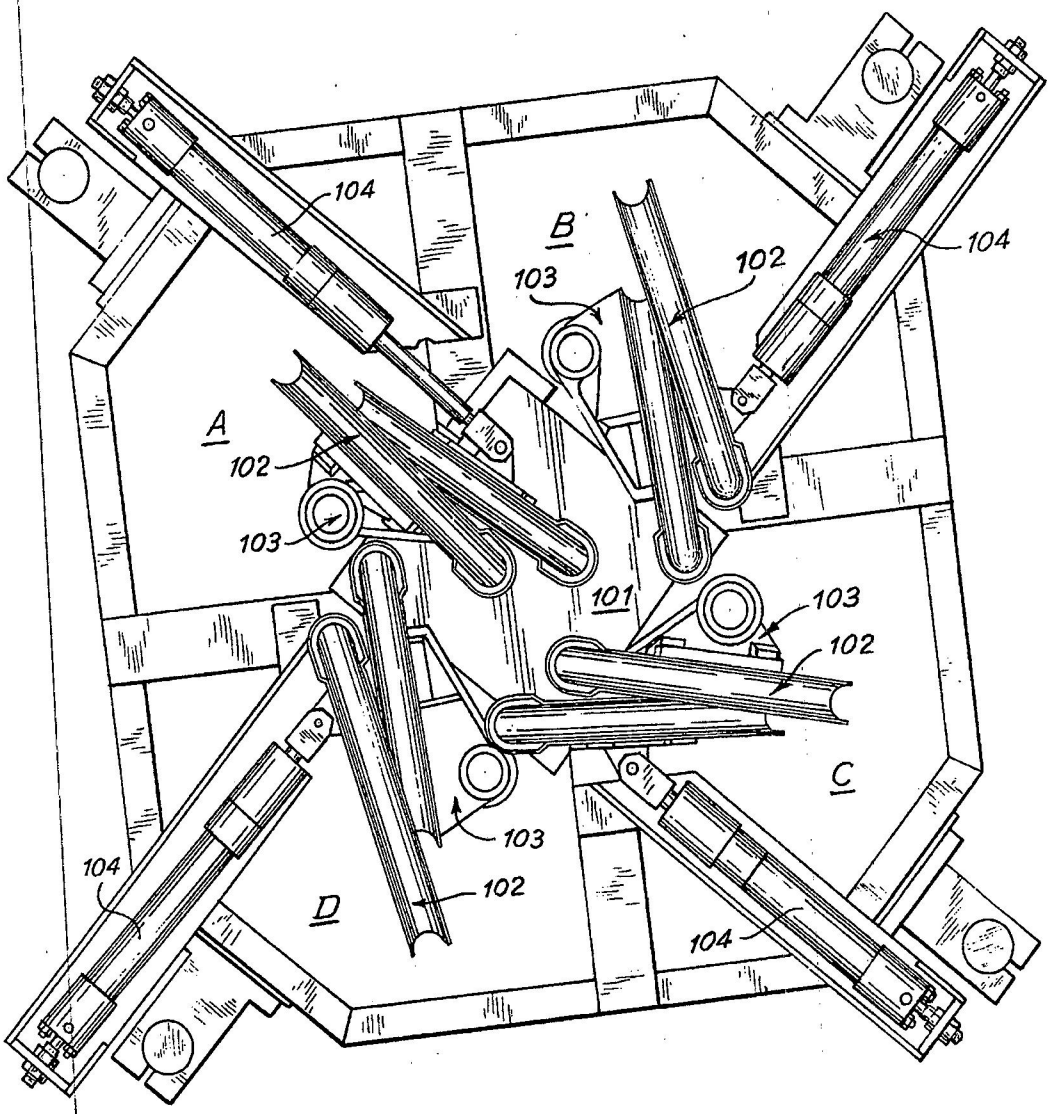


Fig. 3.

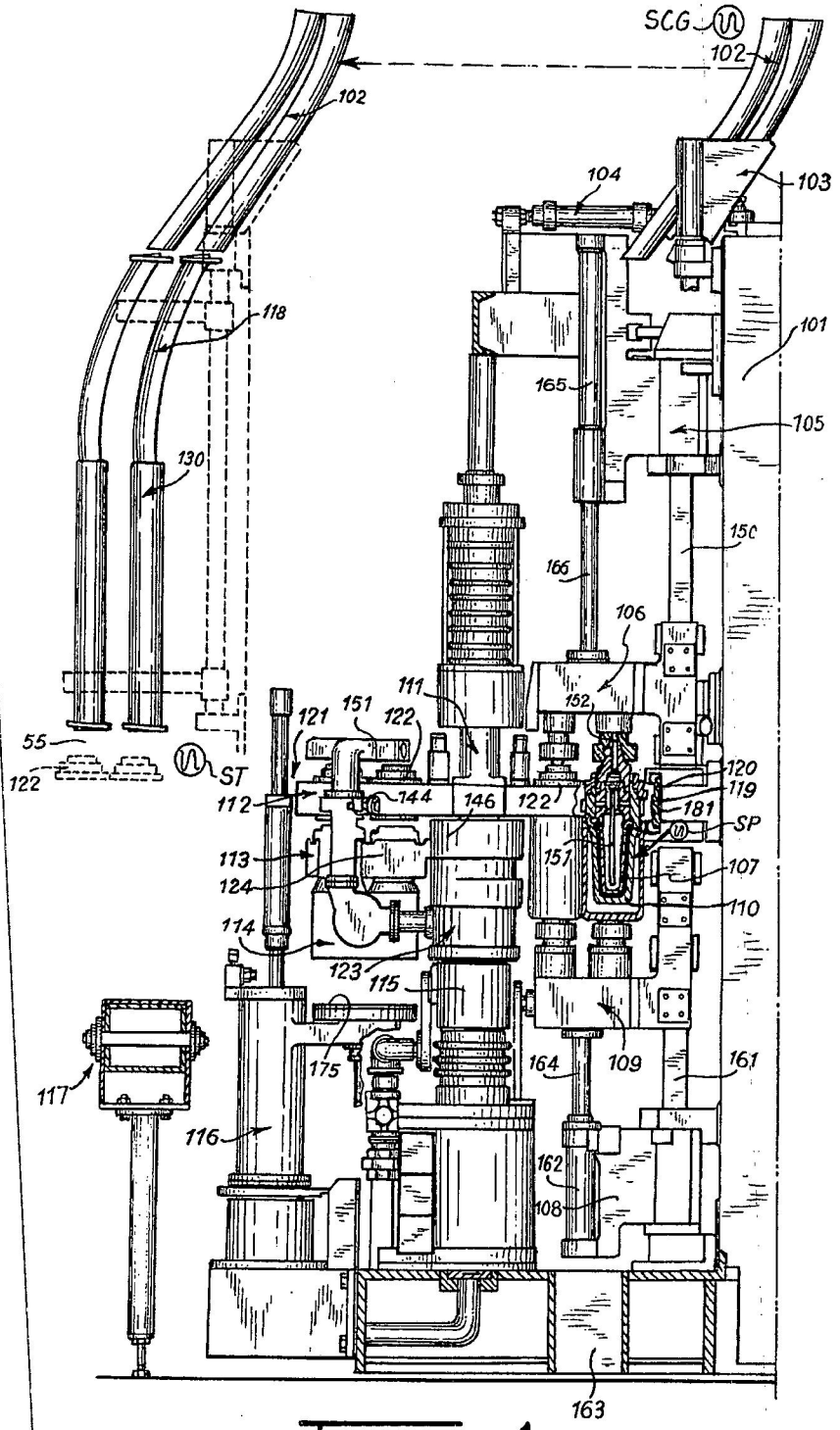
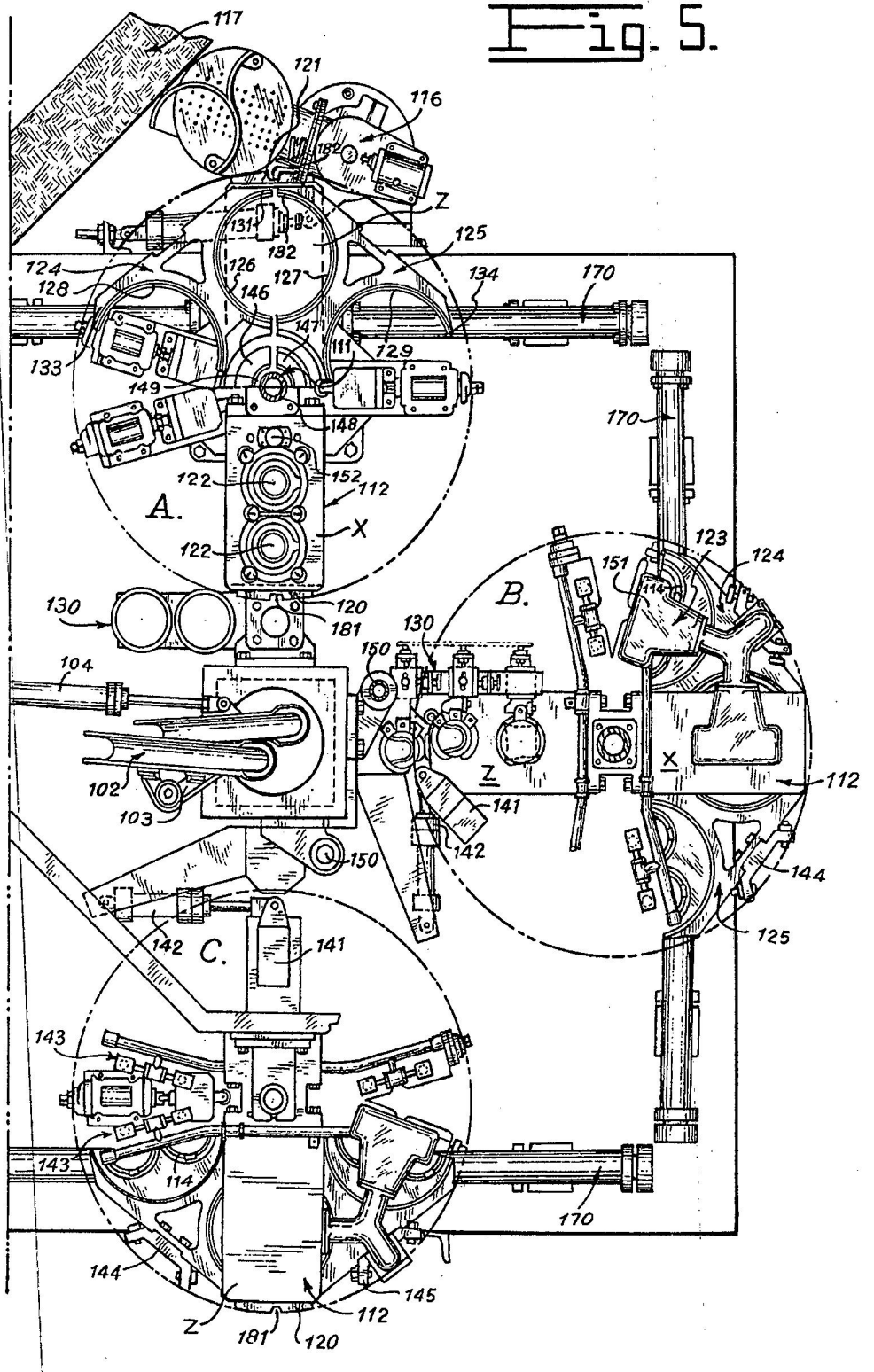

SCG
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Fig. 4.

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Fig. 5.


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Z
X
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145
112
Z
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120

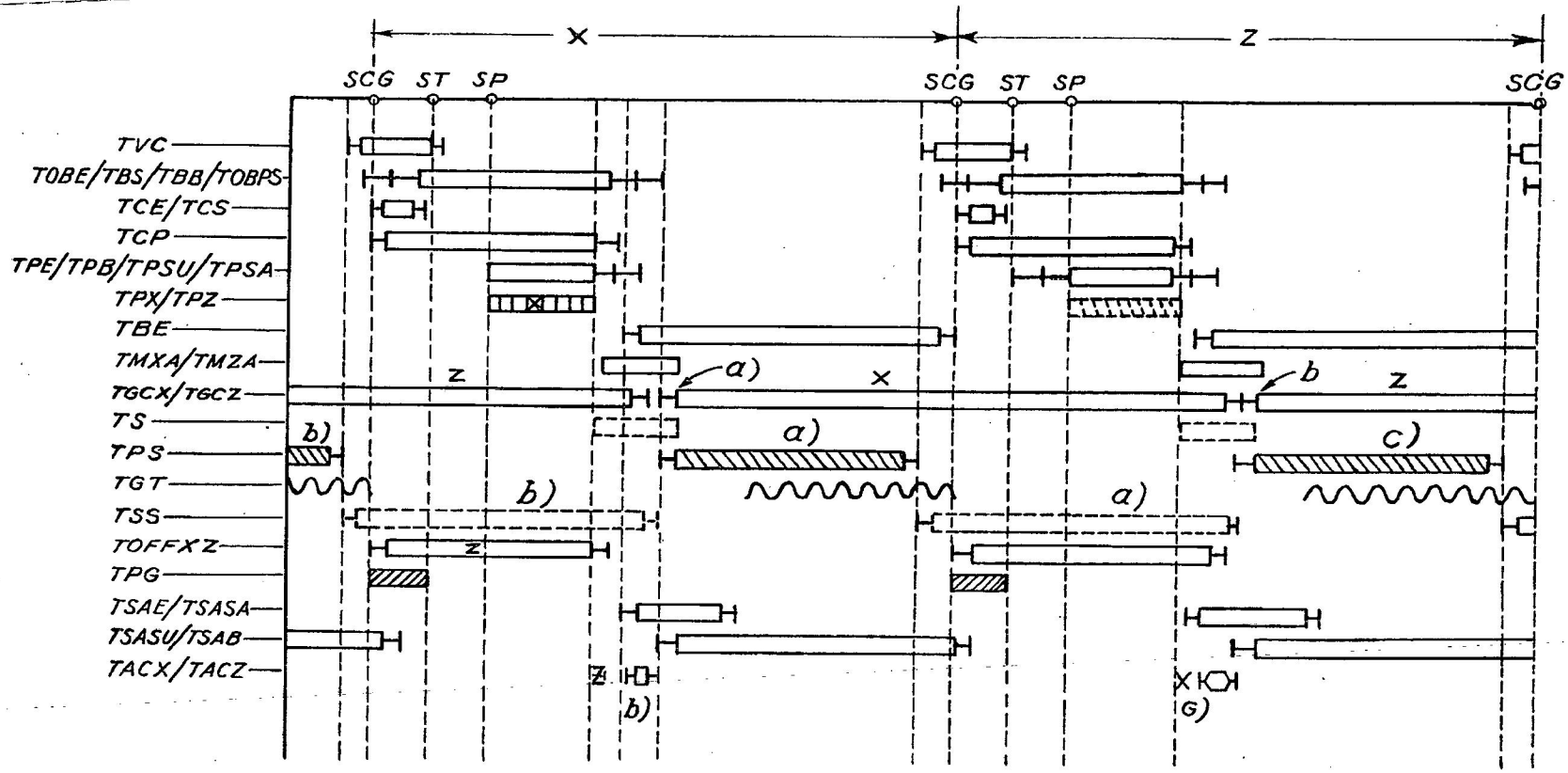

X
Z
SCG
ST
SP
SCG
ST
SP
SCG
TVC
TOBE/TBS/TBB/TOBPS
TCE/TCS
TCP
TPE/TPB/TPSU/TPSA
TPX/TPZ
TBE
TMXA/TMZA
TGCX/TGCZ
TS
TPS
TGT
TSS
TOFFXZ
TPG
TSAE/TSASA
TSASU/TSAB
TACX/TACZ
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b)
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x
b
z
a)
b)
a)
z
b)
G)

Fig. 6.

United States Patent [19]

Zabor

[11] **4,141,711**

[45] **Feb. 27, 1979**

[54] **AUTOMATIC PARISON FREEZE FOR A GLASSWARE FORMING MACHINE**

[75] Inventor: **Eric R. Zabor**, Toledo, Ohio

[73] Assignee: **Owens-Illinois, Inc.**, Toledo, Ohio

[21] Appl. No.: **868,352**

[22] Filed: **Jan. 10, 1978**

[51] **Int. Cl.**[2] **C03B 9/40**

[52] **U.S. Cl.** **65/29**; 65/83; 65/158; 65/160; 65/DIG. 13; 364/473; 364/476

[58] **Field of Search** ..... 65/29, 158, 159, 160, 65/163, 168, DIG. 13, 77, 78, 83, 230; 364/473, 476

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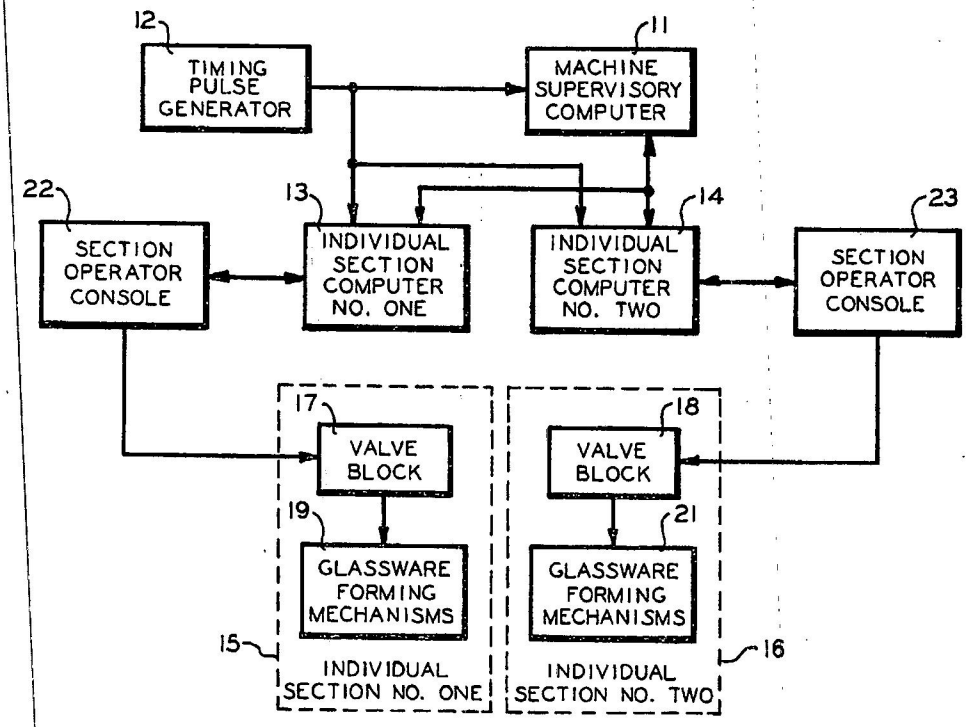
Primary Examiner—Arthur D. Kellogg

Attorney, Agent, or Firm—D. H. Wilson; M. E. Click

[57] **ABSTRACT**

A method and apparatus for automatically producing a frozen parison sample in an automatic glassware forming machine which includes a blank mold station for receiving a gob of molten glass for forming a parison in a first portion of a predetermined sequence of steps and a blow mold station for receiving the parison and completing the formation of the glassware in a second portion of the predetermined sequence of steps. When an operator requests a frozen parison sample, a control means automatically alters the first portion of the predetermined sequence of steps by extending the time the parison typically remains in the blank mold such that the parison freezes. The frozen parison sample is then transferred to the previously disabled blow mold station where it can be subsequently removed for inspection.

14 Claims, 4 Drawing Figures



AUTOMATIC PARISON FREEZE FOR A GLASSWARE FORMING MACHINE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to machines for forming glassware articles from gobs of molten glass and in particular to electronically controlled individual section glassware forming machines.

2. Description of the Prior Art

The individual section or IS glassware forming machine is well known and includes a plurality of sections each having means for forming glassware articles in a timed, predetermined sequence of steps. Typically, each section includes a blank mold station for receiving gobs of molten glass at a predetermined rate and for forming partially formed articles of glassware. A partially formed article of glassware of the type produced by the blank mold is typically referred to as a parison. The parison is then transferred to a blow mold station wherein the formation of the glassware article is completed. The sections are operated in synchronism at a relative phase difference such that one section is receiving a gob while another section is delivering a finished glassware article to a conveyor and one or more other sections are performing various ones of the intermediate forming steps.

The forming means in each section are typically operated from pneumatic motors or actuators. In early prior art machines, the pneumatic motors were controlled by a valve block which in turn was controlled by a timing drum for each section driven from a line shaft which synchronized all parts of the machine. One of the limitations of the timing drum was the difficulty of adjusting the timing during the operation of the machine. One solution to this problem was to replace all the timing drums with an electronic control means. The electronic control means included a master unit which was responsive to a clock pulse generator and a reset pulse generator driven by the line shaft. The master unit generated reset signals to an individual control circuit for each of the individual sections to synchronize the operation of the individual circuits. Each individual circuit included a pulse counter responsive to the clock pulses and the master unit generated reset pulses for counting the degrees of the section cycle. Each individual circuit included forty-eight, three-decade thumbwheel switches for setting the degree of rotation of the machine thereon. Thus, each particular function of the glassware forming cycle was controlled by one of the thumbwheel switches. Such a control system is disclosed in U.S. Pat. No. 3,762,907.

The previously described electronic control system utilized discrete components in its counter and gating circuitry. In a later prior art control apparatus, a digital computer with a memory and associated program storage was utilized. Not only did such a control circuit provide a means for automatically changing the timing values of the functions without the manual resetting of thumbwheel switches, but such a circuit also provided a means for programming events, groups of related functions, in accordance with certain boundary event timings. The computer generated control signals through an interface circuit to actuate solenoid controlled valve blocks. Such a control system is disclosed in U.S. Pat. No. 3,905,793.

One of the problems associated with the aforementioned prior art glassware forming machines occurred when one of the machine sections was producing a malformed article of glassware. It was often difficult to determine whether the malformation occurred in the blank mold station or in the blow mold station. If the parison produced by the blank station was examined before introduction to the blow mold, any defects which were observed could not be attributed to the blow station. In order to produce a parison which was sufficiently frozen to be handled and examined, the valves of the particular section had to be manually actuated to allow the parison to remain in the blank mold for an extended time such that it became sufficiently frozen. This method of producing a frozen parison sample was time consuming and consequently resulted in a drastic loss in production time.

SUMMARY OF THE INVENTION

The present invention is concerned with automatically producing a frozen parison sample in a glassware forming machine. The machine includes a gob distributor which distributes gobs of molten glass at a predetermined rate to a blank mold station which forms a parison from each molten gob of glass during a first predetermined sequence of steps. A transfer mechanism is provided to invert and transfer the parison to the blow mold station wherein the formation of the glassware is completed in a second predetermined sequence of steps.

The glassware forming machine also includes a machine supervisory computer which is connected to a plurality of individual section computers each of which is associated with a particular individual section. A separate section operator console is also provided for each section such that the status of each section can be controlled. In accordance with the present invention, an operator can request a particular section to produce a frozen parison sample utilizing a switch provided on the section operator console. Only that particular individual section which receives the request will produce a sample, while the status of all the other sections will not change.

When a frozen parison sample has been requested, the selected individual section computer initiates a sample routine wherein the last gob received by the blank mold is formed into a parison and held in the blank mold to freeze. Holding the parison in the blank mold for an extended period of time causes the parison to freeze sufficiently so that internal reheat of the parison when it is removed from the blank mold will not cause it to go soft and consequently distort its characteristics. While the parison is being frozen, the forming cycle is completed on the glass in the blow mold and this glassware is transferred from the machine. Then the blow mold functions are disabled. After the parison is frozen, the parison is inverted to the blow mold side where it subsequently can be removed for inspection.

Accordingly, it is an object of the present invention to facilitate the analysis of a malformed article of glassware produced by an automatic glassware forming machine.

It is another object of the present invention to automatically produce a frozen parison sample in an automatic glassware forming machine.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a two section IS machine to which the present invention is applicable;

FIG. 2 is a schematic diagram of the sequence of forming steps in one section of an IS machine;

FIG. 3 is a timing diagram which indicate the sequence and the relative timing positions in a machine cycle at which the various glassware forming functions are performed; and

FIG. 4 is a timing diagram which indicates the sequence and relative timing positions at which the various glassware forming functions are performed to produce a frozen parison sample according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

There is shown in FIG. 1 a block diagram of an individual section glassware forming machine to which the present invention is applicable. Although a brief description appears herein, a more detailed description of this type of glassware forming machine can be found in U.S. Pat. application Ser. No. 866,086 in the names of W. Thomas Dowling and Daniel F. Farkas and assigned to the assignee of the present invention.

A machine supervisory computer **11** receives a train of timing pulses from a timing pulse generator **12** to establish the timing for the machine cycle. The machine supervisory computer **11** is connected to a pair of individual section computers **13** and **14** which are respectively connected to an individual section No. One **15** and an individual section No. Two **16**. The individual sections **15** and **16** respectively include valve blocks **17** and **18** and a plurality of glassware forming mechanisms **19** and **21**.

The individual sections **15** and **16** each receive gobs of molten glass from a gob distributor (not shown). The gob distributor supplies the gobs to the individual sections at a predetermined rate proportional to the speed of the gob distributor drive motor (not shown). The speed of this drive motor is determined by the frequency of the alternating current power generated by a power source such as an inverter drive (not shown). If the timing pulse generator **12** is responsive to the frequency of the power source, the cycle time of each individual section and, therefore, the cycle time of the machine will be proportional to the gob distribution rate.

Initially, the machine supervisory computer **11** loads the individual section computers **13** and **14** with control programs and timing data for controlling the associated individual sections. Thereafter, the individual section computers **13** and **14** control the glassware forming cycles of the associated individual sections by generating control signals to the respective valve block in response to the execution of the control programs and the timing pulses from the timing pulse generator **12**.

The timing pulse generator **12** generates a clock signal to the machine supervisory computer **11** and the individual section computers **13** and **14** which signal provides a reference for timing the machine cycle and the sequence of steps to be performed by the individual section computers. Typically, machine timing is expressed in degrees and a machine cycle is 360° in length. Thus, 360 clock pulses or some multiple thereof comprise one machine cycle. The cycle for each individual section is also 360° but the cycles for the sections will be offset from the start of the machine cycle by a different number of degrees to compensate for the difference in gob delivery time to each section. The timing pulse generator **12** also generates a reset pulse after generating the clock pulses representing one cycle which reset pulse is utilized by the machine supervisory computer **11** and the individual section computers **13** and **14** to define the end and beginning of successive machine cycles. This type of timing pulse generator is the subject matter of U.S. Pat. applications Ser. No. 856,387 in the names of Daniel S. Farkas and Phillip D. Perry and Ser. No. 860,934 in the names of Daniel S. Farkas and Erwin M. Ferenczy, both applications assigned to the assignee of the present invention. The timing pulses generator can also be of the shaft encoder type. In either case, the rate of distribution of the gobs is synchronized with the clock signal generated by the timing pulse generator.

The valve blocks **17** and **18** are connected to control the glassware forming mechanisms **19** and **21** respectively in a predetermined timed sequence of steps to form the articles of glassware. The valves in the valve blocks **17** and **18** are actuated by solenoids (not shown) which are controlled by the respective individual section computers in accordance with the control programs and timing data supplied by the machine supervisory computer **11**.

A pair of section operator consoles **22** and **23** are connected to the individual section computers **13** and **14** respectively and to the valve blocks **17** and **18** respectively. The consoles **22** and **23** are used to make adjustments to the mechanism timing. For example, the actuation of a particular valve may be either advanced or retarded by the operator with the use of the console.

The section operator consoles **22** and **23** are also used to control the operating condition of the respective individual section. When an individual section is forming glassware, it is designated as being in the "run" condition and, when the section is not running, it is designated as being in the "safe" condition. When a section is in the safe condition, the forming mechanisms are stopped and in position for easy access such that the mechanisms can be replaced or repaired. The operator can switch to a manual mode wherein the solenoids of the valve block can be individually controlled using a plurality of switches (not shown) which are provided in the section operator console. The section operator consoles **22** and **23** each are also provided with a switch (not shown) which signals the respective individual section computer to control the respective individual section in a "sample" condition. In accordance with the present invention, when an individual section is in the sample condition, it will automatically produce a frozen parison sample which can subsequently be removed from the machine for inspection. As will be discussed, a gob of molten glass is typically formed into a finished article of glassware by first partially forming the glass in a blank station and then finishing the forming process in a blow station, both stations of which are included in a single individual section. The frozen parison sample formed by the sample condition is the partially formed article of glassware molded at the blank station prior to the introduction of the article to the blow station.

There is shown in FIG. 2 a schematic diagram of the sequence of events for one cycle of an individual section of the glassware forming machine shown in FIG. 1. These steps are illustrative of the method of forming a typical article of glassware known as the blow and blow

cycle. There is shown in FIG. 3 a timing diagram of the relative positions in the section cycle at which the control signals for the various glassware forming steps are generated when the section is in the run condition. It will be understood that there is a response time associated with the actuation of the forming means associated with each of the control signals. Furthermore, the timing of these steps depends upon the type of glassware being formed and that steps may be added, deleted or repeated as necessary. Throughout the following discussion, the steps shown in FIG. 3 will be referred to in capital letters such as DISTRIBUTE GOB.

As was previously discussed, a continuous flow of molten glass is repetitively severed at a predetermined rate to produce a series of molten gobs. A gob distributor (not shown) sequentially delivers a separate gob to each individual section of the machine. As shown in FIG. 3, the distribution (DISTRIBUTE GOB) typically occurs sometime after the start of the section cycle at 0°. There is a travel time lapse between the time at which the gob is severed and the time at which the gob arrives at the blank station. As illustrated in step A of FIG. 2, the gob delivery step, during this travel time a blank mold 24 is moved into its closed position (BLANK MOLD CLOSE) and a funnel 25 is positioned on top of the mold 24 (FUNNEL DOWN) in order to guide the gob into the mold. A plunger 27, adjacent the bottom of the mold, is then moved up into position (PLUNGER UP). When the gob arrives (GOB ARRIVES), it falls through the funnel 25 and into the interior of the mold 24. At or about the same time that the gob arrives, a thimble 28 surrounding the plunger 27 is moved up into position (THIMBLE UP).

In step B of FIG. 2, the settle blow step, a baffle 26 is positioned on top of the funnel 25 (BAFFLE ON). There are the plunger 27, thimble 28 and a neck ring 29 adjacent the bottom of the mold 24. The plunger 27 extends through the thimble 28 which is enclosed by the neck ring 29. When the baffle 26 is in position, air under pressure is momentarily discharged into the top of the mold to force the molten glass into the mold and neck ring and around the plunger (SETTLE BLOW ON-SETTLE BLOW OFF) and then the baffle is removed (BAFFLE OFF). This is the settle blow step. In step C of FIG. 2, the counter blow step, the funnel is removed (FUNNEL UP) and the plunger 27 is retracted (PLUNGER DOWN) leaving a depression in the molten glass. Next, the baffle is positioned on top of the mold (BAFFLE ON) and counter blow air under pressure is introduced through the thimble and into the depression (COUNTER BLOW ON) to force the molten glass against the walls of the blank mold to produce a partially formed article of glassware referred to as a parison. The counter blow air is turned off (COUNTER BLOW OFF) and the thimble is moved down (THIMBLE DOWN). Then the baffle 26 is removed from the mold (BAFFLE OFF).

During the counter blow step, the body of the blank mold extracts sufficient heat from the parison to form a cooled skin thereon which is rigid enough to allow manipulation of the parison. In step D of FIG. 2, the invert or transfer from blank mold to blow mold step, the blank mold is opened (BLANK MOLD OPEN) and a transfer mechanism 30, attached to the neck ring 29 rotates the parison 180° (INVERT) into an open blow mold 31. The neck portion of the parison which has been positioned downward is now in the upward position. Next, the blow mold 31 is closed (BLOW MOLD CLOSE) and the neck ring is opened (NECK RING OPEN) and removed so that the parison is being supported at its neck portion by the blow mold. In this position, step E of FIG. 2, the reheat step, takes place. The skin of the parison is reheated by the relatively hot interior of the parison and the parison becomes sufficiently soft for a final blowing step. The transfer mechanism 30 and the neck ring 29 are rotated back to the blow mold (REVERT) for the next parison to be formed.

In step F of FIG. 2, the final blow step, a blow head 32 is positioned on top of the blow mold 31 (BLOW HEAD ON). Air under pressure is introduced through the blow head 32 (FINAL BLOW ON) into the interior of the parison to force the parison into the shape defined by the blow mold which is the shape of the desired article of glassware. The blow air remains on while the walls of the blow mold absorb heat from the glass such that the glassware becomes stiff enough for handling. The blow air is then turned off (FINAL BLOW OFF) and the blow mold is opened (BLOW MOLD OPEN). The blow head is then removed (BLOW HEAD UP) such that the article of glassware is ready to be removed from the section.

In step G of FIG. 2, the takeout step, a takeout mechanism 33 is moved into position to grasp the article of glassware at its neck position (TAKEOUT IN). The takeout mechanism 33 then transfers (TAKEOUT OUT) the finished article of glassware to a dead plate (not shown) for further cooling and subsequent pushout onto a conveyor (not shown).

As illustrated, in FIG. 3, the foregoing machine operation functions are performed in cycles of 360°. The forming process is a two stage process, wherein the first stage is performed at the blank station and the second stage is performed at the blow station. The respective machine functions are performed at the two stations simultaneously such that each machine cycle a blank station will produce a partially formed article of glassware and a blow station will produce a finished article of glassware. Thus, while the blow station is performing the final blow function, the bank station is producing a partially formed article of glassware to be subsequently transferred to the blow station.

When an individual section of a glassware forming machine begins to produce a malformed article of glassware, it is often difficult to determine by examination of the finished malformed glassware whether the malformation is due to the functions effected by the blank station or those effected by the blow station. If the parison produced by the blank station is examined before introduction to the blow mold, any defects which are observed cannot be attributed to any of the blow station functions. However, if no defects are found in the partially formed glassware and the finished glassware is malformed, the malformation is probably due to one or more of the blow station functions. The glassware forming machine according to the present invention can produce a frozen parison sample when one is requested by the operator.

As previously mentioned, an individual section can be switched to the sample condition wherein a frozen parison sample is produced by actuating a switch (not shown) provided on the respective section operator console. The actuation of this switch causes the respective individual section computer to initiate a sample routine wherein the last parison formed is held in the blank mold to freeze the parison. While the parison is

being frozen, the forming cycle is completed on the glassware in the blow mold and this glassware is transferred from the machine. When the machine is in the run condition, the parison produced by the blank mold is typically held in the blank mold for about one-third of a machine cycle or 120°. During this time heat is extracted from the parison and the outer portion of the parison becomes sufficiently rigid to allow the parison to be transferred to the blow mold. However, once in the blow mold, the inner portions of the parison quickly reheat the outer skin and the parison becomes soft. The sample condition causes the parison to remain in the blank mold longer than it normally would such that more heat is extracted and, when the parison is removed, the internal reheat of the parison will not cause the parison to turn soft.

After the parison is frozen, the parison is inverted to the blow mold side. The blow molds are kept open and the parison is held by the neck rings. After a predetermined time, the neck rings will open to release the frozen parison and the individual section will go to the safe or not running condition. The frozen parison can now be visually inspected for thermal and mechanical defects which develop prior to constant with the blow mold.

There is shown in FIG. 4 a timing diagram which indicates the functions performed by an individual section in producing a frozen parison sample. When an operator requests a parison sample, the respective individual section computer will initiate the sample routine when the section position becomes equal to 0° and the sample routine is executed over a period of three machine cycles. Initially, the first portion of the sample routine is identical to that of the previously described run routine. The first function which is not performed by the sample routine which is performed by the run routine is the turning off of the counter blow air (COUNTER BLOW OFF). This function is disabled along with the INVERT, NECK RING OPEN, and other blank mold functions such that the parison remains in the blank mold. The gob distributor is also disabled from distributing another gob to the section.

During the first machine cycle of the sample routine, the typical blow mold functions are performed on the parison in the blow mold. After this article of glassware is transferred from the section, all the blow mold functions are disabled. Although the amount of time the parison is held in the blank mold can be varied, the parison typically remains in the closed blank mold for about two and one-quarter machine cycles. This amount of time is sufficient to freeze the parison such that, after the parison is removed from the blank mold, internal reheat will not cause the parison to turn soft.

During the second cycle of the sample routine, the blank mold remains closed to continue to freeze the parison and no machine functions are performed. However, one or more of the forming means can be actuated as a safety measure to provide a visual indication to the operator that the machine is still in an operating condition. In the third cycle, the COUNTER BLOW OFF, THIMBLE DOWN and BAFFLE OFF functions are enabled. The BLANK MOLD OPEN and the INVERT functions are also enabled for the third cycle such that the frozen parison will be transferred to the blow mold side where it is held by the neck ring. The neck ring will continue to hold the parison until the NECK RING OPEN function is performed. The respective individual section computer can be programmed to perform the NECK RING OPEN function a predetermined time period after the frozen parison has been transferred to the blow mold. When the neck ring halves are opened, the frozen parison will be released and that particular individual section will go to the safe condition. At this time the frozen parison can be removed from the blow mold station and inspected.

In summary the present invention concerns a method of obtaining a parison sample from an automatic glassware forming machine. The machine forms articles of glassware during successive cycles of a series of predetermined forming steps by distributing gobs of molten glass to a first forming means; actuating the first forming means for a first portion of the series of predetermined forming steps to form a parison from each of the gobs of molten glass; transferring each parison to a second forming means; and actuating the second forming means for a second portion of the series of predetermined forming steps to form an article of glassware from each of the parisons. The first forming means includes the blank mold and its associated apparatus for forming the parison. The second forming means includes the blow mold and its associated apparatus for forming the article of glassware from the parison.

The method comprises discontinuing the distribution of the gobs of molten glass after one of the gobs has been distributed to the first forming means; discontinuing the transfer of the parisons before the parison formed from the one gob is transferred from the first forming means to the second forming means; completing the second portion of the series of predetermined forming steps to form an article of glassware from any parison in the second forming means and automatically altering the first portion of the series of predetermined forming steps to freeze the parison in the first forming means. Typically, these steps are performed during a first cycle of the forming machine, no steps are performed during a second cycle of the forming machine and, during a third cycle of the forming machine, the frozen parison is transferred to the second forming means.

The present invention also concerns an automatic glassware forming machine having means for forming gobs of molten glass, means for forming glassware articles from the gobs of molten glass in successive cycles of a series of predetermined forming steps in response to a plurality of control signals, means for distributing the gobs of molten glass to the forming means and control means for generating the control signals. The forming means includes a first means for performing a first portion of the series of predetermined forming steps on each of the gobs to form a parison, a second means for performing a second portion of the series of predetermined forming steps on each parison to form an article of glassware, and means for transferring the parison from the first forming means to the second forming means.

The control means includes a means for generating a sample signal, such as the SOC 22 and a means responsive to the sample signal, such as the computer 13, for generating control signals to disable the gob distributing means and to disable the parison transferring means and for generating control signals to alter the first portion of the series of predetermined forming steps to freeze the parison. The control signals are generated to the first forming means to freeze a parison formed from a gob by retaining the parison such that enough heat is extracted from the parison to prevent internal reheat from turning

the parison soft. The control signals are also generated to the second forming means to complete the second portion of the series of predetermined forming steps on any other parison in the forming machine.

In accordance with the provisions of the patent statutes, the principle and mode of operation of the invention have been explained in its preferred embodiment. However, it must be understood that the invention may be practiced otherwise than as specifically illustrated and described without departing from its spirit or scope.

What is claimed is:

1. A method of obtaining a parison sample from an automatic glassware forming machine which forms articles of glassware during successive cycles of a series of predetermined forming steps by distributing gobs of molten glass to a first forming means; actuating the first forming means for a first portion of the series of predetermined forming steps to form a parison from each of the gobs of molten glass; transferring each parison to a second forming means; and actuating the second forming means for a second portion of the series of predetermined forming steps to form an article of glassware from each of the parisons, the method comprising:

discontinuing the transfer of the parisons from the first forming means to the second forming means after a selected parison has been transferred to the second forming means;

discontinuing the distribution of the gobs of molten glass to the first forming means after the distribution of the next gob following the transfer of said selected parison;

completing the second portion of the series of predetermined forming steps to form an article of glassware from said selected parison; and

extending the time a parison is in the first forming means and discontinuing selected steps in the first portion of the series of predetermined forming steps to freeze a parison formed from said next gob in the first forming means.

2. A method according to claim 1 including a step of transferring the frozen parison to the second forming means for subsequent removal.

3. A method according to claim 1 including a step of discontinuing the actuating of the second forming means for the second portion of the series of predetermined forming steps after said parison in the second forming means has been formed into an article of glassware.

4. A method according to claim 1 wherein during a first cycle of the automatic glassware forming machine:

the step of discontinuing the distribution of the gobs is performed after one of the gobs has been distributed to the first forming means;

the step of discontinuing the transfer of the parisons is performed before a parison formed from said one gob is transferred from the first forming means to the second forming means;

the step of completing the second portion of the series of predetermined forming steps is performed; and

the step of discontinuing selected steps in the first portion of the series of predetermined forming steps is performed; wherein during a second cycle of the forming machine:

no forming steps are performed; and wherein during a third cycle of the forming machine:

a step of transferring the frozen parison to the second forming means is performed.

5. A method according to claim 4 wherein the first and second forming means include a plurality of glassware forming mechanisms and wherein during said second cycle of the forming machine at least one of said plurality of glassware forming mechanisms is actuated to provide a visual indication that the machine is in an operating condition.

6. A method of obtaining a parison sample from an automatic glassware forming machine which forms articles of glassware during successive cycles of a series of predetermined forming steps including delivering successive gobs of molten glass to a blank mold in a first forming means; performing a settle blow step to force the gob of molten glass to the bottom of the blank mold; performing a counter blow step to form a parison from the gob of molten glass; transferring the parison to a blow mold in a second forming means; performing a reheat step to soften the parison; performing a final blow step to form the article of glassware from the parison; and performing a takeout step to transfer the glassware article out of the blow mold, the steps being performed under the control of a programmed control means wherein the control means responds to a sample signal to automatically alter the series of predetermined steps to perform the method comprising:

discontinuing the delivery of gobs of molten glass after a gob has been delivered to the blank mold;

discontinuing the transfer of the parisons before a parison is formed from said gob;

completing the reheat step, the final blow step and the takeout step for any parison in the blow mold; and

altering the counter blow step to hold a parison formed from said gob in the blank mold for a period of time such that sufficient heat is extracted from said parison to prevent internal reheat to soften said parison.

7. A method according to claim 6 including transferring said parison to the blow mold for removal from the machine.

8. A method according to claim 6 wherein the steps are performed during a first cycle of the forming machine.

9. A method according to claim 8 wherein no steps are performed during a second cycle of the forming machine and a step of transferring said parison to the blow mold for removal from the forming machine is performed during a third cycle of the forming machine.

10. In an automatic glassware forming machine having means for forming gobs of molten glass; means for forming glassware articles from the gobs of molten glass in successive cycles of a series of predetermined forming steps in response to a plurality of control signals; means for distributing the gobs of molten glass to the forming means; and control means for generating the control signals for controlling the forming means in the successive cycles of forming steps, the forming means including a first means for performing a first portion of the series of predetermined forming steps on each of the gobs to form a parison; a second means for performing a second portion of the series of predetermined forming steps on each parison to form an article of glassware; and means for transferring the parison from the first forming means to the second forming means, the control means comprising:

means for generating a sample signal; and

means responsive to said sample signal for generating control signals to disable the gob distributing

means and to disable the parison transferring means and for generating control signals to extend the time the parison remains in the first forming means and to discontinue selected steps in the first portion of the series of predetermined forming steps to freeze the parison.

11. A control means according to claim 10 wherein said means for generating control signals is a programmed digital computer.

12. A control means according to claim 10 wherein said control signal generating means disables the gob distributing means after a gob has been delivered to the first forming means and disables the transferring means before a parison formed from said gob is transferred to the second forming means.

13. A control means according to claim 12 wherein said control signal generating means generates control signals to the first forming means to freeze a parison formed from said gob by retaining said parison such that enough heat is extracted from said parison to prevent internal reheat from turning said parison soft.

14. A control means according to claim 13 wherein said control signal generating means generates control signals to the second forming means to complete the second portion of the series of predetermined forming steps on any other parison in the forming machine.

* * * * *

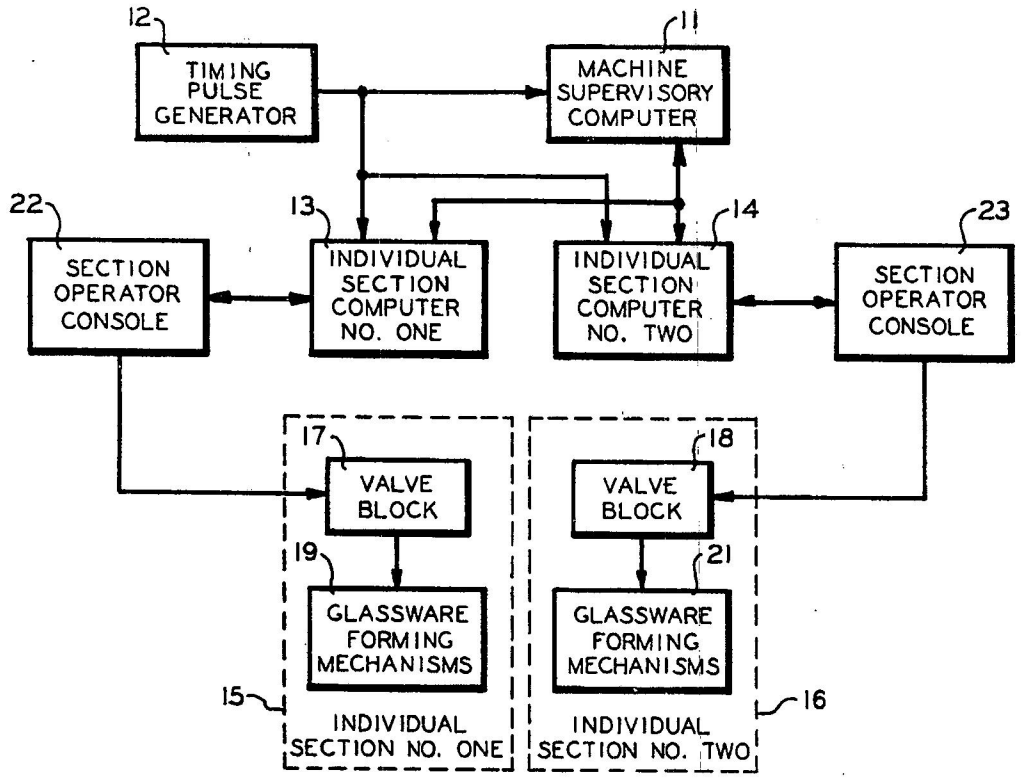

12
TIMING PULSE GENERATOR
11
MACHINE SUPERVISORY COMPUTER
22
SECTION OPERATOR CONSOLE
13
INDIVIDUAL SECTION COMPUTER NO. ONE
14
INDIVIDUAL SECTION COMPUTER NO. TWO
23
SECTION OPERATOR CONSOLE
17
VALVE BLOCK
18
VALVE BLOCK
19
GLASSWARE FORMING MECHANISMS
21
GLASSWARE FORMING MECHANISMS
15
INDIVIDUAL SECTION NO. ONE
16
INDIVIDUAL SECTION NO. TWO

FIG. 1

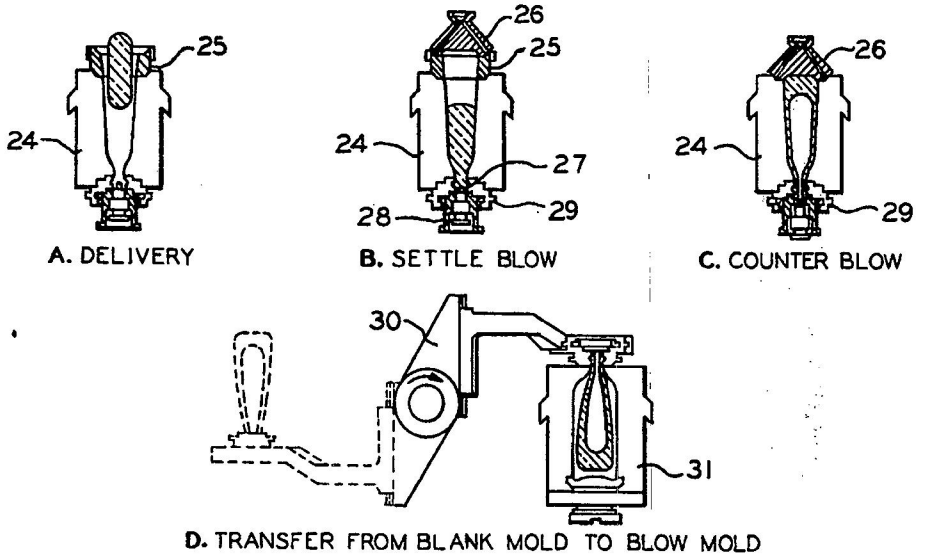

25
24
A. DELIVERY
26
25
24
27
28
29
B. SETTLE BLOW
26
24
29
C. COUNTER BLOW
30
31
D. TRANSFER FROM BLANK MOLD TO BLOW MOLD
31
E. REHEAT
32
31
F. FINAL BLOW
33
G. TAKEOUT

FIG. 2

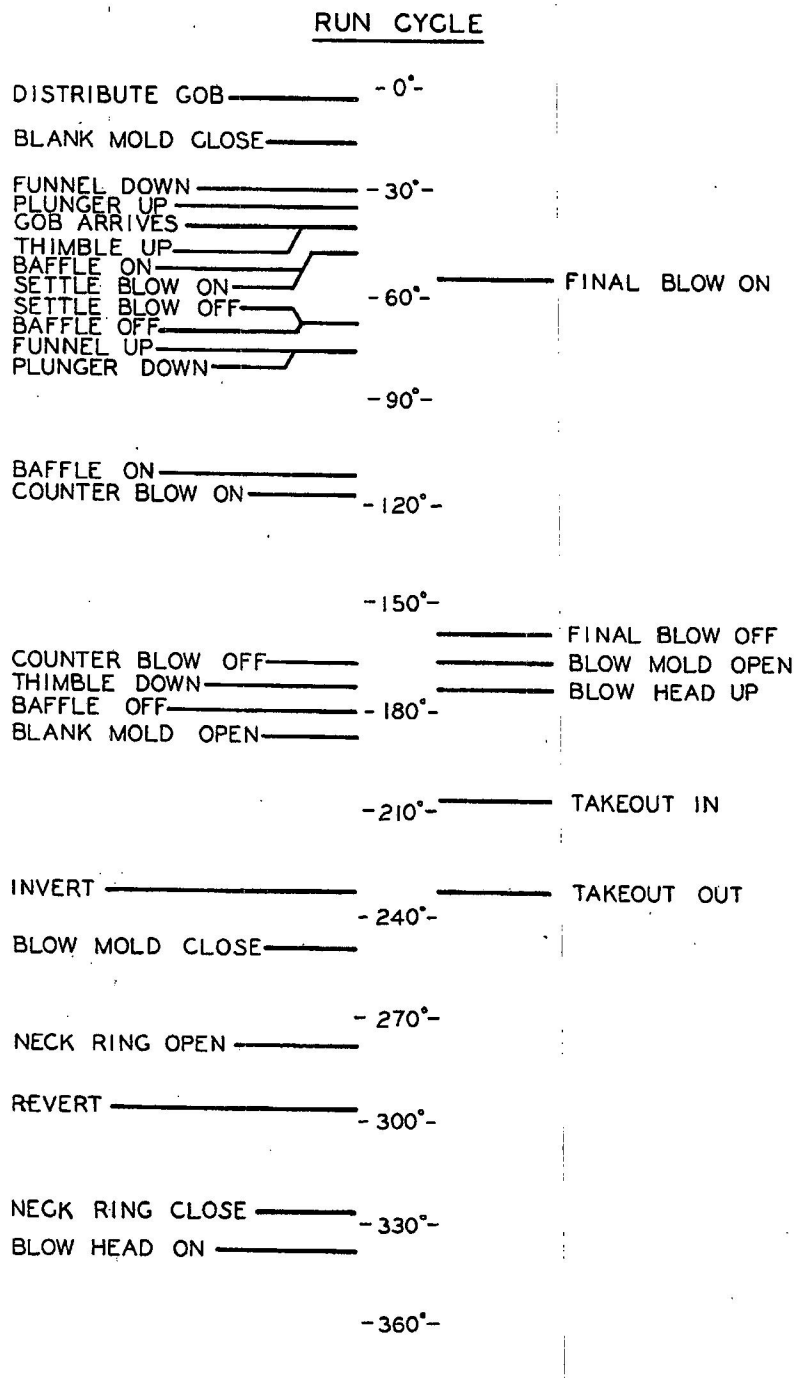

RUN CYCLE
DISTRIBUTE GOB
-0°-
BLANK MOLD CLOSE
FUNNEL DOWN
PLUNGER UP
GOB ARRIVES
-30°-
THIMBLE UP
BAFFLE ON
SETTLE BLOW ON
FINAL BLOW ON
SETTLE BLOW OFF
-60°-
BAFFLE OFF
FUNNEL UP
PLUNGER DOWN
-90°-
BAFFLE ON
COUNTER BLOW ON
-120°-
-150°-
FINAL BLOW OFF
COUNTER BLOW OFF
BLOW MOLD OPEN
THIMBLE DOWN
BLOW HEAD UP
BAFFLE OFF
-180°-
BLANK MOLD OPEN
-210°-
TAKEOUT IN
INVERT
TAKEOUT OUT
-240°-
BLOW MOLD CLOSE
-270°-
NECK RING OPEN
REVERT
-300°-
NECK RING CLOSE
-330°-
BLOW HEAD ON
-360°-

FIG. 3

167
154

SAMPLE ROUTINE

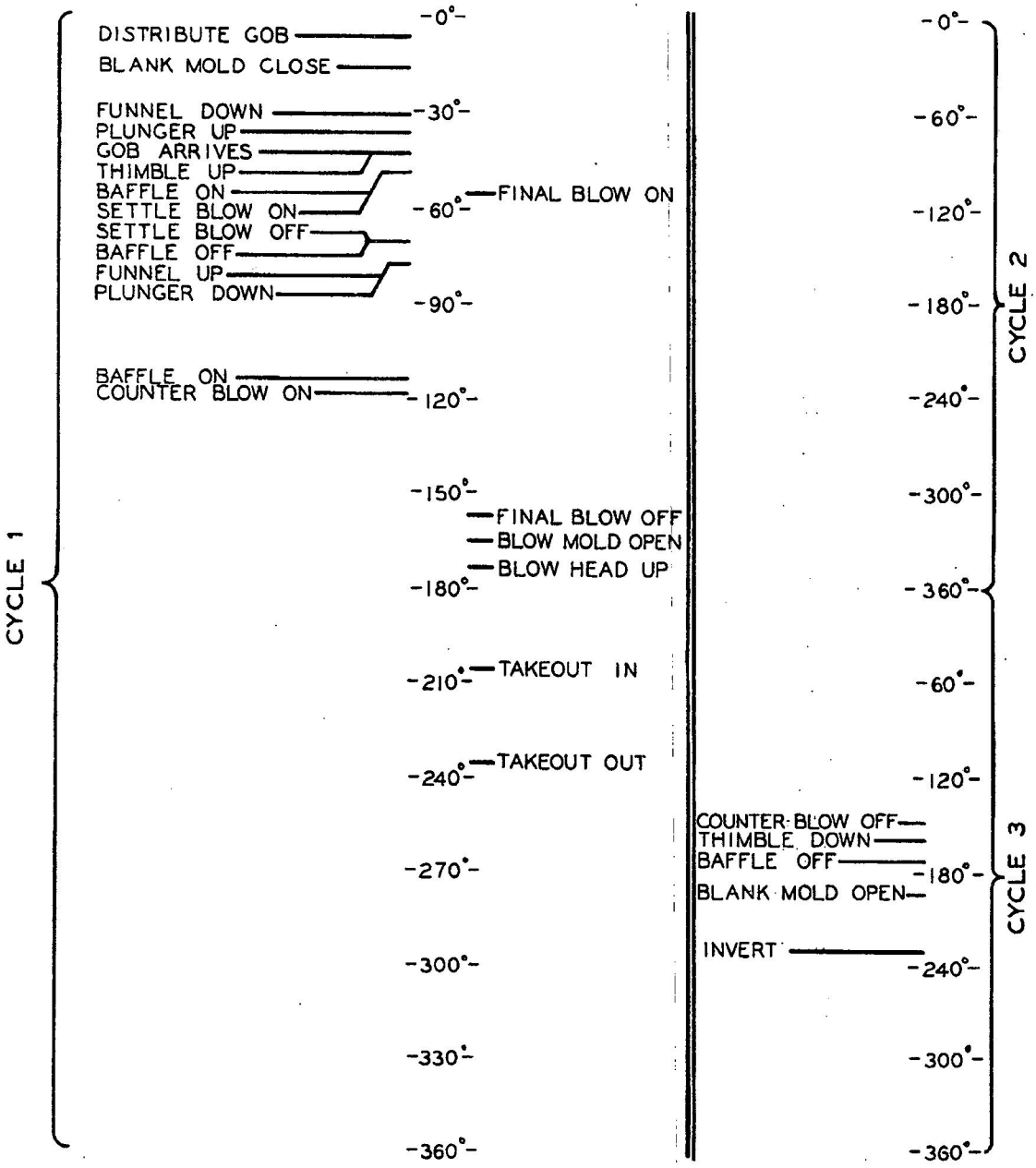


FIG. 4

168
155

United States Patent [19]

Farkas et al.

[11] **4,145,204**

[45] **Mar. 20, 1979**

[54] **TIMING PULSE GENERATOR FOR A GLASSWARE FORMING MACHINE**

[75] Inventors: **Daniel S. Farkas; Philip D. Perry,** both of Toledo, Ohio

[73] Assignee: **Owens-Illinois, Inc.,** Toledo, Ohio

[21] Appl. No.: **856,387**

[22] Filed: **Dec. 1, 1977**

[51] **Int. Cl.**[2] **C03B 9/40**

[52] **U.S. Cl.** **65/164;** 65/158; 65/163; 65/DIG. 13; 364/473; 364/476

[58] **Field of Search** ..... 65/29, 158, 159, 160, 65/163, 164, DIG. 13; 364/473, 476

[56] **References Cited**

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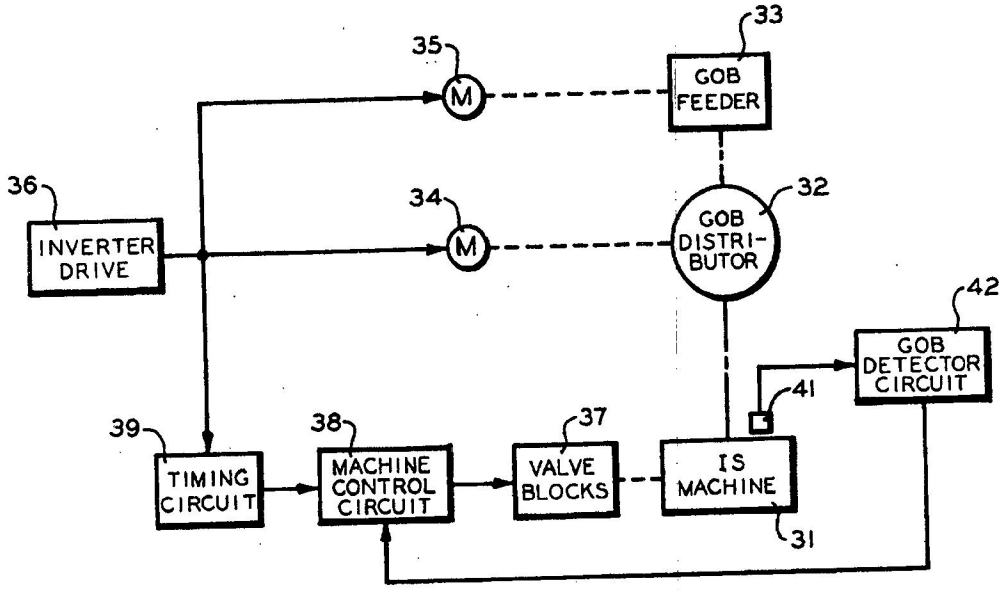
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3,957,477	5/1976	Jones et al.	65/158
4,007,028	2/1977	Bublitz et al.	65/163

Primary Examiner—Arthur D. Kellogg
Attorney, Agent, or Firm—D. H. Wilson; M. E. Click

[57] **ABSTRACT**

A glassware forming machine including means for distributing gobs of molten glass to individual sections of the machine at a predetermined rate, drive means responsive to electrical power of a selected frequency generated by a power source for driving the gob distributing means at the predetermined rate and an automatic control means responsive to timing signals for controlling each of the individual sections in a predetermined timed sequence of steps for forming the glassware wherein the power source generates the timing signals at a frequency proportional to the selected frequency of the power source. Each piece of glassware is formed during a machine cycle which is related in duration to the gob distribution rate and typically is defined in terms of 360°. The power source includes a timing pulse generator which synthesizes the timing signals from the power source electric power frequency at the frequency required for defining 360° per machine cycle.

11 Claims, 6 Drawing Figures



ate reset pulses to define the end and beginning of successive machine cycles.

It is an object of the present invention to improve the performance of glassware forming machines.

It is another object of the present invention to reduce the circuitry required to control an individual section glassware forming machine by eliminating a separate clock source.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a prior art glassware forming apparatus;

FIG. 2 is a block diagram of a glassware forming apparatus according to the present invention;

FIG. 3 is a block diagram of the timing circuit of FIG. 2;

FIG. 4 is a block diagram of an alternate embodiment of the timing circuit according to the present invention;

FIG. 5 is a table of timing values for the glassware forming apparatus of FIG. 2; and

FIG. 6 is a generalized block diagram of the timing circuits according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

There is shown in FIG. 1 a block diagram of a glassware forming apparatus according to the prior art. In this apparatus, the machine control circuit controls the actuation of the glassware forming means in accordance with information on the positions of the gob feeder and the gob distributor in their respective cycles of operation.

An individual section glassware forming machine **11** has a plurality of individual sections (not shown) which receive gobs of molten glass from a gob distributor **12** which in turn receives the gobs from a gob feeder **13**. The gob distributor **12** and the gob feeder **13** are mechanically driven by a pair of drive motors, **14** and **15** respectively, which motors are connected to a supply of variable frequency power generated by an inverter drive **16**. The inverter drive frequency is controlled to determine the rate at which the gobs are formed and distributed to the individual sections of the IS machine **11**.

Each individual section is associated with a separate valve block which valve blocks are designated by the reference **17** in FIG. **1**. Each valve block has valves connected to actuate a plurality of glassware forming means in the associated individual section. The valves in the valve blocks **17** are actuated by solenoids which are controlled by a machine control circuit **18** which determines the timing of the forming steps in accordance with a predetermined sequence of those steps. The control circuit receives information as to the sequence of the steps and the times between the steps from a source (not shown) such as control switches or a computer program. A pair of position transducers **19** and **21** are mechanically coupled to the drive motors **14** and **15** respectively and generate signals representing the relative positions of the gob distributor **12** and the gob feeder **13** respecctively. The gob feeder **13** represents a typical apparatus for expelling a quantity of molten glass from the forehearth of a glass furnace. Thus, the motor **15** can drive a crank (not shown) which is connected to reciprocate a plunger (not shown) to expel the quantity of glass. The quantity of glass is cut by shears (not shown) to form a gob which falls into the gob distributor **12**. Since the forming of the gob is related to the rotational position of the drive motor **15**, the position transducer **21** generates a signal indicating when each gob is formed. The gob distributor **12** is driven by the motor **14** to distribute the gobs to the individual sections of the IS machine in a predetermined sequence. Since the distribution of any one gob is related to the rotational position of the motor **14**, the position transducer **19** generates a signal indicating when a gob is distributed and to which individual section. The control circuit **18** responds to the two position transducer signals to determine when the sequence of steps for each individual section is to be initiated in response to each gob formed and distributed.

The machine control circuit **18** also receives a clock signal from a source **22** which signal provides a reference for timing the machine cycle and the sequence of steps. Typically, machine timing is expressed in degrees and a machine cycle is 360° in length. The cycle for each individual section is also 360° but the cycles for the sections will be offset from the start of the machine cycle by different numbers of degrees to compensate for the difference in gob delivery time to each section. A glassware forming apparatus as shown in FIG. **1** is more fully described in the previously referenced U.S. Pat. No. 4,007,028.

There is shown in FIG. **2** a block diagram of a glassware forming apparatus according to the present invention. In the prior art apparatus of FIG. **1**, the gob distributor motor **14** was considered the zero phase motor and the gob feeder, pushout and conveyor motors are phased in manually at start-up. Thus, the timing of the individual sections relied upon the position of the gob distributor. In the present invention, the IS machine is considered the zero phase motor and the gob feeder, gob distributor, pushout and conveyor motors are phased in. Thus, the timing of the individual sections is fixed and the gob distributor is referenced thereto with a correction to the section timing, if needed, supplied by a detection of the gob at the mold to provide a more accurate control of the machine cycle.

As with the apparatus of FIG. **1**, an individual section glassware forming machine **31** has a plurality of individual sections (not shown) which receive gobs of molten glass from a gob distributor **32** which in turn receives the gobs from a gob feeder **33**. The gob distributor **32** and the gob feeder **33** are mechanically driven by a pair of drive motors, **34** and **35** respectively, which motors are connected to a supply of variable frequency power generated by an inverter drive **36**. Each individual section is associated with a valve block which valve blocks are designated with the reference numeral **37**. Each valve block is connected to a plurality of glassware forming means in the individual section for actuating the forming means in a predetermined timed sequence of steps to form glassware from the gobs supplied by the gob distributor **32**. The valves in the valve blocks are actuated by solenoids which are controlled by a machine control circuit **38** which determines the timed sequence in accordance with a predetermined sequence of steps and timing clock signals generated by a timing circuit **39**.

The control circuit **38** receives information as to the sequence of the steps and the times between the steps from a source (not shown) of such information. The timing circuit **39** is responsive to the frequency of the inverter drive output power to generate the clock signals. Since the speeds of the motors **34** and **35** are proportional to the frequency of the power generated by

the inverter drive, the timing of the forming of the gob by the gob feeder **33** and the timing of the distribution of the gob by the gob distributor **32** are synchronized with the clock signal **39**.

Although the distribution of the gob to each individual section is synchronized with the clock signals, the clock signals only provide information as to the rate of gob distribution and are utilized as a timing reference for the sequence of steps in the machine cycle in a manner similar to the clock signals generated by the clock source **22** of FIG. **1**. Since there is no position transducer provided as in the apparatus of FIG. **1**, the machine control circuit **38** has no information as to the time of gob distribution within the gob feeder cycle. Therefore, the timing circuit **39** also generates a timing reset signal to the control circuit **38** to initiate the machine cycle. The gob feeder **33** and the gob distributor **32** can then be phased in with reference to the reset signal such that the gob is distributed to the individual section at the required time in the machine cycle.

There is also shown in FIG. **2** a gob sensor **41** which generates a signal upon the detection of a gob at the mold in an individual section. A gob detector circuit **42** responds to the signal from the sensor **41** to generate a signal to the control circuit **38** which signal is utilized to adjust the timing of that individual section to the actual presence of the gob rather than to a position related distribution time as was done in the prior art. The gob sensor **41** and gob detector circuit **42** are the subject matter of U.S. patent application Ser. No. 856,473 in the name of Homer F. Peters and assigned to the assignee of the present application.

There is shown in FIG. **3** a block diagram of the timing circuit **39** of FIG. **2**. An input line **51** is connected to the output of the inverter drive **36** of FIG. **2** such that the timing circuit **39** responds to the frequency of the inverter output power to generate a clock pulse train on an output line **52** and reset pulses on a line **53**. The inverter power having a frequency of F(IN) is an input to a frequency dividing circuit **54** having a frequency division factor of M which circuit generates a signal having a frequency of F(IN)/M. The output of the ÷ M circuit **54** is one input to a phase detector **55** in a phase locked loop **56**. The line **52** is an output from the phase locked loop **56** on which is generated the clock pulse train at a frequency F(OUT). The line **52** is connected to an input of a second frequency dividing circuit **57** having a frequency division factor of N which circuit generates a signal having a frequency of F(OUT)/N.

The output of the ÷ N circuit **57** is the other input to the phase detector **55**. The phase detector compares the frequencies of the two input signals, F(IN)/M and F(OUT)/N, and, if the frequencies are different, generates an error signal. The error signal is filtered by a low pass filter **58** external to the phase locked loop **56** and then amplified by an error amplifier **59** internal to the phase locked loop before being applied to the input of a voltage controlled oscillator **61** also internal to the phase locked loop. If the F(IN)/M frequency is greater than the F(OUT)/N frequency, the voltage controlled oscillator **61** responds to the error signal by increasing the F(OUT) frequency. If the F(IN)/M frequency is less than the F(OUT)/N frequency, the voltage controlled oscillator responds to the error signal by decreasing the F(OUT) frequency. Therefore, the phase locked loop drives the error signal to zero such that $F(IN)/M = F(OUT)/N$ and the loop circuit remains locked with $F(OUT) = N \cdot F(IN)/M$.

The clock pulse output line **52** is also connected to an input of a third frequency dividing circuit **62** having a frequency division factor of 360 which circuit generates reset pulses on the line **53**. Typically, the timing of the IS machine is based on a full cycle of 360° which is represented by 360 clock pulses. Therefore, the reset pulses on the line **53** define the end and beginning of successive machine cycles.

The elements shown in FIG. **3** are commercially available as integrated circuits or can be constructed from discrete components in accordance with well-known circuits. For example, the dividing circuits **54** and **57** can be a CD 4018A presettable divide-by-N counter, the dividing circuit **62** can be a CD 4059A programmable divide-by-N counter and the circuit **56** can be a CD 4046 A phase locked loop all manufactured by RCA, Box 3200, Somerville, N.J. 08876.

There is shown in FIG. **4** a block diagram of an alternate embodiment of a circuit which can be used to generate the clock signals and the reset signal to the machine control circuit. A linear voltage controlled oscillator (LVO) **71** is utilized to generate a reference signal F(LVO) at a frequency 60 times the frequency at which the gob distributor and the gob feeder motors are to be driven. This signal is an input to a frequency dividing circuit **72** having a frequency division factor of 10. The ÷ 10 circuit **72** generates an output pulse train having pulses with a width approximately equal to two cycles of the input signal. The output of the ÷ 10 circuit **72** is connected to a monostable multivibrator **73** which generates an output pulse train having pulses with a width approximately equal to the width of the pulses generated by the LVO **71**. The multivibrator **73** functions to reduce the width of the pulses generated by the ÷ 10 circuit **72** such that circuitry internal to an inverter driver **74** will not be overloaded. The output signal of the multivibrator **73** is applied to the inverter driver **74** to generate electric power on a line **75** at a frequency of F(IN) which power is used to drive the gob distributor and the gob feeder motors. Typically, the inverter driver **74** functions as a three-phase, full-wave rectifier such that the frequency F(IN) is equal to the frequency of the inverter driver input signal divided by six. Thus, the gob distributor and the gob feeder motors receive a signal at a frequency $F(IN) = F(LVO)/60$. It should be noted that a buffer circuit (not shown) may be connected between the multivibrator **73** and the inverter driver **74** for interfacing logic voltage levels with the inverter driver control signal voltage levels.

The output of the LVO **71** is also connected to a second frequency dividing circuit **76** having a frequency division factor of P. The output of the ÷ P circuit **76** is connected to a monostable multivibrator **77** which functions to "clean up" the output pulse train of the ÷ P circuit **76**. Another monostable multivibrator **78** is provided to regulate the width of the clock pulses which are generated on a line **79** at a frequency $F(OUT) = F(LVO)/P$. These clock pulses are supplied to the machine control circuit which utilizes the pulses as a reference for timing the machine cycle. An inverter (not shown) may be required between the multivibrators **77** and **78** to keep the LVO **71** output pulses and the clock pulses on the line **79** in phase since the multivibrator **78** typically triggers on the trailing edge of a "1"

pulse. A buffer circuit (now shown) can be connected to the line **79** to function as a signal level interface.

The clock pulse line **79** is also connected to an input of a third frequency dividing circuit **81** having a frequency division factor of six. The ÷ 6 circuit **81** is connected to a fourth frequency dividing circuit **82** having a dividing factor of ten. The ÷ 10 circuit **82** is connected to a fifth frequency dividing circuit **83** having a dividing factor of six. Together, the circuits **81, 82** and **83** function to generate a signal to a monostable multivibrator **84** at a frequency of F(OUT)/360. The multivibrator **84** functions to "clean up" the output pulse train of the ÷ 6 circuit **83**. Another monostable multivibrator **85** is provided to regulate the pulse width of the reset pulses which are generated on a line **86** at a frequency of F(OUT)/360. As previously discussed, the timing of the IS machine is typically based on a full cycle of 360° which is represented by 360 clock pulses. Therefore, the reset pulses on the line **86** define the end and beginning of successive machine cycles. An inverter (not shown) may be required between the multivibrators **84** and **85** to keep the clock pulses on the line **79** and the reset pulses on the line **86** in phase since the multivibrator **85** typically triggers on the trailing edge of a "1" pulse. A buffer circuit (not shown) can be connected to the line **86** as a signal level interface.

The elements shown in FIG. **4** are commercially available as integrated circuits or can be contructed from discrete components in accordance with well-known circuits. For example, a MC14566 industrial time base generator is capable of simultaneously providing a divide-by-10 counter, a divide-by-6 counter and an internal monostable multivibrator. Thus, one MC14566 can be used for the dividing circuits **72** and **81** and multivibrator **77** while another MC14566 can be used for the dividing circuits **82** and **83** and the multivibrator **84**. The dividing circuit **76** can be a MC14569 programmable divide-by-N counter. The multivibrator **73** can be a MC14538 precision monostable multivibrator while the multivibrators **78** and **85** can be NE 555 timers which have been connected to function as monostable multivibrators. The "MC" circuit elements are manufactured by Motorola, Ins., Box 20912, Phoenix, Ariz. 85036 and the NE 555 tuner is manufactured by Signetics.

There is shown in FIG. **5** a table of timing values for various inverter drive frequencies and numbers of individual sections. Typically, the inverter drive output power frequency is variable from twenty to one hundred hertz. The drive motor **35** is connected to the gob feeder **33** through gearing to operate at a speed corresponding to 48 inverter frequency cycles for each gob formed and cut by the shears in an IS machine having six sections. Thus, the number of cuts/minutes is determined by multiplying the inverter frequency in hertz by 60 seconds/minute, and dividing by 48 cycles/cut. There are shown in the table of FIG. **4** values of inverter frequency. The IS machine cycle rate or turns/minute is determined by dividing the cuts/minute value by the number of individual sections, in this example six. The gearing for the gob feeder is changed to accommodate different numbers of sections so as to maintain the same turns/minute value for a selected inverter frequency. As shown in the table, an eight section machine is geared for 36 cycles/cut and a ten section machine is geared for twenty-eight point eight cycles/cut.

The frequency of the output signal from the timing circuit **39** of FIG. **3** must correspond to 360 pulses per machine cycle or turn. At an inverter frequency of 24 hertz, the turns/minute value is five thereby requiring a total of five times 360 pulses per minute which is a frequency of 30 hertz. The value of N/M is one point two five. Therefore, N can be five and M can be four in the block diagram of FIG. **3**.

The frequency of the clock pulses generated by the circuit of FIG. **4** must correspond to 360 pulses per machine cycle. If the inverter driver is generating three-phase power, the input pulse train frequency is six times the output power frequency since six control pulses are required, one for each half cycle. When the LVO **71** frequency is at 1440 Hz the inverter driver is operating at 24 Hz and the turns/minute is five thereby requiring a total of five times 360 pulses per minute which is a frequency of 30 Hz. Thus, if F(OUT) is to equal 30 Hz, the value of P must be 48 since F(OUT) = F(LVO)/P = 1440/48 = 30 Hz.

In summary, the present invention concerns an electric power and timing signals generating means for an apparatus for forming glassware. There is shown in FIG. **6** a block diagram of the electric power and timing signals generating means which diagram will be utilized to summarize the present invention. The glassware forming apparatus includes means for forming gobs of molten glass and for distributing the gobs to an individual section glassware forming machine at a predetermined rate, means for generating electric power at a selected frequency and timing signals at a frequency proportional to the selected frequency, drive means responsive to the electric power for driving the means for forming and distributing gobs at the predetermined rate and a control circuit responsive to said timing signals for cyclically controlling each individual section machine in a predetermined time sequence of steps for forming glassware from the gobs.

The electric power and timing signals generating means includes an electric power and frequency reference signal source **91** and a means responsive to the frequency reference signal for generating the timing signals. The source **91** generates electric power to a drive means **92** for the gob forming and distributing means and the frequency reference signal to a timing signals generating means. In one embodiment, see FIG. **4**, the electric power and frequency reference signal source includes an oscillator for generating the frequency reference signal, a frequency dividing means responsive to the frequency reference signal for generating a control signal having a frequency equal to the reference signal frequency divided by a factor and an inverter drive means responsive to the control signal for generating the electric power at the selected frequency. In another embodiment, see FIG. **3**, the electric power and frequency reference signal source includes an inverter drive means for generating the electric power at the selected frequency. In this embodiment, the electric power signal also functions as the frequency reference signal which is supplied to the timing signals generating means.

The timing signals generating means includes a clock frequency dividing circuit **93** for generating clock pulses which are utilized by the glassware forming machine control circuit as a reference for timing the machine cycle which is typically defined by 360 clock pulses, although more or less pulses could be utilized. The timing means also includes a reset frequency dividing circuit **94** for generating reset pulses which typically have a frequency of one pulse per machine cycle.

In one embodiment, see FIG. 4, the timing signals generating means includes a first frequency dividing means responsive to the frequency reference signal for generating a timing clock signal having a frequency equal to the reference signal frequency divided by a first factor P. A second frequency dividing means is responsive to the timing clock signal for generating a timing reset signal having a frequency equal to the clock signal frequency divided by a second factor 360.

In another embodiment, see FIG. 3, the timing signals generating means includes a first frequency dividing means responsive to the electric power for generating a first input signal having a frequency equal to the electric power frequency divided by a first factor M, second frequency dividing means responsive to the timing signals for generating a second input signal having a frequency equal to the timing signals frequency divided by a second factor N and a phase locked loop responsive to the first and second input signals for generating the timing signals having a frequency equal to the electric power frequency divided by the first factor and multiplied by the second factor. A third frequency dividing means is responsive to the timing signals for generating timing reset signals having a frequency equal to the timing signals frequency divided by a third factor 360.

The circuits shown in FIGS. 3 and 4 can also be combined to form a timing pulse generator where it is desired to operate the drive motor from a selected one of two or more different power sources. For example, power for normal operation could be generated by an inverter and power for emergency operation could be generated by a varidyne. In FIG. 3, the line 51 would be connected to the power input terminal for the drive motor. The ÷ M circuit 54 could be set to a value of one or could be replaced by a filter such that the signal having the frequency of F(IN)/M is of the same frequency as the frequency of the input power to the drive motor. The ÷ N circuit 57 is set to divide by a factor of 60 such that the output signal on the line 52 has a frequency of $F(OUT) = N \cdot F(IN)/M = 60 \cdot F(IN)$. The frequency dividing circuit 62 is not utilized.

In FIG. 4, the LVO 71, the ÷ circuit 72, the monostable multivibrator 73 and the inverter driver 74 are not utilized. The line 52 from the modified circuit of FIG. 3 is connected to the input of the ÷ P circuit 76. If the factor P is set at 48, the relationship between the frequency of the motor power, F(IN) of FIG. 3, and the frequency of the clock pulses, F(OUT) of FIG. 4, will be $F(OUT) = 60 \cdot F(IN)/48 = 1.25\ F(IN)$ to maintain the correct relationship between the speed of the drive motor and the timing of the IS machine.

In accordance with the provisions of the patent statutes, the principle and mode of operation of the invention have been explained in its preferred embodiment. However, it must be understood that the invention may be practiced otherwise than as specifically illustrated and described without departing from its spirit or scope. Although the power source has been described as an inverter drive, any source of AC single or poly-phase power can be utilized such as a motor/generator drive. If it is not desirable to consider the individual section machine as the zero phase reference, means can be provided for changing the ratio of 1.25 between the power source frequence and the clock pulse frequency momentarily to advance or retard the phase of the machine with respect to the gob feeder or gob distributor. For example, in FIG. 4 the counter 76 can be selectively programmed to vary from the normal divide by forty-eight upon the actuation of one or more switches to advance or retard the clock pulses and reset pulses with respect to the phase of the electric power from the inverter driver.

What is claimed is:

1. An apparatus for forming glassware comprising:
   - means for forming gobs of molten glass and for distributing said gobs to an individual section glassware forming machine at a predetermined rate;
   - electric means for generating electric power at a selected frequency;
   - frequency proportioning means connected to said electric power generating means for generating timing signals at a frequency proportional to said selected frequency;
   - electric drive means responsive to the electric power for driving said means for forming and distributing gobs at said predetermined rate; and
   - a control circuit responsive to said timing signals for cyclically controlling each individual section of said individual section machine in a predetermined time sequence of steps for forming glass from said gobs.

2. An apparatus according to claim 1 wherein a machine cycle is equal in duration to the time required for an individual section to form one article of glassware and said timing signals include a timing clock signal having a frequency of 360 pulses per machine cycle.

3. An apparatus according to claim 2 wherein said timing signals include a timing reset signal having a frequency of one pulse per machine cycle.

4. An apparatus according to claim 1 wherein said electric power and timing signals generating means includes an inverter drive means for generating said electric power at said selected frequency.

5. An apparatus according to claim 1 wherein said electric power and timing signals generating means includes means responsive to said electric power for generating said timing signals.

6. An apparatus according to claim 5 wherein said timing signals generating means includes a first frequency dividing means responsive to said electric power for generating a first input signal having a frequency equal to said electric power frequency divided by a first factor, a second frequency dividing means responsive to said timing signals for generating a second input signal having a frequency equal to said timing signals frequency divided by a second factor, and a phase locked loop responsive to said first and second input signals for generating said timing signals having a frequency equal to said electric power frequency divided by said first factor and multiplied by said second factor.

7. An apparatus according to claim 6 wherein said timing means includes a third frequency dividing means responsive to said timing signals for generating timing reset signals having a frequency equal to said timing signals frequency divided by a third factor, said timing reset signals defining the time required for an individual section to form one article of glassware.

8. In an apparatus for forming glassware including gob feeding means for forming gobs of molten glass at a predetermined rate, means for distributing the gobs to an individual section glassware forming machine at the predetermined rate, the individual sections each having means for forming glassware from the gobs in a predetermined timed sequence of forming steps, an inverter for generating electric power at a predetermined fre-

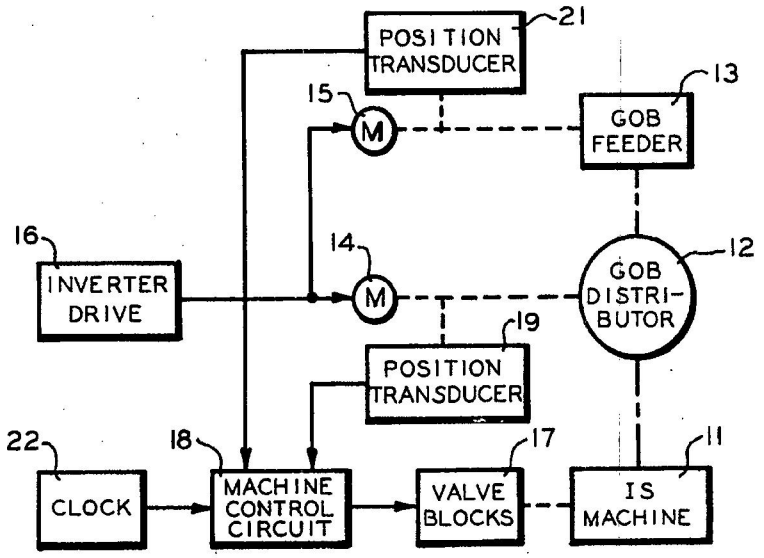


FIG. 1 (PRIOR ART)

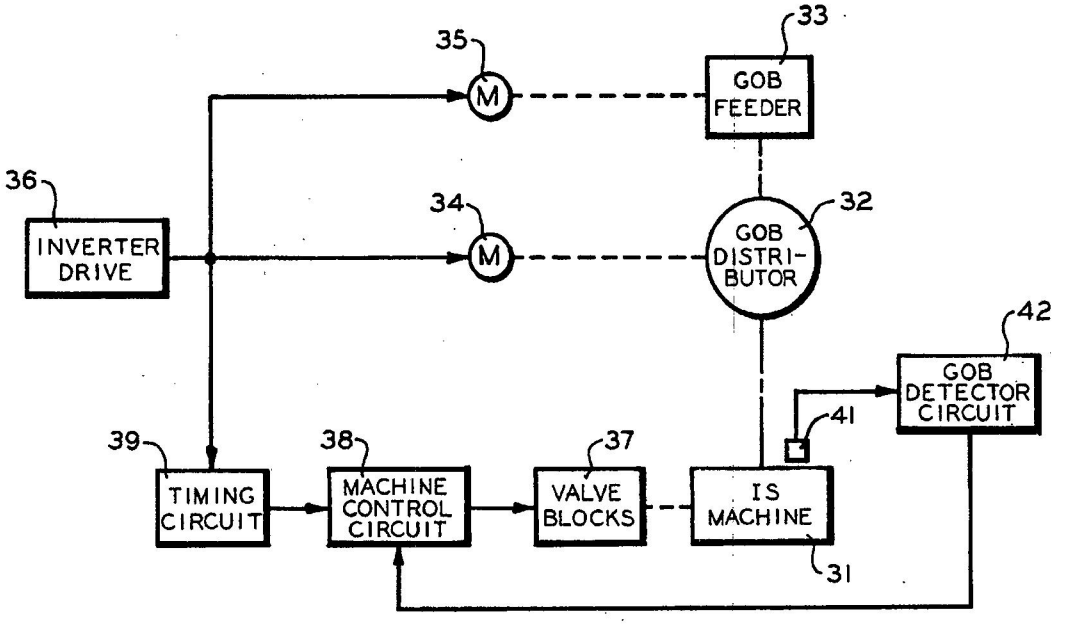


FIG. 2

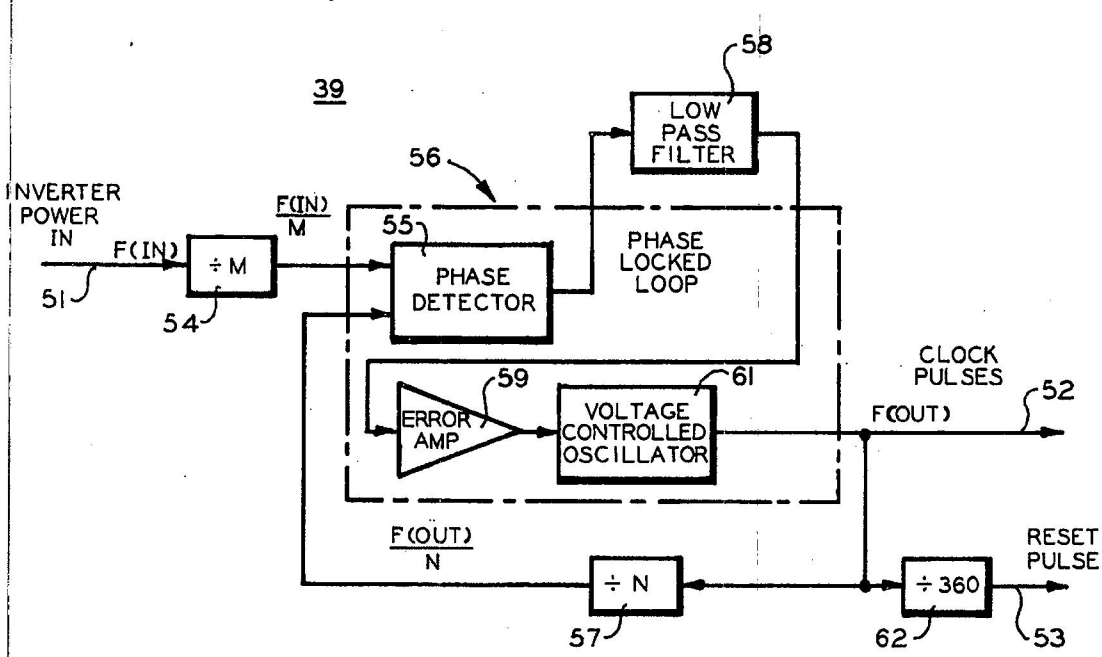


FIG. 3

TABLE OF TIMING VALUES

F(LVO) Hz (FIG. 4 ONLY)	1200	1440	2880	5760	6000	NUMBER OF SECTIONS	F(IN) Hz/CUT
F(IN) Hz	20	24	48	96	100		
CUTS/MINUTE	25.0	30.0	60.0	120.0	125.0	6	48
	33.3	40.0	80.0	160.0	166.6	8	36
	41.6	50.0	100.0	200.0	208.3	10	28.8
TURNS/MINUTE	4.16	5.00	10.00	20.00	20.83		
F(OUT) Hz	25	30	60	120	125		

FIG. 5

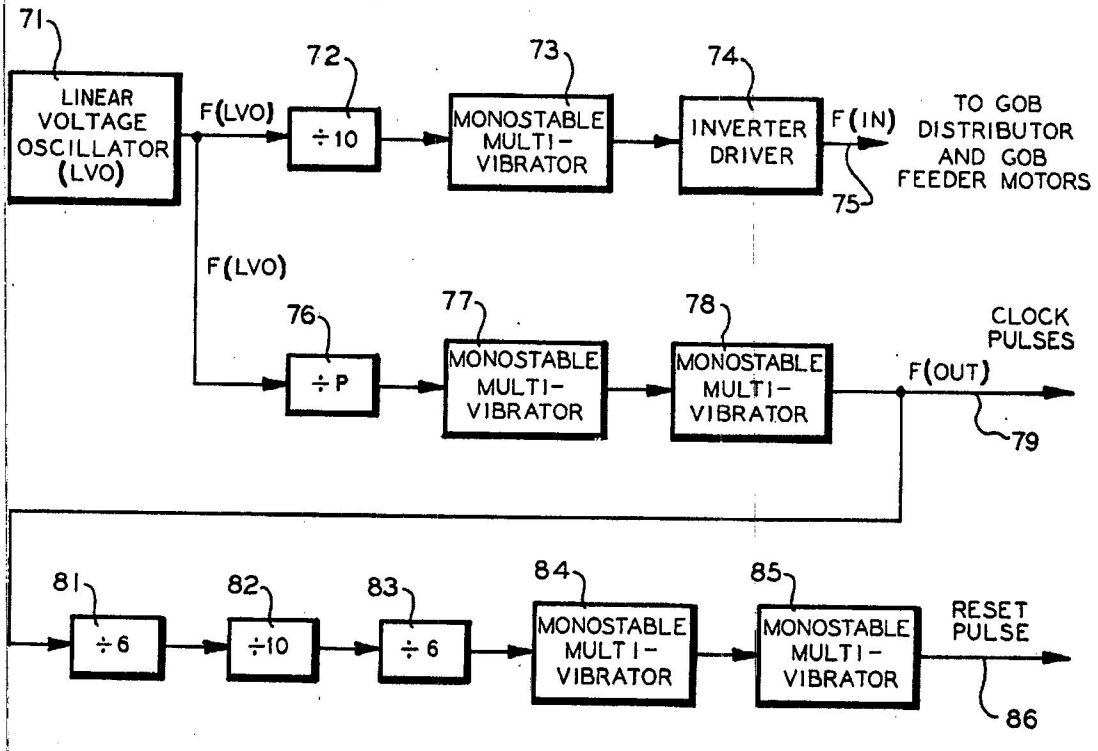

71
LINEAR VOLTAGE OSCILLATOR (LVO)
F(LVO)
72
÷10
73
MONOSTABLE MULTI-VIBRATOR
74
INVERTER DRIVER
F(IN)
75
TO GOB DISTRIBUTOR AND GOB FEEDER MOTORS
F(LVO)
76
÷P
77
MONOSTABLE MULTI-VIBRATOR
78
MONOSTABLE MULTI-VIBRATOR
CLOCK PULSES
F(OUT)
79
81
÷6
82
÷10
83
÷6
84
MONOSTABLE MULTI-VIBRATOR
85
MONOSTABLE MULTI-VIBRATOR
RESET PULSE
86

FIG. 4

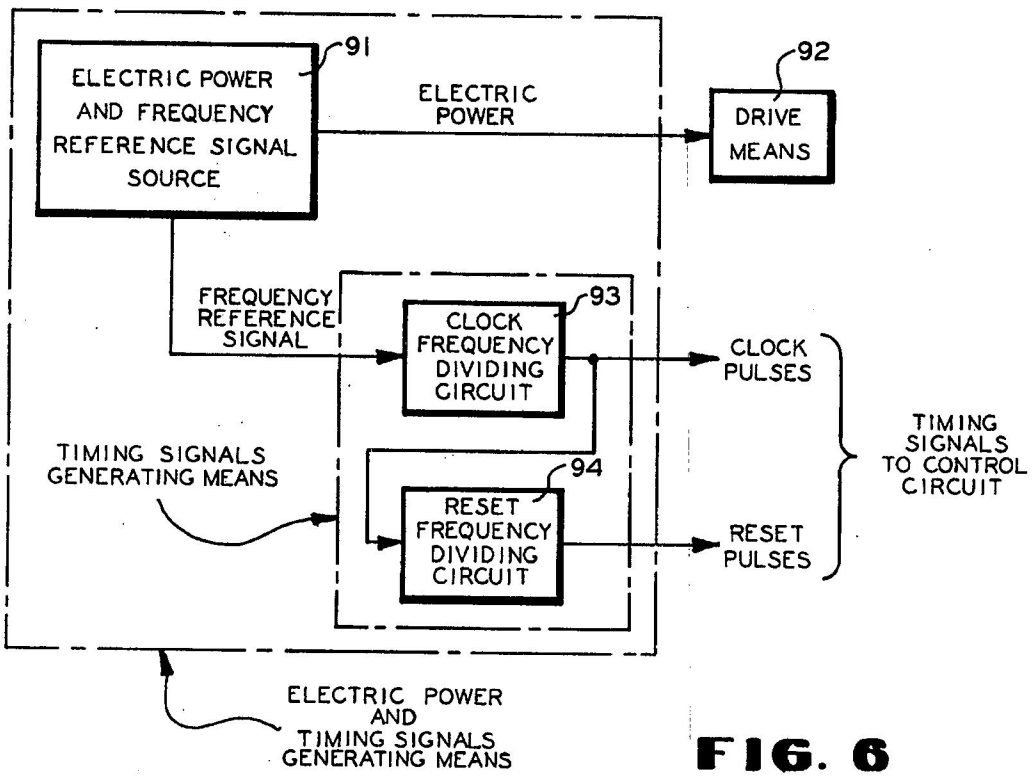

91
ELECTRIC POWER AND FREQUENCY REFERENCE SIGNAL SOURCE
ELECTRIC POWER
92
DRIVE MEANS
FREQUENCY REFERENCE SIGNAL
93
CLOCK FREQUENCY DIVIDING CIRCUIT
CLOCK PULSES
TIMING SIGNALS GENERATING MEANS
94
RESET FREQUENCY DIVIDING CIRCUIT
RESET PULSES
TIMING SIGNALS TO CONTROL CIRCUIT
ELECTRIC POWER AND TIMING SIGNALS GENERATING MEANS

FIG. 6

United States Patent [19]

Cardenas-Franco et al.

[11] **4,357,157**

[45] **Nov. 2, 1982**

[54] **ELECTRONIC GOB DISTRIBUTOR FOR GLASSWARE FORMING MACHINES AND THE LIKE**

[75] Inventors: **Luis Cardenas-Franco; Gustavo A. Sanches-Galindo,** both of Monterrey, Mexico

[73] Assignee: **Investigacion Fic Fideicomiso,** Monterrey, Mexico

[21] Appl. No.: **247,626**

[22] Filed: **Mar. 25, 1981**

[51] **Int. Cl.**³ **C03B 7/20**

[52] **U.S. Cl.** **65/164;** 65/158; 65/163; 65/DIG. 13

[58] **Field of Search** ..... 65/158, 160, 163, DIG. 13, 65/164; 364/473, 476

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,594,146	7/1971	Trudeau	65/164 X
4,007,028	2/1977	Bublitz et al.	65/163
4,108,623	8/1978	Cardenas-Franco	65/163
4,145,204	3/1979	Farkas et al.	65/164

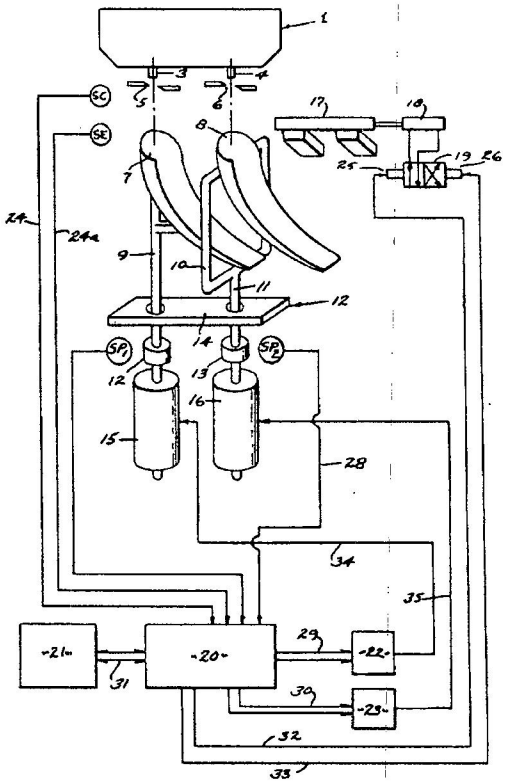
Primary Examiner—Arthur D. Kellogg

Attorney, Agent, or Firm—Charles Richard Werner; William H. Maxwell

[57] **ABSTRACT**

An electronic glass gob distributor for machines which form glassware, thermoplastic or similar articles, comprising one or more glass gob distributing channels each supported on its rotatable shaft, a step motor for actuating each rotatable shaft to move the associated distributor channel toward respective forming stations, a pulse signal generator for each step motor, a pulse amplifier for each glass gob distributor channel to amplify and feed the pulse controlling signals to the respective step motor, and a microcomputer programmer for controlled sequence of the generated pulse signals eminating from a data processing unit connected to an operator's control panel, with suitable conductors from the data processing unit to gob feed sensors and to distribution channel position sensors, with additional conductors to solenoids operating a pneumatic valve adapted to actuate a fluid operated linear motor for moving rejecting channels into gob receiving position to prevent feeding of a gob into the glassware forming position when said gob is not desired for some specific reason, the operator's control panel including three stations, namely: visual information indicators, a digital switch section and a multiple switch section with emergency, start, read, reset, confirm, position and connect buttons, all of the elements of the control panel being connected to the microcomputer through an interface unit of multiple units.

19 Claims, 3 Drawing Figures



ELECTRONIC GOB DISTRIBUTOR FOR GLASSWARE FORMING MACHINES AND THE LIKE

BACKGROUND OF THE INVENTION

The present invention is related to an electronic glass gob distributor, for glassware article forming machines, or machines for forming thermoplastic article or the like, as well as to an electronic control system to readily and efficiently regulate the movement of the glass gob distributing channels in a programmed sequence and with an exact movement between the several forming stations of the machine.

When manufacturing glass articles or other materials, it is necessary to provide specific doses of melted glass gobs to form certain articles.

These melted glass portions or gobs are obtained from a source containing the melted glass delivered in a continuous stream which is cut intermittently by means of an available controlled cutter, in portions called gobs, which are passed through a gob distributor into one or more cavities on a plurality of the article forming stations, such machines being provided generally with eight article forming stations.

Gob distributors for receiving the gobs from a melted glass stream and feed them into the several forming sections of the machines to manufacture glass articles are very well known and have achieved considerable development in the last years, having brought this type of mechanism to a point of considerable efficiency in units which enable the forming of glass articles in machines of multiple stations, thus increasing the production capacity to a great extent.

The gob distributors known in the former technique comprise generally one or more moving channels, each one of them being supported on a vertical axis, and aligned in such a way that they are moved by means of adequate gear mechanism controlled by a movable cam, which, due to its appropriate design, can make a channel swing at the same time between one glassware forming station and the following station in a specific sequence, duly synchronized by the control cam, in order to obtain the programmed distribution of the gobs from the gob cutter, through the mentioned movable channels towards the corresponding fixed channels in synchronized timing to discharge the gob into the preform station and from this preforming station to the final forming station of the glass article forming machine.

For example, U.S. Pat. No. 3,597,187 to Trudeau issued on Aug. 3, 1971, and assigned to Owens Illinois Inc., and its reissue U.S. Pat. No. Re. 28073 dated July 9, 1974, described apparatus to handle the melted glass molding loads that comprise a pair of curve moving channels, supported on vertical axes that, through appropriate gears, are made to swing by means of a ring gear, mounted on a vertical axis that moves sequentially in a predetermined arc through a transverse spindle which comprises also a cam follower, supported on the control cam, of a specific contour to make the curved channels swing at the same time between one molding station and the following, to discharge the gobs through the fixed channels that carry them to the corresponding preforms in such forming stations. The control cam is controlled to swing by means of a ring gear and a worm screw, which is coupled to a shaft rotatable by means of a synchronized motor which rotates the cam at a constant speed synchronized with the operation controls,

for example the timing drum which controls the several operations in each station of a glassware forming machine of glass articles at multiple stations.

U.S. Pat. No. 3,585,017, dated June 15, 1971, to Trudeau, also reveals a device of the same general nature, and it can contain a greater number of channels, for example three, all of them moving at the same time by means of a similar system as shown in U.S. Pat. No. 3,597,187, and its reissue U.S. Pat. No. Re. 28073; such channels being positioned in a block containing a pantograph which keeps the swing of channels from displacing them from their relative positions, in such a form that they are able to swing through the proper angle, preserving their required alignment.

In U.S. Pat. No. 3,721,544, dated Mar. 20, 1973, of Bystrianyk et al, assigned to Emhart Corporation, is also described and claimed a distribution mechanism for gobs for glassware forming machines with multiple cavities and stations, which also comprise essentially a pair of rotating curved channels, each of them being coupled to an indented rack, by means of which they can move at the same time in an angular form from one position to the other of the glassware forming machine, said indented rack being coupled to a common shaft, which at its free end is provided with a cam follower, timed to move by a lever which carries another cam follower supported on a cam, which in this particular case is a horizontal cam, against the vertical cams and with horizontal cam contour as per the Trudeau patents, which in this case performs a function practically identical although by means of another kind of mechanism. The cam in Bystrianyk patent and others, is driven through a transmission that is connected to a synchronized motor causing the cam to swing in synchrony with the operation controls of the diverse forming sections of the machines to manufacture the glass articles.

Finally, U.S. Pat. No. 3,775,083, dated Nov. 27, 1973, to Nebelung et al, assigned to Emhart Corporation, describes and claims a gob distributor for the forming machines of glass articles, which varies in its manner of controlling the movement of the ring gears, timed to move the shafts connected to the moving channels, and at all times in this particular case of the Nebelung's patent and others, such shafts are moved by means of ring gears that are coupled to different racks, each of them being actuated by a linear motor driven by fluid, said motors having a plurality of pistons driven through adequate distances and stopped by adequate stops in such a way that sequential movement can be provided to each one of the motors operated by fluid, in order to enable the mechanism to move the distributor channels between one station and the next one in the sequence, through simple fluid impulses or signals instead of using the traditional cams that were used either by Trudeau or Bystrianyk. Nevertheless, Nevelung and others, use a plurality of individual pistons positioned in tandem in the respective pneumatic cylinders, said pistons being moved individually by means of air signals that are provided from each one of the individual sections of the machine, in order to move the distributing channels in their proper sequence.

The problem encounted due to the use of cams as movable elements to obtain the movement sequences that are required in the distributing channels of a gob distributor for a glassware forming machine, are well known in the art, and reside essentially in the fact that, as the cam is used as a moving element, as was clearly

described in the above mentioned U.S. Patents of Trudeau and Bystrianyk and others, such cams suffer considerable wear due to their continuous actuation, which although is very important in a high speed mechanism, must perform in such a way that the cam surface of such cams is readily damaged and because of the wear the distributing channels begin to change their movement, and the moment comes when it is necessary to stop the machine to replace the cam, the variation caused in the position of the distribution channels due to the wear of the cam surface, cause the distribution of the glass gobs to become inefficient in a short period of time. On the other hand the moving cam mechanism, as above mentioned, has the great disadvantage of requiring frequent and accurate maintenance in the fixed channels that receive the glass gobs corresponding to each one of the forming stations, as it is possible that the distributing channels or the fixed channels can be out of alignment very slightly, although a considerable misalignment can occur between such fixed and moving channels of the distributor, with which the distribution of the glass gobs to the several sections of the glassware forming machine becomes also inefficient in the case of such slight misalignment of the channels. On the other hand, these mechanisms operated by a moving cam require that the motor be strictly synchronized with the timing drum of the forming machine of glass articles, inasmuch that if the motor is delayed or advanced there is no way to correct it unless the machine is stopped and required repairs are performed.

Another considerable disadvantage presented by the mechanical control of a moving cam for the gob distributors, resides in the fact that, such controls, based on a mechanical cam, does not provide for any possibility of modification if desired, of the operational sequence of the several sections of the glassware forming machine, unless the cam is replaced by one totally different, which is designed for another sequence, and this, of course, can be done only after stopping the machine to make the cam replacement, such mechanical operation in itself, being very complicated, since the cam is normally covered and it is necessary to disassembled many parts to make the replacement. Finally, with this type of moving cam, it is necessary to operate the gob rejector, in the event that the glass gobs pass to one or more sections of the machine that may be under repair or in the process of changing of molds or similar operations, in a way separated by controls totally different, which should be operated by means of fluid or mechanical signals totally different which constitutes another serious disadvantage of this kind of moving cam mechanisms.

Even though the control mechanism of the Nebelung et al U.S. Pat. No. 3,775,083 eliminates totally the use of a moving cam to control the moving channels and movement of the glass gob distributor; instead, a considerable complexity is incorporated to the mechanism, whereby the provision and construction of a plurality of individual pistons is required, all of them being placed in tandem and abutting one against the other in a predetermined sequence, in order to make the staged and sequential movements of the distribution channels, so that the complexity in the mechanism causes continuous failures and makes the fluid control highly inefficient, and mainly for high speed performance such as required in the glassware forming machines.

In this particular case an additional signal of the several glassware forming stations for the forming machines of is also required, to provide for rejection in the event that one of the sections is in repair or the mold is being replaced.

Upon carefully analyzing the failings in the prior art devices and all of these problems, herein enumerated, Fabricación de Máquinas, S. A., a Mexican company, located at Guerrero Norte No. 3200, Monterrey, Nuevo León, México, designed and built a hydraulic control mechanism for a gob distributor in glassware forming machines, in which the rotary channels of the gob distributor were engaged to respective gears, which were synchronized by means of a rack coupled to a hydraulic system, including a hydraulic servomechanism which provides all the movement control, and the hydraulic servomechanism followed a control cam that provided the angles of the movement, times of stop, acceleration and deceleration of the system, and including the distribution channels of the melted glass gob distributor. In that way, the cam that traditionally had been used as a moving element, as per the former description, with regard to the Trudeau and Bystrianyk and other patents, this particular system is used only as a control element that was not exerting any considerable effort, since the effort was exerted by the hydraulic system itself when moving the total gearing and the distribution channels, and, therefore as this was a semihydraulic system operating at high speed, it achieved much better responses and more precise than the previously described mechanical systems, and furthermore, the endurance of the cam was much longer, and had less problems in regard to the type of maintenance required. Nevertheless, this system proved to be inefficient at low speed, since it presented serious adjusting and maintenance problems, in addition that normally, the hydraulic systems require certain amount of care in operation.

SUMMARY OF THE INVENTION

Having in mind the defects of former techniques, it is a primary object of the present invention to provide an electronic gob distributor, and a control system for the same in the glassware forming machines, which does not use mechanical or hydraulic means to achieve the movement control, but instead uses an electronic system for an easy performance and high flexibility.

It is another object of the present invention to provide an electronic gob distributor and an electronic control, of the above mentioned nature, which enables the independent performance of the actuating shafts of the distribution channels for the glassware forming machines, in order to independently control each one of such channels to achieve a higher accuracy and flexibility.

A further object of the present invention, is to provide an electronic control system, of the above mentioned nature, which operates at the same time, in a predetermined sequence, the rejecting mechanism of melted glass gobs, when the gobs are not desired to arrive to a certain section of the glassware forming machine, that is under repair or during mold replacement.

Another particular object of the present invention is to provide an electronic gob distributor and an electronic control system for the same, of the nature described above, that are capable of operating independently for each one of the distribution channels for the glassware forming machine of multiple stations, and to each multiple chambers station, through the simple

electronic drive of pulse or step motors which operate each one of the shafts independently.

Another object of the present invention is to provide an electronic control system, in accordance to the aforementioned, that is able to vary the operation sequence by the simple feeding of logic signals to the system, without the need of lengthy operational stops of the machine, for the purpose of replacing the mechanical or hydraulic actuating members as was heretofore necessary.

A further object of the present invention is to provide an electronic gob distributor and an electronic control system of the before mentioned nature, which although of greatly increased efficacy, efficiency and accuracy, could remain within a competitive cost range in relation to the hydraulic or mechanical systems.

It is a further object of the present invention to provide an electronic control system, of the above mentioned nature, that is able to correct the angular position of each one of the distribution channels which are independent one from the other, in order to compensate any phase difference or misalignment of the fixed channels of the gob distributor of a glassware forming machine of multiple stations.

The aforementioned and other related objects, are preferably achieved, in accordance with the present invention by providing an electronic gob distributor which is free of mechanical or hydraulic operating means, and which comprises at least one distributing channel; one pulse or step motor coupled directly or indirectly to the rotary axis of each distributing channel to move the distribution channel towards the respective forming station; one pulse or step motor controller, which actuates as a pulse source, a pulse amplifier, to amplify the pulses of the controller and feed them to the pulse motor; and one microprogrammed sequence system, to sequence the controller.

A particular aspect of the distributor, and especially to control the distributor electronically, the pulse motor controller can be included in an information or a data processor which receives and processes the information within the operation parameters.

Further, we have provided an electronic control system which comprises essentially a pulse or step motor coupled directly or indirectly to each one of the rotary axes of the distribution channels; one gob feed sensor which could be either a gob cutter sensor, or a gob cutter sensor which detects when the gob reaches the distributing channel, adapted to send a signal at the moment when the gob cutter is placed directly over the distributing channels, thus cutting the gob and/or sending a signal at the moment the gob is cut, and when the gob reaches the channel and/or to provide a signal from both sensors in order to calculate the dropping time of the gob, or the time between when the gob is cut and when it drops into the distributing channel; a signal amplifier for each distributing channel to operate the respective pulse or step motors; a gob rejection system, which comprises a lineal motor operated by fluid coupled to a rejection channel and to a solenoid valve in order to actuate the linear motor, which is capable to divert the gob toward a collector, when it is desired to prevent the gob from being fed to a forming station which is out of operation; and one information or data processor which comprises a computer, and interphase card and an operator board, in which the signals from the gob feed sensor are received and fed to actuate the distributing channels and/or to provide a delay time independent from the height from which the gob falls after being cut in the intake of the distributing channel and to provide for actuation of the pulse or step motors at a determined number of pulses into an ordered and programmed sequence on the information or data processor; and, finally, to send a signal to the solenoid valve to actuate the lineal motor to reject or deviate a gob between the rejecting channel or channels.

The system can be accomplished by the provision of the position sensors placed on each one of the individual pulse or step motors, which sent the signals to the information or data processor in order to correct the angular position of any one of the individual distributing channels, in the case that misalignment occurs between the distributing channels and the fixed conducts of each forming station of the machines to produce glass articles with multiple stations and cavities.

On the other hand, regardless that we have indicated that either the distributor or the control system can include a pulse or step motor for each channel, a single pulse or step motor could be included for coupling to a common axis which moves the shafts of the channels in conjunction.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel aspects considered characteristic of the present invention are established in particular in the claims following the description. Nevertheless, the invention itself, due to its organization or the operational methods, in conjunction with other objects and advantages of the same, will be better understood by reference to the following detailed description of one specific mode, when read in relation to the accompanying drawings, in which:

FIG. 1, is a diagram which shows schematically the distribution channels of the electronic gob distributor for a glassware forming machine, and illustrating in block diagram the electronic control system for the same, constructed in accordance with our invention.

FIG. 2, is a block diagram of the processing system of the present invention, and particularly of the computer and the operator's control board. And

FIG. 3, is a block diagram ilustrating the computer and its interphase card with their interrelation with the operator's board and with the sensors and motors of the control system of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings by numerals of reference, in FIG. 1 is diagrammatically shown a form of the electronic gob distributor as well as the electronic control for same, constructed in accordance with the present invention, and designed for use with a glassware forming machine of the Hartford IS type, an "IS" machine being one with Individual Sections for blowing glass articles.

In the form particularly described in the accompanying drawings and in FIG. 1 in particular, the electronic glass gob distributor for the glassware forming machines with multiple stations, is a distributor which provides simultaneously two gobs to the two cavities of each one of the stations of the glassware forming machine, from a molten glass supply which comprises a receptable 1 from which is fed the glass gobs through a glass gob distributor 2. Receptacle 1 contains discharge conducts 3 and 4, located respectively immediately above cutter elements 5 and 6, adapted to sever or cut

the glass into gobs which drop by gravity into the moving distribution channels 7 and 8, said distribution channels as illustrated in this application, being in duplicate and placed one behind the other, the front channel being provided with a ring support 10, which is supported on a shaft 11, while the rear channel 7 passes through the mentioned ring support 10 and is carried on the shaft 9, to achieve rotational movement to attain predetermined angles of said channels 7 and 8.

The moving distribution channels 7 and 8, for the purpose of guiding the glass gob which drops towards them from the cutters, may be provided with adequate funnels (not shown).

The shafts 9 and 11 of the distribution channels 7 and 8 respectively, pass through a common support 14, and are coupled by means of available coupling members 12 and 13, responsively to the pulse or step motors 15 and 16, which are adapted to rotate the shafts independently by means of precise measured movements imparted by pulses fed to each of the motors 15 and 16, each pulse of the motors being approximately equivalent to a 0.9° angle.

In this particular case, the pulses or step motors 15 and 16 are operated by a data processing unit 20 through the signal amplifiers 22 and 23, the additional operation and purposes of which being described hereinafter.

The electronic control system per se, as constituted in accordance with the present invention, comprises essentially a gob feeding sensor which, in this particular embodiment of the invention, comprises gob cutting sensor SC which sends a signal to the information processor at the moment when the gob is cut, or, by the gob cutting sensor SC as well as an intake gob sensor SE which detects the gob when it contacts the channel, in order to detect the passage of the gob to the distributing channels and/or to calculate the time of dropping of the gob, or in other words the time between the cutting of the gob by cutters 5 and 6 and the time it reaches the distributing channels 7 and 8; this data being received by the data information processing unit 20 to which the gob feed sensors SC or SC and SE, are connected by the conductors 24 and 24*a*.

The electronic control system, in accordance with the present invention, also comprises the pulse or step motors 15 and 16, which operate independently through shafts 9 and 11 of the distribution channels 7 and 8, such pulse or step motors 15 and 16 being connected by means of respective conductors 34 and 35, to the signal amplifiers 22 and 23 which are actuated in sequence and controlled through the data processing unit 20, which sends logic signals 29 and 30 to the signal amplifiers 22 and 23.

The electronic control system built in accordance to the present invention, is also provided with the operator's panel 21, which sends and receives the logic signals 31 from and to the mentioned data processing unit 20, in accordance with what will be further described with more detail as related to FIGS. 2 and 3 of the drawings.

We have provided an option of at least two position sensors SP1 and SP2 to determine the angular position of each pulse or step motor 15 and 16, respectively, in order to supply a signal through conductors 27 and 28 to the data processing unit 20 to enable to effect correctional positioning when required, as well as to indicate the initial position of the distributing channels 7 and 8.

The illustrated electronic control system comprises further a system for gob rejection which can adopt several forms but preferably comprises in a set of rejecting channels 17, actuated by a linear fluid motor 18, capable of introducing and/or removing the rejecting channels to and from an intercepting position of glass gobs, by placing the set of channels 17 directly under the conducts 3 and 4, or into a position out of alignment with the conducts 3 and 4 from which the glass gobs are fed. Linear motor 18 is actuated by pneumatic valve 19, which in turn is actuated by a pair of solenoids 25 and 26 to provide reciprocal movement in a manner to be described in more detail hereinafter.

The data processing unit 20, functions to send electrical signals through conductors 32 and 33 to the respective solenoids 25 and 26 of the pneumatic valve 19, to cause movement of the lineal fluid driven motor 18, which actuates the rejecting channels 17 in the desired sequence.

As clearly illustrated in FIG. 2 of drawings, the operator's control panel 21 is comprised of three sections, one section 36 containing the displays or signs of information, generally indicated by reference numeral 36 in FIG. 2 of drawings, a second section 37 which contains a plurality of digital switches 47 and a third section 38 which contains a plurality of stop or cutting switches and a plurality of command switches, which will be described in more detail hereinafter. Each of the sections 36, 37 and 38 of the operator's control panel 21, are connected to the data processing unit 20, which is comprised of a computer 57 and an interface card 58, the latter being coupled to the operator's control panel by means of logic signals 54, 55 and 56, each one corresponding to certain sections of operator's control panel 21.

Section 36 of the operator's control panel 21, preferably contains a plurality of signs and luminous indicators as follows: 39, 39*a* to indicate when the control system is turned on; 40, 40*a* to request and acknowledge receipt of the height from which the cut glass gob is dropped by the mechanisms 5 and 6 to the channels 7 and 8 to request and acknowledge receipt of the sequence in the electronic control system; 42, 42*a*, to request and indicate that the degree correction signal has been introduced for movement of the distribution channels 7 and 8, in order to align them with the fixed channels which are phase displaced or deviated in the glass gob distributor system; 43 is a signal which indicates lack of information; 44 and 44*a* requests and acknowledges receipt of an indication that the system is ready to operate; 45 is a signal to indicate that the system is in operation; and 46 is a digital exhibitor or display of seven segments and ten digits, capable of indicating the numeral information necessary for the operator.

Section 37 of the operator's control panel 21 contains merely a plurality of digital switches 47, numbered from 1 through 9 to 0 and including also switches denoted by a, b, c, and d for the purpose which will be described in detail hereinafter. In addition, a digital thumbwheel type switch is provided to introduce the datum of the section number which is to be affected by the rejecting mechanism.

Finally, section 38 of the operator's control panel 21, contains seven interruptor switches, namely; 48 which is an emergency push button, 49 which is a start button and 49*a* which is the turn-on button, 50 which is the button for reading the information from the plurality of digital switches 47, 51 is a reset key, 52 is a button to

confirm the turning on and off of the rejecting mechanism, and 53 is a position switch to determine the turning on and off of the rejecting mechanism.

All the switches of section 38 on the operator's control panel 21 send signals through the conductor 56 to the interface card 58 which transmits them to the computer 57 of the data processing unit 20, in order to perform the several functions of the machine with which the electronic control system is associated.

In FIG. 3 also is illustrated a block diagram, the schematic interconnection of the several sections of the electronic control system of the present invention, and it will also be seen that the computer 57 receives the signals from sensors SC, or from SC and SE, as well as from the operative positioning sensors SP1 and SP2, which indicate the angular position of the shaft and of channels 12 and 13 and the pulse or step motors 15 and 16 (See FIG. 1), and sends logic signals 29 and 30 to the amplifiers 22 and 23 for the motors 15 and 16, as well as electronic signals 32 and 33 to the solenoids 25 and 26 of the valve 19 to motor 18.

In particular, each signal amplifier 22 and 23, comprises one signal decoder 65 and 67, and an amplifier 66 and 68, which receive the signals 29 and 30 from the computer 57, said signals being decodified thereby and transmitted to the amplifiers, and thence the amplified signals pass through lines 34 and 35 to the pulse or step motors 15 and 16, which are actuated in response to said mentioned signals.

The interface card 58, by itself, comprises a plurality of sections. A first section 59 handling the digital display 46 for numerical information and which receives a signal 69 from the computer 57, for transmitting same through conductor 54*a* to the digital display 46 in order to give the operator the required data of the control system. A second section 60 of the interface card 58 receives a signal 70 from the computer 57 to operate indicators 39*a*, 40*a*, 41*a*, 42*a* and 44*a*. A third section 61 receives a signal 71 from computer 57 to operate the information signs 39, 40, 41, 42, 43, 44 and 45 through conductor 54*c*. A fourth section 62 receives and sends the logic signals 72 to the computer 57, and at the same time will receive and send said signals through conductor 55 to the set of digital switches 47. A fifth section 63 sends a signal 73 to computer 57, received through conductors 56*a* of any of the interruptor switches 48, 49, 51 and 53. And finally, a sixth section 64 which receives the signals from switches 50 and 52 through conductor 56*b* to transmit signal 74 to computer 57.

MODE OF OPERATION OF THE ELECTRONIC CONTROL SYSTEM

The operation of the electronic control system, constructed in accordance with the present invention and as per the above description in relation with the accompanying drawings, is as follows:

To initiate the operation of the system constructed in accordance with the present invention, the start button 49*a* is operated first which will cause the indicator lights 39, 39*a* to be lighted, thus indicating that the system is turned on. At the same time, the indicator 40 will be actuated to indicate height of the gob drop and notifies the operator to introduce the height data to the data processing unit 20 in the system of the present invention, in such a way that the control is ready to wait for the information.

Through digital switches 47, the time data is selected corresponding to the height from which gobs are dropping, and this information appears in the digital display 16. Further the reading button 50 is pushed and indicator 40*a* is lighted, which indicates that height data has been passed to the memory in the data processing unit 20 at which time height indicator 40 turns off. At the same time the sequence sign 41 is turned on, indicating that sequence data should be introduced by the operator to the data processing unit 20, and the system waits for the information. Through digital switches 47 sequence data is introduced, and it appears in the exhibitor 46. Switch 50 is again actuated to take the reading and when indicator 41*a* is lighted it indicates that the sequence has been introduced in the memory of the data processing unit 20, and at the same time the sequence sign 41 is turned off. At that moment sign 42 turns on automatically and requires the correction in degrees and the system is ready to wait for the information.

By use of the digital switches 47 the information is placed in the degrees correction necessary for anyone of the sections, by introducing the information on the number of section and the degrees of corrections, which cavity is involved and whether positive or negative correction is required in said section, said information appearing in the digital exhibitor 46. Reading switch 50 is pushed again, and if additional corrections are required for the other sections of the forming machine for glass articles, the control automatically again waits for the information to correct the degrees, and the corresponding sign 42 is again lighted. If no further corrections are necessary, key d is pushed on the digital switches 47, lighting indicator 42*a* automatically to indicate that correction will be introduced in degrees to the data processing unit 20, and signal 42 in degrees of correction will be turned off simultaneously.

At this moment, the system is programmed to prove that aforementioned data has already been given, and if so then the signal of lack of information 43 automatically turns off and signal ready to operate 44 turns on.

Start switch 49 is then pushed, and signal of ready to operate 44 is turned off and switch 44*a* turns on, which indicates that information is ready to operate the system, at which time signal 45 turns on, indicating that the system is ready in operation.

On the contrary, if the system indicates that all data has not been provided, then signal 43 of lack of information turns on immediately.

When this occurs digital switch a, b or c is pushed on the digital switches board 47, depending on whether the height indicators 40*a*, sequence indicators 41*a* or degrees correction indicators 42*a*, are turned off, respectively, or if desired to make an additional correction in any of such data.

In the case that switch a is pushed, the system returns automatically to light signal 40 of height, and will wait for information in this respect. If digital switch b is pushed, then the system returns immediately to the stage of lighting signal 41 of sequence and will await information on this respect. Finally, if digital switch c is pushed, then the system returns automatically to the stage of lighting signal 42 of degrees correction and will wait the corresponding information to this respect.

Finally, if digital switch d is pushed, then the system returns to the stage of checking if all the information is introduced into the processing unit 20, preparatory to go ahead.

Although the operation sequence just described is the preferred one to handle the electronic control system of the present invention, it should be noted that such sys-

tem can operate without following the former sequence, when there exists full assurance that data to be introduced into the machine is the correct data, in which case checking for the lack of information is not necessary. This means that the machine can operate by using the digital switches a, b, c, and d, by introducing to the data processing unit **20**, all the data by means of the digital switches **47**, and posteriorly to order the execution of them by means of the starting button **49**.

Independent of the sequence used to operate the electronic control system of the present invention, such control calculates the times and places the gobs rejector **17** in the operative position. The rejector is placed in the section in which the cycle is initiated, and awaits the dropping of two consecutive gobs in such section, in order to calculate the time cycle through the derivation of this data from the cuts per minute that are being done and immediately after, removes the rejector **17** through the adequate signals **32** and **33**, so that the section as per the sequences that have been fed to the machines will begin to function. This cycle of time will be determined by means of the signal that sends the gob cutting sensor SC, or SC and SE through the line **24** to the data processing unit **20**, waiting, as stated before, the dropping of two consecutive gobs in order to calculate the time of delay between the dropping of one gob and the dropping of the other, so that, the time data of the total cycle endurance of the system be is fed in order to drive the pulse or step motors **15** and **16** at the proper speed towards the positions marked in the sequence that was fed.

Finally, when the emergency stop button is pushed, the system is stopped placing the rejector **17** in its operative position so that no more gobs will drop into the forming machine of glass articles.

On the other hand, in order to check the position of rejector **17**, confirmation of rejection by use of button **52** is possible; to operate the rejector, the information is introduced to the corresponding section on the digital switch board **47***a*, and the reject acting switch **53** is placed in position to posteriorly push the switch **52**, which confirms the position of rejector in order of placing it in the desired position.

From the above, it can be seen that for the first time an extremely efficient system has been provided, which does not readily wear out mechanical parts, and which independently operates the shafts of each one of the distributing channels of the electronic distributing system of glass gobs, for a machine of multiple sections, whereby there exists the possibility of introducing any sequence of operation for such channels, through the simple feeding of the information through the adequate digital switches, without the need of undesirable stoppage of the machine. Furthermore, with the electronic control of the present invention it is possible to independently correct, by means of 0.9° increments, the position of any of the distributing channels, in order to put them in alignment with the fixed channels of the drop distributor of the machine. This was not possible with any of the mechanical or hydraulic systems of the former technology. Also, by the introduction of position sensors of each one of the individual pulse or step motors, the data processor receives information at a given moment of the position in which the distributing channels of glass gobs are placed, and to reinitiate the sequence in any point or section of the machine without the necessity of pushing the reset button to initiate again the cycle of the machine from the beginning, in any momentous stop that could exist in the machine. Besides, such position sensors provide a feed-back signal to the data processing unit so that, at any moment it can correct the movement equation of the channels from one position to the next, whereby the operator can designate a given sequence, in order that the forming stations of glass articles that were programmed are not apart in more than five stations. In that way, the controller can determine a higher or lower acceleration, by the signals received from these positions sensors SP1 and SP2, in order to give a greater flexibility to the control of the present invention over the prior art. This did not exist in any other of the mechanical or hydraulic mechanical controls of the former technology, ours is synchronized automatically.

Although certain specific modes have been shown and described of the present invention, it should be noted that it is possible to make several modifications to such modes. Therefore, the present invention should not be restricted to what has been described and illustrated, but should be reviewed in the light of what novelty has been disclosed and claimed herein and illustrated in the accompanying drawings.

What we claim is:

1. An electronic gob distributor, for glassware forming machines and machines for forming thermoplastic articles and the like, which comprises in combination: means delivering gobs severed by cutting action from a continuous source; at least one vertical and axially curved distributing channel mounted to a vertical rotatable shaft, the top end of the channel being open for gob reception from said means and maintained in the same axial position independent of the shaft rotation; means for synchronized movement of the lower end of the channel into a plurality of positions and each of which conveys the gobs to one of a plurality of forming stations of the machine; a step motor coupled to the rotary shaft of each distributing channel for said rotation of said shaft to position the lower end of the channel in alignment with a forming station; a step motor controller which actuates a pulse source; a pulse amplifier for each channel to amplify the pulses of the controller and feed them to the respective step motor; and a computer means programmed to sequence the controller for said synchronized movement of the lower end of the channel into said plurality of positions with respect to said plurality of forming stations.

2. The electronic glass gob distributor as set forth in claim **1**, which comprises a gob rejector that diverts a gob towards a collector, in order to avoid its feeding to any of the forming stations selected in the machine.

3. The electronic glass gob distributor as set forth in any one of claims **1** or **2**, which comprises a synchronized signal source to actuate the step motor in synchronization with relation to the gob cutting action of the first mentioned means, to the operational sequence of the forming stations of the machines, and to actuate the gob rejector when required.

4. The electronic glass gob distributor as set forth in claim **1**, which comprises only one step motor coupled to a common drive which moves the shafts of the channels.

5. The electronic glass gob distributor as set forth in claim **1**, in which the step motor controller and the computor means programmed to sequence the controller and a synchronized signal source are included in an information processor.

6. An electronic control system for a glass gob distributor of a forming machine of glass articles, thermo-

plastics and the like, in combination with a glass gob distribuutor of the type which comprises, means delivering a gob severed by cutting means from a continuous source, at least one vertical and axially curved distributing channel mounted on its upper end to a vertical rotatable shaft, the upper end of the channel being open for gob reception from said cutting means and maintained in the same axial position of the gob reception, independent of the rotation of the shaft, means for synchronized movement of the lower end of the channel between a plurality of conduits which convey the gob to a corresponding forming station of the machine; the electronic control system comprising: at least one step motor coupled to the rotary shaft of each distributing channel for rotation of said shaft and to position the lower end of the channel in a coincident relation with the corresponding conduit; an information processor to receive and process information on the operation parameters; an information source to introduce the information to the processor; a signal conditioning circuit to condition the signals from the information source between the information source and the processor; a signal amplifier for each one of the distributing channels to send operation signals to the step motor; a gob feed sensor to send the signal to the information processor at the moment a gob is being fed into a channel; and a gob rejection system which diverts the gob toward a recollector in order to avoid feeding the gob into one of the selected forming stations of the machine in response to a signal from the information processor.

7. The electronic control system as set forth in claim 6, in which only one step motor is included, said step motor being coupled to a common drive which simultaneously moves the channel shafts.

8. The electronic control system as set forth in claim 6 or 7, in which the information source is an operator's control panel which comprises a plurality of indicators and switches.

9. The electronic control system as set forth in claim 6, in which the glass gob feed sensor is responsive to the cutting means cutting the gob and which sends a signal to the information processor at the moment in which the gob is cut to be fed into the channel.

10. The electronic control system as set forth in claim 6, in which the gob feed sensor is a gob severed sensor and a gob intake sensor related to a channel, and which sends a signal to the information processor when the gob is cut and reaches said channel.

11. The electronic control system as set forth in claim 6, in which a gob cut sensor and a sensor for gob intake to the channel send their signals to the information processor which receives and processes the signals from both sensors to calculate the time of delay between the time of cutting of a gob and the time it is received in the channel.

12. The electronic control system as set forth in cllaim 6, in which the gob rejection system diverts a gob from at least one channel and toward a recollector, comprises: a linear motor driven by fluid coupled to movement of the rejecting channel, and one valve operated by a solenoid to actuate the linear motor, in accordance to the rejecting sequence which is fed into the information processor.

13. The electronic control system as set forth in claim 6, in which the operation parameters which are fed into the information processor are the time of cutting of the glass gob, the operation sequence of the forming stations of the machine, the angular correction of the initial position of the channels, the equation to calculate the forming cycle time from the period between two consecutive cuttings of the gobs fed by a gob cut sensor, and the gob rejection sequence.

14. The electronic control system as set forth in claim 6, including at least one position sensor coupled to the step motor in order to send a re-freed signal to the information processor, to make the necessary corrections in the number of pulses fed to the step motor, and to indicate the initial position of the channels.

15. The electronic control system as set forth in claim 6, in which the operator's control panel comprises a plurality of digital switches to provide digital information on the adequate operation parameters such as the time of cutting of gobs, and including, a plurality of cut switches which comprises a resetting switch, a start switch, and emergency stop switch, and an intake switch for the gob rejection system, and a plurality of common switches including a switch to read the information, a switch to check the position of the gob in the rejection system, one starting switch, and a plurality of displays.

16. The electronic control system as set forth in claim 6, in which the information processor comprises a computor and a signal conditioner circuit in the form of an interface card that communicates with the circuits on the operator's control panel, the interface card comprising command decodifying circuits to control the step motor, handling circuits with visible digital dials to display and handle the digital information displayed on the operator's panel, resilience eliminating circuits for the operation of the operator's control panel switches, and resistor cutoff circuits for the operation of the cutoff switches of the operator's control panel.

17. The electronic control system as set forth in claim 16, in which the computor includes a non-volatile memory containing the cycle equation and a volatile memory interconnected with the non-volatile memory and which is capable to receive the respective operation parameters fed by the operator's control panel and by the sensor in order to determine the enduring times and sequence contained in the non-volatile memory.

18. The electronic control system as set forth in claim 6, in which the electronic control system is associated with a glass gob electronic distributor comprising a plurality of distributing channels, each one of the distributing channel shafts being independently coupled with a step motor driven from the information processor, whereby said distributing channels can be handled independently from the operator's control panel.

19. The electronic glass gob distributor as set forth in claim 1, wherein such channels are provided with a funnel on the upper end of each channel.

* * * * *

FIG. 1.

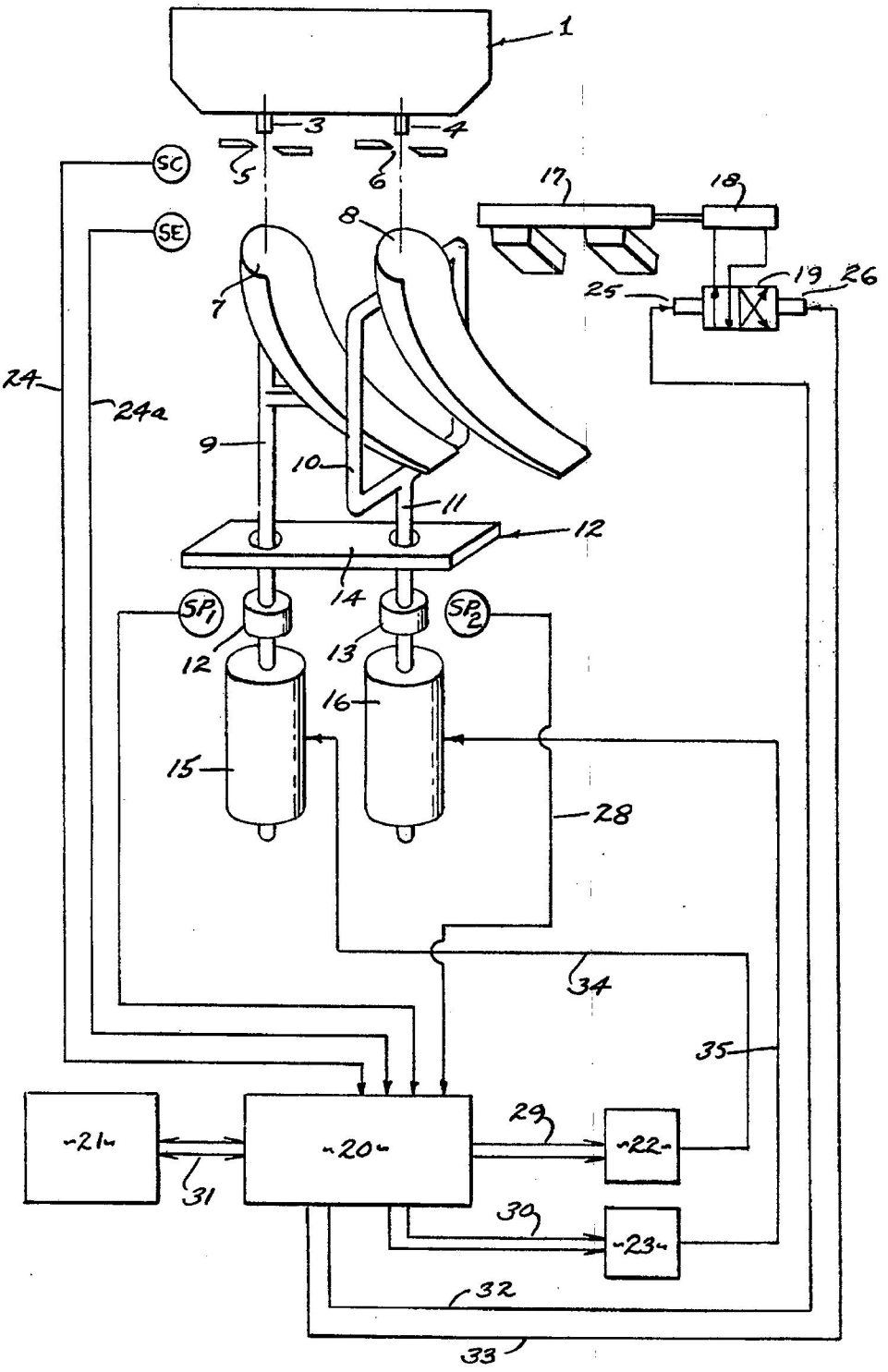

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SC
SE
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24
24a
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10
11
12
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SP1
SP2
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FIG. 2.

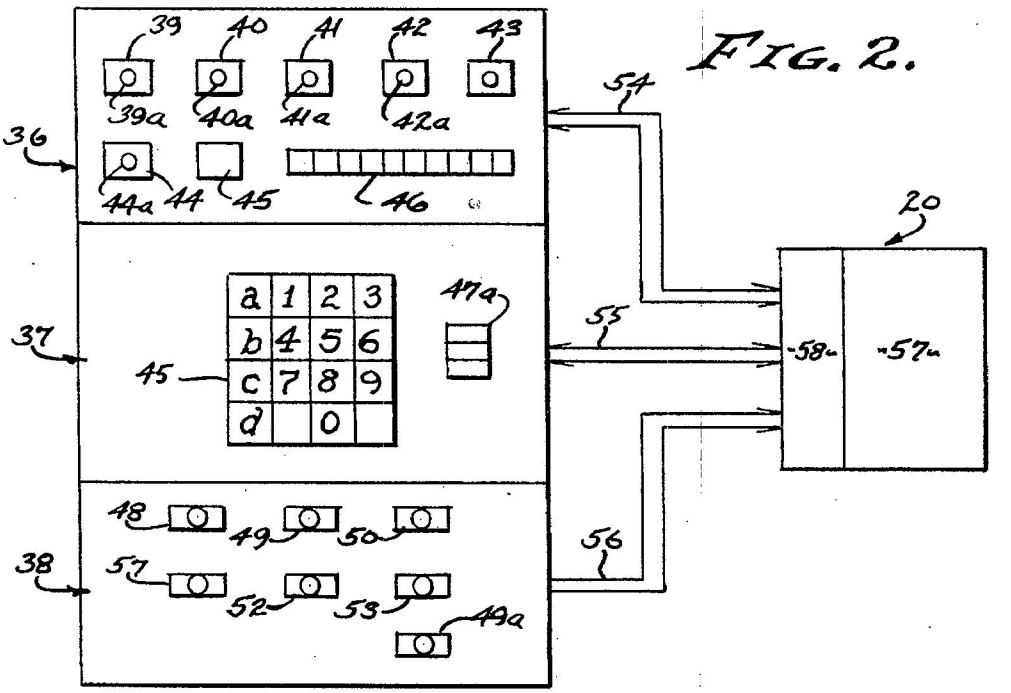
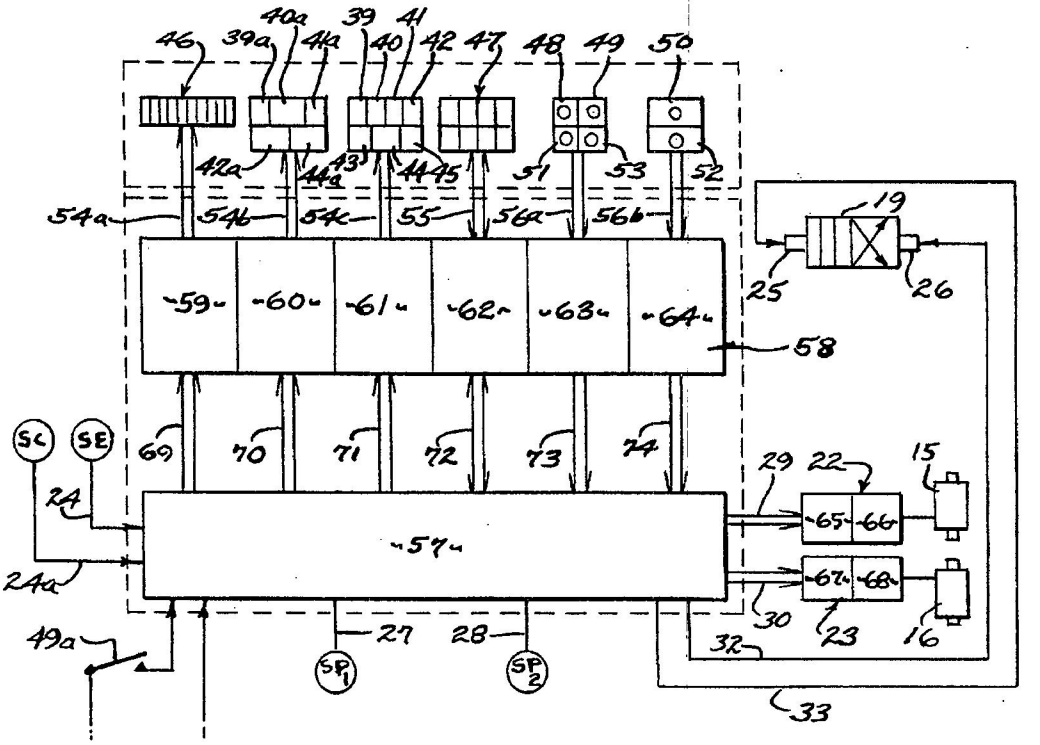

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41a
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a 1 2 3
b 4 5 6
c 7 8 9
d 0
47a
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58
57
48
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56
38
57
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53
49a

FIG. 3.


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39a
40a
44a
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42a
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54a
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54c
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24a
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49a
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SP1
SP2
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Owens-Illinois Inc (USA–Ohio)
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(54) **Indicating the relative degree positioning between and/or the frequency of mechanisms in a glassware forming machine**

(57) Pulse generators are connected to those forming mechanisms to be monitored. A clock pulse source generates three hundred and sixty clock pulses for each machine cycle and the pulse generators generate one reset pulse for every 360° of monitored forming means cycle. A switch means is provided for selecting the outputs of two of the pulse generators to be compared. The pulses generated by these selected generators are fed to a counter/display circuit having three inputs. A clock input receives the clock pulses generated by the clock pulse source. A clear input receives the reset pulse from the first selected generator. An enable input receives the reset pulse from the second selected generator. The counter/-display circuit counts the number of clock pulses received between the clear and enable pulses. The number of counted clock pulses represents the relative degree positioning between the selected forming mechanisms and can be displayed on a digital visual display. Alternatively, the counter/display circuit can receive pulses from a real time clock circuit and a selected forming operation generator to generate a display of operation per unit time, such as bottles per minute.

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SPECIFICATION

Improvements in or relating to apparatus for indicating the relative degree positioning between and/or the frequency of mechanisms in a machine such as a glassware forming machine

The present invention relates in general to machine timing indicating mechanisms and in particular to apparatus for indicating the relative degree positioning between mechanisms of a glassware forming machine.

The individual section (IS) glassware forming machine is well known and includes a plurality of sections, each having means for forming glassware articles in a timed predetermined sequence of steps. Typically, the sections are fed from a single source of molten glass. The source forms gobs of molten glass which are distributed to the individual sections. The sections are operated in synchronism at a relative phase difference such that the section is receiving a gob while another section is delivering a finished glassware article to a conveyor and one or more other sections are performing various ones of the intermediate forming steps.

Typically, machine timing is expressed in degrees and a machine cycle is 360° in length. The cycle for each individual section is also 360°, but the cycles for each of the sections will be offset from the start of the machine cycle by different numbers of degrees to compensate for the difference in gob delivery time to each section. The beginning and ending of the various forming operations in each section can thus be expressed in terms of degrees of section cycle. Once determined, the relative degree positioning between the beginnings of any two particular forming operations should remain generally constant throughout the operation of the machine.

The forming means in each individual section are typically operated by pneumatic motors or actuators. In early prior art machines, these pneumatic motors are controlled by a valve block which, in turn, is controlled by a timing drum. The timing drum for each section is driven from a line shaft which synchronizes all parts of the machine. Manually adjustable cams are positioned on the timing drum for actuating the valves in the valve block. Relative timing between the various forming means in each section can be adjusted by loosening, moving, and tightening the cams as the drum rotates.

Later prior art machines utilize an electronic control means to synchronize the operation of the individual sections. The electronic control means includes a master unit which is reponsive to a clock pulse generator and to a reset pulse generator, both of which are driven by a line shaft. The master unit generates reset signals to a separate control circuit for each of the individual sections. Each control circuit includes a pulse counter responsive to the clock pulses and the reset pulses for counting the degrees of the section cycle. Each individual circuit includes forty-eight three-decade thumbwheel switches for setting the degree of rotation of the machine thereon at which associated control signals are generated. Thus, each particular function of the glassware forming cycle is controlled by one of the thumbwheel switches. Such a control system is disclosed in U.S. Patent Specification No. 3,762,907.

One prior art attempt to improve the operation of the IS glassware forming machine involves the use of position, temperature, and pressure sensors. There is disclosed in U.S. Patent Specification No. 4,108,623 an electronic control system in which the initiation of each forming cycle is determined by a shear cut sensor. A temperature sensor senses the passage of a gob into a blank mold to trigger the actuation of the parison forming mechanisms. A pressure sensor senses the commencement of the parison forming operation within the blank mold to trigger the remaining program of the forming cycle. A real time clock generates a time base and the controller compares the actual forming times as indicated by the sensor signals with stored information to check the operation of the machine.

It has been found desirable to monitor the relative degree positioning of various forming mechanisms within an individual section of a glassware forming machine to aid the operator in aligning the mechanisms. There are presently two systems known in the art for accomplishing this. One system is a synchro system which utilizes a plurality of synchros. A synchro is a small motor-like device containing a stator and a rotor which is capable of transforming an angular-position input into an electrical output. Each synchro is mounted on a particular forming mechanism to be monitored. The electrical output of the synchros can be compared to determine the relative degree positioning between the monitored forming mechanisms. A synchro monitoring system is simple and easy to install and maintain. However, the synchro system does not operate accurately when the glassware forming machine is operated at high speeds.

The other monitoring system known in the art is an induction resolver system, wherein an induction resolver is mounted on each of the glassware forming mechanisms to be monitored. A resolver is an electro-mechanical transducing device which develops an output voltage proportional to the product of an input voltage and the sine of the shaft angle. Although the induction resolver system is very accurate even when the glassware forming machine is operated at high speeds, such a system is very complex and, hence, is difficult

and expensive to repair.

According to one feature of the present invention an apparatus for indicating the relative positioning between the beginnings of cycles of forming means in a glassware forming machine including at least two forming means for forming glassware in a timed predetermined cycle of forming operations, each forming means having a cycle beginning at a predetermined position in the machine cycle, comprises a source of clock pulses at a frequency proportional to the cycle speed of the machine, first pulse generator means responsive to one of the forming means for generating reset pulses representing the cycle position of said one forming means, second pulse generating means responsive to another of the forming means for generating reset pulses representing the cycle position of said another forming means, means responsive to said clock and reset pulses for determining the number of said clock pulses received between the receipt of one of said reset pulses from said first pulse generator and the receipt of one of said reset pulses from said second pulse generator, and means responsive to said determining means for displaying an indication of the relative positioning between the beginnings of the two forming means cycles.

According to another feature of the present invention an apparatus for indicating the relative positioning between cycles of two forming means in a glassware forming machine including a plurality of forming means for forming glassware in a timed predetermined cycle of forming operations, each forming means having a cycle beginning at a predetermined position in the machine cycle, comprises a source of clock pulses at a predetermined frequency, pulse generating means responsive to each of the forming means for generating timing pulses representing the cycle position of the associated one of the forming means, switch means for detecting a first and a second of said pulse generating means, means responsive to said selected pulse generating means for determining the number of clock pulses received from said source of clock pulses between the receipt of a timing pulse generated by said first pulse generating means and the receipt of a timing pulse generated by said second pulse generating means, and means responsive to said determining means for displaying said determined number of clock pulses as an indication of the relative positioning between the two selected forming means.

The present invention provides a simple and accurate apparatus for monitoring the relative degree positioning between the various mechanisms of an individual section glassware forming machine. Pulse generators such as proximity switches, pulse encoders, or similar timing interfaces are connected to those forming mechanisms which are desired to be monitored. For example, such generators can be connected to the feeder, scoop, and sweepout forming mechanisms as well as to the machine for monitoring the overall machine forming cycle. The pulse encoders generate three hundred and sixty clock pulses and one reset pulse for every 360°of monitored operation cycle whereas the proximity switches only generate the reset pulses. A switch means is provided for selecting two of the generators to determine the relative degree positioning between the associated selected forming mechanisms.

The pulses generated by the selected encoders are fed to a counter/display circuit. The counter/display circuit has three inputs. The clock input receives clock pulses generated by the machine cycle encoder or a clock source representing the machine forming cycle. The start input receives the rest pulse from the first selected machine operation pulse generator while the stop input receives the reset pulse from the second selected machine operation pulse generator. The counter/display circuit counts the number of clock pulses between the receipt of the start and stop input pulses. The number of counted clock pulses represents the relative degree positioning between the selected forming mechanism and can be displayed on a digital visual display.

If the relative degree positioning between monitored forming operations has changed from a predetermined value, an operator can either advance or retard one or more of the operations to obtain a desired relative positioning.

Alternatively, the counter/display circuit can receive pulses from a real time clock circuit and a selected operation pulse generator to generate a display of operations per unit time, such as bottles per minute.

Thus, according to a further feature of the present invention, an apparatus for indicating the frequency of at least one of the machine cycles and the forming means cycles in a glassware forming machine, including a plurality of forming means for forming a glassware in a timed predetermined cycle of forming operations, each forming means having a cycle beginning at a predetermined position in the machine cycle, comprises a source of clock pulses at a frequency proportional to one of the machine cycle and the forming means cycles, timing circuit means for generating first and second pulses at predetermined time intervals, means responsive to said clock and reset pulses for determining the number of said clock pulses received between the receipt of one of said first reset pulses and the receipt of one of said second reset pulses, and means responsive to said determining means for displaying an indication of the frequency of said one of the machine cycle and the forming means cycles.

The present invention will be further de-

scribed by way of example with reference to the accompanying drawings, in which:

Figure 1 is a block diagram of one type of glassware forming machine incorporating the present invention;

Figure 2 is a block diagram of another type of glassware forming machine incorporating the present invention; and

Figure 3 is a schematic block diagram of a relative degree position indicator in accordance with the present invention.

Referring now to the drawings, there is shown in Fig. 1 a block diagram of a glassware forming machine which is more fully described in U.S. Patent Specification Nos. 4,145,204 and 4,145,205. An individual section (IS) glassware forming machine 10 has a plurality of individual sections (not shown) which receive gobs of molten glass from a gob distributor 12 which, in turn, receives the gobs from a gob feeder 14. The gob distributor 12 and the gob feeder 14 are mechanically driven by a pair of drive motors 16 and 18, respectively, both of which are connected to a supply of variable frequency power such as generated by an inverter drive 20.

Each individual section is associated with a valve block, which valve blocks are designed with the reference numeral 22. Each valve block is connected to a plurality of glassware forming means in the individual section for actuating the forming means in a timed predetermined sequence of steps to form glassware articles from the gobs supplied by the gob distributor 12. The valves in the valve blocks are actuated by solenoids (not shown) which are controlled by a machine control circuit 24. The machine control circuit 24 determines the timed sequence of forming steps in accordance with a stored predetermined sequence of steps and timing clock signals generated by a timing circuit 26.

The machine control circuit 24 receives information as to the sequence of the steps and the times between the steps from a source (not shown) of such information. The timing circuit 26 is responsive to the frequency of the output power generated by the variable frequency power supply 20 to generate the clock signals. Since the speeds of the motors 16 and 18 are proportional to the frequency of the power generated by the variable frequency power supply 20, the timing of the forming of the gob by the gob feeder 14 and the timing of the distribution of the gob by the gob distributor 12 are synchronized with the clock signals generated by the timing circuit 26.

A gob sensor 28 generates a signal upon the detection of a gob at the mold in an individual section. A gob detector circuit 30 responds to the signal from the gob sensor 28 to generate a signal to the machine control circuit 24, which signal is utilized to adjust the timing of that individual section to the actual presence of the gob, rather than to a position related distribution time as was done in the prior art. The gob sensor and gob detector circuit are disclosed in more detail in U.S. Patent Specification No. 4,162,909.

A feeder shaft encoder 32 is connected to the gob feeder 14 for generating electrical timing signals in response to the mechanical movement thereof. The feeder shaft encoder 32 is conventional in the art and generates a plurality of electrical pulses, the number of such pulses being proportional to the amount of rotation of a shaft. The feeder shaft encoder 32 generates one rest pulse over a FEEDER INDEX line for every 360° of feeder cycle.

A scoop shaft encoder 34 and a sweepout shaft encoder 36 are each responsive to the mechanical movement of the respective glassware forming mechanisms in an individual section of the machine 10. The scoop shaft encoder 34 generates three hundred and sixty clock pulses over a SCOOP CLOCK line and one reset pulse over a SCOOP RESET line for every 360° of scoop cycle. Similarly, the sweepout shaft encoder 36 generates three hundred and sixty clock pulses over a SWEEPOUT CLOCK line and one reset pulse over a SWEEPOUT RESET line for every 360° of sweepout cycle.

Finally, a machine timing interface 38 is responsive to the signals generated by the machine control circuit 24 for generating electrical pulses similar to those generated by the above-described encoders. The machine timing interface 38 is conventional in the art and generates three hundred and sixty clock pulses over a MACHINE CLOCK line and one reset pulse over a MACHINE RESET line for every 360° of machine cycle.

It will be appreciated that the present invention can be adapted for use on early prior art machines in which a mechanical timing drum is utilized to synchronize the parts of the glassware forming machine. A machine shaft encoder (not shown) can be substituted for the machine timing interface 38 to generate the clock and reset pulses. As will be described in detail below, the signals generated by the encoders 32, 34, and 36 and the interface 38 are fed to a relative position indicator for comparison. Also, it will be appreciated that the above-described pulses can be generated at other frequencies to provide a different output scale for the cycle rates of the forming operations.

Fig. 2 is a block diamgram of an individual section glassware forming machine and associated electronic control system which is more fully described in U.S. Patent Specification No. 4,152,134. A machine supervisory computer (MSC) 40 and a plurality of individual section computers (ISC) 42 (only one is illustrated) receive a train of timing pulses from a

timing pulse generator 44. The MSC 40 is connected to each ISC 42 and each ISC 42 is connected to an associated individual section 46 of the glassware forming machine.

The timing pulse generator 44 generates clock signals to the MSC 40 and the ISC 42, thus providing a reference for timing the machine cycle and the sequence of steps to be performed by the ISC 42. An input/output device 48 and a data storage device 50 are both connected to the MSC 40 by a pair of bi-directional lines. The MSC 40 is also connected over a bi-directional line to a bottle reject control panel 52. The panel 52 includes a plurality of switches (not shown), each of which corresponds to a particular cavity of the mold in each individual section 46. If the operator desires to reject a particular article of glassware, he actuates the appropriate switch in the panel 52. The MSC 40 periodically scans the panel 52 to see if any switches have been actuated. When the MSC 40 senses an actuated switch, it will compare the reject synchronization value corresponding to the section of the rejected glassware with the current postion. If these two values are equal, a reject signal will be supplied to a bottle reject station 54 such that the appropriate bottle will be rejected.

The ISC 42 generates control signals to a valve block 56 through a section operator console (SC) 58. The valve block 56 is connected to a plurality of glassware forming mechanisms 60 for actuating the forming mechanisms in a predetermined timed sequence of steps to form the articles of glassware. The valves in the valve block 56 are actuated by solenoids (not shown) which are controlled by signals generated in accordance with the control program and the timing data currently stored in the ISC 42. The valve block 56 and the glassware forming mechanisms 60 together comprise the individual section 46.

There is also shown in Fig. 2, a gob sensor 62 which is similar to the gob sensor 28 of the prior art glassware forming machine illustrated in Fig. 1. The gob sensor 62 includes a gob detector circuit (not shown) for generating a signal to the ISC 42, which signal is utilized to adjust the timing of that individual section 46 to the presence of the gob rather than to a position related distribution time. The SOC 58 is connected to the ISC 42 and the valve block 56 and is used by the operator to make adjustments to the mechanism timing. The actuation of a particular valve may either be advanced or retarded by the operator with use of the SOC 58.

The scoop shaft encoder 34 and the sweepout shaft encoder 36 described above can be connected to the appropriate glassware forming mechanisms 60 to provide the clock and reset pulses over the respective lines. Similarly, the machine timing interface 38 can be connected to the SOC 58 to generate the above-described machine clock and reset pulses. Since the SOC 58 generates timing pulses directly to the feeder (not shown), a feeder timing interface 64 can be connected to the SOC 58 to generate one reset pulse over a FEEDER INDEX line for every 360° of feeder cycle. It will be appreciated that any means for generating the clock and reset pulses can be utilized such that the present invention can be adapted for use on any type of glassware forming machine.

Referring now to Fig. 3, there is illustrated a schematic block diagram of a relative degree position indicator in accordance with the present invention. The signals from the various encoders and interfaces described above are fed to a five-pole, four-position switch means, indicated generally at 66. Additionally, a real time clock circuit 68 is provided to generate reference signals according to a real time base. These signals are generated over a REFERENCE INDEX line and a REFERENCE RESET line to the switch 66. The signal generated over the REFERENCE INDEX line is followed, after a predetermined length of time, by the signal generated over the REFERENCE RESET line. The utility of the real time clock signals will be explained in greater detail below.

The switch 66 has a first pole 70 which is connected to an ENABLE LATCH line. A first contact 70–1 of the pole 70 is connected to the MACHINE RESET (MR) line. A second contact 70–2 is connected to the SCOOP RESET (SCR) line. A third contact 70–3 is connected to the SWEEPOUT RESET (SWR) line. A fourth contact 70–4 is connected to the REFERENCE RESET (RR) line.

The switch 66 has a second pole 72 which is connected to CLOCK line. A first contact 72–1 of the pole 72 is connected to the MACHINE CLOCK (MC) line. A second contact 72–2 is connected to the SCOOP CLOCK (SCC) line. A third contact 72–3 is connected to the SWEEPOUT CLOCK (SWC) line. A fourth contact 72–4 is connected to the MACHINE CLOCK (MC) line.

The switch 66 has a third pole 74 which is connected to a CLEAR COUNTER line. A first contact 74–1 of the pole 74 is connected to the FEEDER INDEX (FI) line. A second pole 74–2 is also connected to the FEEDER INDEX (FI) line. A third contact 74–3 is connected to the MACHINE RESET (MR) line. A fourth contact 74–4 is connected to the REFERENCE INDEX (RI) line.

The switch 66 has a fourth pole 76 which is connected to an ADVANCE line. A first contact 76–1 of the foruth pole 76 is connected to a MACHINE ADVANCE line. A second contact 76–2 is connected to a SCOOP ADVANCE line. A third contact 76–3 is connected to a SWEEPOUT ADVANCE line. A fourth contact 76–4 is an open connection.

The MACHINE ADVANCE line, the SCOOP ADVANCE line, and the SWEEPOUT ADVANCE line are each connected to their respective advance control unit (not shown) to enable an operator to change the relative timing of the forming operations such that a selected operation occurs earlier in the three hundred and sixty degree cycle.

The switch 66 has a fifth pole 78 which is connected to a RETARD line. A first contact 78–1 of the pole 78 is connected to a MACHINE RETARD line. A second contact 78–2 is connected to a SCOOP RETARD line. A third contact 78–3 is connected to a SWEEPOUT RETARD line. A fourth contact 78–4 is an open connection. The MACHINE RETARD line, the SCOOP RETARD line, and the SWEEPOUT RETARD line are each connected to their respective retard control units (not shown) to enable an operator to change the relative timing of the forming operations such that the selected function occurs later in the three hundred sixty degree cycle.

A single-pole, double-throw switch 80 is utilized to selectively advance or retard a selected control unit. The ADVANCE line is connected to a first contact 80–1 of the switch 80. The RETARD line is connected to a second contact 80–2 of the switch 80. The switch 80 is manually operable into contact with either the first contact 80–1 or the second contact 80–2. The pole of the switch 80 is connected to ground potential, thereby completing an electrical circuit with the selected advance or retard control unit. An operator can thereby select advance or retard and adjust the relative degree positioning between the monitored forming operations.

A counter/display means 81 is provided for displaying the relative positioning between the monitored forming operations. The couner/-display unit 81 includes a binary coded decimal (BCD) counter 82, a latch 84, and a digital display 86. The second pole 72 of the switch 66 is connected over the CLOCK line to a clock input of the BCD counter 82. The signals carried over the CLOCK line represent the clock pulses generated by the selected one of the above-described encoder or timing interface units. Since all of the units generate three hundred and sixty clock pulses for every 360° of forming operation cycle, the output of the BCD counter 82 will be a count total signal similarly incremented three hundred and sixty times for each such cycle.

The third pole 74 of the swich 66 is connected over the CLEAR COUNTER line to a clear or zeroing input of the BCD counter 82. The clear signals carried over the CLEAR COUNTER line are the pulses carried over the FEEDER INDEX line, the MACHINE RESET line, or the REFERENCE INDEX line. Thus, the output signal of the BCD counter 82 will be cleared to zero whenever a feeder index, reference index, or machine reset pulse is received. The receipt of such a pulse indicates that the first selected operation to be monitored is beginning a new cycle. When the BCD counter 82 is cleared to zero, it will begin to count upwardly therefrom in response to the signals received at the clock input.

The first pole 70 of the switch 66 is connected over the ENABLE LATCH line to an enabling input of the latch 84. The latch 84 receives the binary coded decimal output of the BCD counter 82 in parallel fashion. The enable signals carried over the ENABLE COUNTER line are the reset pulses carried over the MACHINE RESET line, the SCOOP RESET line, the SWEEPOUT RESET line, or the REFERENCE RESET line. Thus, the output of the BCD counter 82 will be stored in the latch 84 whenever a reset pulse is received. The receipt of a reset pulse indicates that the second selected operation to be monitored is beginning a new cycle. When the enable signal is recieved, the output of the BCD counter 82, which has been increasing from zero since the clear signal was received by the counter 82, is stored in the latch 84.

Since the clock pulses which have been utilized to increment the BCD counter 82 represent the actual degree position of the selected forming operation in its cycle, the number stored in the latch 84 is equal to the relative degree positioning between the beginnings of the two selected forming operation cycles. The binary coded decimal output of the latch 84 is utilized to drive the digital display 86, which can be a conventional three digit light emitting diode array. Thus, a visual representation of the relative degree positioning between the beginnings of the two selected forming operation cycles is provided.

From the above-described circuit construction, it will be appreciated that the digital display 86 will display the relative degree positioning between the machine cycle and the feeder cycle when the poles of the switch 66 are connected to their respective first contacts. Similarly, the relative degree positioning between the scoop and feeder cycles will be displayed when the poles of the switch 66 are connected to their respective second contacts. The relative degree positioning between the sweepout and machine cycles will be displayed when the poles of the switch 66 are connected to their respective third contacts. Finally, the number of machine cycles per unit time will be displayed when the poles of the switch 66 are connected to their respective fourth contacts.

In operation, the synchronization of the machine is initially accomplished by experienced forming personnel. As each operation is brought into the desired degree position, a number value will be displayed on the digital display 86 which can be recorded for later use. In the event of a machine shutdown, resyn-

chronization can be readily achieved by using the advance or retard switch 80. The switch 80 can be located on the counter/display unit 81 for convenience. The operator can utilize the switch 80 to either advance or retard the relative degree positioning of the selected forming operation to re-attain the previous synchronized number value on the digital display 86.

Alternatively, the relative degree position indicator can be utilized to display the number of selected forming operation cycles per unit time. In the illustrated embodiment, the digital display 86 can be utilized to display the number of shear cuts per minute when the switch 66 is operated to connect each of the poles to their respective fourth contact. In this position, it will be appreciated that the advance or retard switch 80 is inoperable since both the ADVANCE and RETARD lines are connected to open circuits.

Although the present invention has been illustrated in Fig. 3 as having three sources of clock pulses, a single source of clock pulses can be utilized. The single source can be the machine timing interface, the feeder, the scoop, the sweepout, or any other source having a frequency proportional to the machine speed. The clock source could be connected to the clock input of the counter 82 and the second pole 72 of the switch 66 could be eliminated. The reset pulses for the forming means could be generated by proximity switches at the rate of one pulse per machine cycle.

CLAIMS

1. An apparatus for indicating the relative positioning between the beginnings of cycles of forming means in a glassware forming machine including at least two forming means for forming glassware in a timed predetermined cycle of forming operations, each forming means having a cycle beginning at a predetermined position in the machine cycle, comprising:

a source of clock pulses at a frequency proportional to the cycle speed of the machine,

first pulse generator means responsive to one of the forming means for generating reset pulses representing the cycle position of said one forming means;

second pulse generator means responsive to an other of the forming means for generating reset pulses representing the cycle position of said another forming means;

means responsive to said clock and reset pulses for determining the number of said clock pulses received between the receipt of one of said reset pulses from said first pulse generator and the receipt of one of said reset pulses from said second pulse generator; and

means responsive to said determining means for displaying an indication of the relative positioning between the beginnings of the two forming means cycles.

2. An apparatus as claimed in claim 1, in which said reset pulses are generated as one pulse per forming means cycle.

3. An apparatus as claimed in claim 1 or 2, in which said clock pulses are generated as three hundred and sixty pulses per forming means cycle.

4. An apparatus as claimed in claim 1, 2 or 3, in which at least one of said first and second pulse generators for generating reset pulses is a shaft encoder connected to an associated one of the forming means.

5. An apparatus as claimed in claim 1, 2, 3 or 4, in which said number of clock pulse determining means includes a binary coded decimal counter having an output and a latch connected to said counter output.

6. An apparatus as claimed in claim 5, in which said counter is responsive to each of said clock pulses for incrementing a count total signal at said counter output and is responsive to each of said reset pulses from said first pulse generator means for clearing said count total signal to zero.

7. An apparatus as claimed in claim 5 or 6, in which said latch is responsive to each of said reset pulses from said second pulse generator means for storing said output signal of said counter.

8. An apparatus as claimed in any of claims 1 to 7, in which said display means is a light emitting diode array.

9. An apparatus as claimed in any of claims 1 to 8, further including means for selectively advancing or retarding the beginning of the cycle of at least one of the forming means.

10. An apparatus for indicating the relative positioning between cycles of two forming means in a glassware forming machine including a plurality of forming means for forming glassware in a timed predetermined cycle of forming operations, each forming means having a cycle beginning at a predetermined position in the machine cycle, comprising:

a source of clock pulses at a predetermined frequency,

pulse generating means responsive to each of the forming means for generating timing pulses representing the cycle position of the associated one of the forming means;

switch means for selecting a first and a second of said pulse generating means;

means responsive to said selected pulse generating means for determining the number of clock pulses received from said source of clock pulses between the receipt of a timing pulse generated by said first pulse generating means and the receipt of a timing pulse generated by said second pulse generating means; and

means responsive to said determining means for displaying said determined number

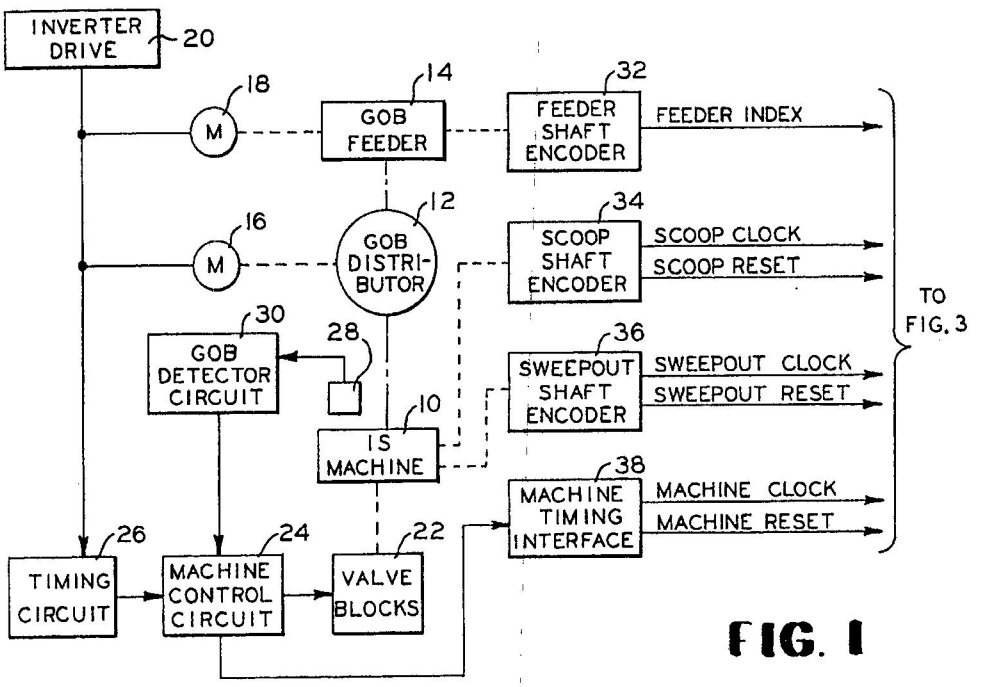

INVERTER DRIVE
20
18
M
14
GOB FEEDER
32
FEEDER SHAFT ENCODER
FEEDER INDEX
16
M
12
GOB DISTRI-BUTOR
34
SCOOP SHAFT ENCODER
SCOOP CLOCK
SCOOP RESET
TO FIG. 3
30
GOB DETECTOR CIRCUIT
28
36
SWEEPOUT SHAFT ENCODER
SWEEPOUT CLOCK
SWEEPOUT RESET
10
IS MACHINE
38
MACHINE TIMING INTERFACE
MACHINE CLOCK
MACHINE RESET
26
TIMING CIRCUIT
24
MACHINE CONTROL CIRCUIT
22
VALVE BLOCKS

FIG. 1

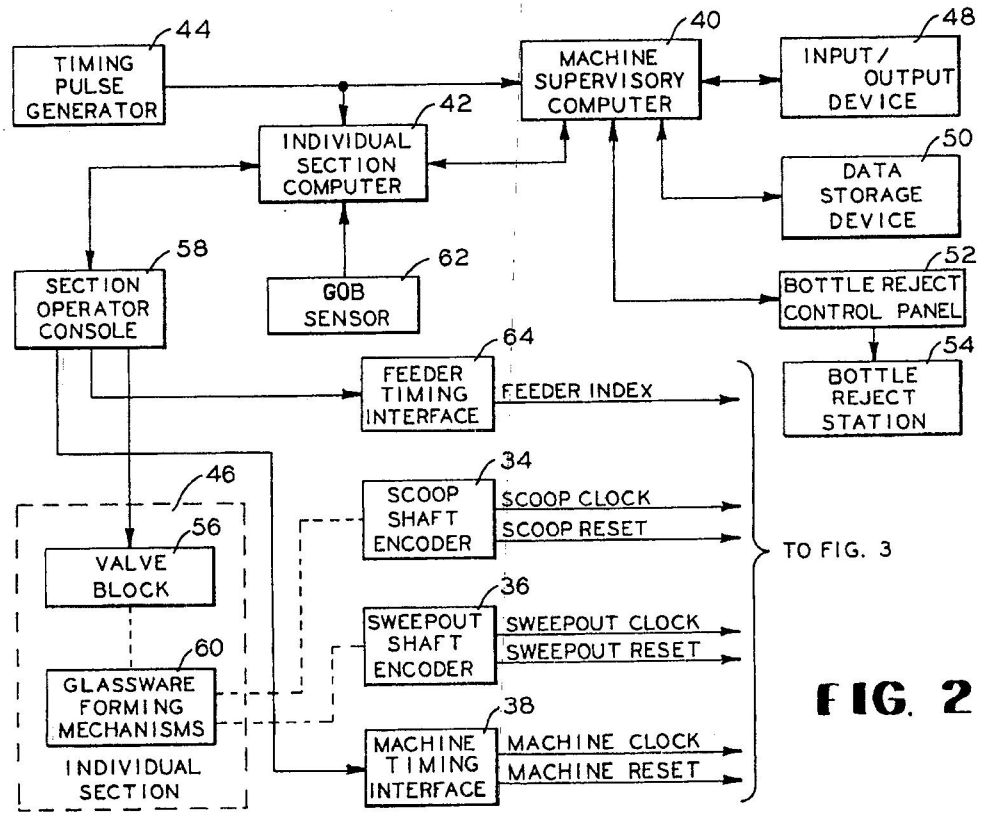
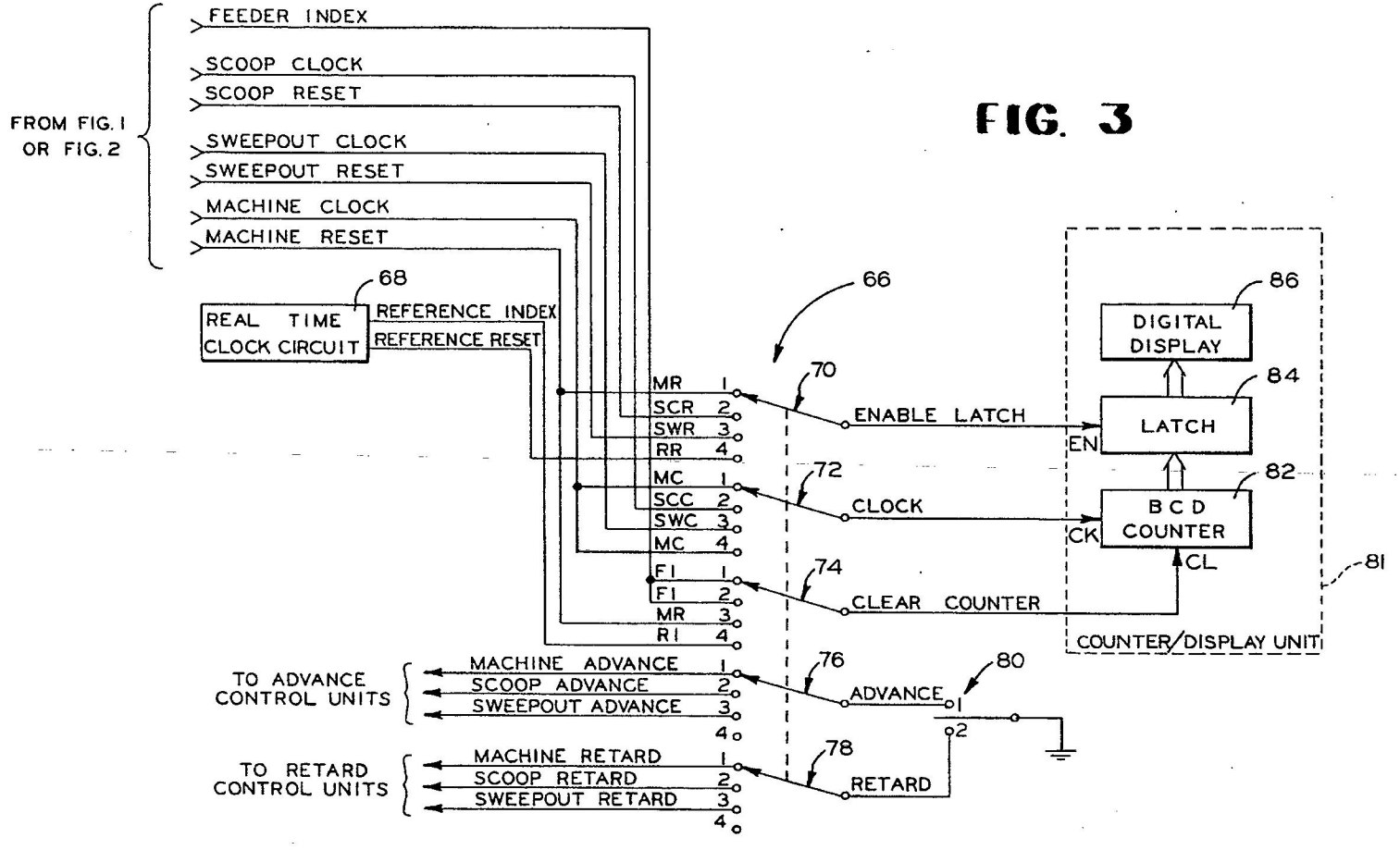

44
TIMING PULSE GENERATOR
40
MACHINE SUPERVISORY COMPUTER
48
INPUT/ OUTPUT DEVICE
42
INDIVIDUAL SECTION COMPUTER
50
DATA STORAGE DEVICE
58
SECTION OPERATOR CONSOLE
62
GOB SENSOR
52
BOTTLE REJECT CONTROL PANEL
64
FEEDER TIMING INTERFACE
FEEDER INDEX
54
BOTTLE REJECT STATION
46
34
SCOOP SHAFT ENCODER
SCOOP CLOCK
SCOOP RESET
TO FIG. 3
56
VALVE BLOCK
36
SWEEPOUT SHAFT ENCODER
SWEEPOUT CLOCK
SWEEPOUT RESET
60
GLASSWARE FORMING MECHANISMS
38
MACHINE TIMING INTERFACE
MACHINE CLOCK
MACHINE RESET
INDIVIDUAL SECTION

FIG. 2

FIG. 3



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