# United States Patent [19]

**Frische**

[11] **3,869,249**

[45] **Mar. 4, 1975**


[54] **CURING OVEN**


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[73] Assignee: **Indian Head Inc.,** New York, N.Y.



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[52] **U.S. Cl.** ..... **432/121,** 432/133, 432/137, 432/152

[51] **Int. Cl.** ..... **F27b 9/14**

[58] **Field of Search** ..... 432/121, 130, 133, 137, 432/149, 152



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*Primary Examiner*—John J. Camby

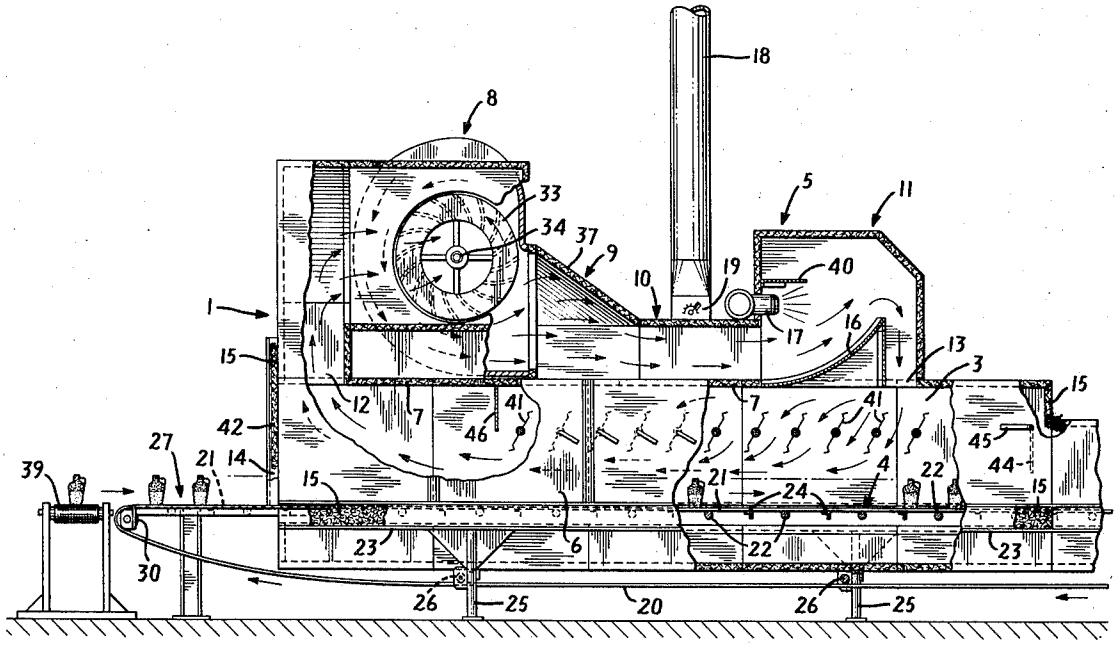
*Attorney, Agent, or Firm*—Brumbaugh, Graves, Donohue & Raymond



[57] **ABSTRACT**

An oven for the curing of coated articles, such as bottles, has a forced air heating section and a cooling section with a coated article conveyor belt extending through the sections.


**7 Claims, 5 Drawing Figures**



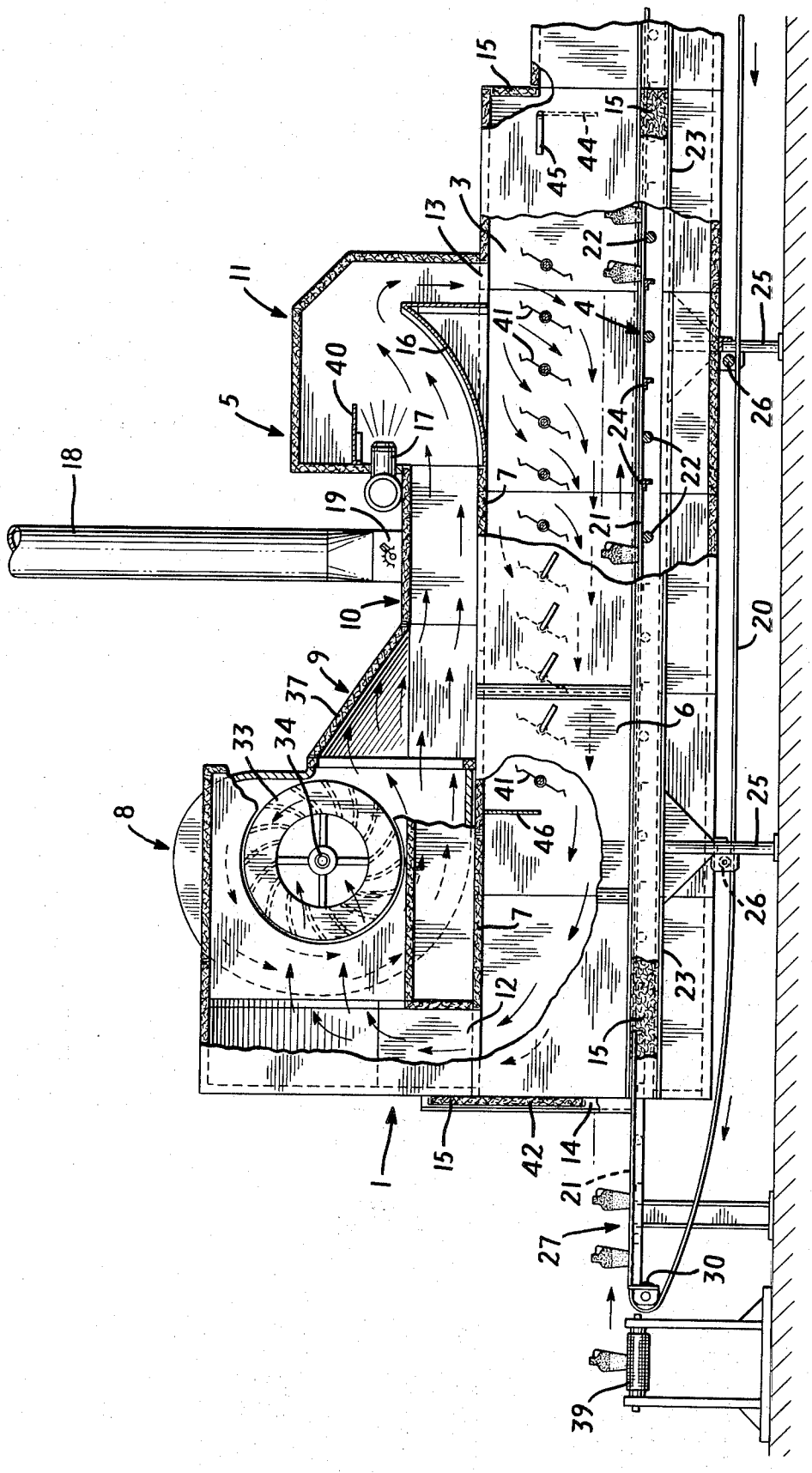

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FIG. 1A

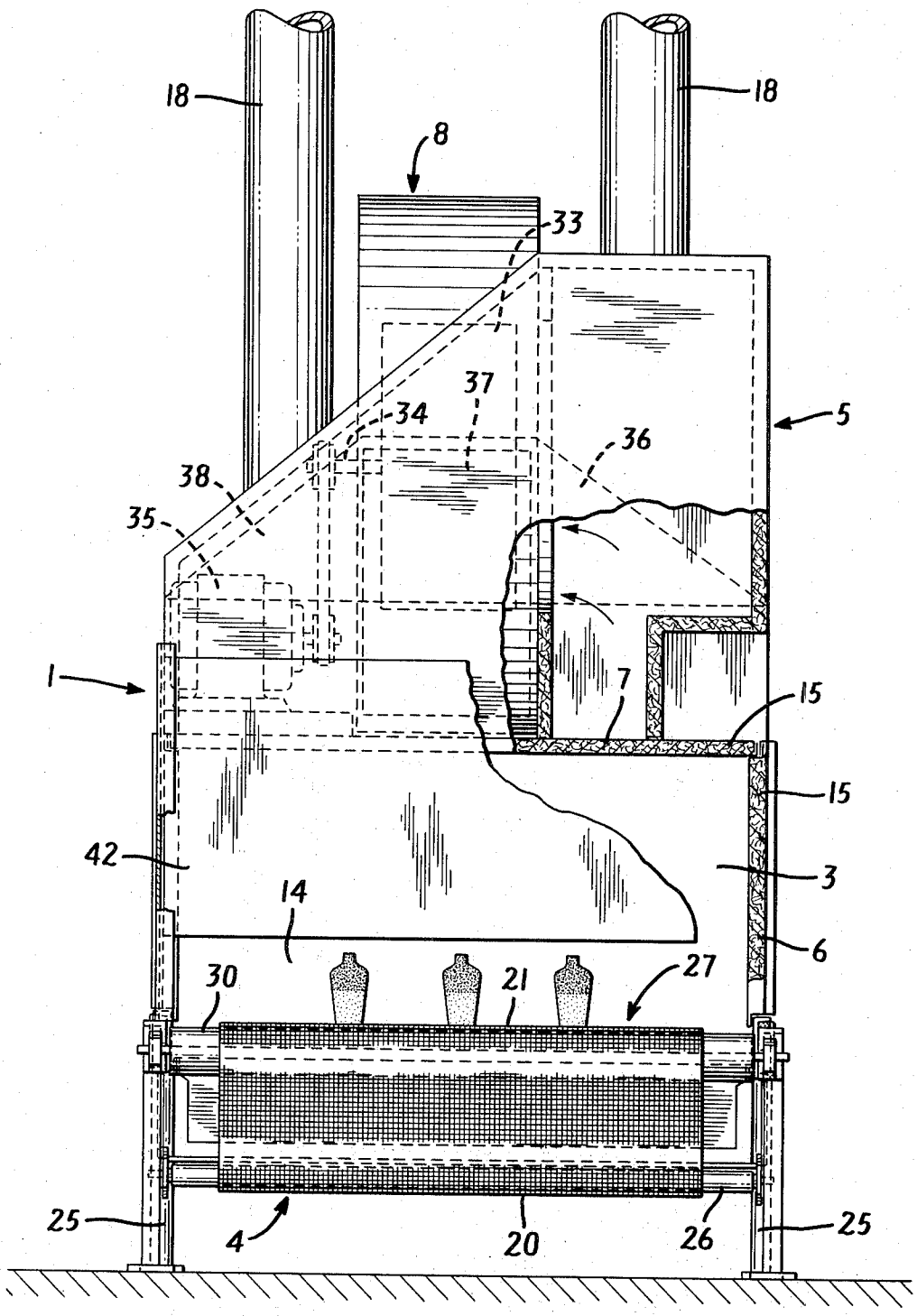
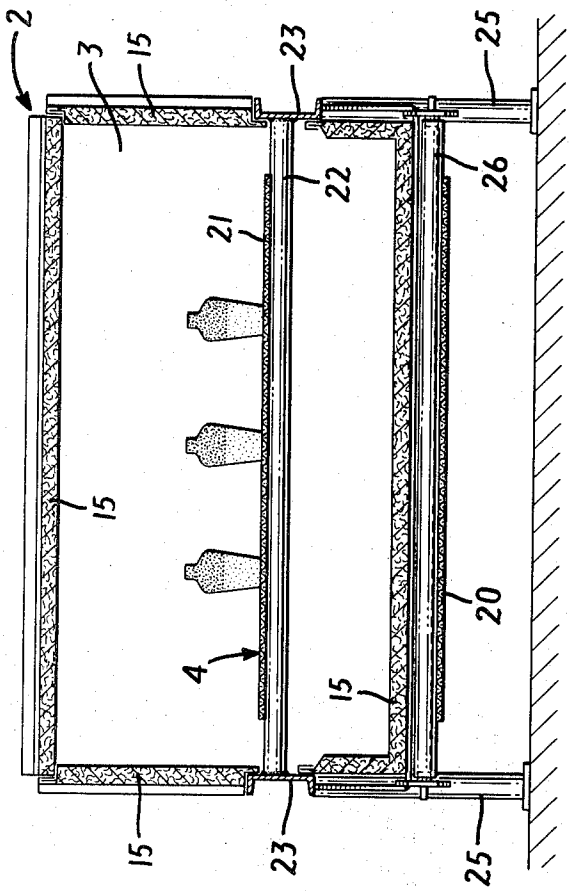



FIG. 2

FIG. 4


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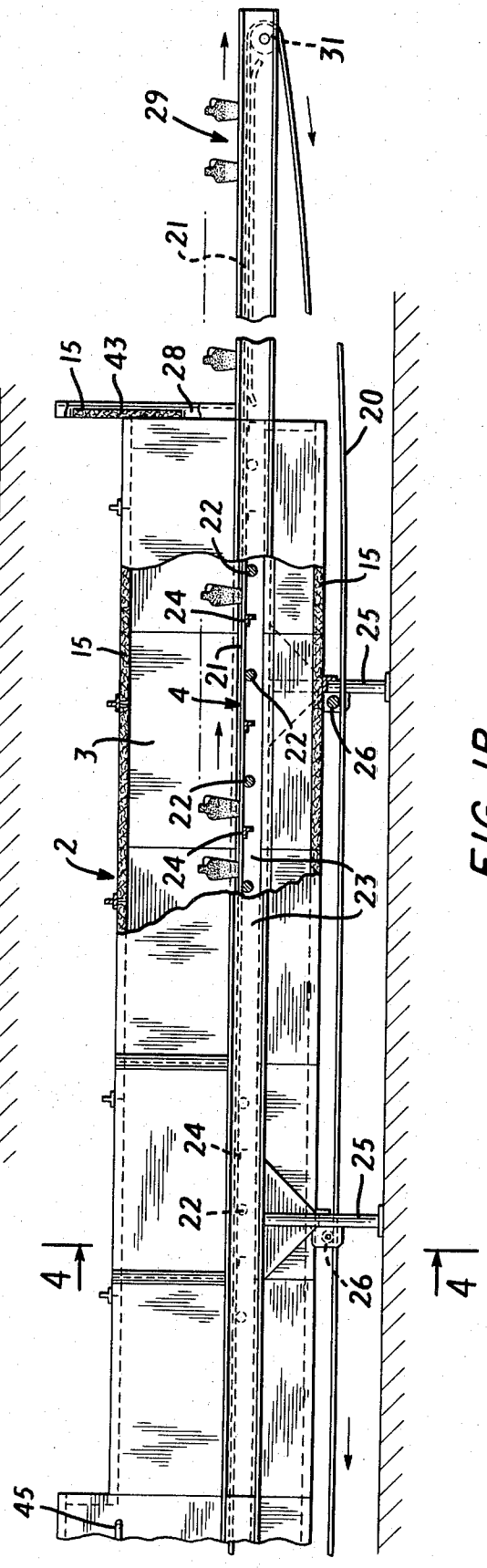

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FIG. 1B

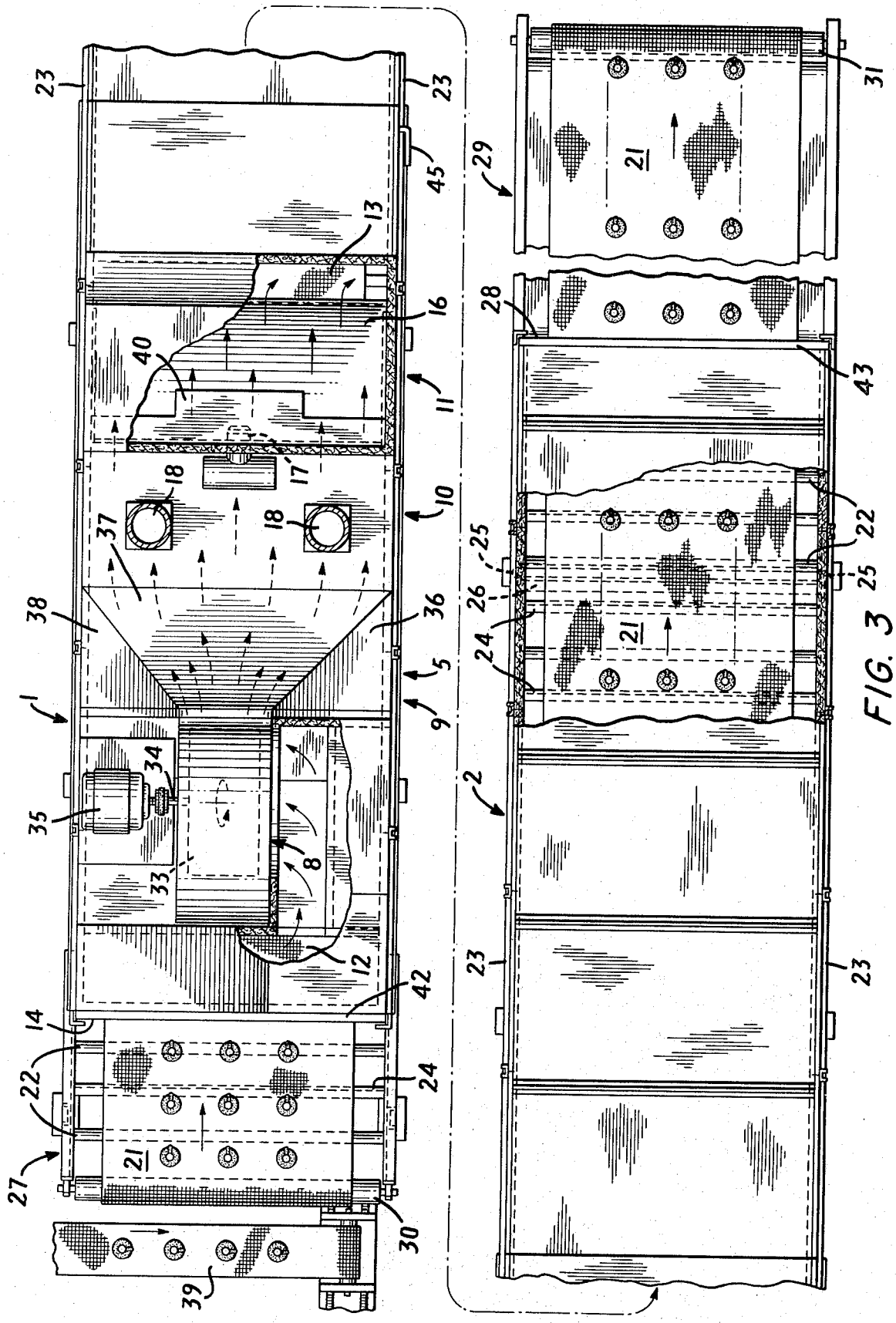

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FIG. 3

# CURING OVEN

The present invention relates to a curing oven.

In my copending U.S. application Ser. No. 404,034, filed Oct. 5, 1973, the disclosure of which is hereby incorporated by reference herein, there is disclosed a high speed bottle coating system and process. In my copending U.S. application Ser. No. 453,829, filed Mar. 22, 1974, the disclosure of which is also hereby incorporated by reference herein, there is disclosed an ultra high speed bottle coating system and process. Each of these two systems and processes uses as an element thereof a curing oven having heating and cooling sections. The present invention is directed to a particularly advantageous form of an exemplary curing oven suitable for use in each of these two systems and processes or elsewhere.

In general, the oven for the curing of coated articles of the invention comprises a heating section and a cooling section, a segmented continuous duct passing through both these sections and having a coating article conveyor belt extending therethrough, at least one superstructure above the heating section segment of the continuous duct and separated therefrom by a top panel, each superstructure having interconnecting sequential air blower, air diffuser, vent stack and fuel burner chambers, the air blower and fuel burner chambers each being in separate communication with the heating section segment of the continuous duct.

In the preferred embodiments or variations of the curing oven of the invention an air blower chamber is adjacent an entrance to the heating section segment of the continuous duct and a fuel burner chamber is remote from the entrance to the heating section segment of the continuous duct. The continuous duct is preferably insulated. It is further preferred that each fuel burner chamber have an air deflector plate and a heat director plate adjacent a fuel burner nozzle. In addition, in the preferred embodiments of the invention each vent stack chamber has at least one vent stack with a damper therein. In yet another preferred embodiment of the invention the conveyor belt has a return course outside the segmented continuous duct. It is also preferred that the heating section segment of the continuous duct have a series of overhead pivotable interlockable transverse louvres.

The curing oven of the invention will be more specifically described in connection with the accompanying drawings wherein:

FIG. 1 is a side elevational view, partly in section or broken away, of the curing oven,

FIG. 1A is a front portion of the view, and FIG. 1B is a rear portion of the view,

FIG. 2 is a front elevational view, partly in section or broken away, of the curing oven,

FIG. 3 is a top plan view, partly in section or broken away, of the curing oven, and

FIG. 4 is a sectional view taken on section line 4—4 of FIG. 1.

The oven for the curing of coated articles, such as bottles, of the invention comprises a heating section **1** and a cooling section **2.** A segmented continuous duct **3** passes through both these sections **1** and **2** and has a coated article conveyor belt **4** extending therethrough. A superstructure **5** is above the heating section segment **6** of the continuous duct **3** and is separated therefrom by a top panel **7.** The superstructure **5** has interconnecting sequential air blower **8,** air diffuser **9,** vent stack **10** and fuel burner **11** chambers. The air blower and fuel burner chambers **8** and **11** are each in separate communication with the heating section segment **6** of the continuous duct **3** via their respective ports **12** and **13.** By such an arrangement forced hot air convection (indicated by the directional convection arrows) is achieved through the superstructure interconnecting chambers **8, 9, 10** and **11** and the heating section segment **6** of the continuous duct **3.**

The air blower chamber **8** is adjacent an entrance **14** to the heating section segment **6** of the continuous duct **3** and the fuel burner chamber **11** is remote from the entrance **14** to the heating section segment **6** of the continuous duct **3.** Countercurrent flow of the forced hot air and the coated articles (as indicated by the respective directional arrows) is thereby effected.

The continuous duct **3** is lined with mineral wool insulation **15** in order to lessen heat loss from the heating section **1** and in order to cool down gradually the coated articles in the cooling section **2.**

The fuel burner chamber **11** has an air deflector plate **16** and a heat director plate **40** adjacent a fuel burner nozzle **17** to effect, respectively, deflection of the forced air passed the fuel burner nozzle **17** and direction of the heat generated by fuel combustion into the forced air and thereby increase air heating and fuel combustion efficiency.

The vent stack chamber **10** has at least one vent stack **18** with a damper **19** therein which enables the regulation of the heat in the heating section **1** and the exhausting or venting of the flue gas or combustion products from the fuel burner chamber **11** as well as any coating vapors released from the coated articles being dried or cured.

The return or lower course **20** of the conveyor belt **4** is outside or beneath the segmented continuous duct **3.**

The heating section segment **6** of the continuous duct **3** has a series of overhead pivotable interlockable transverse louvres **41** for directing downwardly the forced hot air and prolonging its contact with the coated articles and thereby flattening out the elevated temperature gradient to which the conveyed coated articles are subjected.

The conveyor belt **4,** which is a wide wire mesh belt, has its upper coated article carrying course **21** supported by a plurality of support rollers **22** rotatably mounted between two parallel channel irons **23** which are connected together with alternating angle irons **24** and are supported from the floor by a plurality of legs **25.** The heating section **1** and the cooling section **2** are affixed to and supported by the two parallel channel irons **23.**

The return course **20** of the conveyor belt **4** lies outside or below the segmented continuous duct **3,** as noted above, and passes beneath guide rollers **26** rotatably mounted between opposed legs **25.** By having the return course **20** so positioned, its temperature is lowered by the cooler air outside the oven (as opposed to the embodiment where the return course **20** lies entirely within the continuous duct **3** and its temperature is elevated by the heating section **1**). Accordingly, freshly coated bottles or other articles can be stacked in multi-files at a multi-file stacking station **27** without the danger of searing the partially dried coating on the bottom of the bottles by contact with an unduly hot conveyor belt.

The portion of the conveyor belt **4** which extends forward of the entrance **14** to the heating section **1** constitutes the above-mentioned multi-file article stacking station **27** and the portion of the conveyor belt **4** which extends rearward of the exit **28** of the cooling section **2** constitutes an article packing station **29.** The termini of the conveyor belt **4** pass around idler roller **30** and drive roller **31** which is connected to a drive motor (not shown).

The fan **33** in the air blower chamber **8** is driven by drive shaft **34** connected to a drive motor **35.**

The air blower chamber **8** is narrower than the width of the vent stack chamber **10** and the fuel burner chamber **11.** Therefore, the air blower chamber **8** is interconnected to the vent stack chamber **10** and the fuel burner chamber **11** by an intermediate air diffuser chamber **9** which has downwardly and sidewardly tapering extension panels **36, 37** and **38.** Such an arrangement permits the air forced and circulated by the fan **33** in the air blower chamber **8** to diffuse without excessive turbulence from the air blower chamber **8** through the air diffuser chamber **9** and then into the vent stack chamber **10** and the fuel burner chamber **11.**

In order to assist in regulating the heat in the heating section segment **6** of the continuous duct **3,** the entrance **14** is provided with a vertically adjustable insulated door **42.** The exit **28** from the cooling section **2** is similarly provided with a vertically adjustable insulated door **43.** Adjacent or at the junction of the heating section **1** and the cooling section **2** and within the continuous duct **3,** there is a pivotable solid transverse baffle plate **44** operatively connected to an external control handle **45** which serves to confine and to regulate further the heat within the heating section segment **6** of the continuous duct **3.** At the forward end of the series of louvres **41** there is a stationary vertical baffle **46.**

In operation, freshly spray coated articles, such as bottles, fed from a single file article belt conveyor **39** are stacked manually or by a gang stacker in multi-files at the multi-file article stacking station **27** portion of the conveyor belt **4.** This conveyor belt **4** carries the coated articles through the segmented continuous duct **3** wherein the coated articles are gradually heated in the heating section **1** to dry and cure the coating, e.g., at 450°F.-600°F. for 15–5 minutes, respectively, by forced hot air convection in countercurrent flow to the path of the coated articles. The hot coated articles are thereafter gradually cooled down to a temperature at which they can be manually handled at the article packing station **29** portion of the conveyor belt **4** by passing through the still and cooler air in the cooling section **2.**

The forced hot air convection (as indicated by the directional convection arrows) is achieved in the heating section **1** by means of the air being forced by the fan **33** in the air blower superstructure chamber **8** into the air diffuser superstructure chamber **9,** then through the vent stack superstructure chamber **10** and upwardly passed the fuel burner nozzle **17** in the fuel burner superstructure chamber **11** due to contact with the air deflector plate **16** therein. The heated air and flue gas or combustion products from the fuel burner nozzle **17** pass from the fuel burner chamber **11** via port **13** into the heating section segment **6** of the continuous duct **3** and flow countercurrent to the path of the coated articles being conveyed by the conveyor belt **4.** The hot air and flue gas mixture passes upwardly through port **12** into the air blower chamber **8** to complete the gas cycle.

Flue gas from the fuel burner chamber **11** and any coating vapors released from the hot coated articles are exhausted or vented from the heating section **1** by means of the vent stacks **18** of the vent stack chamber **10.**

In those cases where a more rapid heating of the coated articles can be withstood or is desired, the sequence of the air blower **8,** air diffuser **9,** vent stack **10** and fuel burner **11** chambers is reversed in the superstructure **5,** i.e., the fuel burner chamber **11** is adjacent the entrance **14** to the heating section segment **6** of the continuous duct **3** and the air blower chamber **8** is remote from the entrance **14** to the heating section segment **6** of the continuous duct **3.** Thus the air blower chamber **8** then communicates with the heating section segment **6** of the continuous duct **3** via port **13** and the fuel burner chamber **11** then communicates with the heating section segment **6** of the continuous duct **3** via port **12.** By this arrangement the forced hot air and coated articles are then in cocurrent flow so that the coated articles are immediately subjected to the highest temperature within the continuous duct. **3.**

In order to increase the heating capacity of the curing oven, the heating section **1** can have two or more identical superstructures **5** mounted in sequence or end to end above the heating section segment **6** of the continuous duct **3** and each having its respective chambers **8,** 9, 10 and **11** and ports **12** and **13.**

Where a more rapid cooling of the hot coated articles is desired, the cooling section **2** can have an air blower superstructure chamber mounted thereon and connected thereto via ports near the entrance and exit of the cooling section so as to provide forced air cooling.

The curing oven of the invention uses forced hot air heating or indirect heating of the coated articles rather than open flame or direct firing of the coated articles and thereby eliminates the danger of explosion or burning of any combustible coating vapors within the continuous duct.

It will be appreciated that various modifications and changes may be made in the curing oven of the invention in addition to those mentioned above by those skilled in the art without departing from the essence of the invention and accordingly the invention is to be limited only within the scope of the appended claims.

What is claimed is:

**1.** An oven for the curing of coated articles such as bottles which comprises a heating section and a cooling section, a segmented continuous duct passing through both these sections and having a coated article conveyor belt extending therethrough, at least one superstructure above the heating section segment of the continuous duct and separated therefrom by a top panel, each superstructure having interconnecting sequential air blower, air diffuser, vent stack and fuel burner chambers, the air blower and fuel burner chambers each being in separate communication with the heating section segment of the continuous duct.

**2.** The oven as defined by claim **1** wherein an air blower chamber is adjacent an entrance to the heating section segment of the continuous duct and a fuel burner chamber is remote from the entrance to the heating section segment of the continuous duct.

3. The oven as defined by claim 1 wherein the continuous duct is insulated.

4. The oven as defined by claim 1 wherein each fuel burner chamber has an air deflector plate and a heat director plate adjacent a fuel burner nozzle.

5. The oven as defined by claim 1 wherein each vent stack chamber has at least one vent stack with a damper therein.

6. The oven as defined by claim 1 wherein the conveyor belt has a return course outside the segmented continuous duct.

7. The oven as defined by claim 1 wherein the heating section segment of the continuous duct has a series of overhead pivotable interlockable transverse louvres.

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