INSTITUT NATIONAL
DE LA PROPRIÉTÉ INDUSTRIELLE

DIRECTION DES BREVETS

V/Réf :
N/Réf : 1102600, L059

MR LERUSTE REGIS
1 IMPASSE DU LANGUERNAIS
44350 ST MOLF
FR

PARIS, le 06 Juillet 2012

OBJET : demande de Brevet, n° 1102600, déposée le 25 Août 2011
Rapport de recherche préliminaire sans obligation de réponse

Madame, Monsieur,

J'ai l'honneur de vous adresser en annexe **le rapport de recherche préliminaire** pour la demande de brevet citée en référence. Ce rapport cite les documents qui peuvent être pris en considération pour apprécier la nouveauté et l'activité inventive de l'invention, objet de votre demande de brevet. Il est accompagné, le cas échéant, d'une opinion écrite.

Conformément aux dispositions des articles R. 612-57 à R. 612-60 du code de la propriété intellectuelle, vous disposez d'un délai de **3 mois** à compter de la date de réception de ce rapport de recherche préliminaire pour formuler une réponse par écrit. Ce délai peut être **renouvelé une fois** sur simple requête de votre part, avant son expiration.

Votre réponse peut consister :

- **en des observations** à l'appui des revendications maintenues, aux fins de discuter de l'opposabilité des documents cités ;
- **en une nouvelle rédaction des revendications**, éventuellement accompagnée d'observations. En cas de dépôt de nouvelles revendications, les changements apportés aux revendications doivent être signalés.

Veuillez agréer, Madame, Monsieur, l'expression de ma considération distinguée.

Pour le Directeur Général de l'Institut
National de la Propriété Industrielle

Le Directeur des Brevets

Philippe CADRE

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RÉPUBLIQUE FRANÇAISE

INSTITUT NATIONAL DE LA PROPRIÉTÉ INDUSTRIELLE

RAPPORT DE RECHERCHE PRÉLIMINAIRE

établi sur la base des dernières revendications déposées avant le commencement de la recherche

N° d'enregistrement national

FA 761812
FR 1102600

DOCUMENTS CONSIDÉRÉS COMME PERTINENTS		Revendication(s) concernée(s)	Classement attribué à l'invention par l'INPI
Catégorie	Citation du document avec indication, en cas de besoin, des parties pertinentes		
A	US 4 503 502 A (CHAPIN ROGER A [US]) 5 mars 1985 (1985-03-05) * colonne 5, ligne 45 - colonne 6, ligne 6 * * colonne 6, ligne 22 - colonne 8, ligne 2 * * figures 1,5 *	1-5	G05D23/30 A47J37/00
A	US 2009/168835 A1 (HEINKE THOMAS [US] ET AL) 2 juillet 2009 (2009-07-02) * alinéas [0001], [0002]; figure 5 *	1-5	
A	EP 1 231 681 A1 (PHILIPS CORP INTELLECTUAL PTY [DE]; KONINKL PHILIPS ELECTRONICS NV [NL]) 14 août 2002 (2002-08-14) * revendications 1,2; figure 2 *	1-5	

DOMAINES TECHNIQUES RECHERCHÉS (IPC)

A47J
G05D
H05B

Date d'achèvement de la recherche	Examinateur
4 juillet 2012	Messelken, M

CATÉGORIE DES DOCUMENTS CITÉS

X : particulièrement pertinent à lui seul
Y : particulièrement pertinent en combinaison avec un autre document de la même catégorie
A : arrière-plan technologique
O : divulgation non-écrite
P : document intercalaire

T : théorie ou principe à la base de l'invention
E : document de brevet bénéficiant d'une date antérieure à la date de dépôt et qui n'a été publié qu'à cette date de dépôt ou qu'à une date postérieure.
D : cité dans la demande
L : cité pour d'autres raisons

& : membre de la même famille, document correspondant

EPO FORM 1503 12.99 (P04C14)

ANNEXE AU RAPPORT DE RECHERCHE PRÉLIMINAIRE RELATIF A LA DEMANDE DE BREVET FRANÇAIS NO. FR 1102600 FA 761812

La présente annexe indique les membres de la famille de brevets relatifs aux documents brevets cités dans le rapport de recherche préliminaire visé ci-dessus.
Les dits membres sont contenus au fichier informatique de l'Office européen des brevets à la date du 04-07-2012
Les renseignements fournis sont donnés à titre indicatif et n'engagent pas la responsabilité de l'Office européen des brevets, ni de l'Administration française

Document brevet cité au rapport de recherche	Date de publication	Membre(s) de la famille de brevet(s)	Date de publication
US 4503502 A	05-03-1985	AUCUN	
US 2009168835 A1	02-07-2009	AUCUN	
EP 1231681 A1	14-08-2002	CN 1372180 A	02-10-2002
		DE 10106025 A1	14-08-2002
		EP 1231681 A1	14-08-2002
		JP 2002304238 A	18-10-2002
		KR 20020066380 A	16-08-2002
		US 2002111076 A1	15-08-2002

EPO FORM P0465

RÉPUBLIQUE FRANÇAISE

INSTITUT NATIONAL DE LA PROPRIÉTÉ INDUSTRIELLE

OPINION ÉCRITE SUR LA BREVETABILITÉ DE L'INVENTION

FA761812	Date de dépôt *(jour/mois/année)* 25.08.2011	Date de priorité *(jour/mois/année)*	N° d'enregistrement national FR1102600
Classification internationale des brevets (CIB) G05D23/30 A47J37/00			
Déposant LERUSTE, REGIS			

La présente opinion contient des indications et les pages correspondantes relatives aux points suivants :

☒	Point I	Base de l'opinion
☐	Point II	Priorité
☐	Point III	Absence de formulation d'opinion quant à la nouveauté, l'activité inventive et la possibilité d'application industrielle
☐	Point IV	Absence d'unité de l'invention (Article L. 612-4 du Code de la Propriété Intellectuelle)
☒	Point V	Opinion motivée (Article R. 612-57 du Code de la Propriété Intellectuelle) quant à la nouveauté, l'activité inventive et la possibilité d'application industrielle; citations et explications à l'appui de cette déclaration
☐	Point VI	Certains documents cités
☒	Point VII	Irrégularités dans la demande
☒	Point VIII	Observations relatives à la demande

	Examinateur Messelken, M

OPINION ÉCRITE

N° d'enregistrement national
FR1102600

Point I Base de l'opinion

Cette opinion a été établie sur la base des dernières revendications déposées avant le commencement de la recherche.

Point V Opinion motivée quant à la nouveauté, l'activité inventive et la possibilité d'application industrielle; citations et explications à l'appui de cette déclaration

1. Déclaration

Nouveauté	Oui :	Revendications	1-5
	Non :	Revendications	
Activité inventive	Oui :	Revendications	1-5
	Non :	Revendications	
Possibilité d'application industrielle	Oui :	Revendications	1-5
	Non :	Revendications	

2. Citations et explications

voir feuille séparée

Point VII Irrégularités dans la demande

voir feuille séparée

Point VIII Observations relatives à la demande

voir feuille séparée

Ad point V

Déclaration motivée quant à la nouveauté, l'activité inventive et la possibilité d'application industrielle ; citations et explications à l'appui de cette déclaration

1 Il est fait référence au document suivant:

D1: US 4,503,502

2 La présente invention concerne un système pour automatiser la surveillance active de la température d'une enceinte de cuisson.

3 L'état de la technique le plus proche est connu du document D1 qui montre un tel système comprenant aussi une application logicielle installée sur le mémoire d'un ordinateur, une sonde dédie à la mesure de température et un terminal d'acquisition de cette température.

4 Le problème associé à cet état de la technique est qu'il ne fonctionne pas avec une table de cuisson électrique. Par ailleurs la connexion entre la sonde dédiée à la mesure de la température et l'ordinateur n'est pas standardisée.

5 L'invention résout ces problèmes par un terminal de puissance qui applique ou interrompt le secteur monophasé 220 Volts de la table de cuisson. De plus, il est prévu un bus USB 2.0 sur lequel le terminal d'acquisition de la température et le terminal de puissance sont connectés.

Ad point VII

Certaines irrégularités relevées dans la demande

6 La description ne mentionne pas l'état de la technique pertinent qui est divulgué dans D1 et ne cite pas ce document.

7 La revendication 1 n'est pas présentée en deux parties, alors qu'une telle présentation serait appropriée en l'espèce. Il conviendrait ainsi d'inclure dans le préambule les caractéristiques qui, combinées entre elles, font partie de l'état de la technique, et d'introduire dans la partie caractérisante les caractéristiques restantes.

Ad point VIII

Certaines observations relatives à la demande

8 L'objet des revendications 1, 2, 4 et 5 n'est pas clair.

8.1 La revendication 1 fait référence a "l'ordinateur" et "la table de cuisson" en utilisant l'article défini bien que ces composants ne soient pas mentionnés auparavant. La revendication 4, en faisant référence a "le couple des deux modules", comporte le même problème.

8.2 Le terme "diagramme", employé dans la revendication 2, est vague et imprécis, et laisse subsister un doute quant à la signification de la caractéristique technique à laquelle il se rapporte, au point que l'objet de ladite revendication n'est pas clairement défini.

8.3 Le terme "module ME 630", employé dans la revendication 5, ne définit pas les caractéristiques techniques de ce module.

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 231 681 A1

(12) EUROPÄISCHE PATENTANMELDUNG

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Benannte Erstreckungsstaaten:
AL LT LV MK RO SI

(30) Priorität: **09.02.2001 DE 10106025**

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(54) Datenschnittstellengesteuerte Mehrfachsteckdose

(57) Die Erfindung betrifft eine Anordnung zur Stromversorgung von Peripheriegeräten eines elektronischen Geräts (1) mit wenigstens einer Datenübertragungsschnittstelle. Die Aufgabe wird erfindungsgemäß dadurch gelöst, indem eine Anordnung zur Stromversorgung von Peripheriegeräten (2, 3, 4) eines dektronischen Geräts (1) mit wenigstens einer Datenübertragungsschnittstelle vorgesehen ist, wobei die Anordnung wenigstens eine Steckdose (14) und einen Netzanschlussstecker (12) aufweist sowie eine Datenübertragungsschnittstelle (10), welche zur Steuerung des Einschaltens und Ausschaltens der Steckdose (14) vorgesehen ist.

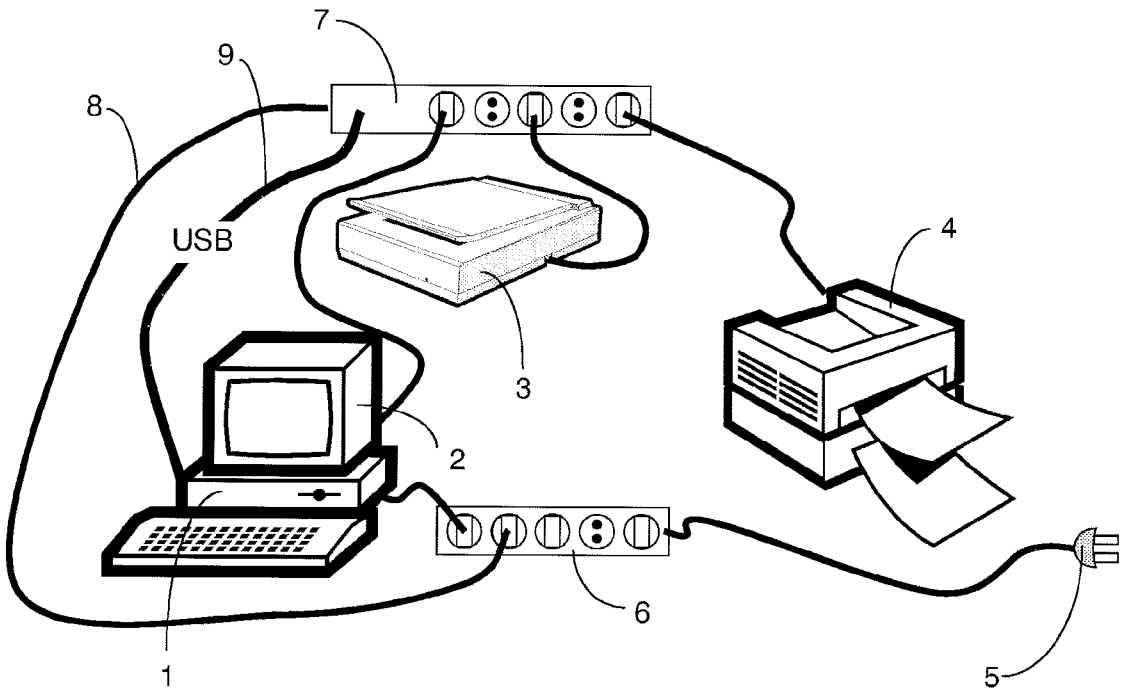

FIG. 1

EP 1 231 681 A1

Beschreibung

[0001] Die Erfindung betrifft eine Anordnung zur Stromversorgung von Peripheriegeräten eines elektronischen Geräts mit wenigstens einer Datenübertragungsschnittstelle.

[0002] In den vergangenen Jahren hat sich der USB (Universal Serial Bus)-Anschluss als Datenübertragungsschnittstelle bei Computern als Standardschnittstelle durchgesetzt. Dieser Bus hat neben der Funktion der Datenübertragung auch die Aufgabe die Stromversorgung für kleinere angeschlossene Peripheriegeräte wie zB. Scanner zu übernehmen. Der Leistungsbereich der Stromversorgung ist jedoch sehr begrenzt.

[0003] Aus JP 2000-231969 ist eine Vorrichtung bekannt, welche einen sogenannten USB-Hub enthält, welcher mehrere USB-Anschlüsse miteinander verbindet, sowie ein Netzteil, welches eine Netzspannung in eine Gleichspannung zur Versorgung angeschlossener USB-Peripheriegeräte zur Verfügung stellt. Des weiteren ist eine Steckdose vorgesehen, an die ein weiteres elektrisches Gerät angeschlossen werden kann.

[0004] E s ist Aufgabe der vorliegenden Erfindung, insbesondere die Stromversorgung von Peripheriegeräten eines Computers durch eine zentrale Stromversorgung sicherzustellen, welche vom Computer gesteuert werden kann. Des weiteren soll so der Stromverbrauch der Peripheriegeräte im sogenannten Stand-by Modus auf Null reduziert werden.

[0005] Die Aufgabe wird erfindungsgemäß dadurch gelöst, indem eine Anordnung zur Stromversorgung von Peripheriegeräten eines elektronischen Geräts mit wenigstens einer Datenübertragungsschnittstelle vorgesehen ist, wobei die Anordnung wenigstens eine Steckdose und einen Netzanschlussstecker aufweist sowie eine Datenübertragungs-schnittstelle, welche zur Steuerung des Einschaltens und Ausschaltens der Steckdose vorgesehen ist.

[0006] Eine solche Anordnung bietet den großen Vorteil, dass die Stromzufuhr zu den Peripheriegeräten eines elektronischen Geräts von diesem selbst gesteuert werden kann. Das elektronische Gerät wird meistens ein PC oder Laptop bzw. Notebook sein, da diese Geräte über Datenübertragungsschnittstellen verfügen, es können aber auch andere elektronische Geräte mit einer solchen Schnittstelle sein. Dazu zählen zB. Set-Top Boxen für das digitale Fernsehen oder digitale Videorekorder. Sobald z.B. ein Computer eingeschaltet wird, liegt an der Datenübertragungsschnittstelle des Computers eine Spannung an. Diese liegt über ein Kabel verbunden auch an der Datenschnittstelle der Anordnung zur Stromversorgung an und betätigt einen Schalter. Damit werden die in der Anordnung vorhandenen Steckdosen eingeschaltet und die Peripheriegeräte mit Strom versorgt. Auf diese Art und Weise können beliebige Peripheriegeräte verwendet werden, auch solche, die nicht über eine entsprechende Datenschnittstelle verfügen, da keine Kommunikation zwischen den Peripheriegeräten und dem Computer erforderlich ist. Da die Anordnung zur Stromversorgung unmittelbar am Stromnetz hängt, können auch leistungsstarke Peripheriegeräte problemlos mit Strom versorgt werden. Dies ist wichtig, da die heute oft verwendete Datenschnittstelle nach dem USB-Standard nur Peripheriegeräte mit kleiner elektrischer Leistungsaufnahme mit Strom versorgen kann. Zusätzlich werden die Peripheriegeräte vollständig vom Stromnetz getrennt, wenn der Computer ausgeschaltet wird, da damit am Schalter der Anordnung zur Stromversorgung keine Spannung mehr anliegt und diese somit ausgeschaltet wird. Die Netzschalter der einzelnen Peripheriegeräte müssen somit nicht mehr betätigt werden. Dies erhöht den Komfort und reduziert den Stromverbrauch bei abgeschaltetem Computer auf Null. Dies ist um so bedeutender, als viel Peripheriegeräte aus Kostengründen überhaupt nicht mehr über einen Netzschalter verfügen und somit ständig im Stand-by Modus Strom ziehen würden. dies wird mit der erfindungsgemäßen Anordnung zuverlässig verhindert.

[0007] Die Ausgestaltung nach Anspruch 2 zeichnet sich dadurch aus, dass als Datenschnittstelle der USB-Anschluss genutzt wird. Jeder aktuelle Computer ob Tischgerät oder tragbares Gerät verfügt heute über einen solchen USB-Anschluss. Damit ist sichergestellt, dass die erfindungsgemäße Anordnung mit allen auf dem Markt befindlichen Computern zusammenarbeiten kann.

[0008] Mit der Ausgestaltung nach Anspruch 3 ist eine individuelle Ansteuerung einzelner Steckdosen möglich. So wird nun nicht mehr nur unterschieden, ob an der Datenschnittstelle eine Spannung anliegt: oder nicht, sondern der Computer kann einzelne Steckdosen ein- und ausschalten. Damit sind dann nur die Peripheriegeräke mit Strom versorgt, auf die der Computer gerade zugreift. Wenn zB. ein Ausdruck gemacht werden soll, wird der Drucker mit Strom versorgt. Wird hingegen eine Zeichnung eingescannt, wird nur der Scanner mit Strom versorgt. So wird der Stromverbrauch auch beim Betrieb des Computers durch selektive Schaltung der Peripheriegeräte reduziert

[0009] Die Ausgestaltung nach Anspruch 4 stellt eine besonders einfach Möglichkeit dar, die Steckdosen zu schalten. Liegt an der Datenübertragungsschnittstelle eine Spannung an, wird ein Relais aktiviert, welches die Steckdosen an die Netzspannung schaltet. Sobald die Datenübertragungsschnittstelle keine Spannung mehr führt, schaltet das Relais die Steckdosen wieder ab. Somit werden die Steckdosen eingeschaltet, sobald der Computer eingeschaltet ist, und sie werden wieder ausgeschaltet, wenn der Computer ausgeschaltet ist. Da Relais kostengünstig sind, ist so eine preiswerte Realisierung der erfindungsgemäßen Anordnung möglich.

[0010] Wird als Datenübertragungsschnittstelle ein USB-Anschluss verwendet, so bietet die Ausgestaltung nach Anspruch 5 den Vorteil, dass neben der Steuerung der Stromversorgung an den gleichen USB-Anschluss

ein weiteres USB-Peripheriegerät angeschlossen werden kann Halbleiterschalter wie zB. Opto-Relais oder Halbleiterrelais benötigen nur einen geringen Steuerstrom. Somit kann an den selben USB-Anschluss eine weitere Last angeschlossen werden.

[0011] Mit der Ausgestaltung nach Anspruch 6 wird ein separates Einschalten aller an den Computer angeschlossenen Peripheriegeräte überflüssig. Dies erhöht den Bedienkomfort, da die Peripheriegeräte mit dem Einschalten des Computers betriebsbereit sind.

[0012] Die Ausgestaltungen nach Anspruch 7 und 8 haben den Vorteil, dass neben der Steuerung der Stromversorgung gleichzeitig noch die Verkabelung der Datenströme mittels ein und der selben Anordnung möglich ist. Mit mehreren USB-Anschlüssen können mehrere Peripheriegeräte mit dem Computer kommunizieren. Dies ist sinnvoll, da die meisten Computer nur über zwei USB-Anschlüsse verfügen und daher für mehrere Peripheriegeräte ein USB-Verteiler, ein sogenannter USB-Hub sinnvoll ist. Solche USB-Hubs werden normaler Weise als Einheit gefertigt. Es ist daher fertigungstechnisch einfach zu bewerkstelligen, einen solchen fertigen USB-Hub an die USB-Datenschnittstelle der erfindungsgemäßen Anordnung zur Stromversorgung anzuschließen und in das Gehäuse mit zu integrieren. Somit bilden USB-Hub und Mehrfachsteckdose eine Einheit, welche weniger Platz benötigt und sämtliche angeschlossenen Peripheriegeräte nicht nur mit Strom versorgt, sondern auch an den USB-Anschluss des Computers anbindet.

[0013] Die Stromversorgung leistungsstarker Geräte wie Drucker ist somit sichergestellt, da diese sonst über den USB-Anschluss selbst nicht mit ausreichend Strom versorgt werden könnten.

[0014] Auch die Ausgestaltung nach Anspruch 9 bietet vor allem fertigungstechnische Vorteile. Die Verwendung konventioneller Mehrfachsteckdosenleisten reduziert die Kosten. Des weiteren ist in diesen Mehrfachsteckdosenleisten fast immer noch ungenutzter Raum vorhanden, in den die Datenübertragungsschnittstelle mit den notwendigen Schaltmitteln eingebaut werden kann. Auch ein USB-Hub ist in vielen Mehrfachsteckdosenleisten noch unterzubringen, ohne dass sich das Gesamtvolumen erhöht.

[0015] Ausführungsbeispiele der vorliegenden Erfindung werden nachfolgend an Hand einiger Figuren näher erläutert. Es zeigen:

Figur 1 einen Computer und mehrere Peripheriegeräte, welche über eine vom Computergesteuerte Steckdosenleiste mit Strom versorgt werden,

Figur 2 den Aufbau einer mittels USB-Anschluss computergesteuerten Steckdosenleiste und

die Figuren 3 und 4 die Stecketbelegung der einzelnen Pins eines USB-Steckers.

[0016] In Figur 1 ist zu sehen, wie das Prinzip einer über eine Datenschnittstelle gesteuerten Steckdosenleiste 7 aussieht. An einen PC 1 sind über Datenleitungen diverse Peripheriegeräte angeschlossen. Das sind ein Monitor 2, ein Scanner 3 und ein Drucker 4. Da diese Peripheriegeräte 2, 3, 4 einen Netzanschluss aufweisen, müssen sie mit dem Stromnetz verbunden sein. Dazu sind die Peripheriegeräte 2, 3, 4 in die neuartige Steckdosenleiste 7 eingesteckt. Diese wird wiederum von einer herkömmlichen Steckdosenleiste 6 versorgt, über die auch der PC 1 mit Strom versorgt wird. Über einen Netzstecker 5 ist die herkömmliche Steckdosenleiste 6 unmittelbar mit dem Stromnetz verbunden. D.h der PC 1 und die herkömmliche Steckdosenleiste 6 befinden sich in ständiger Verbindung mit dem Netz Die Peripheriegeräte 2, 3, 4 werden nur dann mit Strom versorgt, wenn die neuartige Steckdosenleiste 7 sie zuschaltet. Dies geschieht im einfachsten Fall dadurch, dass der PC 1 eingeschaltet wird Dann liegt an der Datenschnittstelle des PCs1, hier ein USB-Anschluss, eine Spannung an, welche in der computergesteuerten Steckdosenleiste 7 den Strom zu den Steckdosen 14 der Peripheriegeräke 2,3,4 durchschaltet. Wird der PC 1 wieder ausgeschaltet, wird auch der USB-Anschluss spannungslos, wodurch die Steckdosenleiste 7 abschaltet.

[0017] In Figur 2 wird nun der Aufbau einer solchen computergesteuerten Steckdosenleiste 7 näher gezeigt, welcher als Datenübertragungsschnittstelle den USB-Anschluss verwendet. Die Steckdosen 14 für die Peripheriegeräte 2,3,4 sind durch einen Schalter 13 von der Stromzuführung 12 trennbar. Der Schalter 13 wird dabei von einem Schaltungsbauteil 11, USB-Interface genannt, angesteuert. Dieses USB-Interface 11 besitzt ein USB-Anschlusskabel mit einem USB-Stecker 10. Dieser ist an den USB-Anschluss des PCs 1 angeschlossen. Wie die Steckerbelegung eines solchen USB-Steckers 10 aussieht, ist den Figuren 3 und 4 zu entnehmen Die beiden äußeren Pins des Steckers 10 dienen der Stromversorgung angeschlossener Geräte, welche einen geringen Stromverbrauch haben. So kann zB. der Scanner 3 auch direkt über den USB-Anschluss mit Strom versorgt werden. Beim Monitor 2 und beim Drucker 4 ist dies aber nicht möglich, da sie zuviel Strom verbrauchen und die maximale Last am USB-Anschluss 500 mA beträgt. Hier ist auf jeden Fall ein Netzanschluss notwendig. Als Schalter 13 ist ein Relais vorgesehen. Ist nun der PC 1 eingeschaltet, liegt an den beiden äußeren Pins des Steckers 10 eine Spannung an und das Relais schaltet die Steckdosen 14 an die Stromzuführung 12. Nun werden alle Peripheriegeräte 2,3,4 mit Strom versorgt. Wird der PC wieder ausgeschaltet, öffnet das Relais wieder und die Stromversorgung der Steckdosen 14 wird unterbrochen.

[0018] Statt eines Relais kann als Schalter 13 aber auch ein Opto-Relais oder ein Halbleiterschalter verwendet werden. Diese benötigen nur einen schwachen Steuerstrom von ca. 10 mA, so dass der USB-Anschluss 10 kaum belastet wird und von einem weiteren

USB-Gerät belastet werden kann. Ist an der Steckdosenleiste 7 ein externer USB-Anschluss vorgesehen, so kann an diesen das weitere USB-Gerät angeschlossen werden, indem das USB-Signal an dieses Gerät durchgeschleift wird

[0019] An Stelle des einen externen USB-Anschlusses kann auch ein USB-Hub in die Steckdosenleiste 7 integriert werden, so können mehrere Geräte mit USB-Anschluss angeschlossen werden, wobei die Stromversorgung dann zweckmäßiger Weise über die Steckdosen 14 erfolgt, da über den USB-Anschluss selbst allen Geräten insgesamt nur maximal 500 mA zur Verfügung stehen, was nicht ausreicht. Eine solche Steckdosenleiste 7 stellt eine Datenverteilungszentrale mit Stromversorgungszentrale dar und passt in das leicht modifizierte Gehäuse einer herkömmlichen Steckdosenleiste.

[0020] Als Ausbaustufe ist vorgesehen, nicht auf die Betriebsspannung der beiden äußeren Pins des USB-Steckers 10 zurückzugreifen, sondern die USB-Signale selbst zu verwenden. Dazu ist in das USB-Interface 11 ein Decoder für USB-Signale eingebaut. Außerdem sind statt des einen Schalters 13 alle Steckdosen 14 der Steckdosenleiste 7 durch den Decoder separat in Abhängigkeit der USB-Signale schaltbar. Die Steckdosen 14 können nun vom PC 1 aus individuell über eine entsprechende Software ein- und ausgeschaltet werden. So kann zB. gezielt der Drucker 4 nur dann zugeschaltet werden, wenn ein Druckvorgang anliegt. Dies senkt den Stromverbrauch, da sich dann der Drucker 4 nicht im Stand-by Modus befindet, wenn er nicht benötigt wird, sondern komplett ausgeschaltet ist.

[0021] Anstatt des im Ausführungsbeispiel verwendeten USB-Anschluss sind auch andere Datenübertragungsschnittstellen wie parallele und serielle Computerschnittstellen oder der IEEE 1394-Anschluss nutzbar.

Patentansprüche

1. Anordnung zur Stromversorgung von Peripheriegeräten (2, 3, 4) eines elektronischen Geräts (1) mit wenigstens einer Datenübertragungsschnittstelle, wobei die Anordnung wenigstens eine Steckdose (14) und einen Netzanschlussstecker (12) aufweist sowie eine Datenübertragungsschnittstelle (10), welche zur Steuerung des Einschaltens und Ausschaltens der Steckdose (14) vorgesehen ist.

2. Anordnung nach Anspruch 1,
dadurch gekennzeichnet,
dass die Datenübertragungsschnittstelle (10) ein USB-Anschluss ist.

3. Anordnung nach Anspruch 1,
dadurch gekennzeichnet,
dass wenigstens zwei (14) Steckdosen vorhanden sind, welche unabhängig voneinander über von der Datenschnittstelle (10) übertragene Befehle geschaltet werden können.

4. Anordnung nach Anspruch 1,
dadurch gekennzeichnet,
dass als Schaltelement (13) zum Schalten der Steckdosen (14) ein elektromagnetisches Relais vorgesehen ist.

5. Anordnung nach Anspruch 2,
dadurch gekennzeichnet,
dass als Schaltelement (13) zum Schalten der Steckdosen (14) ein Halbleiterrelais vorgesehen ist.

6. Anordnung nach Anspruch 1,
dadurch gekennzeichnet,
dass vorgesehen ist, dass die Steckdosen (14) gemeinsam eingeschaltet werden, wenn über die Datenschnittstelle (10) ein Strom fließt und gemeinsam ausgeschaltet werden, wenn kein Strom über die Datenschnittstelle (10) fließt.

7. Anordnung nach Anspruch 2,
dadurch gekennzeichnet,
dass diese zusätzlich zum USB-Anschluss (10) wenigstens einen USB-Anschluss zur Datenübertragung an Peripheriegeräte (2, 3, 4) aufweist.

8. Anordnung nach Anspruch 2,
dadurch gekennzeichnet,
dass zusätzlich zum USB-Anschluss (10) ein USB-Hub integriert ist.

9. Anordnung nach Anspruch 8,
dadurch gekennzeichnet,
dass die Datenübertragungsschnittstelle (10) und erforderliche Schaltmittel (11,13) in eine Mehrfachsteckdosenleiste (7) eingsbaut sind.

10. System mit einem elektronischen Gerät (1) und wenigstens einem Peripheriegerät (2,3, 4),
dadurch gekennzeichnet,
dass vorgssehen ist, das Peripheriegerät (2, 3, 4) über eine Anordnung nach Anspruch 1 mit Strom zu versorgsn.

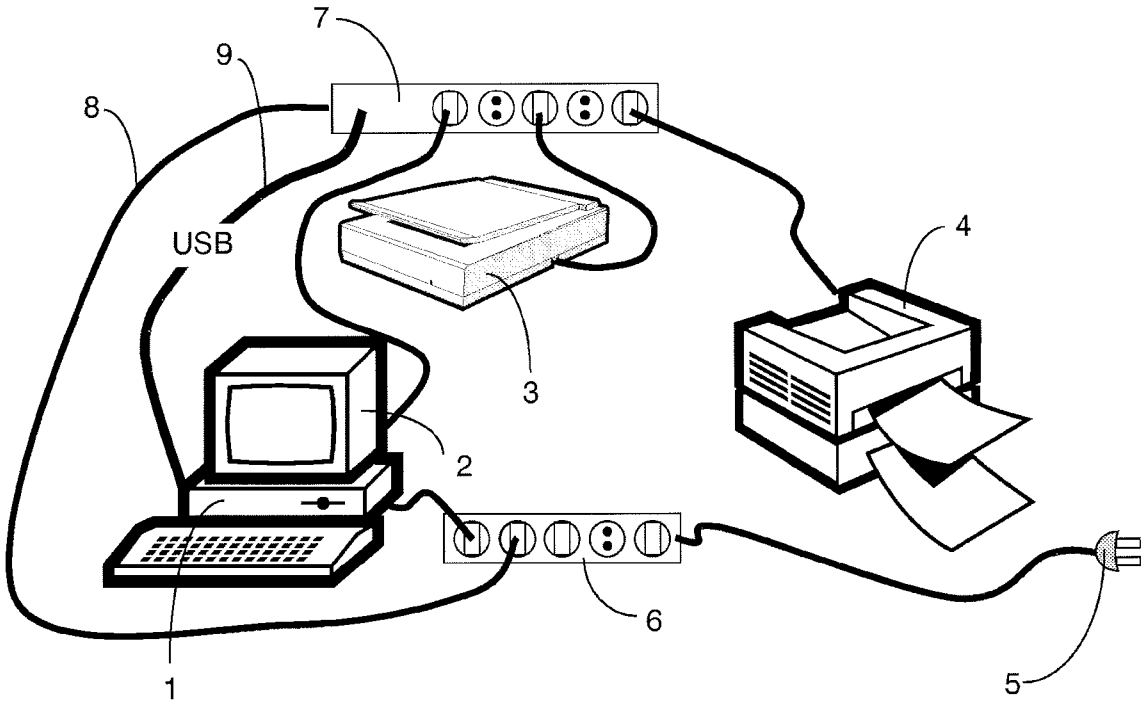

FIG. 1

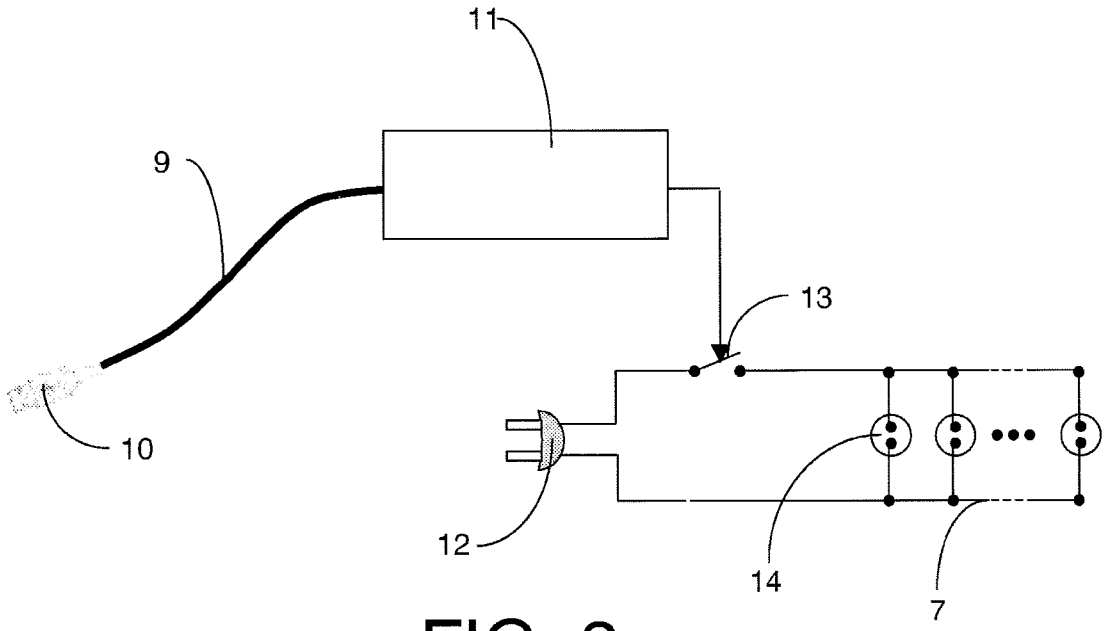

FIG. 2

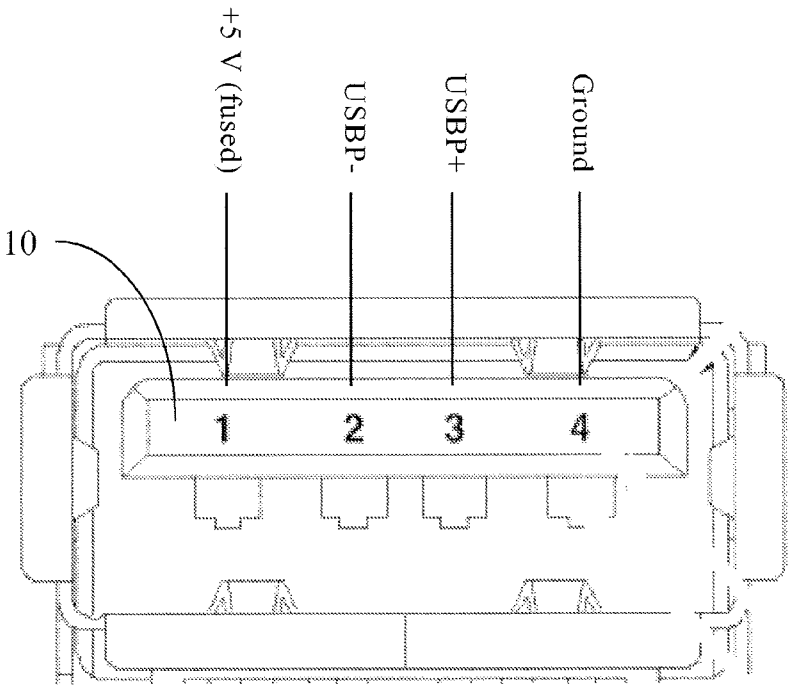

FIG. 3

Pin	Signal Name
1	+5 V (fused)
2	USBP-
3	USBP+
4	Ground

FIG. 4

Europäisches Patentamt

EUROPÄISCHER RECHERCHENBERICHT

Nummer der Anmeldung
EP 02 10 0109

EINSCHLÄGIGE DOKUMENTE

Kategorie	Kennzeichnung des Dokuments mit Angabe, soweit erforderlich, der maßgeblichen Teile	Betrifft Anspruch	KLASSIFIKATION DER ANMELDUNG (Int.Cl.7)
X	DE 94 17 271 U (ZÄH) 23. Februar 1995 (1995-02-23) * Seite 4, Zeile 26 - Seite 8, Zeile 21 *	1,3-5,10	H01R25/00
X	DE 44 25 876 A (REIMANN WOLFGANG DIPL JUR ;PAUL ANDREE DR (DE)) 11. Januar 1996 (1996-01-11) * Spalte 3, Zeile 37 - Spalte 4, Zeile 45 *	1,4	
X	DE 198 41 369 A (ARNOLD FRANK) 16. März 2000 (2000-03-16) * Spalte 2, Zeile 60 - Spalte 3, Zeile 17 *	1	

RECHERCHIERTE SACHGEBIETE (Int.Cl.7)

H01R

Der vorliegende Recherchenbericht wurde für alle Patentansprüche erstellt

Recherchenort	Abschlußdatum der Recherche	Prüfer
DEN HAAG	6. Mai 2002	Bertin, M

KATEGORIE DER GENANNTEN DOKUMENTE

X : von besonderer Bedeutung allein betrachtet
Y : von besonderer Bedeutung in Verbindung mit einer anderen Veröffentlichung derselben Kategorie
A : technologischer Hintergrund
O : nichtschriftliche Offenbarung
P : Zwischenliteratur

T : der Erfindung zugrunde liegende Theorien oder Grundsätze
E : älteres Patentdokument, das jedoch erst am oder nach dem Anmeldedatum veröffentlicht worden ist
D : in der Anmeldung angeführtes Dokument
L : aus anderen Gründen angeführtes Dokument

& : Mitglied der gleichen Patentfamilie, übereinstimmendes Dokument

EPO FORM 1503 03.82 (P04C03)

ANHANG ZUM EUROPÄISCHEN RECHERCHENBERICHT ÜBER DIE EUROPÄISCHE PATENTANMELDUNG NR. EP 02 10 0109

In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten europäischen Recherchenbericht angeführten Patentdokumente angegeben.
Die Angaben über die Familienmitglieder entsprechen dem Stand der Datei des Europäischen Patentamts am
Diese Angaben dienen nur zur Unterrichtung und erfolgen ohne Gewähr.

06-05-2002

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie	Datum der Veröffentlichung
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EPO FORM P0461

Für nähere Einzelheiten zu diesem Anhang : siehe Amtsblatt des Europäischen Patentamts, Nr.12/82

US 20090168835A1

(19) **United States**

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Heinke et al.

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(43) **Pub. Date: Jul. 2, 2009**

(54) **PORTABLE IR THERMOMETER HAVING USB-HID INTERFACE**

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Publication Classification

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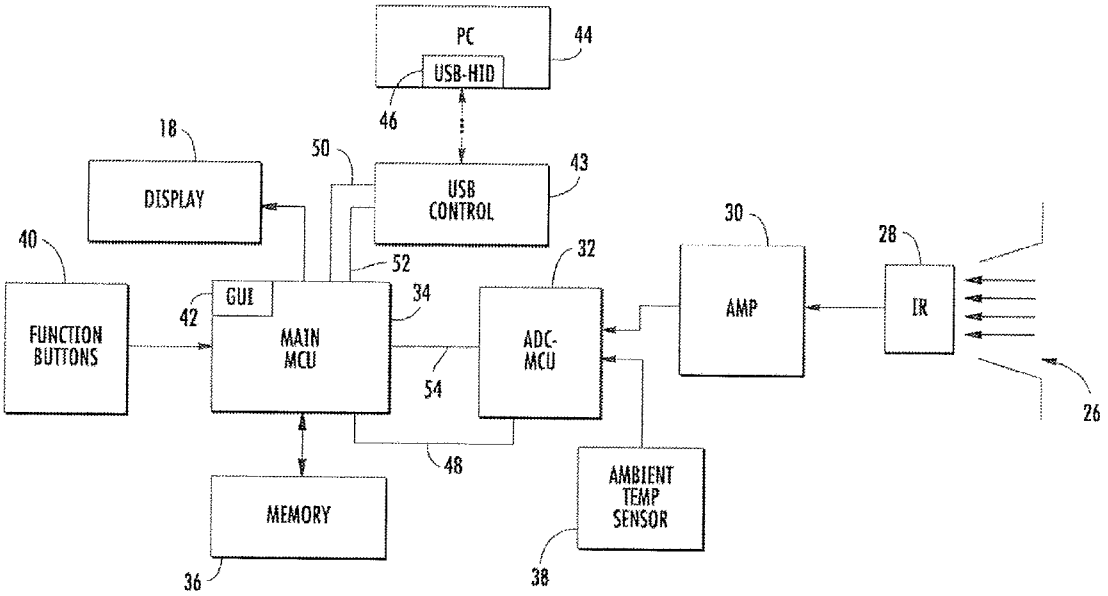
G01J 5/00 (2006.01)

(52) **U.S. Cl.** **374/121**; 702/135

(57) **ABSTRACT**

A portable noncontact thermometer comprising a hand-held housing defining an aperture for ingress of incident thermal energy from a target location. A thermometer module including a noncontact thermal energy detector is also provided. The thermometer module further includes at least one microcontroller operative to interpret electrical signals derived from an output of the noncontact thermal energy detector so as to determine temperature at the target location. A USB-HID communication interface is operative to permit electrical communication between the microcontroller(s) and a remote computer. A display device, fixed with respect to the housing, is also provided.



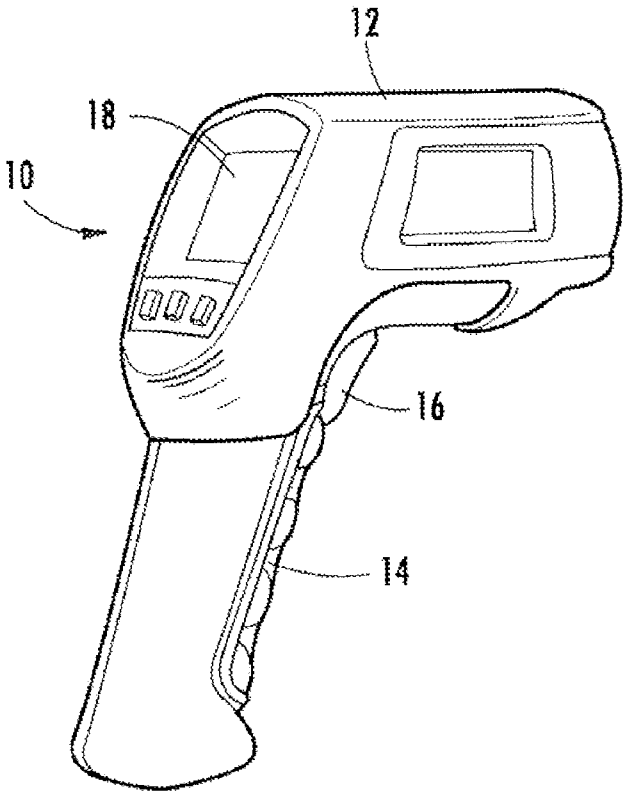


FIG. 1

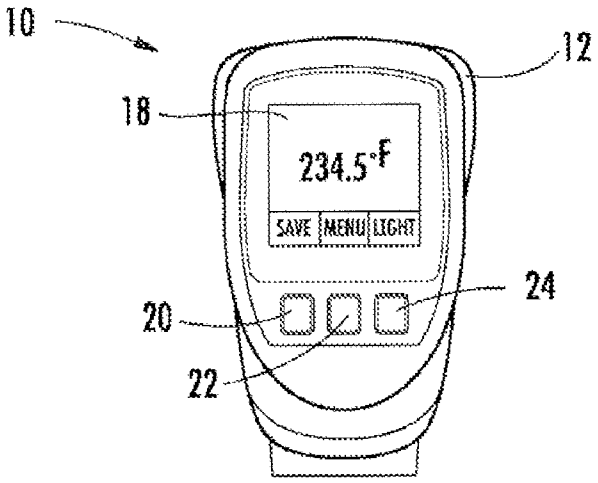


FIG. 2

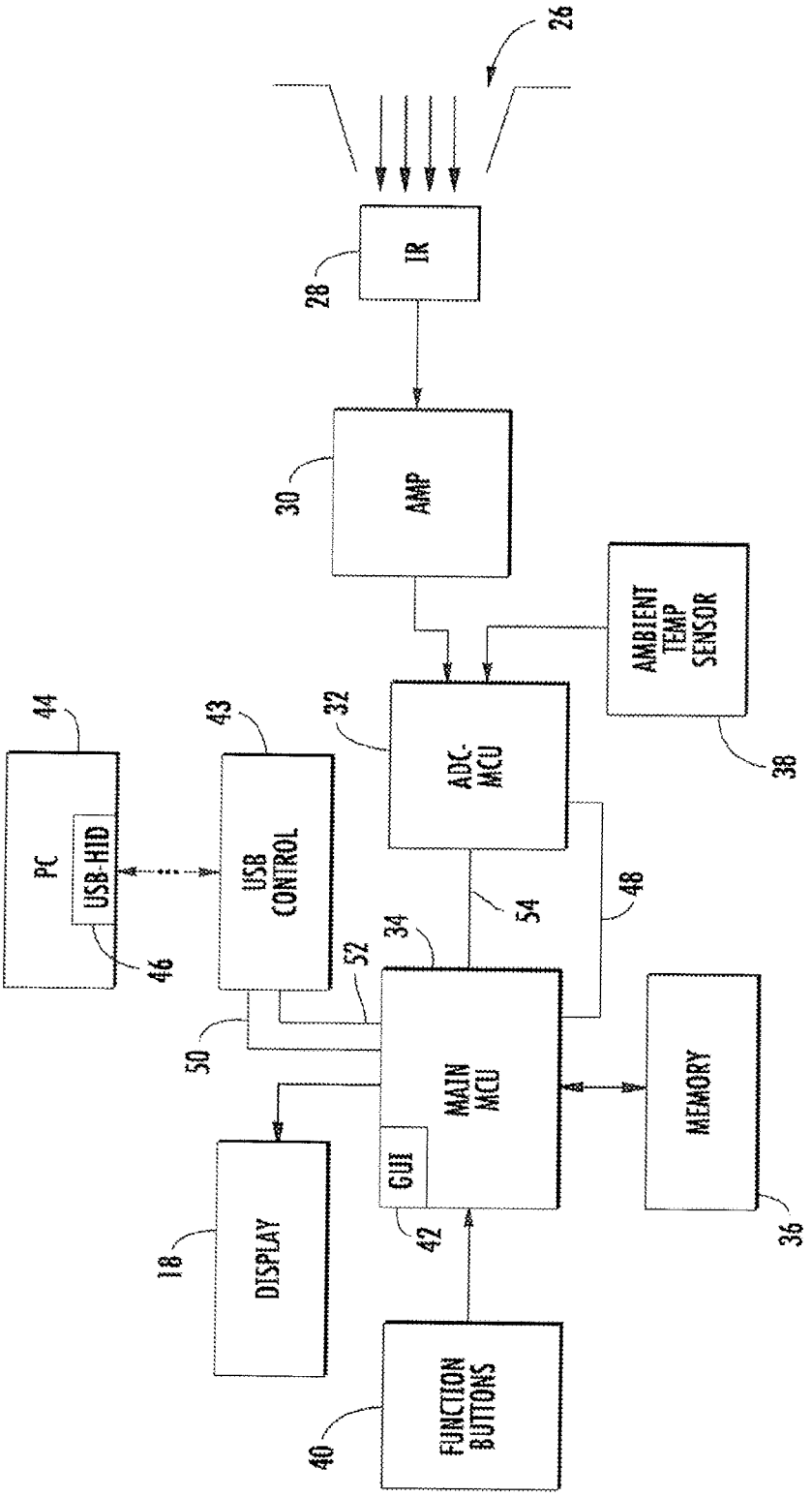

26
IR
28
AMP
30
AMBIENT TEMP SENSOR
38
ADC-MCU
32
44
PC
USB-HID
46
43
USB CONTROL
54
48
34
52
50
MAIN MCU
GUI
42
MEMORY
36
DISPLAY
18
FUNCTION BUTTONS
40

FIG. 3

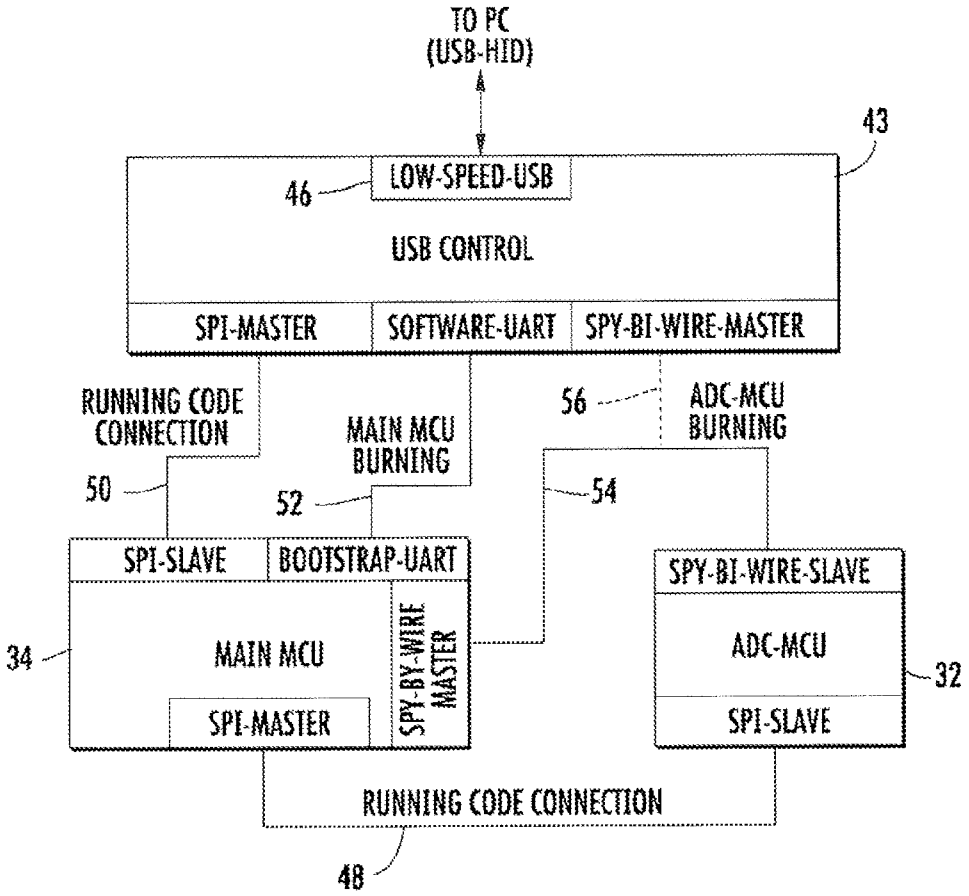

TO PC
(USB-HID)
43
46
LOW-SPEED-USB
USB CONTROL
SPI-MASTER
SOFTWARE-UART
SPY-BI-WIRE-MASTER
RUNNING CODE
CONNECTION
MAIN MCU
BURNING
56
ADC-MCU
BURNING
50
52
54
SPI-SLAVE
BOOTSTRAP-UART
SPY-BI-WIRE-SLAVE
34
MAIN MCU
SPY-BY-WIRE
MASTER
ADC-MCU
32
SPI-MASTER
SPI-SLAVE
RUNNING CODE CONNECTION
48

FIG. 4

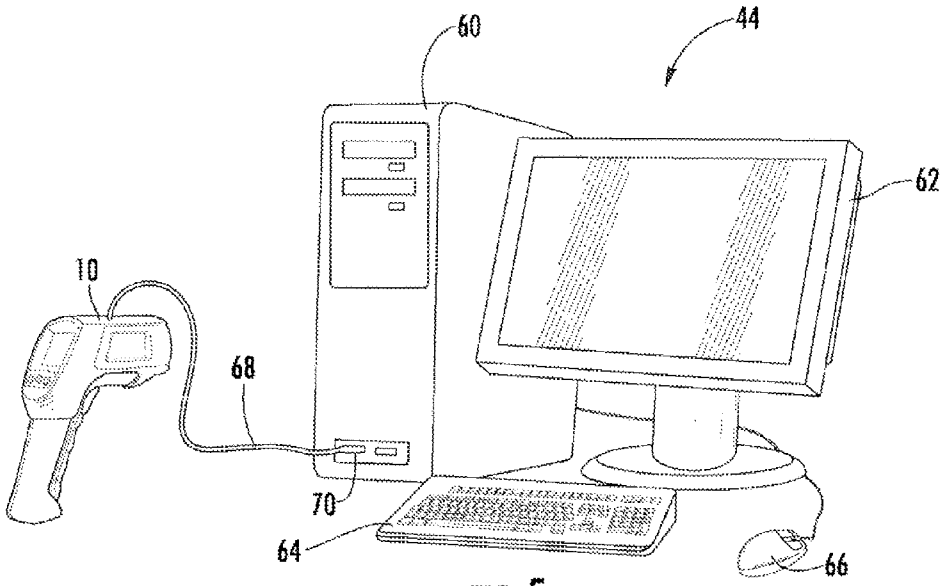


FIG. 5

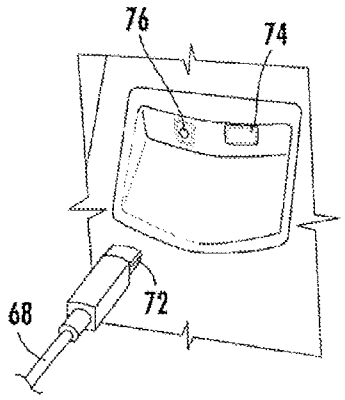


FIG. 6

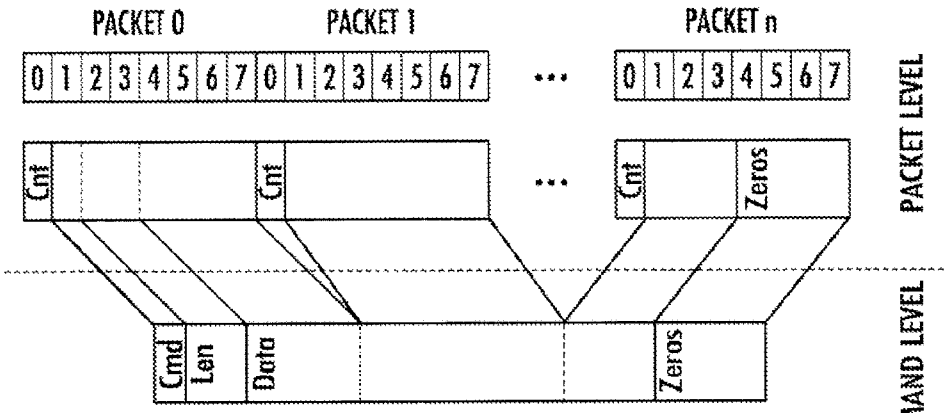

PACKET 0
PACKET 1
PACKET n
0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7
0 1 2 3 4 5 6 7
Cnt
Cnt
Cnt
Zeros
Cmd
Len
Data
Zeros
PACKET LEVEL
COMMAND LEVEL

FIG. 7

cAck
Len
Data
Zeros
COMMAND LEVEL

FIG. 8

PORTABLE IR THERMOMETER HAVING USB-HID INTERFACE

BACKGROUND OF THE INVENTION

[0001] The present invention relates generally to portable IR thermometers. More particularly, the invention relates to a portable IR thermometer having a USB-HID interface for communication with a common personal computer (PC) in an easily used plug and play manner.

[0002] Portable infrared (IR) thermometers allow a user to ascertain the temperature of a remote target using a point and click technique. These instruments are commonly utilized for purposes ranging from automotive diagnostics to food safety. In the past, such instruments have been adapted for connection to a PC so that measured data could be downloaded to the PC via serial connection. In some cases, routes and emissivity data could be uploaded from the PC to the instrument.

[0003] Various details regarding the construction and operation of noncontact thermometers may be discerned from U.S. Pat. Nos. 4,634,294, 5,640,015 and 6,234,669, each of which is incorporated herein by reference in its entirety.

SUMMARY OF THE INVENTION

[0004] According to one aspect, the present invention provides a portable noncontact thermometer comprising a hand-held housing defining an aperture for ingress of incident thermal energy from a target location. A thermometer module including a noncontact thermal energy detector is also provided. The thermometer module further includes at least one microcontroller operative to interpret electrical signals derived from an output of the noncontact thermal energy detector so as to determine temperature at the target location. A USB-HID communication interface is operative to permit electrical communication between the microcontroller(s) and a remote computer. A display device, fixed with respect to the housing, is also provided.

[0005] In some exemplary embodiments, the communication interface is capable of downloading information from the microcontroller(s) and uploading information to the microcontroller(s). Preferably, the communication interface also permits reprogramming of the microcontroller. Oftentimes, the at least one microcontroller may comprise a main microcontroller and an ADC microcontroller in communication with each other. The ADC microcontroller in such embodiments may be reprogrammed via the main microcontroller. The noncontact thermometer may further comprise a mini-USB port located on the housing and electrically connected to the communication interface.

[0006] According to another aspect, the present invention provides a system comprising a portable noncontact thermometer having a USB-HID communication interface. The communication interface of the noncontact thermometer is operative to convert In and Out reports pursuant to HID protocol. A remote computer having an operating system running a USB-HID driver so as to communicate with the thermometer via the communication interface is also provided. Preferably, the system will comprise software running on the computer for downloading temperature information from the noncontact thermometer to the computer and/or uploading emissivity data from the computer to the noncontact thermometer. The communication interface of the noncontact thermometer may be operative to communicate with the remote computer via a wired connection.

[0007] Additional aspects of the present invention, including various combinations and subcombinations of the disclosed elements, will be apparent from the remainder of the specification.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] A full and enabling disclosure of the present invention, including the best mode thereof, to one of ordinary skill in the art, is set forth more particularly in the remainder of the specification, including reference to the accompanying drawings, in which:

[0009] FIG. **1** is a perspective view of a portable IR thermometer constructed in accordance with the present invention;

[0010] FIG. **2** is a rear view of the thermometer of FIG. **1** showing the graphical display;

[0011] FIG. **3** is a diagrammatic representation showing certain internal components of the thermometer of FIG. **1**;

[0012] FIG. **4** is a diagrammatic representation of the various microcontrollers installed in the thermometer of FIG. **1** according to a preferred embodiment;

[0013] FIG. **5** shows a personal computer connected to the thermometer of FIG. **1** via the USB-HID connection;

[0014] FIG. **6** is an enlarged view showing the USB connector port of the thermometer shown in FIG. **1**;

[0015] FIG. **7** is a diagrammatic representation showing the Out report protocol; and

[0016] FIG. **8** is a diagrammatic representation showing the In report protocol at command level.

[0017] Repeat use of reference characters in the present specification and drawings is intended to represent same or analogous features or elements of the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0018] It is to be understood by one of ordinary skill in the art that the present discussion is a description of exemplary embodiments only, and is not intended as limiting the broader aspects of the present invention, which broader aspects are embodied in the exemplary constructions.

[0019] FIGS. **1** and **2** illustrate an exemplary hand-held thermometer **10** in accordance with principles of the present invention. Thermometer **10** includes an internal detector which collects energy radiated from a selected target. The energy, typically in the form of infrared (IR) radiation, is isolated and focused on the detector. The detector converts the energy into an electrical signal which is then internally processed to yield a temperature value.

[0020] As shown, thermometer **10** includes a housing **12** in which various internal components are located. While any suitable material can be utilized, housing **12** is preferably formed of a rigid high impact plastic material. As shown, housing **12** includes a handle **14** on which a trigger **16** is located. Activating trigger **16** puts the thermometer in a "scan" (or active measurement) mode. A laser diode may be provided to project a dot of light forward of the thermometer to facilitate aiming.

[0021] As indicated at **18**, a graphical display device is preferably located at the rear of thermometer **10**. In this case, a variety of information is shown on display device **18**, including a reading of the target temperature. The target temperature (234.5° F. in FIG. **2**) is preferably shown in large font

in the center of the screen. Various functions of thermometer **10** are controlled by buttons **20**, **22** and **24**.

[0022] Preferably, thermometer **10** is configured to implement a graphical user interface (GUI) on display device **18**. As shown in FIG. **2**, for example, three tabs are located at the bottom of the screen in regions corresponding to buttons **20**, **22** and **24**, respectively. In this case, the respective tabs contain the words "Save," "Menu" and "Light" as indicators of the function that may be performed by pressing the corresponding button. These functions may change depending on where a particular screen appears in the GUI menu tree. Various icons may also be displayed on the screen.

[0023] Certain internal components of thermometer **10** will be explained with reference to FIG. **3**. Thermal energy from a selected target passes through an aperture **26** defined in housing **12**, where it is directed by optics to an IR detector **28**. The output of detector **28** is fed to an amplifier **30**, and then to analog-to-digital converter (ADC) **32**. In this case, ADC **32** is implemented using a microcontroller having a high-resolution A/D converter. The resulting digital signal from ADC **32** is then fed to main microcontroller (MCU) **34**. Microcontroller **34** utilizes preprogrammed algorithms to convert the digital detector data into temperature information. A memory **36** (which may be internal to microcontroller **34**) stores temperature information, along with firmware and other information (such as emissivity) utilized during operation. Detector **28** along with its associated circuitry (e.g., amplifier **30**, ADC **32**, main microcontroller **34** and memory **36**) can be thought of collectively as a thermometer module (whether or not they form a single physical unit). In some embodiments, the thermometer module may further include an ambient temperature sensor **38**. The function buttons **20**, **22** and **24** are collectively indicated at **40**.

[0024] As shown, display device **18** is in electrical communication with microcontroller **34**. Preferably, display device **18** may be configured as a dot matrix or other suitable graphical display which implements the GUI. For example, display device **18** may be a 98×96 pixel LCD dot matrix display in some presently preferred embodiments. As a result, complex functions can be implemented with a minimum of control buttons and the user can be guided towards selecting functions and inputting parameters to the thermometer. In addition, the graphical display allows for flexible display of data and inputs, and can be customized for language, font size and the like. Different operating modes can also have different screen appearances. In this embodiment, the GUI is run on main microcontroller **34** (as indicated at **42**).

[0025] It is desirable for a noncontact thermometer to have a connection to a PC so that data can be transferred between the instrument and the PC. In this case, a controller **43** installed in thermometer **10** permits communication with a common PC **44** using a driver already included within the PC's operating system. In particular, PCs running the common Windows operating system (since at least Windows 98) include a driver (schematically indicated at **46**) for communicating with a Human Interface Device (HID), such as a keyboard or mouse, using the PC's universal serial bus (USB). In accordance with the present invention, it has been found that USB-HID protocol may be utilized with a noncontact thermometer instrument for "plug and play" convenience and ease of use. The USB-HID interface permits download of measured data, as well as upload of routes and emissivity information. Updates to the instrument's firmware and calibration can also be easily accomplished in the field.

[0026] Referring now also to FIG. **4**, certain additional aspects of the communication interface can be most easily explained. While embodiments are contemplated in which a single microcontroller fulfills all functional needs of the instrument, the present invention utilizes three microcontrollers **32**, **34** and **43**. As indicated at **46**, USB microcontroller **43** includes a hardware USB interface or a USB interface implemented in software. In particular, the interface functions to provide "In" or "Out" reports by way of data exchange in the manner used by USB-HID interfaces. In this case, for example, USB controller **43** may be a CY7C63813 controller available from Cypress Semiconductors.

[0027] As noted above, ADC **32** may take the form of a microcontroller having a high resolution A/D converter. One chip suitable for this purpose is MSP430F20x3 available from Texas Instruments. While this device has an excellent A/D converter, it has limited onboard memory. Additional memory, however, may be desirable in instrument **10** to implement the GUI, as well as a sophisticated temperature calculation algorithm, etc. This additional memory and processing capability may be provided by main microcontroller **34**, which may be a MSP430F1491 chip in some exemplary embodiments. This device is also available from Texas Instruments.

[0028] During normal operations, digital data produced by ADC **32** is fed to main microcontroller **34** along line **48**. In this embodiment, main microcontroller **34** implements a SPI master interface, whereas a SPI slave interface is implemented on ADC **32**. Similarly, data transfer between USB controller **43** and main microcontroller **34** occurs along line **50**. In this regard, USB controller **43** implements a SPI master interface, whereas a SPI slave interface is implemented on main microcontroller **34**. Thus, temperature data as calculated by main microcontroller **34** may be provided to USB controller **43** along line **50** for transfer to the remote computer. Likewise, route information and emissivity tables can be transferred from the PC to main microcontroller **34** along line **50**.

[0029] Flash memory in ADC **32** and main microcontroller **34** may be reprogrammed using the USB-HID interface. In this case, for example, controller **43** runs software implementing a universal asynchronous receiver transmitter (UART) which is in communication with a "bootstrap" (i.e., hardware) UART of main microcontroller **34** via line **52**. This line may be utilized to replace firmware and calibration data in the flash memory of main microcontroller **34**. If this flash memory requires special protocols to be programmed, then the USB-HID controller implements the required protocols and converts the "In" and "Out" reports into the datastream required by the flash ROM programming protocols. For example, new firmware can be provided for debugging purposes, as well as to add additional functions to the instrument.

[0030] In this exemplary case, ADC **32** is not equipped with a UART interface, so it may be reprogrammed using a "spy-bi-wire" interface. In one preferred embodiment, for example, a spy-bi-wire master interface is implemented (such as by software) on main microcontroller **34** which communicates with a spy-bi-wire slave interface (via line **54**) implemented on ADC **32**. In this manner, main microcontroller **34** functions as an intermediary between USB controller **43** and ADC **32** for programming purposes. Alternatively, a spy-bi-wire master interface may be implemented on USB controller **43**, which communicates directly with the spy-bi-wire slave interface of ADC **32**, as indicated at **56**.

[0031] In the illustrated embodiments, in which main microcontroller **34** functions as a programming intermediary, the following steps may be implemented during the reprogramming process: (1) Existing firmware in main microcontroller **34** is deleted. (2) The firmware in main microcontroller **34** is then reprogrammed via USB controller **43** so that main microcontroller **34** can be used to reprogram ADC **32**. (3) ADC **32** is then reprogrammed. (4) Next, the original (or updated) firmware in main microcontroller **34** is replaced.

[0032] FIG. **5** shows thermometer **10** in electrical communication with a conventional personal computer **44**. As one skilled in the art will appreciate, the term "computer" as used herein is not limited to a traditional desktop or laptop personal computer. Instead, "computer" is included to cover other devices, such as various personal digital assistants (PDAs), that may be capable of performing the described functionality. In this embodiment, however, computer **44** is a traditional desktop personal computer having a main housing **60** containing processing electronics, disk drives and the like. A suitable computer display **62**, in this case an LCD flat screen display, is also provided. The user interacts with computer **44** using keyboard **64** and mouse **66** in the conventional manner.

[0033] The invention contemplates various techniques for providing a data link between thermometer **10** and computer **44**, such as various wireless communication protocols. In the illustrated embodiment, however, electrical communication between thermometer **10** and computer **44** is accomplished using a typical serial cable **68**. Cable **68** includes universal serial bus (USB) connectors at each end, one of which plugs into a corresponding port on the front of housing **60** (as indicated at **70**).

[0034] As can be most clearly seen in FIG. **6**, the other connector **72** is configured as a mini-USB connector. Connector **72** is inserted into a corresponding port **74** located on the top of thermometer **10**. In this embodiment, a receptacle **76** is located adjacent to mini-USB port **74** for connecting a thermocouple probe for contact measurements. Computer **44** preferably includes application software which creates a user interface for displaying temperature data, logged data sets, allows editing routes and emissivity tables, and supports firmware and calibration data updates in the field. The PC application converts the data streams, required for such functions, into "In" and "Out" reports, which are used for data exchange pursuant to USB-HID protocol.

[0035] FIGS. **7** and **8** show the format of the "In" and "Out" reports in accordance with a preferred embodiment. All data transfers are in binary.

Host to Device Data Transfer

[0036] The host sends command and data to the device.

[0037] Data transferring from the host to the device is through USB Control.

[0038] Out Report (FIG. **7**)

[0039] A transfer reside in one or more USB Data Packet. According to USB Low Speed specification, each Data Packet is 8-byte long.

[0040] As shown in FIG. **7**, at Packet Level each packet contains a Cnt.

[0041] At Command Level, each transfer has Cmd, Len, Data, and Zeros. At Command Level, a transfer can be of any length.

Packet Level			
Cnt	1 byte	Bit 7	Reset 0 Continued packet to the previous packet in a transfer. 1 First packet in a transfer
		Bit 6-0	7-bit counter. Increases by one for each packet and wraps to 0. In this way, a lost packet can be detected. A discontinuous value indicates a transfer error. 0-127

Command Level		
Cmd	1 bytes	Command code. 1~127. 0 is reserved for heading zero. 128~255 is reserved for protocol extension.
Len	2 bytes	The byte length of this transfer. The length includes Cmd, Len and all Data parts in this command, but does not include any Cnt or the zeros part. Low byte first. 3~65535.
Data	Variable bytes	Data of this command. 0 bytes minimum. 65532 bytes Maximum.
Zeros	Variable bytes	0s added at the end of the last packet to make all packet 8-byte length. 0 bytes minimum. 6 bytes maximum.

[0042] Every command transaction is preferably followed by one Device to Host Data Transfer at the minimum acknowledge receipt and validation of the transmitted Host Data to Device transfer.

[0043] Device to Host Data Transfer

[0044] The device sends data to the host as a response to the host command. Data transferring from the device to the host is through USB Interrupt In Report.

Packet Level Same as Host to Device Transfer. a Device to Host Transfer resides in one or more USB Data Packet. Each Data Packet is 8-byte long.			
Cnt	1 byte	Bit 7	Reset 0 Continued packet to the previous packet in a transfer or 1 First packet in a transfer
		Bit 6-0	7-bit counter. Reference to as described above under Host to Device Data Transfer. As a response to a previous Host to Device Transfer, the counter in the first packet sent by the Device is one more than that of the previous packet sent by the Host with Reset bit has a value of 1. 0-127

Command Level (FIG. 8)		
cAck	1 bytes	If command was valid cAck = 30 (ASCII char '0') If the command was not valid/acted on, a value should be between 31 and 39 Command code. 0 Reserved for heading zeros 1-127 Acknowledge code 128-255 Reserved for protocol extension
Len	2 bytes	The byte length of this transfer. The length includes Cmd, Len and all Data parts in this command, but does not include any Cnt or the zeros part. Low byte first. 3~65535.
Data	Variable bytes	Data to transfer. 0 bytes minimum. 65532 bytes Maximum.
Zeros	Variable bytes	0s added at the end of the last packet to make all packet 8-byte length. 0 bytes minimum. 6 bytes maximum.

[0045] It can thus be seen that the present invention provides a portable IR thermometer having a USB-HID interface. While preferred embodiments of the invention have been shown and described, modifications and variations may be made thereto by those of ordinary skill in the art without departing from the spirit and scope of the present invention. In addition, it should be understood that aspects of the various embodiments may be interchanged both in whole or in part. Furthermore, those of ordinary skill in the art will appreciate that the foregoing description is by way of example only, and is not intended to be limitative of the invention as further described in the appended claims.

What is claimed is:

1. A portable noncontact thermometer comprising:

a hand-held housing defining an aperture for ingress of incident thermal energy from a target location;

a thermometer module including a noncontact thermal energy detector;

said thermometer module further including at least one microcontroller operative to interpret electrical signals derived from an output of said noncontact thermal energy detector so as to determine temperature at said target location;

a USB-HID communication interface operative to permit electrical communication between said at least one microcontroller and a remote computer; and

a display device fixed with respect to said housing.

2. A portable noncontact thermometer as set forth in claim **1**, wherein said communication interface is capable of downloading information from said at least one microcontroller and uploading information to said at least one microcontroller.

3. A portable noncontact thermometer as set forth in claim **1**, wherein said communication interface permits reprogramming of said at least one microcontroller.

4. A portable noncontact thermometer as set forth in claim **3**, wherein said at least one microcontroller comprises a main microcontroller and an ADC microcontroller in communication with each other.

5. A portable noncontact thermometer as set forth in claim **4**, wherein said ADC microcontroller is reprogrammed via main microcontroller.

6. A portable noncontact thermometer as set forth in claim **1**, comprising a mini-USB port located on said housing, said mini-USB port being electrically connected to said communication interface.

7. A system comprising:

a portable noncontact thermometer having a USB-HID communication interface, said communication interface being operative to convert in and out reports pursuant to HID protocol; and

a remote computer having an operating system running a USB-HID driver so as to communicate with said thermometer via said communication interface.

8. A system as set forth in claim **7**, further comprising software running on said computer for downloading temperature information from said noncontact thermometer to said computer.

9. A system as set forth in claim **7**, further comprising software running on said computer for uploading emissivity data from said computer to said noncontact thermometer.

10. A system as set forth in claim **7**, wherein said communication interface of said noncontact thermometer is operative to communicate with said remote computer via a wired connection.

* * * * *

United States Patent [19]

Chapin

[11] **Patent Number: 4,503,502**

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

[54] **METHOD AND APPARATUS FOR AUTOMATED CHINESE STIR-FRY COOKING**

[76] Inventor: **Roger A. Chapin**, 715 Boyd Rd., Pleasant Hill, Calif. 94523

[21] Appl. No.: **432,333**

[22] Filed: **Jun. 3, 1983**

[51] **Int. Cl.**[3] **G06F 15/20**; G06G 7/48; A47J 27/00

[52] **U.S. Cl.** ..... **364/400**; 99/328; 99/329 R; 99/333; 99/335; 99/348; 364/477

[58] **Field of Search** ..... 364/400, 477, 557; 219/490, 491, 494, 413; 99/325, 326, 327, 328, 329 R, 329 P, 330, 333, 335, 348

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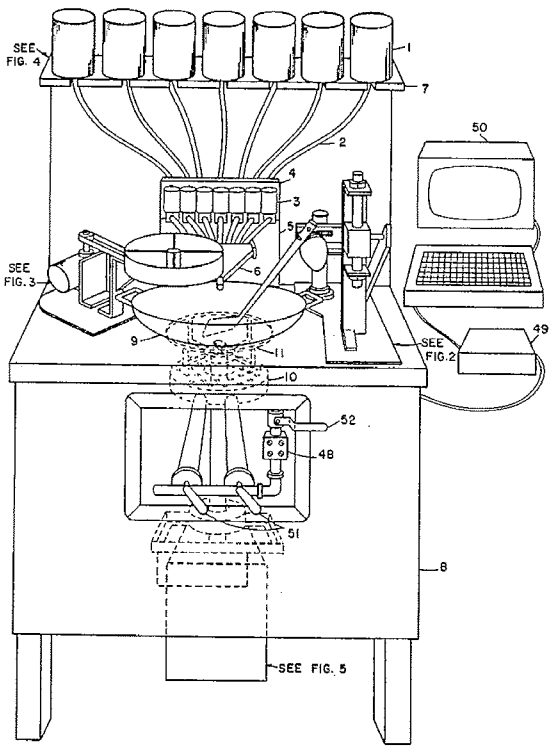
Primary Examiner—Jerry Smith
Assistant Examiner—John R. Lastova

[57] **ABSTRACT**

A method and apparatus by which an operator without Chinese cooking skills or knowledge can cook consistent, superior Chinese stir-fry dishes with higher productivity and with a wider repertoire of recipes than that of the traditional Chinese chef. This invention includes means for entering and storing recipe data in a computer control system, means for selecting a recipe from a displayed menu, and means for cooking the selected recipe automatically by the computer control system including addition of food and liquid ingredients at proper intervals, temperature control throughout the cooking process, stirring of the cooking food, and timing of the cooking process, all according to the recipe selected.

9 Claims, 9 Drawing Figures



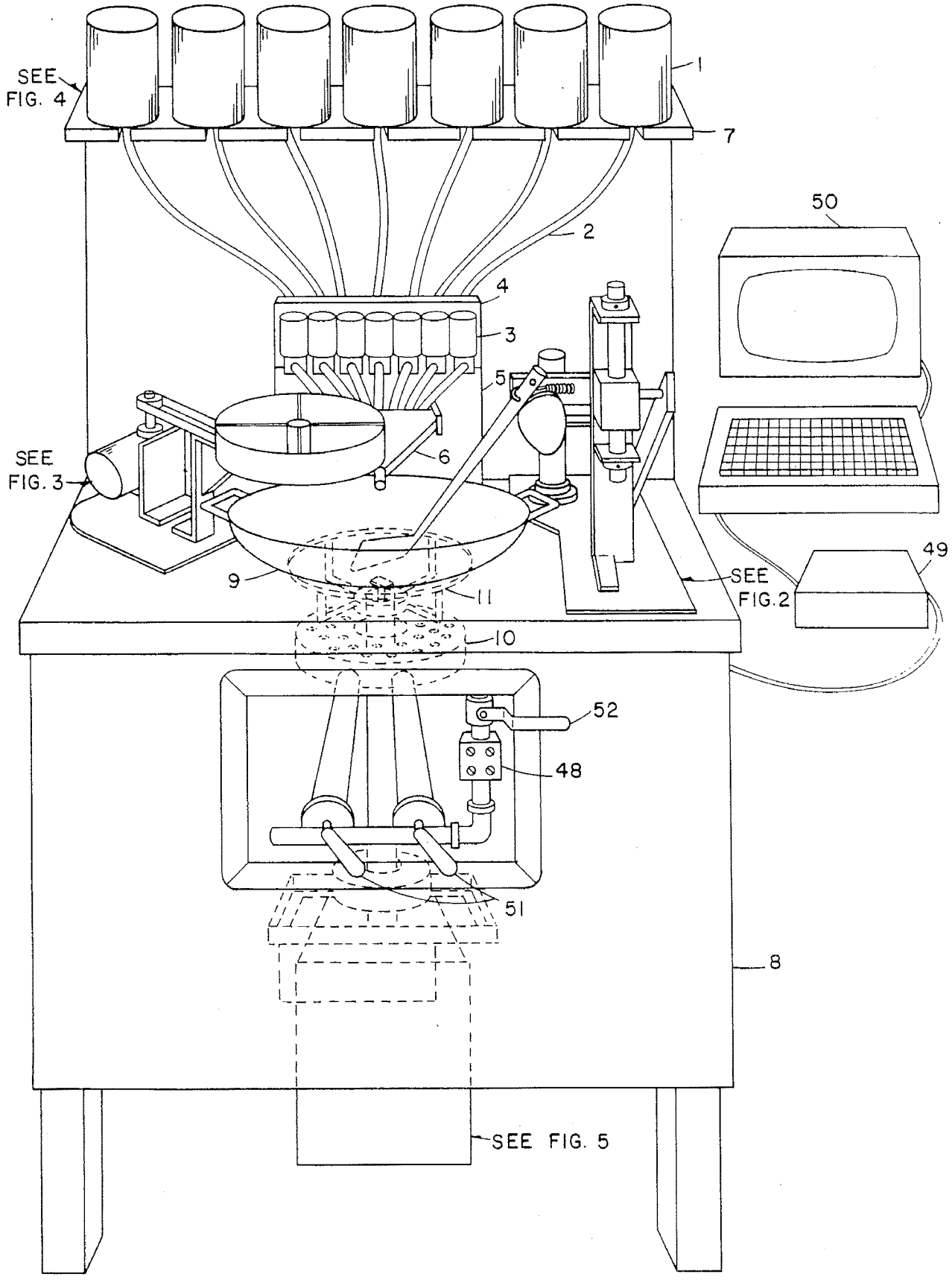

SEE FIG. 4
1
7
50
2
4
3
5
SEE FIG. 3
6
9
11
10
49
SEE FIG. 2
52
48
51
8
SEE FIG. 5

FIG. 1

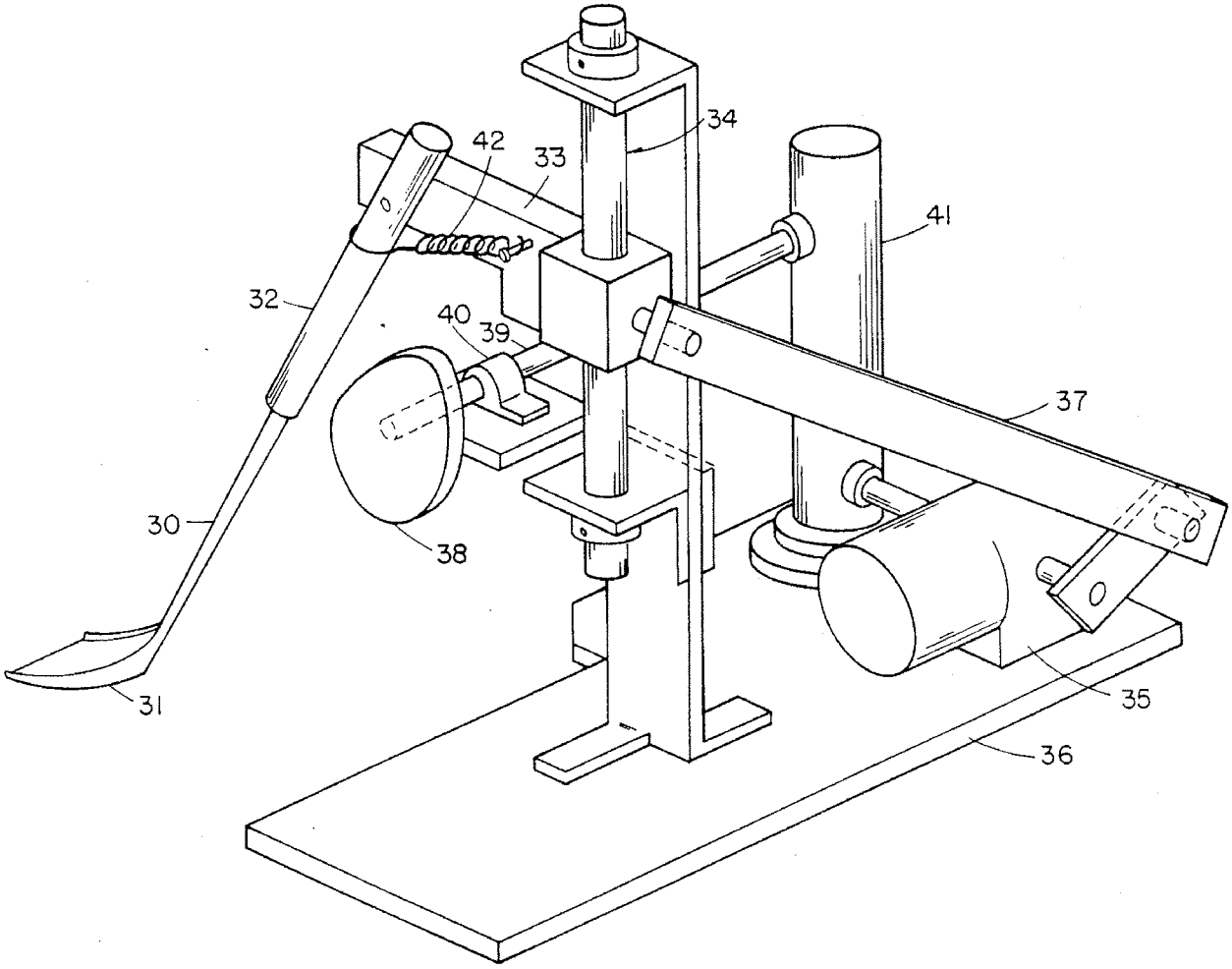


FIG. 2

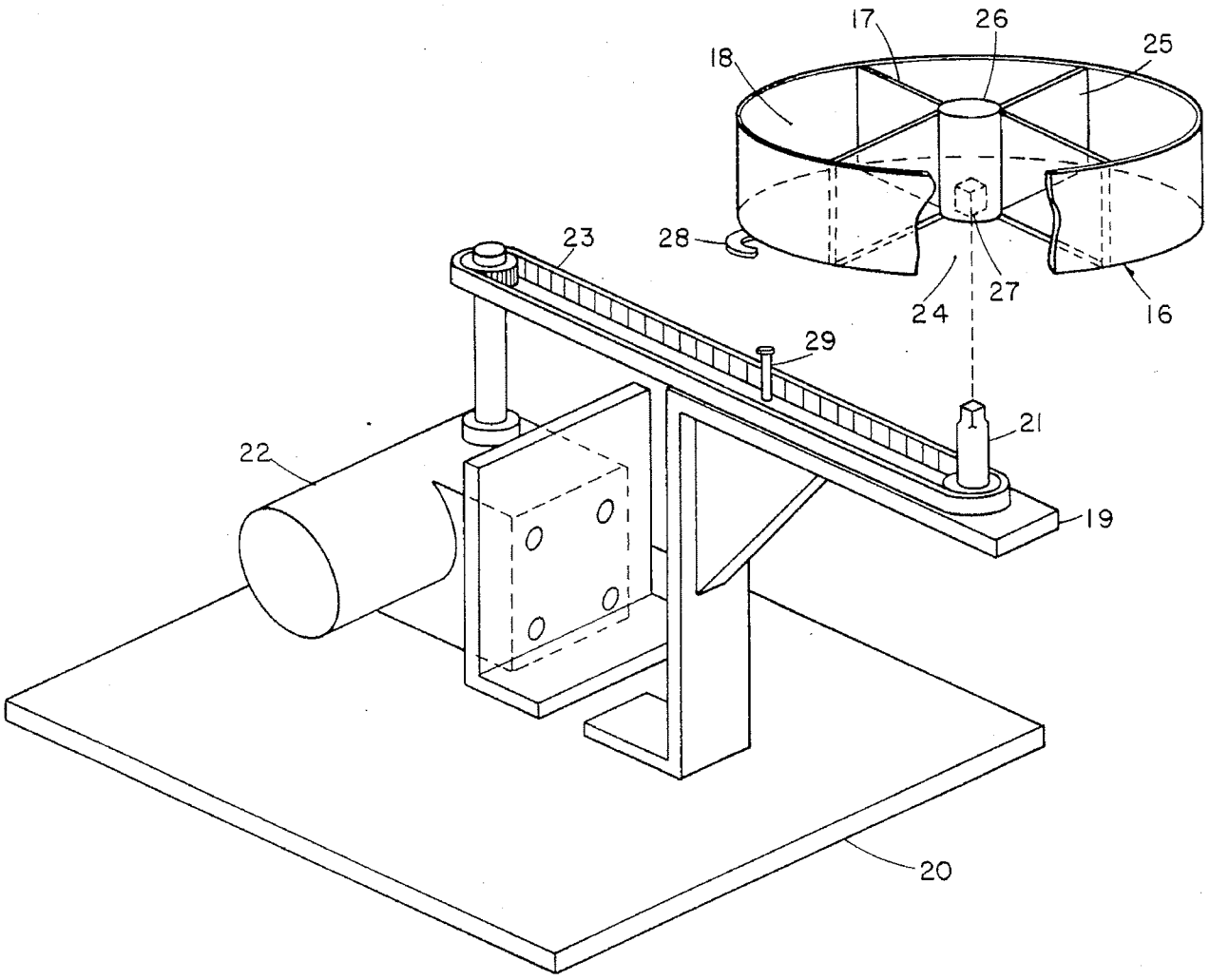


FIG. 3

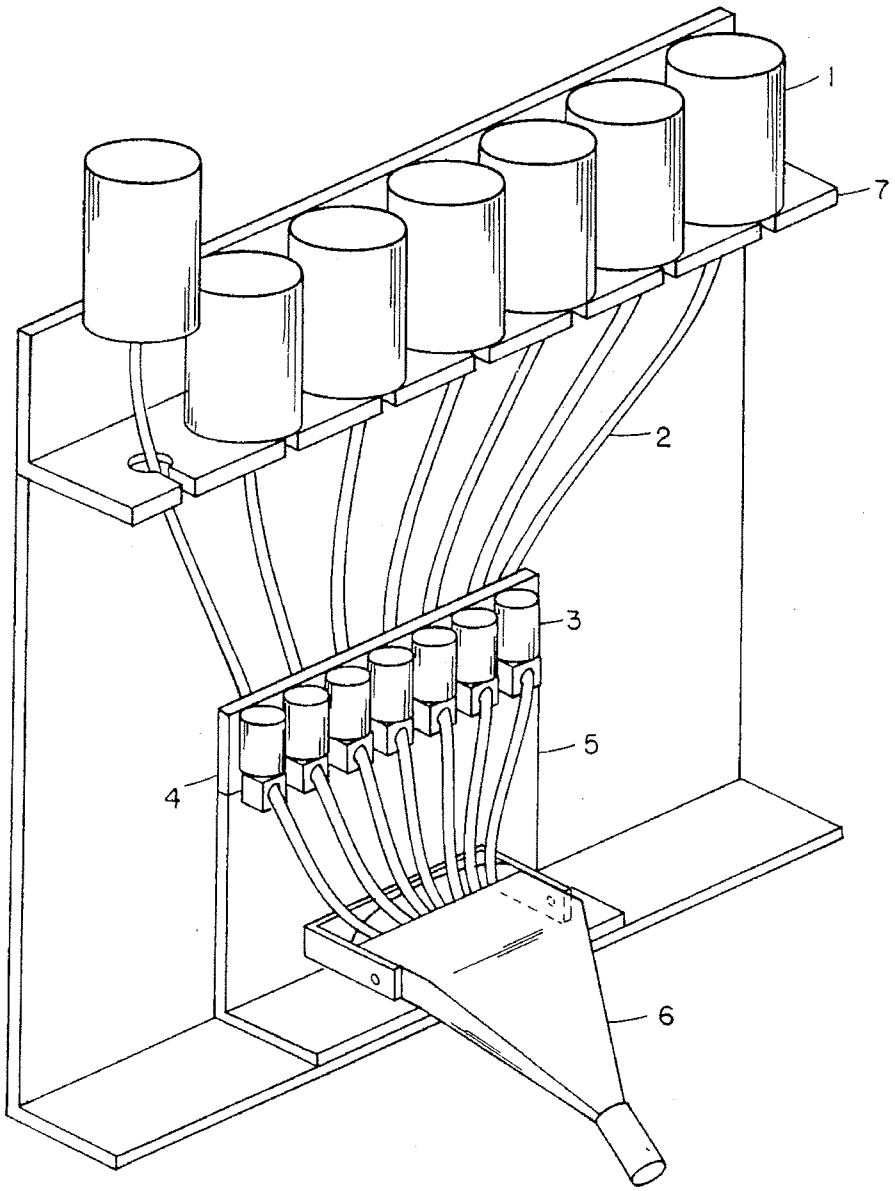


FIG. 4

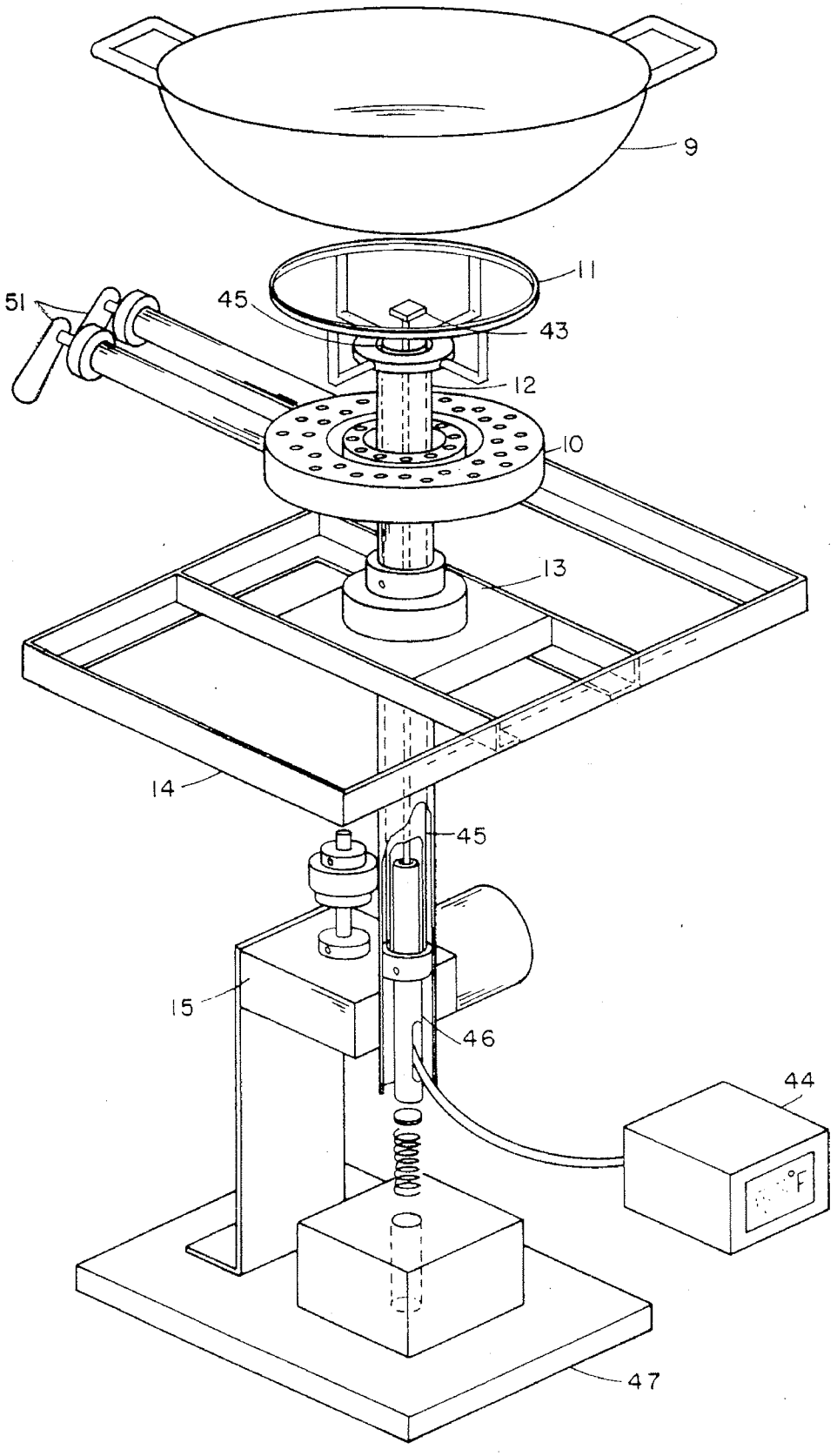


FIG. 5

RECIPE WORKSHEET

NAME OF RECIPE: CHICKEN WITH VEGETABLES

INITIAL COOKING TEMPERATURE: 350 °F

RECIPE

1	OIL	3 TBS	20
2	FOOD	30	
3	FOOD	30	
4	FOOD	15	
5	TEMP	325	
6	BROTH	4 TBS	30
7	SOY	1 TBS	0
8	SHERRY	1 TBS	0
9	STARCH	1 TBS	0
10	SESAME	2 TSP	0
11	OYSTER	2 TBS	30
12	END		
13			
14			
15			
16			
17			
18			
19			
20			

COMMENTS

add 1 TBS oil, heat 20 secs
add first food ingredient, chicken, cook 30 secs
add second food ingredient, bok choy; cook 15 secs
add third food ingredient, sugar peas, cook 15 secs
reduce temperature to 325°
add 4 TBS chicken broth, cook 30 secs
add 1 TBS soy sauce
add 1 TBS sherry
add 1 TBS liquid cornstarch
add 2 TSP sesame oil
add 2 TBS oyster sauce and cook 30 secs.
end of recipe

ABBREVIATIONS

FOOD - ADD FIRST OR NEXT FOOD INGREDIENT IN TRAY
BROTH - ADD CHICKEN BROTH
OIL - ADD COOKING OIL
OYSTER - ADD OYSTER SAUCE
SESAME - ADD SESAME OIL
SHERRY - ADD SHERRY
SOY - ADD SOY SAUCE
STARCH - ADD LIQUID CORN STARCH
TSP - TEASPOON
TBS - TABLESPOON
TEMP - RAISE OR LOWER COOKING TEMPERATURE
END - END OF RECIPE

FIG. 6

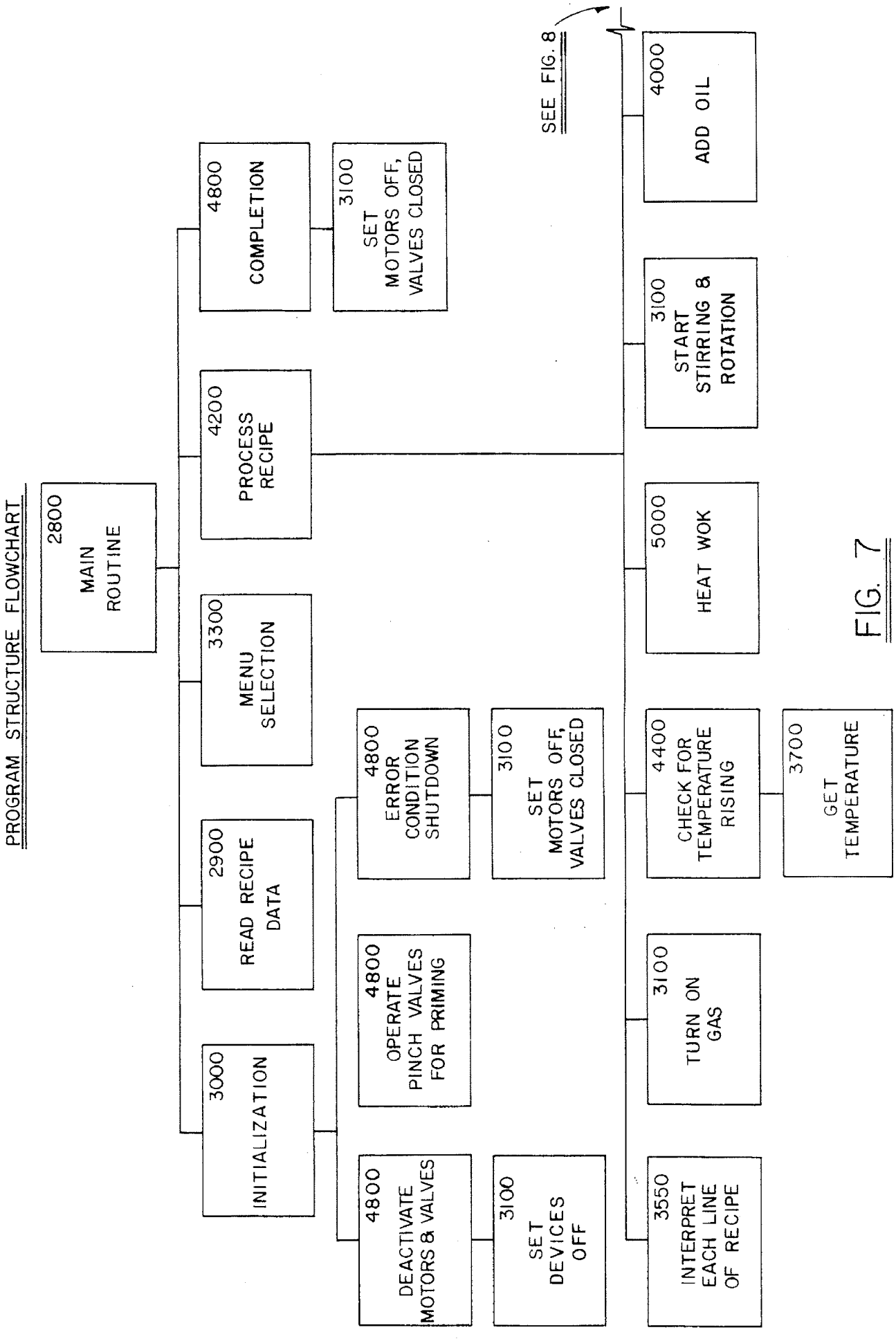

PROGRAM STRUCTURE FLOWCHART
2800 MAIN ROUTINE
3000 INITIALIZATION
2900 READ RECIPE DATA
3300 MENU SELECTION
4200 PROCESS RECIPE
4800 COMPLETION
3100 SET MOTORS OFF, VALVES CLOSED
4800 DEACTIVATE MOTORS & VALVES
3100 SET DEVICES OFF
4800 OPERATE PINCH VALVES FOR PRIMING
4800 ERROR CONDITION SHUTDOWN
3100 SET MOTORS OFF, VALVES CLOSED
SEE FIG. 8
3550 INTERPRET EACH LINE OF RECIPE
3100 TURN ON GAS
4400 CHECK FOR TEMPERATURE RISING
3700 GET TEMPERATURE
5000 HEAT WOK
3100 START STIRRING & ROTATION
4000 ADD OIL

FIG. 7

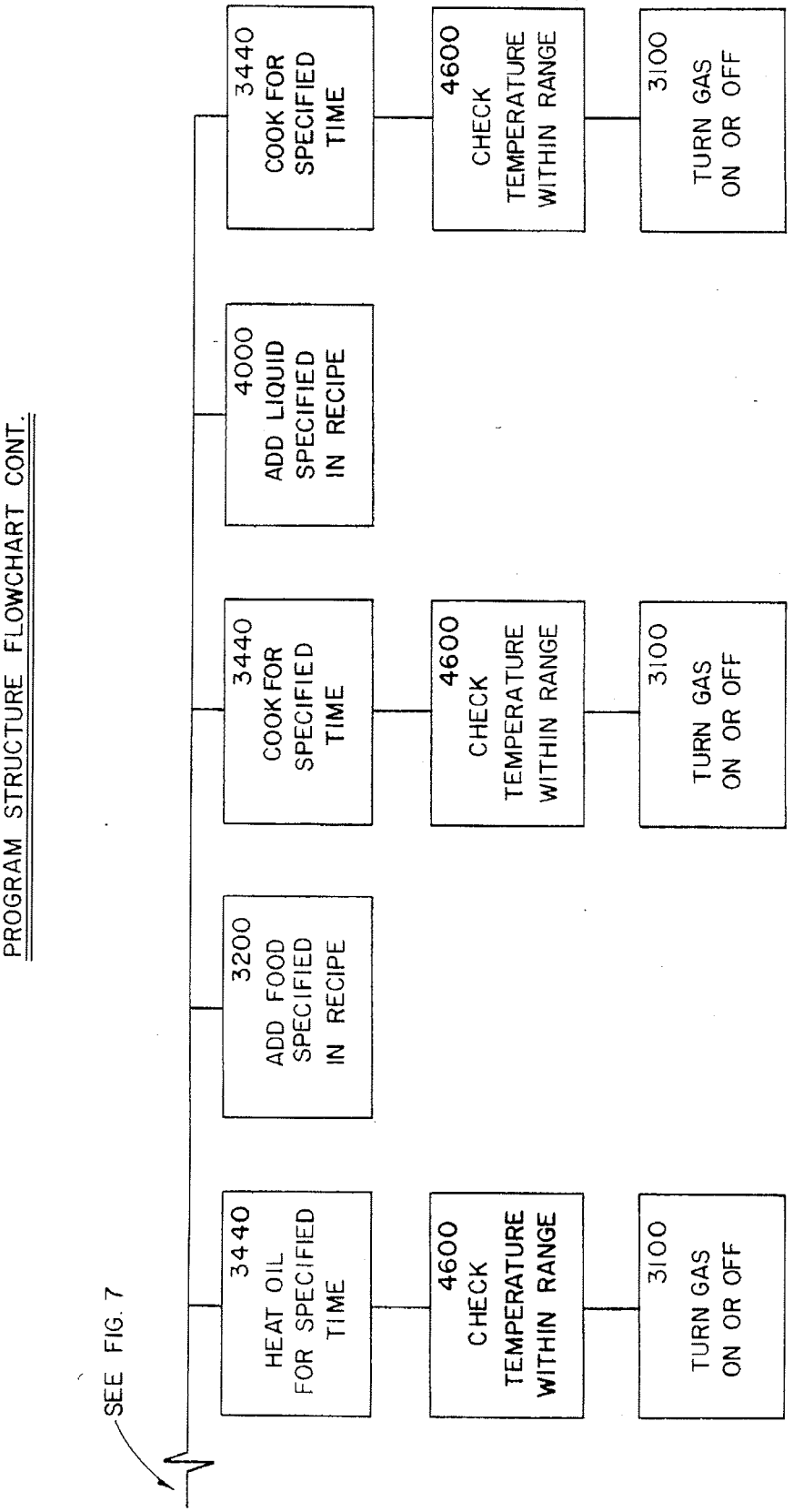

PROGRAM STRUCTURE FLOWCHART CONT.
SEE FIG. 7
3440
HEAT OIL FOR SPECIFIED TIME
4600
CHECK TEMPERATURE WITHIN RANGE
3100
TURN GAS ON OR OFF
3200
ADD FOOD SPECIFIED IN RECIPE
3440
COOK FOR SPECIFIED TIME
4600
CHECK TEMPERATURE WITHIN RANGE
3100
TURN GAS ON OR OFF
4000
ADD LIQUID SPECIFIED IN RECIPE
3440
COOK FOR SPECIFIED TIME
4600
CHECK TEMPERATURE WITHIN RANGE
3100
TURN GAS ON OR OFF

FIG. 8

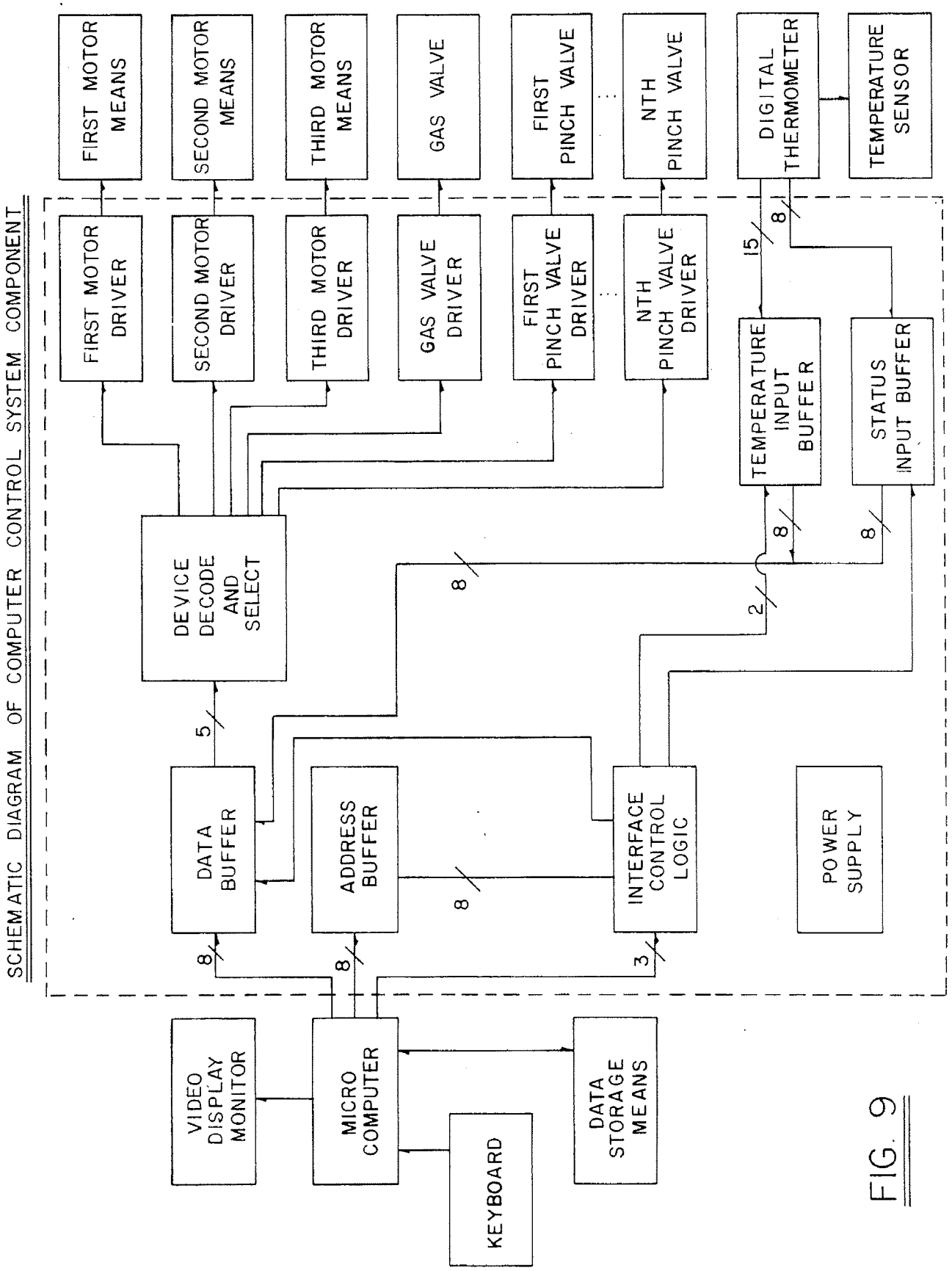

SCHEMATIC DIAGRAM OF COMPUTER CONTROL SYSTEM COMPONENT
FIRST MOTOR MEANS
SECOND MOTOR MEANS
THIRD MOTOR MEANS
GAS VALVE
FIRST PINCH VALVE
NTH PINCH VALVE
DIGITAL THERMOMETER
TEMPERATURE SENSOR
FIRST MOTOR DRIVER
SECOND MOTOR DRIVER
THIRD MOTOR DRIVER
GAS VALVE DRIVER
FIRST PINCH VALVE DRIVER
NTH PINCH VALVE DRIVER
TEMPERATURE INPUT BUFFER
STATUS INPUT BUFFER
DEVICE DECODE AND SELECT
DATA BUFFER
ADDRESS BUFFER
INTERFACE CONTROL LOGIC
POWER SUPPLY
VIDEO DISPLAY MONITOR
MICRO COMPUTER
KEYBOARD
DATA STORAGE MEANS
15
8
8
8
8
2
5
8
8
8
3

FIG. 9

METHOD AND APPARATUS FOR AUTOMATED CHINESE STIR-FRY COOKING

BACKGROUND OF THE INVENTION

This invention relates to Chinese cooking and specifically to a method and apparatus that a restaurant might use for automated Chinese stir-fry cooking which does not require the operator to possess knowledge or skills in the art of Chinese stir-fry cooking. This invention incorporates steps including entering and storing recipe data, selection of a recipe from a menu, addition of food and liquid ingredients at the proper intervals, temperature control throughout the cooking process, stirring of the cooking food, and timing of the cooking process, all performed automatically by a computer control system.

DESCRIPTION OF PRIOR ART

Chinese stir-fry cooking is the brisk cooking of small cuts of meats and vegetables in hot oil over intense heat, calling for split-second timing and swift movements in an uninterrupted rhythm. It is the most common method of cooking Chinese food and means literally "toss-cooked". Two elements are crucial to stir-frying. Firstly, thorough organization, in the sense that everything needed is within reach so no interruption will disturb the cooking once it starts; and secondly, vigilance from the chef who must be ready to measure and add ingredients, and adjust timing and volume of heat instantly. Each dish is allowed to cook for only one to four minutes. This cooking process requires considerable skill with the chef judging the progress of the dish by the smell, look and feel of the food and the sound of the cooking. Each order is cooked individually. At the completion of the cooking process, the chef scoops the cooked food onto a serving dish, cleans the cooking pan, and prepares to cook the next order. Because of the required knowledge and skill, many Chinese chefs begin their training at a young age and specialize in a regional style of cooking such as Cantonese or Szechwanese. Virtually all Chinese restaurants are operated by Chinese families who compete for the good chefs. J. B. Bakos, Editor of the trade magazine *Restaurant Business,* has written: "It is interesting to note that we have not seen the development of a Chinese restaurant chain". One reason for this is that a good Chinese restaurant is dependent on its chef, and a chef's span of control rarely exceeds one restaurant. Were there a way to capture and multiply the knowledge and the skills of a good Chinese chef, a whole new opportunity would be created for expansion in the Chinese restaurant industry.

BRIEF SUMMARY OF THE INVENTION

Accordingly, several objects of this invention are: (1) to provide a method and apparatus by which an operator without Chinese cooking skills or knowledge can cook consistent, superior Chinese stir-fry dishes, (2) to increase the level of productivity over that of even the skilled Chinese chef by allowing the operator of this invention to cook several dishes concurrently, (3) to provide for cooking a wider range of regional stir-fry dishes than is commonly found in the repertoire of the traditional Chinese chef, to include the styles of Canton, Hunan, Peking, Shanghai and Szechwan. Further objects and advantages of this invention will become apparent from a consideration of the drawings and descriptions which follow.

The method and apparatus of this invention include the following interrelated components:

(a) a Chinese stove with gas burner;

(b) a wok with means for rotation about its vertical axis during the cooking process; as used in this description and in the appended claims, the term "wok" means a bowl-shaped cooking pan;

(c) a food tray with a rotatable divider for holding and dispensing food ingredients into the wok in predetermined time sequences;

(d) a spatula with driving means for stirring and tossing the food as it cooks;

(e) a plurality of liquid dispensers for holding and dispensing liquid ingredients into the wok in predetermined quantities and in predetermined time sequences;

(f) a temperature measuring component for measuring the temperature of the wok throughout the cooking process;

(g) a gas valve for controlling a supply of gas to the gas burner;

(h) a computer control system for storing, displaying and processing recipe information, for activating and deactivating the means to rotate the wok, the means to drive the spatula, the means to rotate the rotatable divider of the food tray, for activating and deactivating the plurality of liquid dispensers, for activating and deactivating the gas valve, and for receiving temperature measurements from the temperature measuring component.

The method and apparatus of this invention performs the entire cooking process automatically. The operator selects a recipe from a displayed menu, mounts a corresponding food tray, and presses a "start" key. When the cooking is complete, the operator scoops the food onto a serving dish, replaces the wok and spatula with clean utensils, and is ready to repeat the process for the next order. The computer control system under program instructions heats the wok, adds and stirs the food, times the cooking, measures and adds liquid ingredients and regulates the heat, all according to the recipe selected. The computer control system accommodates a multiplicity of recipes each of which may be individually varied by the person preparing the recipes. New recipes may be added to the computer control system using a straightforward cookbook notation. Furthermore, by operating several of these inventions, a single operator may cook several orders concurrently.

BRIEF DESCRIPTION OF THE DRAWINGS

For an illustration of the construction and operation of the preferred embodiment, reference is made to the attached several views wherein identical reference numbers are utilized to refer to identical or equivalent components throughout the several views.

FIG. 1 is a front elevation view of the overall assembly.

FIG. 2 is a side elevation view of the spatula with driving means for stirring and tossing the food as it cooks.

FIG. 3 is a side elevation view of the food tray with rotatable divider for holding and dispensing food ingredients into the wok.

FI. 4 is a side elevation view of the plurality of liquid dispensers for holding and dispensing liquid ingredients into the wok.

FIG. 5 is a side elevation view of the wok with means for rotation about a vertical axis, and the temperature measuring component for measuring the temperature of the wok.

FIG. 6 is a "filled-out" recipe worksheet used for preparing a recipe to be entered into the computer control system.

FIG. 7 and FIG. 8 are program structure flowcharts illustrating the program logic of the computer control system.

FIG. 9 is a schematic diagram of the computer control system interface.

DESCRIPTION OF THE PREFERRED EMBODIMENT

For a description of the construction and utilization of this method and apparatus, reference is made to the attached drawings. This applicant has constructed, tested and extensively experimented with a fully operational prototype of this invention in his kitchen at home.

The construction of the apparatus begins with a conventional Chinese stove **8** of FIG. **1** as used in Chinese restaurants and a wok **9** of FIGS. **1** and **5**. In conventional usage of the Chinese stove, the wok is stationary over a gas burner **10**. A Chinese chef controls the heat by a manual gas valve **52**. The air and gas mixture to the gas burner is adjustable by two air/gas mixture valves **51**. In the apparatus of this invention the wok rests on a metal collar **11** rotatably supported over the gas burner. The collar is operably attached to the top of a vertical pipe **12**. The vertical pipe passes downward through the center of the gas buner **10**, and is rotatably supported beneath the gas burner by a ball bearing pillow block **13**. The ball bearing pillow block is operably mounted to the framework **14** of the Chinese stove. A first motor means **15**, operably coupled to the vertical pipe, rotates the vertical pipe thereby rotating the collar and the wok. The first motor means is activated and deactivated by signals from a computer control system to be subsequently described.

A food dispensing component illustrated in FIG. **3**, is comprised of a food tray **16**, a rotatable divider **17** which fits in the food tray and which partitions the food tray into a plurality of compartments **18**, a tray arm **19** which projects horizontally over the wok, a first base **20** which supports the tray arm, a tray spindle **21** rotatably mounted vertically on the tray arm over the wok, a second motor means **22** operably mounted on the first base, a first driving means **23** which operably couples the second motor means to the tray spindle. The food tray is comprised of a round pan with bottom means having a hole in the center thereof and a sector-shaped opening thereof **24**. The rotatable divider is comprised of a plurality of panels **25** which radiate outward from a hub **26**. A keyed mounting ring **27** is operably attached to the bottom of the hub. The tray spindle has a keyed tip matching the keyed mounting ring. The food tray containing the rotatable divider is removably mounted upright on the tray spindle by the operator with the tray spindle fitting through the hole in the bottom means of the food tray and into the keyed mounting ring on the bottom of the hub of the rotatable divider. The second motor means is activated by signals from the computer control system.

When activated, the second motor means rotates the first driving means to rotate the tray spindle thereby turning the rotatable divider. This rotation moves the food ingredients, in the compartment adjacent to the sector-shaped opening in the food tray, over the sector-shaped opening where, by gravity, the food ingredients fall into the wok. The amount of rotation is a predetermined quantity programmed in the computer control system. At the end of the predetermined rotation the computer control system deactivates the second motor means. This allows the food ingredients in each compartment to be dispensed into the wok in a predetermined sequence and in predetermined intervals by signals from the computer control system. A further detail of the food tray is a catch means **28** operably attached to the food tray which engages a stop means **29** operably attached to the tray arm when the food tray with rotatable divider is mounted on the tray spindle. This prevents the food tray from turning when the rotatable divider turns.

The components for stirring the food and liquid ingredients, illustrated in FIG. **2**, is comprised of a spatula **30** with a blade **31** and a handle **32**, a spatula arm **33**, a vertical reciprocating linear motion means **34**, a third motor means **35**, a second base **36** on which the third motor means is mounted, a second driving means **37** for coupling the third motor means to the vertical reciprocating linear motion means, a cam **38**, a rotatable cam rod **39**, a cam rod support means **40**, a third driving means **41** for coupling the cam to the third motor means. The spatula is removably connected pivotally at the handle to the spatula arm. The spatula arm is operably attached to the vertical reciprocating linear motion means. The vertical reciprocating linear motion means is operably coupled to the second driving means. The second driving means is operably coupled to the third motor means. This coupling converts the rotary motion of the third motor means to a vertical reciprocating linear motion of the spatula arm. On the downward motion of the spatula arm the blade of the spatula sweeps down the inside surface of the wok until reaching just past bottom center of the wok. The blade of the spatula is biased against the inside surface of the wok by a spring means **42** operably attached removably to the handle of the spatula and operably attached to the other end to the spatula arm. When the blade of the spatula reaches just past bottom center of the wok the movement of the spatula arm reverses direction and draws the blade of the spatula back to its initial position at the inside edge of the wok.

As the blade of the spatula is drawn back, the cam, positioned directly beneath the spatula handle, rotates to make contact with the spatula handle. On contact, the cam lifts the spatula up from the inside surface of the wok as the spatula is drawn back. With the wok rotating, the motion of the spatula blade stirs and tosses the food and liquid ingredients from all sides of the wok. Further details of the cam are as follows. The cam is operably mounted perpendicularly to the end of the cam rod. The cam rod is rotatably mounted operably to the cam rod support means. The cam rod is operably attached to the third driving means. The third driving means is operably coupled to the third motor means. The third driving means transmits a counterclockwise rotary motion of the third motor means to clockwise rotary motion of the cam. The motion of the cam is synchronized with the motion of the spatula arm since both the cam and the spatula arm are driven by the same third motor means. The third motor means is activated and deactivated by signals from the computer control system.

The liquid dispensing component illustrated in FIG. 4, is comprised of a plurality of identical liquid dispensers each comprised of a bulk container 1 to hold the liquid, a length of hose 2 operably attached to an outlet means on each bulk container, a pinch valve 3 installed on each length of hose so that the flow of liquid is controlled by the pinch valve; a horizontal rack to support the pinch valves 4, a funnel means 6, a third base 5 to support the horizontal rack and the funnel means, and a fourth base 7 to support the bulk containers. The individual pinch valves are electrically activated (to open) and deactivated (to close) by signals from the computer control system. The pinch valves are operably mounted on the horizontal rack which is operably mounted on the third base. The discharging ends of the hoses converge into the funnel means. The funnel means is mounted on the third base with the spout of the funnel means pointing into the wok. The bulk containers, holding liquid ingredients such as soy sauce, chicken broth, cooking oil and the like, are mounted on the fourth base which is operably attached to the back of the Chinese stove.

When a pinch valve is activated, gravity feed produces a flow of the respective liquid which passes downward through the respective hose through the funnel means and into the wok. The length of time a pinch valve is opened is calculated by the computer control system to dispense a desired quantity of the respective liquid. Through extensive experimentation mathematical equations for flow rates for each liquid have been derived and programmed into the computer control system. These equations allow a recipe specification of one teaspoon of soy sauce, for example, to be converted to a time interval for which the respective pinch valve is to remain open in order to dispense one teaspoon of soy sauce. These equations are shown in lines 4070–4130 of the computer program listing which is subsequently presented. Although gravity feed is employed in this applicant's prototype, it is apparent that pressurization of the liquid containers could be used to increase the flow rates. It is also apparent that food-grade micropumps and corresponding control means could be substituted for the pinch valves to meter precise quantities of the various liquids.

The temperature measuring component, illustrated in FIG. 5, is comprised of a temperature sensor 43 for sensing the temperature of the wok, a digital thermometer 44 with BCD output for converting electrical signals from the temperature sensor to temperature measurements for input to the computer control system, a thermocouple protection tube 45, a sensor support means 46 for supporting the temperature sensor and thermocouple protection tube, and a fifth base 47 for supporting the sensor support means. The thermocouple protection tube is positioned inside the vertical pipe 12. The temperature sensor fits inside the thermocouple protection tube thereby insulating the temperature sensor from the vertical pipe in the region around the intense heat of the gas burner. The temperature sensor and the thermocouple protection tube are operably attached to the sensor support means. The tip of the temperature sensor extends upward through the thermocouple protection tube to touch the bottom surface of the wok. Electrical leads of the temperature sensor extend downward through the thermocouple protection tube and into the sensor support means. The electrical leads emerge from the sensor support means and travel beneath the Chinese stove to the digital thermometer located near the computer control system. The sensor support means fits into a hole in the fifth base. A spring means 42 in the hole of the fifth base biases the sensor support means upwardly thereby biasing the tip of the temperature sensor against the bottom of the wok.

The gas valve component is comprised of a gas valve 48 of FIG. 1, electrically operated, operably installed in the gas burner supply line of the Chinese stove downstream of the supply branch to the pilot light. The gas valve is activated (to open) and deactivated (to close) by signals from the computer control system. In the deactivated position only the pilot light is on. In the activated position a full flow of gas is supplied to the gas burner from the supply source. As a matter of safety, when the computer control system activates the gas valve the computer control system checks for an immediate increase in temperature of the wok. If this temperature increase does not occur within a few seconds the computer control system deactivates the gas valve and displays a message to the operator to check the pilot light.

The computer control system component is comprised of a general purpose digital microcomputer system 50 with a minimum of 16000 bytes of memory, a programming language BASIC, a video display monitor, a data storage means, a data entry keyboard, an electronic interface 49 which by computer generated signals activates and deactivates the means to rotate the wok, the means to drive the spatula, the means to rotate the rotatable divider of the food tray, activates and deactivates the plurality of liquid dispensers, activates and deactivates the gas valve, and receives the temperature measurements from the digital thermometer. A schematic diagram of the electronic interface is shown in FIG. 9. The numbers with slashes on the lines connecting the components in the diagram indicate the number of wires connecting those components. When no number is given one wire may be assumed.

Activation and deactivation of the respective first, second and third motor means, the gas valve and the plurality of pinch valves is achieved by a program instruction in BASIC: "OUT, port, value". This instruction outputs a byte value to a specified computer port and generates a write command. The byte value contains an address of the device to be selected and a bit pattern which indicates whether the device is to be activated or deactivated. When the computer control system interface receives a write command and a valid address from the computer, it decodes the address and routes the 5 low-order bits on the computer data bus to the device decode and select logic. The device decode and select logic decodes the 5 low-order bits and activates or deactivates the selected device. Temperature measurements of the wok are input to the computer control system by a program instruction in BASIC: "INP, port". This instruction inputs a byte value from the specified computer port and generates a read command. Four of these instructions are utilized under program instructions to input a temperature measurement. The first and second INP instructions input a status indicator from the digital thermometer. When the status indicator shows that the temperature measurement is latched on the computer data bus, the third and fourth INP instructions input the low and high order bits of the 15 bit temperature measurement. When the computer control system interface receives a read command and a valid address from the computer, it decodes the address and then reads the temperature status or the tempera-

ture measurement respectively from the digital thermometer.

The computer control system is further comprised of program instructions to store and process recipe data, to display a menu to the operator, to accept a selection from the menu, and to activate and deactivate the above components to cook the menu selection. The computer control system interface is constructed using conventional techniques for digital circuit logic and commercially available components. A program structure flowchart is shown in FIGS. 7 and 8. The number in the upper right corner of each box refers to the beginning line number in the computer program for the respective subroutine. Following is the source listing of the entire computer program according to this invention.

```
1  DATA 12
2  'ENTER THE TOTAL NUMBER OF RECIPES ON THE ABOVE LINE
5  ' ********
10 DATA CHICKEN WITH VEGETABLES
15 DATA 350
20 DATA OIL  3 TBS  20
25 DATA FOOD        30
30 DATA FOOD        15
35 DATA FOOD        15
40 DATA TEMP  325
45 DATA BROTH  4 TBS 30
50 DATA SOY    1 TBS  0
55 DATA SHERRY 1 TBS  0
60 DATA STARCH 1 TBS  0
65 DATA SESAME 2 TSP  0
70 DATA OYSTER 2 TBS 30
75 DATA END
78 ' ********
80 DATA GREEN ONION BEEF
85 DATA 350
90 DATA OIL  3 TBS  20
95 DATA FOOD        45
100 DATA FOOD       30
105 DATA SHERRY 1 TSP 0
110 DATA SOY    1 TSP 30
115 DATA END
120 ' ********
125 DATA PORK WITH VEGETABLES
130 DATA 350
135 DATA OIL  3 TBS  20
140 DATA FOOD        60
145 DATA FOOD         0
150 DATA SHERRY 1 TBS 60
155 DATA BROTH  4 TBS 15
160 DATA STARCH 1 TBS 10
165 DATA FOOD         0
170 DATA SOY    1 TBS 60
175 DATA END
180 ' ********
185 DATA PORK IN HOT BEAN SAUCE
190 DATA 350
195 DATA OIL  3 TBS  20
200 DATA FOOD   30
205 DATA TEMP  325   80
210 DATA FOOD   10
215 DATA SHERRY 1 TBS 0
220 DATA SOY    2 TSP 0
225 DATA SESAME 2 TSP 0
230 DATA TEMP  350   30
235 DATA END
240 ' ********
245 DATA KING'S CHICKEN
250 DATA 350
255 DATA OIL  2 TBS  20
260 DATA FOOD   40
265 DATA FOOD   60
270 DATA BROTH 4 TBS 60
275 DATA END
```

```
280 ' ********
285 DATA MO-SHU PORK
290 DATA 350
295 DATA OIL  3 TBS  20
300 DATA FOOD    30
305 DATA FOOD    60
310 DATA BROTH  5 TBS 90
315 DATA SHERRY 2 TSP  0
320 DATA SOY    2 TSP 30
325 DATA FOOD    30
330 DATA SESAME 1 TSP 10
335 DATA END
340 ' ********
345 DATA DUCK WITH GINGER AND PEPPERS
350 DATA 350
355 DATA OIL  4 TBS  20
360 DATA FOOD  60
365 DATA SHERRY  2 TBS  0
370 DATA SOY  2 TBS  20
375 DATA BROTH 16 TBS 60
380 DATA END
385 ' ********
390 DATA CHICKEN WITH ORANGE PEEL
395 DATA 350
400 DATA OIL  2 TBS  20
405 DATA FOOD    0
410 DATA SESAME  2 TSP  60
415 DATA TEMP 325   0
420 DATA FOOD   0
425 DATA SHERRY  1 TSP  0
430 DATA SOY  1 TBS  60
435 DATA TEMP 350   20
440 DATA END
445 ' ********
450 DATA KUNG PAO CHICKEN
455 DATA 350
460 DATA OIL  3 TBS  20
465 DATA FOOD  30
470 DATA FOOD  40
475 DATA SESAME  1 TSP 20
480 DATA END
485 ' ********
490 DATA HARVEST PORK
495 DATA 350
500 DATA OIL  3 TBS  20
505 DATA FOOD   30
510 DATA FOOD   60
515 DATA BROTH  8 TBS 0
520 DATA SOY  2 TBS 0
525 DATA STARCH 1.5 TBS 20
530 DATA END
535 ' ********
540 DATA BEEF WITH CARROTS AND BOK CHOY
545 DATA 350
550 DATA OIL  3 TBS 20
555 DATA FOOD  30
560 DATA FOOD  60
565 DATA FOOD   0
570 DATA SHERRY 1 TBS 30
575 DATA SESAME 2 TSP 20
580 DATA END
585 ' ********
590 DATA PORK WITH PEKING SAUCE
595 DATA 350
600 DATA OIL  4 TBS  20
605 DATA FOOD  60
```

```
610 DATA SHERRY  2 TSP 0
615 DATA SOY  2 TSP   30
620 DATA END
625 ' ********
2800 ' MAIN SUBROUTINE
2810 CLEAR 300
2820 GOSUB 3000  'INITIALIZATION
2830 GOSUB 2900  'READ RECIPE DATA
2840 GOSUB 3300  'DISPLAY MENU & ACCEPT SELECTION
2850 GOSUB 4200  'PROCESS SELECTED RECIPE
2855 MF=0
2860 GOSUB 4800  'COMPLETION - TURN OFF MOTORS & GAS
2870 GOTO 2840
2880 END
2900 ' SUBROUTINE TO READ RECIPE DATA
2905 READ NR  'TOTAL # OF RECIPES
2910 DIM RM$(NR,12), RT$(NR), TT$(NR)  'SET UP TABLES
2920 FOR I = 1 TO NR  'FOR EACH RECIPE
2930 READ RT$(I)  'RECIPE NAME
2940 READ TT$(I)  'INITIAL TEMPERATURE
2950 J = 1        'SEQ #
2960 READ RM$(I,J)  'INGREDIENT LINE
2970 IF LEFT$(RM$(I,J),3) <> "END" THEN J=J+1: GOTO 2960
2980 NEXT I  'END OF THIS RECIPE
2990 RETURN
3000 ' SUBROUTINE TO INITIALIZE SYSTEM
3005 TI% = 0  'DEFINED TO BE FIRST IN VARIABLE TABLE SINCE
3010 TC% = 0  'TIMING IS CRITICAL. USED IN TIMING LOOP.
3020 M% = 0   'PORT VALUE
3024 N% = 0   'PORT VALUE
3028 P% = 128 'PORT INDEX
3034 MF = 1: GOSUB 4800  'INITIALIZE MOTORS & VALVES
3036 FG = 0
3038 DIM F1$(4)  'TABLE OF 4 VALUES FROM INGREDIENT LINE
3040 PRINT "TYPE Y TO PRIME LIQUID DISPENSERS"
3042 PRINT "TYPE N TO SKIP THIS STEP"
3044 E$ = INKEY$
3046 IF E$ = "" THEN GOTO 3044
3048 IF E$ = "N" THEN GOTO 3070
3050 A2 = 3: A3$ = "TBS"
3051 P$ = "OIL": AMT=A2: U$=A3$: GOSUB 4000  'CYCLE THROUGH
3052 P$ = "SOY": AMT=A2: U$=A3$: GOSUB 4000  'PINCH VALVES
3054 P$ = "BROTH": AMT=A2: U$=A3$: GOSUB 4000  'TO PRIME
3056 P$ = "SHERRY": AMT=A2: U$=A3$: GOSUB 4000
3058 P$ = "STARCH": AMT=A2: U$=A3$: GOSUB 4000
3060 P$ = "SESAME": AMT=A2: U$=A3$: GOSUB 4000
3062 P$ = "OYSTER": AMT=A2: U$=A3$: GOSUB 4000
3070 PRINT "ENTER ROOM TEMPERATURE OF COOKING OIL"
3075 INPUT OT
3080 IF OT < 50 OR OT > 120 THEN PRINT "OUT OF RANGE, REENTER": GOTO 3075
3090 CLS
3092 PRINT "GETTING RECIPE DATA; ONE MOMENT PLEASE"
3095 RETURN
3097 MF = 2: GOSUB 4800: STOP  'SHUTDOWN
3100  ' SUBROUTINE TO TURN ON OR OFF THE GAS VALVE AND  STIR/ROT
ATE MOTORS. PRIOR TO CALLING, SET M$ = "STIR-ON", "STIR-OFF", "
ROTATE-ON", "ROTATE-OFF",                "GAS-ON" OR "GAS-OFF".
3105  IF FG=1 THEN PRINT "BEGIN "; M$
3110  I=0
3120  IF M$ = "GAS-ON" THEN I = 16: GAS$ = "ON"
3125  IF M$ = "GAS-OFF" THEN I = 0: GAS$ = "OFF"
3130  IF M$ = "STIR-ON" THEN I = 22
3135  IF M$ = "STIR-OFF" THEN I = 6
3140  IF M$ = "ROTATE-ON" THEN I = 21
3145  IF M$ = "ROTATE-OFF" THEN I = 5
3150  OUT P%,I
```

```
3160  IF FG>1 THEN PRINT "END "; M$
3170  M$ = ""
3180  RETURN
3199  '
3200  ' SUBROUTINE FOR TURNING FOOD TRAY. NO PARAMETERS REQ'D.
3205  IF FG=1 THEN PRINT "TURN FOOD TRAY"
3210 TC% = 2000 ' LOOP COUNTER
3215 M% = 23: N% = 7
3220 OUT P%,M%
3230 FOR TI% = 1 TO TC%: NEXT TI%
3240 OUT P%,N%
3250 OUT P%,N%
3260  IF FG>1 THEN PRINT "END TURN FOOD TRAY"
3270  RETURN
3299  '
3300 ' SUBROUTINE TO DISPLAY MENU AND ACCEPT SELECTION
3303 CLS
3306 PRINT "ENTER RECIPE # OR  M  FOR MENU,  PRESS ENTER"
3309 INPUT R$
3312 IF R$ = "M" THEN GOTO 3320
3315 IF VAL(R$) > 0 AND VAL(R$) <= NR THEN R = VAL(R$):  GOTO 3375

3318 GOTO 3303
3320 NN = 1   'RECIPE # POINTER
3321 LC = 1   'LINE CT
3324 PRINT NN; TAB(3); RT$(NN)
3327 IF LC=10 OR NN=NR THEN GOTO 3348    'FULL SCREEN OR END
3330 NN=NN+1: LC=LC+1
3333 GOTO 3324
3348 PRINT
3351 PRINT "ENTER RECIPE #  OR  TYPE  C  TO CONTINUE MENU,"
3354 PRINT "OR TYPE  B  TO DISPLAY MENU FROM BEGINNING."
3357 INPUT R$
3360 IF R$ = "B" THEN CLS: GOTO 3320
3363 IF VAL(R$) > 0  AND VAL(R$) <= NR THEN R = VAL(R$):    GOTO 3375

3366 IF R$ = "C" AND NN = NR THEN PRINT "NO MORE RECIPES": GOTO 3351

3369 IF R$ = "C" THEN CLS: NN = NN+1: GOTO 3321
3375 CLS
3380 PRINT "RECIPE "; R; " "; RT$(R)
3381 PRINT
3382 PRINT "TYPE  Y  TO CONFIRM SELECTION,  OR"
3383 PRINT "TYPE  N  TO REENTER RECIPE #"
3385 X$ = INKEY$
3387 IF X$ = "" THEN GOTO 3385
3388 IF X$ = "N" THEN GOTO 3303
3390 CLS
3392 PRINT "RECIPE "; R; " "; RT$(R)
3394 PRINT "WOK HEATING"
3396 RETURN
3440 ' SUBROUTINE TO TIME COOKING.  SET TIME = # OF SECONDS.
3445 IF TIME = 0 THEN RETURN
3450 T1=1
3455 TIME = INT((TIME/1.5) + .5)
3460  GOSUB 4600  'CHECK TEMP WITHIN RANGE
3465 IF T1 < TIME THEN T1=T1+1: GOTO 3460
3470 RETURN
3550 ' SUBROUTINE TO PARSE INGREDIENT LINES.       VALUES A
RE PUT IN F1$(I).
3555 FOR I = 1 TO 4   'CLEAR
3560  F1$(I) = "": NEXT I
3570 P = 1   'PTR TO 1ST NONBLANK CHAR IN LINE
3580 FOR I = 1 TO 4
3590 IF MID$(SB$,P,1) <> " " THEN GOTO 3610
3600 IF P = LEN(SB$) THEN RETURN ELSE P=P+1: GOTO 3590
```

```
3610 N = P + 1  'PTR TO 1ST BLANK CHAR
3620 IF MID$(SB$,N,1) = " " OR N >= LEN(SB$) THEN GOTO 3640
3630 N = N+1: GOTO 3620
3640 IF N = LEN(SB$) THEN F1$(I) = MID$(SB$,P,N-P+1) ELSE  F1$(
I) = MID$(SB$,P,N-P)
3650 IF N >= 17 THEN RETURN ELSE P=N+1
3660 NEXT I
3670 RETURN
3699  '
3700 ' SUBROUTINE TO READ TEMPERATURE INPUT IN BCD AND STORE IN CTEMP
.
3705  IF FG=1 THEN PRINT "READ TEMPERATURE"
3710  F=0: L=0: H=0: M=0: CTEMP=0
3730  F = INP(130)  'INPUT FROM PORT 130
3740  IF (F AND 1) =0 THEN GOTO 3730  ' WAIT TIL SIGNAL IS 1
3750  F = INP(130)
3760  IF (F AND 1) = 1 THEN GOTO 3750 ' THEN AS SOON AS SIGNAL
                       GOES 0 (LOW), READ
3770  L = INP(128)
3780  H = INP(129)
3790  M = ((H AND 16)/16) * 1000
3800  M = M + (H AND 15) * 100
3810  M = M + ((L AND 240)/16) * 10
3820  CTEMP = M + (L AND 15)
3830  IF FG>1 THEN PRINT "END READ TEMP"
3840  RETURN
3999  '
4000  'SUBR TO OPERATE PINCH VALVES FOR SPECIFIED INGREDIENT AND AMOUNT
. PRIOR TO CALLING SET P$, AMT AND U$   E.G.  P$ = "OIL":  AMT = 2:  U$
 = "TBS": GOSUB 4000
4020  IF AMT=0 OR AMT > 16 THEN PRINT "ERROR IN PV AMT, AMT = " ; AMT: GO
TO 3097
4040  IF U$ = "TSP" THEN X = AMT : GOTO 4070
4050  IF U$ = "TBS" THEN X = AMT * 3 : GOTO 4070
4065  PRINT "ERROR IN PV UNITS, U$ = "; U$: GOTO 3097
4070  IF P$ = "OIL" THEN Y = INT(550*X*(1.867-.01333*OT)):  I = 27 :
 GOTO 4140
4080 IF P$ = "SOY" THEN Y = INT(78*X+40): I=28: GOTO 4140
4090  IF P$ = "BROTH" THEN Y = INT(62*X+60): I=24: GOTO 4140
4100  IF P$ = "SHERRY" THEN Y = INT(65*X+30): I=26: GOTO 4140
4110  IF P$ = "STARCH" THEN Y = INT(205*X): I=29: GOTO 4140
4120  IF P$ = "SESAME" THEN Y = INT(440*X+30): I=25: GOTO 4140
4130  IF P$ = "OYSTER" THEN Y = INT(270*X): I=30: GOTO 4140
4135  PRINT "ERROR IN PV INGREDIENT, P$ = "; P$: GOTO 3097
4140 M% = I: N% = I-16
4150 TC% = Y
4155 OUT P%,M%
4160 FOR TI% = 1 TO TC%: NEXT TI%
4165 OUT P%,N%
4170 P$ = "": AMT = 0: U$ = ""
4180  RETURN
4200 ' SUBROUTINE TO PROCESS RECIPE SELECTED.  INTERPRETS EACH INGREDIE
NT LINE AND PERFORMS OPERATIONS.
4205 SL = 1  'SEQUENCE LINE #
4210 SB$ = RM$(R,SL)  'PUT SEQ LINE IN BUFFER
4215 GOSUB 3550  'PARSE
4220 IF F1$(1) = "OIL" THEN GOTO 4225 ELSE GOTO 4270
4225  TEMP = VAL(TT$(R))  'INITIAL TEMP
4228  M$ = "GAS-ON": GOSUB 3100  'TURN ON GAS
4230  GOSUB 4400  'CHECK FOR RISING TEMP
4235  IF T$ <> "RISING" THEN PRINT "CHECK PILOT LIGHT":GOTO3097
4240  GOSUB 5000  'HEAT WOK TO TEMP
4245  M$ = "ROTATE-ON": GOSUB 3100  ' START ROTATION OF WOK
4250  M$ = "STIR-ON":   GOSUB 3100  ' START STIRRING
4255  P$ = "OIL": AMT = VAL(F1$(2)): U$ = F1$(3): GOSUB 4000
4260  TIME = VAL(F1$(4)): GOSUB 3440  'HEAT OIL
```

```
4265  SL = SL+1: SB$ = "": GOTO 4210  'GET NEXT SEQ LINE
4270 IF F1$(1) = "FOOD" THEN GOTO 4275 ELSE GOTO 4290
4275  GOSUB 3200  'TURN FOOD TRAY
4280  TIME = VAL(F1$(2)): GOSUB 3440  'COOK
4285  SL = SL+1: SB$ = "": GOTO 4210  'GET NEXT SEQ LINE
4290 IF F1$(1) = "TEMP" THEN GOTO 4295 ELSE GOTO 4310
4295  TEMP = VAL(F1$(2))
4300  TIME = VAL(F1$(3)): GOSUB 3440  'COOK
4305  SL = SL+1: SB$ = "": GOTO 4210  'GET NEXT SEQ LINE
4310 IF F1$(1) = "END" THEN RETURN  'END OF RECIPE
4320 IF F1$(1) = "BROTH" THEN GOTO 4360
4322 IF F1$(1) = "SOY"   THEN GOTO 4360
4324 IF F1$(1) = "SHERRY" THEN GOTO 4360
4326 IF F1$(1) = "STARCH" THEN GOTO 4360
4328 IF F1$(1) = "SESAME" THEN GOTO 4360
4330 IF F1$(1) = "OYSTER" THEN GOTO 4360
4340 PRINT "ERROR IN INGREDIENT, INGRED = "; F1$(1): GOTO 3097
4360  F$=F1$(1): AMT=VAL(F1$(2)): U$=F1$(3)
4362  GOSUB 4000
4365 TIME = VAL(F1$(4)): GOSUB 3440  'COOK
4370 SL = SL+1: SB$ = "": GOTO 4210
4399  '
4400  ' SUBROUTINE TO CHECK FOR CHANGING TEMPERATURE. ROUTINE SETS T$
= "RISING" OR "FALLING" DEPENDING ON CHANGE   IN A 4 SECOND PERIOD.
4410  IF FG=1 THEN PRINT "CHECK RISING/FALLING TEMP"
4430  Q1=0: Q2=0
4440  GOSUB 3700   ' GET TEMP
4450  Q1 = CTEMP
4460  FOR I = 1 TO 3000
4470  NEXT I
4480  GOSUB 3700   ' GET TEMP
4490  Q2 = CTEMP
4500  IF Q2 > Q1 + 1 THEN T$ = "RISING" ELSE T$ = ""
4520 IF FG > 1 THEN PRINT "END RISING CHECK. TEMP "; T$
4530  RETURN
4599  '
4600  ' SUBROUTINE TO CHECK TEMP WITHIN SPECIFIED RANGE.  PRIOR TO
 CALLING, SET TEMP = # DEGS.
4610 GOSUB 3700  ' GET TEMPERATURE (CTEMP)
4620 IF FG=1 THEN PRINT "DESIRED ";TEMP; "PRESENT ";CTEMP
4630 IF CTEMP < .97 * TEMP THEN GOTO 4675
4640 IF CTEMP < 1.03 * TEMP  THEN RETURN  'NOT TOO HOT
4645 IF GAS$ = "OFF" THEN RETURN  'TOO HOT, BUT GAS IS OFF
4650 M$ = "GAS-OFF"
4660 GOSUB 3100
4670 RETURN
4675 IF GAS$ = "ON" THEN RETURN  'TOO LOW, BUT GAS IS ON
4680 M$ = "GAS-ON"
4685 GOSUB 3100
4710 RETURN
4799  '
4800 ' SUBROUTINE TO TURN OFF MOTORS & CLOSE VALVES.  THIS IS DONE FOR
INITIALIZATION, COMPLETION OR ON ERROR COND.
4810  IF FG>1 THEN PRINT "SHUTDOWN"
4820  M$ = "GAS-OFF"
4830  GOSUB 3100
4840  M$ = "STIR-OFF"
4850  GOSUB 3100
4855  M$ = "ROTATE-OFF"
4860  GOSUB 3100
4870  FOR I = 8 TO 14  'CLOSE PINCH VALVES
4880  OUT P%,I  'CLOSE PV
4900  NEXT I
4910  OUT P%,7  'FOOD TRAY MOTOR OFF
4940  IF MF=0 THEN PRINT "COMPLETION": RETURN
4950  IF MF=1 THEN PRINT "INITIALIZATION": RETURN
```

```
4960  IF MF=2 THEN PRINT "ERROR OR MALFUNCTION - SHUTDOWN":STOP
4970  END
5000 ' SUBROUTINE TO  HEAT WOK TO TEMP SPECIFIED IN RECIPE.  SET TEMP
 = DEGS.
5010 GOSUB 3700  'GET TEMP
5020 IF CTEMP < TEMP THEN GOTO 5010  'CONTINUE HEATING
5030 RETURN
```

METHOD AND OPERATION OF THE DEVICE

In the utilization and operation of this invention, the bulk containers are filled with one cup to several quarts, depending on the expected number of orders to be prepared, of soy sauce, chicken broth, cooking oil, sherry, liquid corn starch, oyster sauce, sesame oil, etc. In a priming step performed once each day, each normally deactivated pinch valve is briefly activated to allow the respective liquid to flow into the respective hose forcing out the air in the hose between the bulk container and the pinch valve. To do this the operator, prompted by a meassage on the video display monitor, presses a key on the computer keyboard. Next, the operator, prompted by a message on the video display monitor, enters the ambient temperature of the cooking oil. This data is used by the computer control system in calculating the flow rate for the cooking oil since the flow rate is temperature dependent. At the completion of these steps, a menu is presented to the operator on the video display monitor. When an order is to be cooked, the operator selects a corresponding food tray marked with the name of the menu selection ordered and containing the precut food ingredients for that recipe. The operator mounts the food tray on the tray spindle, types the number of the menu selection on the computer keyboard, visually confirms the name of the recipe which is displayed and presses the Y key on the keyboard to start the automatic cooking. The operator is now free to initiate another order on another device of this invention. The computer control system activates the normally deactivated gas valve, igniting the gas burner and heating the wok. Temperature measurements of the wok are continually read from the digital thermometer by the computer control system. When the gas burner has heated the wok to the cooking temperature specified in the recipe the computer control system activates the normally deactivated first motor means which initiates rotation of the wok. The computer control system then activates the corresponding pinch valve to dispense cooking oil in the quantity specified for this recipe. Next, the computer control system activates the normally deactivated third motor means which initiates the stirring action of the spatula. After a few seconds, to allow the cooking oil to heat, the computer control system activates the normally deactivated second motor means to rotate the rotatable divider of the food tray to add the first food ingredient and then deactivates the second motor means. At subsequent precisely timed intervals, specified by the recipe, the computer control system rotates the rotatable divider of the food tray as above to add additional food ingredients. Additionally, the computer control system activates appropriate pinch valves to add liquid ingredients at precisely time intervals and in the precise quantities as specified in the recipe. Throughout the cooking process temperature measurements are checked approximately once every one and a half seconds to insure the proper cooking temperature is being maintained. If the temperature should rise too high, that is, if it reaches the upper limit of an allowable range, the computer control system deactivates the gas valve until the temperature drops to the lower limit of the allowable range, at which time the computer control system again activates the gas valve to turn on the gas burner. The allowable temperature range is plus or minus 3% of the temperature specified in the recipe. For example, a cooking temperature of 350° F. has an allowable range of 340° F. to 360° F. At the completion of the specified cooking time, the computer control system deactivates the first and third motor means which stops the wok rotation and the stirring action of the spatula, and deactivates the gas valve which turns off the gas burner. This signals the operator that the food is done at which time the operator scoops the food onto a dish for serving. The operator then removes the spatula and the wok and replaces them with a clean spatula and wok. The menu is automatically redisplayed on the video display monitor and the apparatus is ready to cook the next order. Although the computer program of this applicant's prototype employs a technique of counting computer cycles of known duration to determine the number of elapsed seconds for timing purposes, it is apparent that a real time clock with appropriate interface means to the computer control system could be used for precise timing control.

The method and apparatus of this invention has extreme versatility for cooking virtually any stir-fry recipe from virtually any Chinese school of cooking. Any desired food ingredients or combination of food ingredients can be added in any chosen sequence at any chosen time interval in the cooking process. Likewise, any liquid ingredient or combination of liquid ingredients can be precisely measured and added in any chosen sequence at any chosen time intervals. Furthermore, the cooking temperature can be repeatedly changed during the cooking process at any chosen time interval. The program instructions of the computer control system are designed to allow easy entry and modification of recipes. The number of recipes that can be stored is limited only by the amount of computer memory available. It is anticipated that a restaurant user of this invention might utilize anywhere from a dozen recipes to 300 or more.

To enter a new recipe the person preparing the recipe first writes the recipe on a recipe worksheet. A sample filled out recipe worksheet is shown in FIG. 6. Using the abbreviations shown at the bottom of the recipe worksheet the person lists the name of the recipe, the initial cooking temperature and then lists the food and liquid ingredients of the recipe in the sequence in which they are to be added. For each food ingredient, the person lists the cooking time desired prior to adding the next ingredient. For each liquid ingredient the person lists the quantity of the liquid ingredient to be added and the desired cooking time prior to adding the next ingredient. The person also lists any changes in cooking temperature desired for the recipe in the sequence desired. This is the essential recipe information that would be described in any Chinese cookbook.

The recipe information is then keyed from the recipe worksheet into the computer program by the person preparing the recipe. Each line is entered as a DATA statement beginning with the next available line number. For example, in the program listing, DATA statements containing recipe information occupy lines 1 to 625. Therefore, a new recipe could be entered beginning at line 626. When all recipe changes or additions have been entered, the person also updates line 1 containing the total number of recipes. If line 1 previously showed "75" recipes and 4 new recipes were entered, this line would be changed to "79". New or revised recipes are permanently stored for immediate or later use.

The components of this invention taken individually are not considered to be the particular novel portion of this invention. The novelty is believed to reside in the combined use of the components to achieve a result not anticipated by the prior art, namely, the ability of an unskilled operator to cook superior Chinese stir-fry food, and to do so with higher productivity and with a larger repetoire of multiregional recipes than the skilled traditional Chinese chef.

I claim:

1. A system for controlling the operation of a stir-fry cooking apparatus comprising:

a rotatable food container means for holding liquid and solid foods to be cooked;

means for rotating the food container means;

heating means positioned beneath the food container means;

a plurality of food dispensing means for dispensing liquid and solid foods into the container means;

stirring manipulator means for stirring the foods in the food container means;

first memory means for storing a plurality of recipe data;

second memory means for storing program data for operating the heating means, the food dispensing means, and the stirring manipulator means;

input means, connected to the first and second memory means, for inputting the recipe data into the first memory means and the program data into the second memory means;

digital processing means, connected to the first and second memory means and the input means for controlling the operation of the heating means, the food dispensing means and the stirring manipulator means in accordance with selected recipe requirements and the program data corresponding to the selected recipe requirements stored in the first and second memories respectively.

2. An apparatus according to claim **1**, further comprising:

a display means, connected to the first and second memory means, the input means, and the digital processing means, including means for displaying data to be input to the first memory means and means for displaying the recipe selected from the first memory means.

3. An apparatus according to claim **1**, wherein each recipe stored in the first memory means includes a plurality of cooking temperatures, a plurality of liquid and solid food ingredients, and a cooking time for each food.

4. An apparatus according to claim **1**, wherein the digital processing means includes:

means for electrically activating and deactivating the heating means;

means for measuring a sensed temperature of the food container means and comparing the sensed temperature with a selected temperature set forth in a selected recipe;

means for causing the sensed temperature to become equal to the selected recipe temperature.

5. An apparatus according to claim **1**, wherein the digital processing means includes:

means for activating and deactivating a means to rotate the food container about a vertical axis over the heating means;

means for selectively activating and deactiving each of the plurality of food dispensing means in accordance with food quantities set forth in a selected recipe which has been stored in the first memory means;

means for activating and deactivating the stirring manipulator to stir the solid and liquid foods in the food container means.

6. An apparatus according to claim **1**, wherein the dispensing means for dispensing solid foods includes:

a rotatable food tray, having a plurality of solid food sections divided into separate section compartments in the tray;

means to rotate the tray so that the solid foods in each section compartment may be successively added to the food container means through a sector-shaped opening in the base of the tray.

7. An apparatus according to claim **1**, wherein the dispensing means for liquid foods includes:

liquid container means, each liquid container holding a single liquid ingredient;

tube means connecting each of the liquid container means to a valve means;

funnel means for receiving the liquid ingredients from each of the valves and directing the liquid ingredients into the food container means.

8. An apparatus according to claim **1**, further comprising a temperature measuring means including:

a temperature sensor positioned inside a thermocouple protection tube and biased against the exterior of the base of the food container means for sensing the temperature of the food container means;

conversion means for receiving electrical signals from the temperature sensor and outputting digital temperature signals corresponding to the temperature of the food container means to the digital processing means.

9. An apparatus according to claim **1**, wherein the stirring manipulator means includes:

a spatula with a blade and a handle;

a spatula arm connected pivotally to the handle of the spatula;

a vertical reciprocating linear motion means attached to the spatula arm;

a first driving means coupling the vertical reciprocating linear motion means to a first motor means to drive the spatula arm in a vertical reciprocating linear motion, thereby sweeping the spatula blade down the inside surface of the food container on a downward motion of the spatula arm and drawing the blade of the spatula back on an upward motion of the spatula arm;

a cam operably attached perpendicularly to the end of a cam rod, the cam projecting horizontally to a

position directly beneath the handle of the spatula, the cam rod operably mounted rotatably to a cam rod support means;

a second driving means operably coupling the cam rod to the first motor means thereby transmitting a counterclockwise rotary motion of the first motor means to a clockwise rotary motion of the cam, the cam rotating to contact and lift the spatula handle thereby lifting the blade of the spatula from the inside surface of the food container as the blade of the spatula is drawn back.

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