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(54) **COMPRESSED FUEL PRODUCT USING FLAX STRAW DERIVATIVE**

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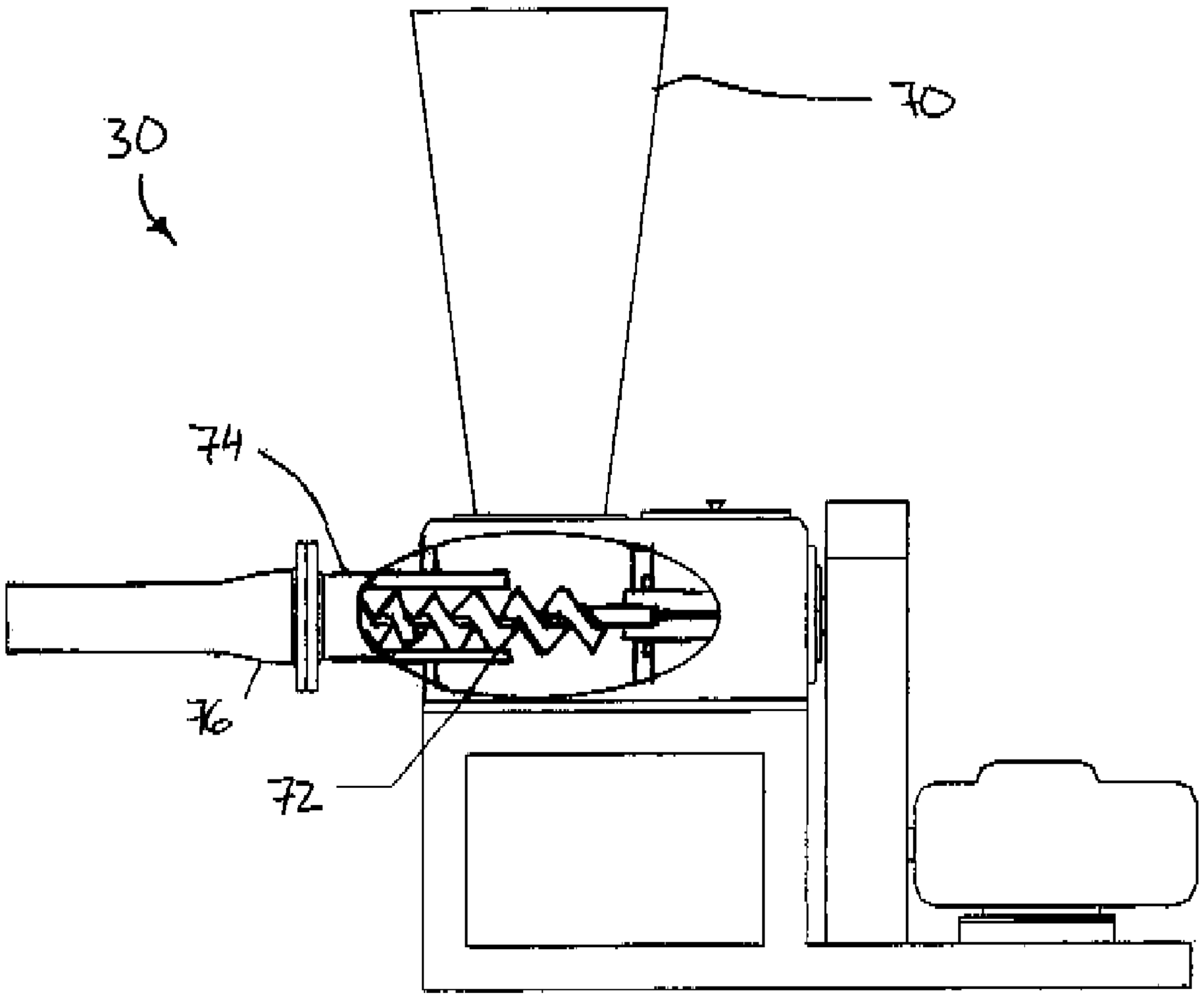
(57) **ABSTRACT**

A compressed fuel product, for example a firelog or other like product, comprises a material comprising a flax straw derivative, for example flax shives or other material derived from flax, which is compressed into a solid body. The material is bonded together under pressure into the solid body solely by natural lignin in the flax straw derivative.



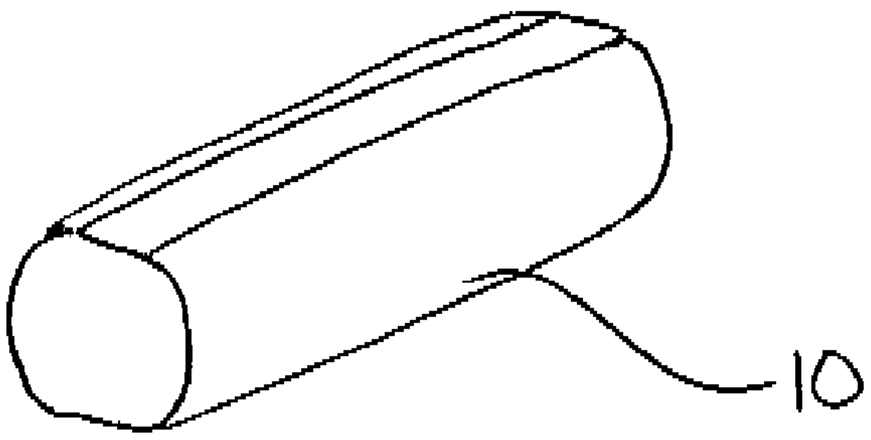


FIG. 1

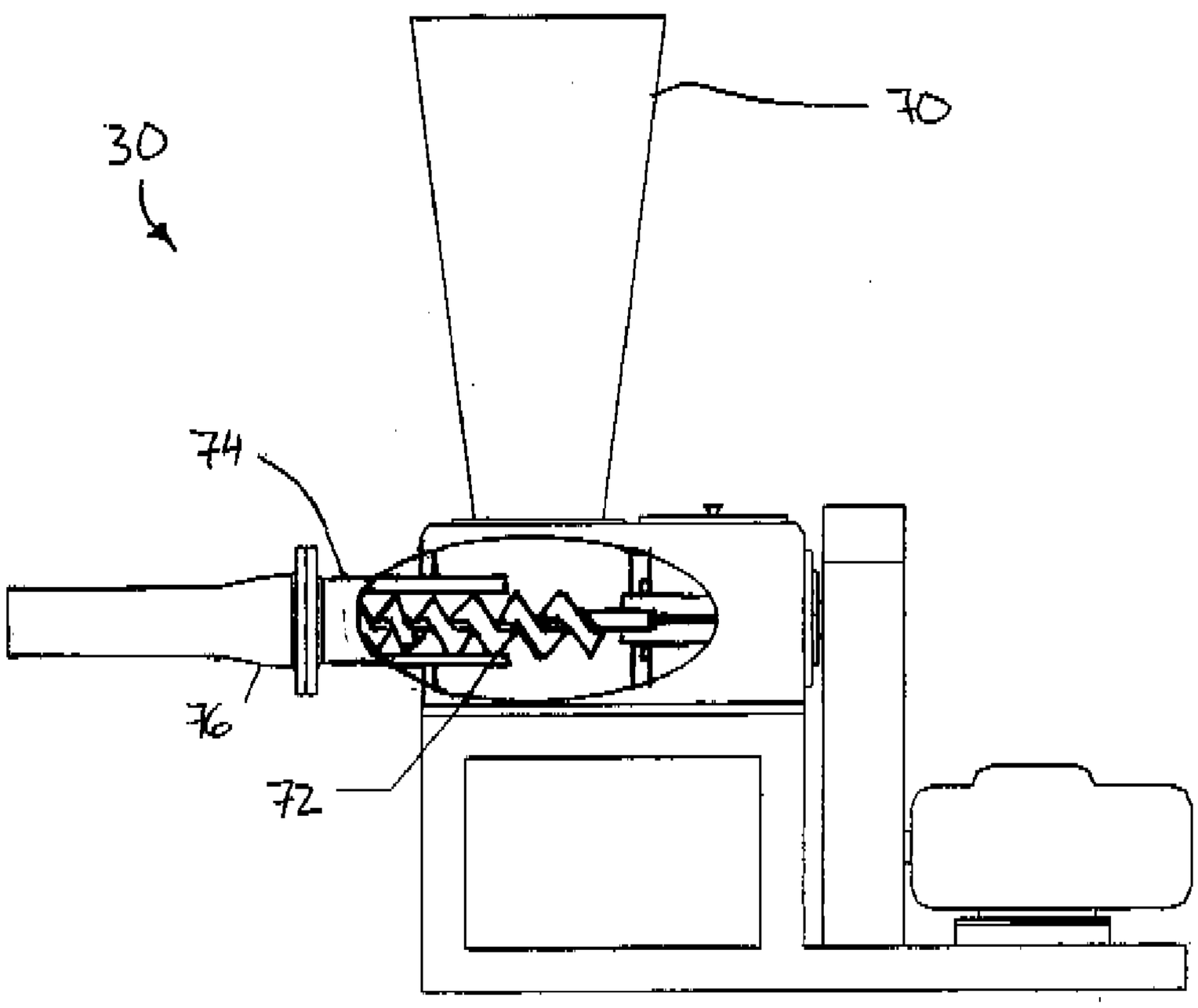


FIG. 6

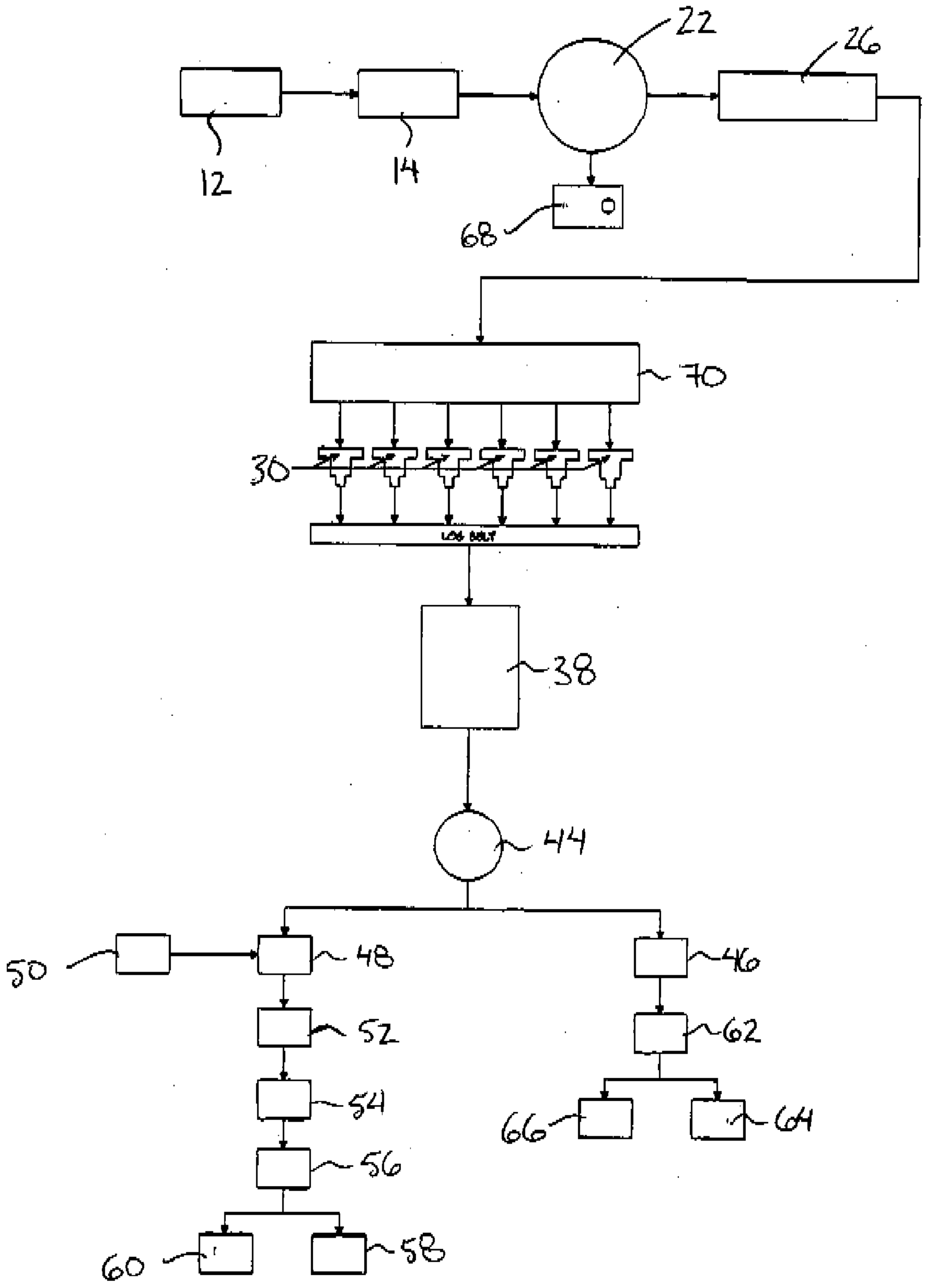


FIG. 2

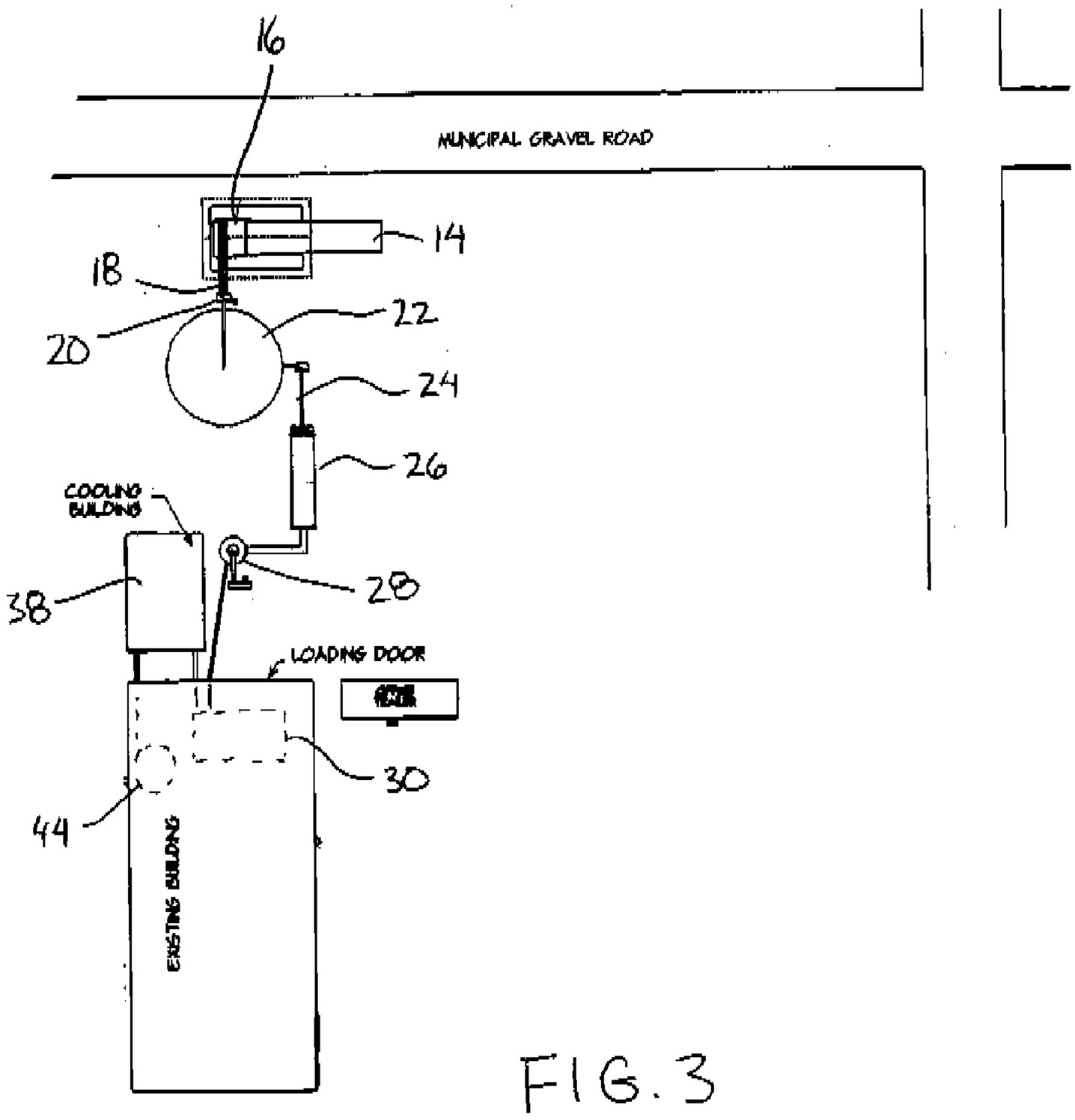

16
MUNICIPAL GRAVEL ROAD
14
18
20
22
24
26
COOLING BUILDING
28
38
LOADING DOOR
30
44
EXISTING BUILDING

FIG. 3

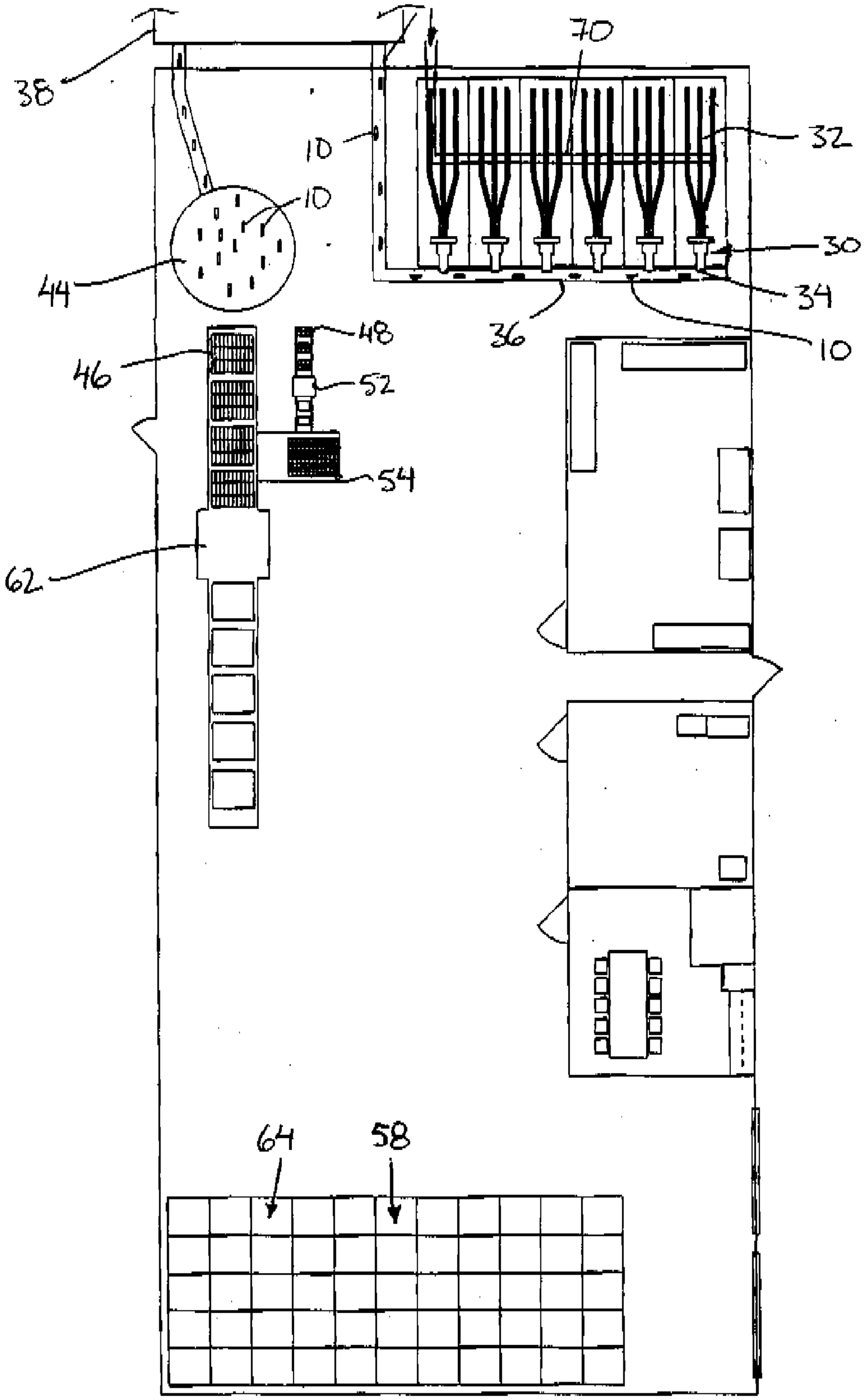


FIG. 4

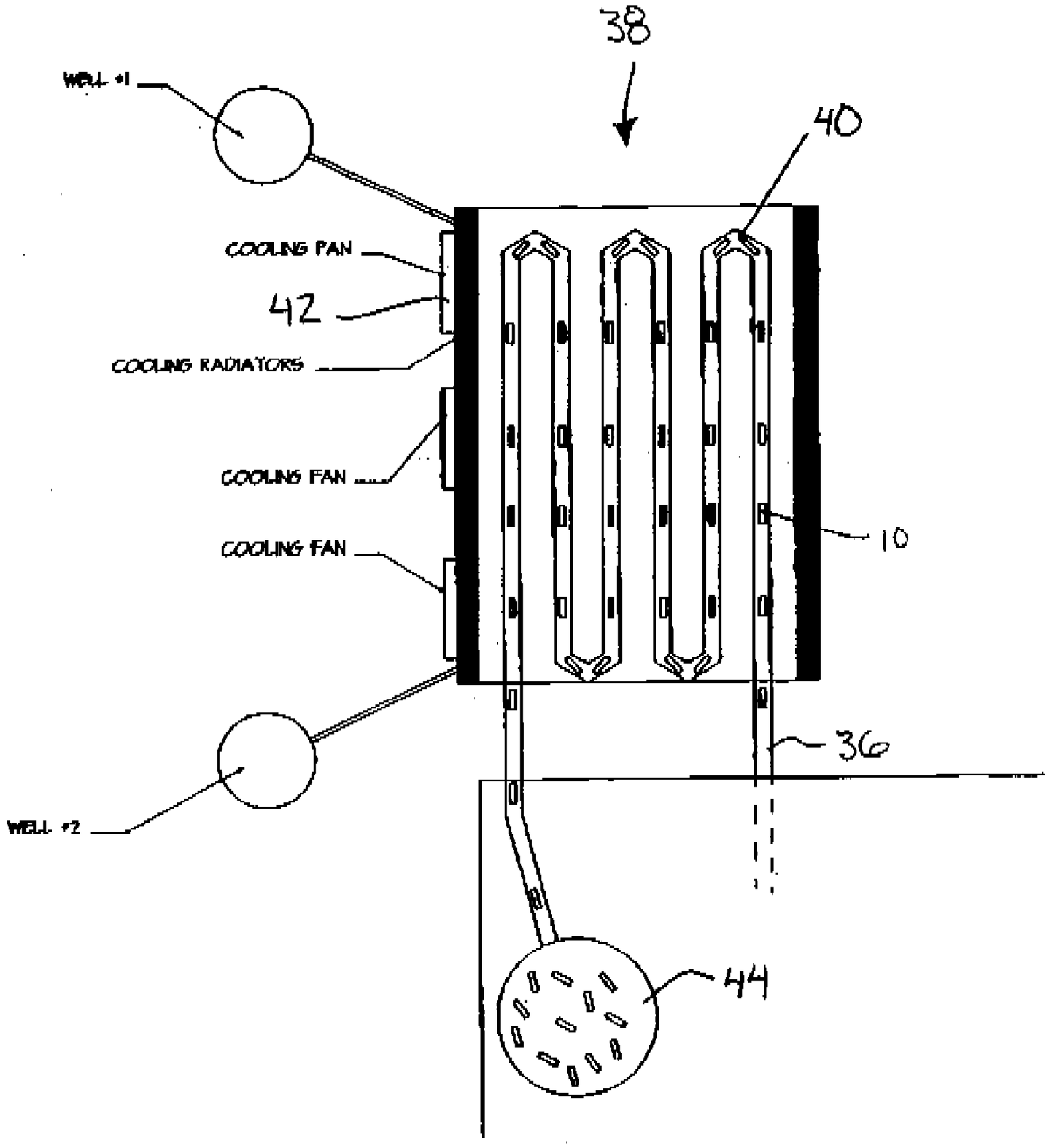

38
40
WELL #1
COOLING FAN
42
COOLING RADIATORS
COOLING FAN
COOLING FAN
10
36
WELL #2
44

FIG. 5

COMPRESSED FUEL PRODUCT USING FLAX STRAW DERIVATIVE

[0001] This application claims foreign priority benefits from the corresponding Canadian Patent Application, of the same title, filed Apr. 13, 2007.

FIELD OF THE INVENTION

[0002] The present invention relates to a compressed fuel product, for example a firelog, fuel pellets, briquettes or wafers and the like, and more particularly relates to a compressed fuel product which comprises a flax straw derivative.

BACKGROUND

[0003] It is known to modify natural fuels such as wood products and the like to improve the burning characteristics thereof. For example it is known to manufacture a fire log comprising various wood products which are densified and compressed into a solid body using waxes, resins or other additives other than natural cellulose material to both improve the burning of the material and the bonding of the finished compressed product. Known additives are typically costly and in addition are generally considered to be not environmentally friendly.

[0004] U.S. Pat. Nos. 6,113,662 to Sprules and 4,478,601 to Stephens disclose examples of compressed fuel products in which combustible materials are compressed into a solid body requiring bonding agents to form the finished product. U.S. Pat. No. 4,553,978 to Yvan discloses an example of a fuel product which does not make use of additional waxes or binders, however the resulting product is instead highly friable as it may be broken up by hand due to its small specific gravity in the order of 0.25. Due to the characteristics of the finished product according to the techniques of Yvan, the resulting product is unusable as a fire log as the product is not sufficiently durable. U.S. Pat. No. 2,177,557 discloses a further example of fuel product, however the product relies on alcohols and other additives in order to function properly so that the product is both costly to manufacture and results in undesirable fumes.

SUMMARY OF THE INVENTION

[0005] According to one aspect of the present invention there is provided a compressed fuel product comprising a material compressed into a solid body, the material comprising a flax straw derivative.

[0006] According to second aspect of the present invention there is provided a method of forming a compressed fuel product comprising providing a material comprising a flax straw derivative and compressing the material into a solid body.

[0007] Use of a flax straw derivative for forming a compressed fuel product results in the product being formable into a fire log or other compressed solid body without the addition of any other waxes, resins or bonding type agents being required as the natural lignins in the flax straw derivative are sufficient to effect bonding of the log into the desirable solid body. The resulting composition of the log is therefore environmental friendly while being both simple and low cost to manufacture.

[0008] The material may primarily comprise a flax straw derivative as a majority thereof, but preferably the material consists only of a flax straw derivative.

[0009] Preferably, the flax straw derivative consists only of flax shives in which the shives consist of the remainder of flax straw once the fibrous material has been removed. The flax straw derivative used in the present invention however may comprise flax straw in its entirety, with or without the flax seeds, and with or without fibrous material known to be extracted from the flax straw. The flax straw derivative may further comprise parts of flax seed, for example seed hulls or other remnants resulting from the removal of flax oil from the flax.

[0010] The method of forming the compressed fuel product preferably includes bonding the material together in the solid body solely by natural lignin in the flax straw derivative.

[0011] Preferably the material is compressed until the solid body has a specific gravity greater than 1, and more preferably approximately 1.25.

[0012] The method may include extruding the material through an extruder having a screw press and heating the material as it is extruded solely by friction generated from rotating the screw press.

[0013] Preferably the solid body comprises a firelog.

[0014] One embodiment of the invention will now be described in conjunction with the accompanying drawings in which:

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. **1** is a perspective view of a compressed fuel product according to the present invention.

[0016] FIG. **2** is a schematic view of the process for forming the compressed fuel product.

[0017] FIG. **3** is a plan view a site for effecting the process of FIG. **2**.

[0018] FIG. **4** is an enlarged plan view of a portion of the site plan according to FIG. **3**.

[0019] FIG. **5** is an enlarged plan view of a cooling section of the site plan according to FIG. **3**.

[0020] FIG. **6** is a partly sectional side schematic view of one of the extruders for forming the compressed fuel products.

[0021] In the drawings like characters of reference indicate corresponding parts in the different figures.

DETAILED DESCRIPTION

[0022] Referring to the accompanying figures there is illustrated a compressed fuel product generally indicated by reference numeral **10**. In the illustrated embodiment, the product **10** is formed in the shape of a fire log and consists solely of flax shives so that the completed compressed fuel product has a specific gravity in the order of 1.25. No additional waxes or bonding agents are included as the natural lignin in the flax shives provides sufficient bonding to maintain the fuel product compressed as a single body once heated and compressed under considerable pressure.

[0023] Prior to formation of the compressed fuel product **10**, harvested flax is first processed to remove the seeds and is then subsequently processed at a plant **12** to remove fibrous material from the straw so that only the shives remain. The flax shives are then transported from the processing plant **12** to the site illustrated in FIG. **3**. The flax shives are transported by trailers **14** which feed the flax shives into an unloading

hopper **16** at the site. An auger **18** carries the flax shives from the unload hopper to a blower **20** which conveys the shives into a wet storage bin **22** on the site.

[0024] When it is desirable to form the compressed fuel product, the flax shives are carried from the storage bin **22** by an auger **24** to a dryer **26** which dries the shives to a moisture content of approximately 4% to prepare it for subsequent processing. The dryer **26** is heated by raw flax material being burned in a suitable burner **68**. A cyclone **28** assists in subsequently carrying the material from the dryer **26** to a dry storage area **70**.

[0025] A plurality of feed augers **32** in the dry storage area **70** feed the flax shives into a series of extruders **30** supported in parallel with one another where the compressed fuel product is extruded therefrom to respective log cutters **34** which cut the compressed fuel product into individual logs deposited on a conveyor belt **36**.

[0026] Once formed into individual logs, the compressed fuel product is delivered by the conveyor belt **36** to an outdoor cooling building **38** prior to packaging. The cooling building **38** includes a cooling belt **40** which conveys the product **10** along multiple passes in front of cooling fans **42** which cool the product. The product is then returned indoors for being deposited on a receiving table **44**.

[0027] From the receiving table **44**, the product **10** is either loaded onto bulk pallets **46** or the product is placed in cardboard grocery trade boxes **48** in quantities of six per box. When packaged in grocery trade boxes, fire starter **50** is packaged with the logs with the boxes being subsequently taped by an automatic taper **52** before being loaded onto pallets **54** which are subsequently wrapped by a suitable wrapper **56** for placement either in storage **58** on the site or onto carrier trucks **60** for delivery.

[0028] The bulk pallets **46** are also wrapped by a suitable automatic wrapper **62** for either being placed in storage **64** or for being loaded onto carrier trucks **66** for subsequent delivery.

[0029] Turning now to the extruders **30** in more detail as shown in FIG. **6**, each extruder **30** includes an inlet hopper **70** which receives the flax shives for distribution to the inlet of a screw press **72**. The screw press **72** feeds the flax shives through a surrounding barrel **74** to force the shives under pressure through a die **76** which continuously extrudes the compressed fuel product consisting solely of flax shives therefrom. The screw press **72** is tapered to be reduced in diameter towards the die **76**. An internal cooling jacket is provided surrounding the barrel prior to the die **76**.

[0030] Sufficient pressure is generated by the screw press **72** which in turn provides sufficient heat by friction that the natural lignins in the flax shives cause the flax shives to be bonded together to form the finished compressed fuel product. The cutters **34** form the individual fire logs from the continuously extruded material exiting the extruder.

[0031] As described above flax straw derivative, comprising either whole flax straw including both shives and fiber or just flax shives, is bonded into a compressed fuel product using pressure, heat and natural lignins of the flax to effect the bonding. To begin the process, the raw, screened material is first received in a walking floor trailer with a moisture content of about 10 to 12%.

[0032] The unloading hopper receives the bulk flax straw at a rate of about one tonne per minute.

[0033] The raw material is augured out of the bin and deposited into either a blower or a screw auger that carries the straw up to the top of the 100 tonne "wet" bin. The raw flax straw is metered out of the 100 tonne bin at a consistent rate of approximately six tonnes per hour. The material is fed into a horizontal continuous run dryer. The dryer is fueled by a bio-fuel burner **68** that is supplied with dried flax straw that has already passed through the dryer.

[0034] A suction fan that is creating negative pressure in the dryer actually pulls the flax straw through the dryer & then through a cyclone. The cyclone is used to separate the flax straw from the air created by the fan.

[0035] The dried flax straw now falls to the bottom of the cyclone through a rotary gate & drops in to an auger that will carry the dried material into a dry bin **70** inside the building.

[0036] The dry bin **70** in the manufacturing plant has a live bottom floor. This means that the bottom of the bin is mostly covered with the screw feed augers **32** to draw the product out at a very precise & even rate. This is the metering system that controls the flow of raw, dried material into the densified log extruder. Once the product is augured out of the dry bin it is transferred via another screw auger to the hopper on to of the extruder.

[0037] The raw, dried material is now gravity fed from the extruder hopper down into the extruder itself.

[0038] The extruder, powered by a 100 horse power electric motor, consists of a receiving chamber, screw, barrel, and forming die.

[0039] The receiving chamber is the area around the tail end of the extruder screw that allows the initial course flights of the screw to pick up material. The flax straw is then forced into the barrel of the extruder. The material is starting to pack in the barrel. The screw, turning at about 300 rpm continuously pushes more material into the barrel and then forces it into the die. The die forms the material into a round log about 4 inches in diameter with diametrically opposed flat sides of approximately 1.5 inches in width.

[0040] The screws of the extruders are operated to generate heat to achieve temperatures in the range of 300 to 350 degrees Fahrenheit by friction alone. This heat is sufficient to effectively melt the natural lignins in the flax straw to successfully glue the logs together without the addition of any glues, waxes, or resins of any kind.

[0041] The end product is a densified, all natural 4 inch diameter fire log, ten to twelve inches long weighing about 5 pounds with a specific gravity of around 1.25.

[0042] Since various modifications can be made in my invention as herein above described, and many apparently widely different embodiments of same made within the spirit and scope of the claims without department from such spirit and scope, it is intended that all matter contained in the accompanying specification shall be interpreted as illustrative only and not in a limiting sense.

1. A compressed fuel product comprising a material compressed into a solid body, the material comprising a flax straw derivative.

2. The product according to claim **1** wherein the material primarily comprises a flax straw derivative.

3. The product according to claim **1** wherein a majority of the material comprises a flax straw derivative.

4. The product according to claim **1** wherein the material consists only of a flax straw derivative.

5. The product according to claim **1** wherein the flax straw derivative consists only of flax shives.

6. The product according to claim **1** wherein the material consists only of flax shives.

7. The product according to claim **1** wherein the material in the solid body is bonded together solely by natural lignin in the flax straw derivative.

8. The product according to claim **1** wherein the solid body has a specific gravity greater than 1.

9. The product according to claim **1** wherein the solid body has a specific gravity near 1.25.

10. The product according to claim **1** wherein the solid body is formed in the shape of a firelog.

11. A method of forming a compressed fuel product comprising providing a material comprising a flax straw derivative and compressing the material into a solid body.

12. The method according to claim **11** wherein the material primarily comprises a flax straw derivative.

13. The method according to claim **11** wherein a majority of the material comprises a flax straw derivative.

14. The method according to claim **11** wherein the material consists only of a flax straw derivative.

15. The method according to claim **11** wherein the flax straw derivative consists only of flax shives.

16. The method according to claim **11** wherein the material consists only of flax shives.

17. The method according to claim **11** including bonding the material together in the solid body solely by natural lignin in the flax straw derivative.

18. The method according to claim **11** including compressing the material until the solid body has a specific gravity greater than 1.

19. The method according to claim **11** including extruding the material through an extruder having a screw press and heating the material as it is extruded solely by friction generated from rotating the screw press.

20. The method according to claim **11** including forming the solid body in the shape of a firelog.

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