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(19) **United States**(12) **Patent Application Publication****Kohnen et al.**(10) **Pub. No.: US 2007/0295248 A1**(43) **Pub. Date: Dec. 27, 2007**(54) **ENERGY AND STEEL RECOVERY SYSTEM**(52) **U.S. Cl. 110/118**

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(57) **ABSTRACT**

An energy and steel recovery system has a suspension column and a plurality of suspension burners operably disposed therein wherein the burners are spaced from one another along the length of thereof. The suspension column includes a mechanism for receiving tires onto one of the burners and feeding the tires to an adjacent downwardly disposed burner to further combust the same. The column is configured to provide for a number of zones including heating, drying, volatilizing, combusting and ashing which are collectively referred to herein as a "fractionation process." A first conduit includes a first end communicably connected to the suspension column and a second end communicably connected to a boiler wherein air flow passes from the boiler to the suspension column. A second conduit includes a first end communicably connected to the suspension column and a second end communicably connected to the boiler wherein air flow passes from the suspension column to the return air flow path of the boiler. The system includes a mechanism for removing residual waste materials from the suspension column.

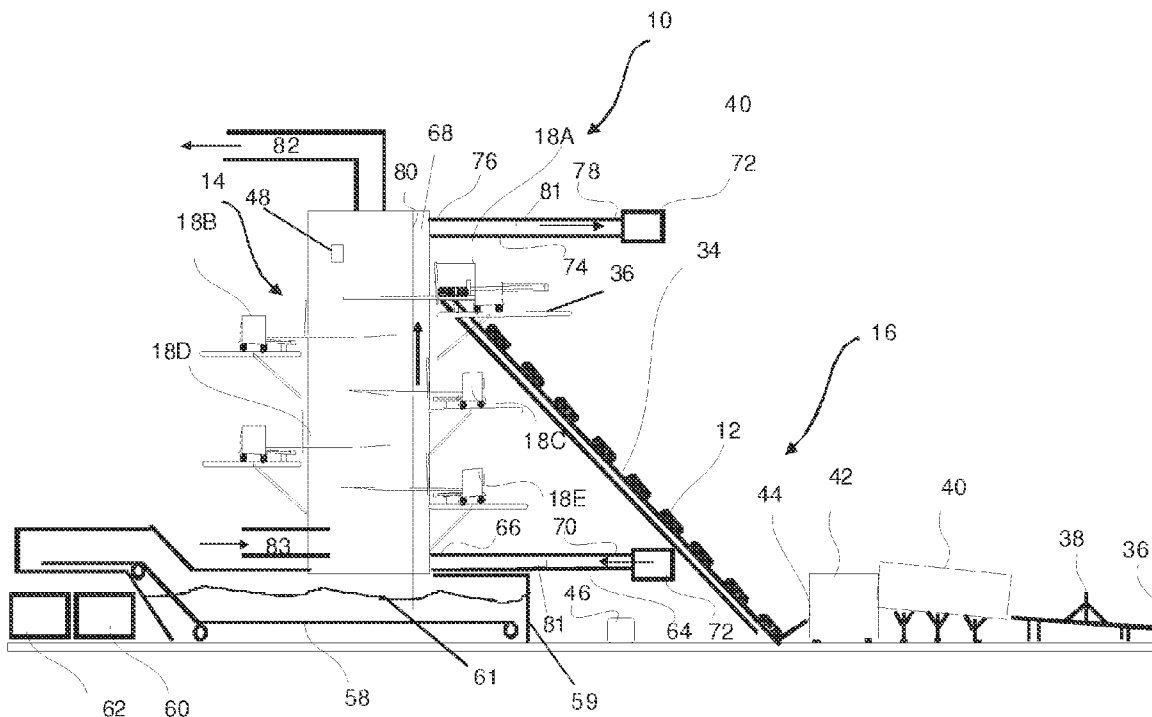
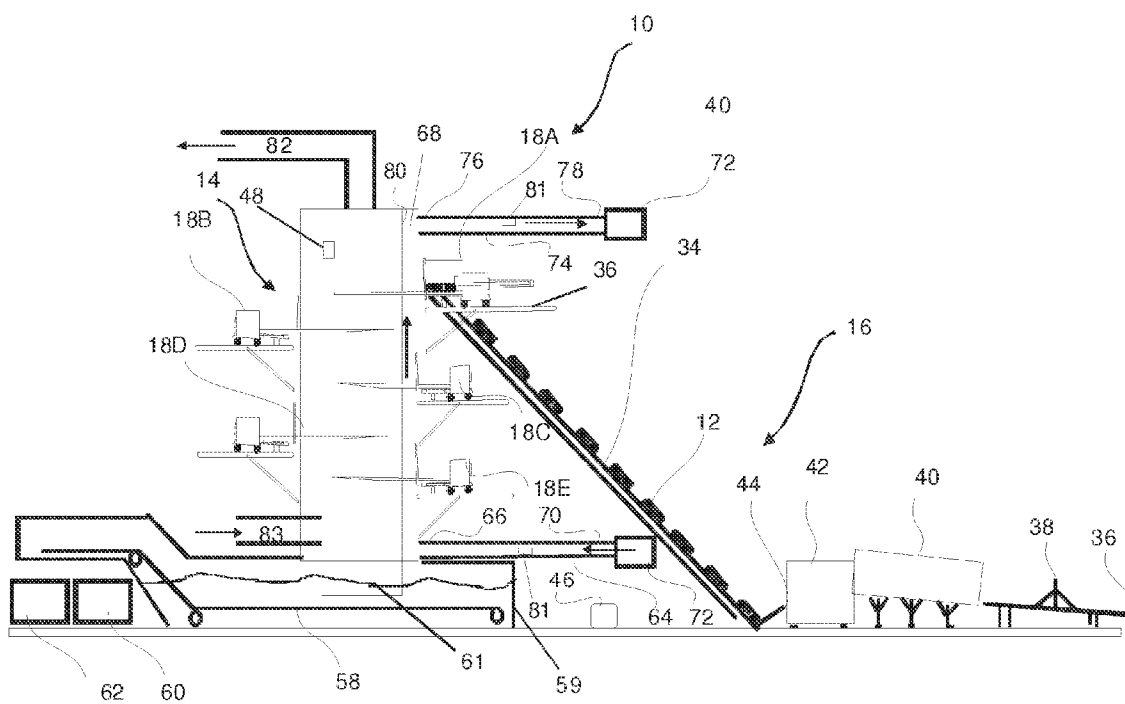
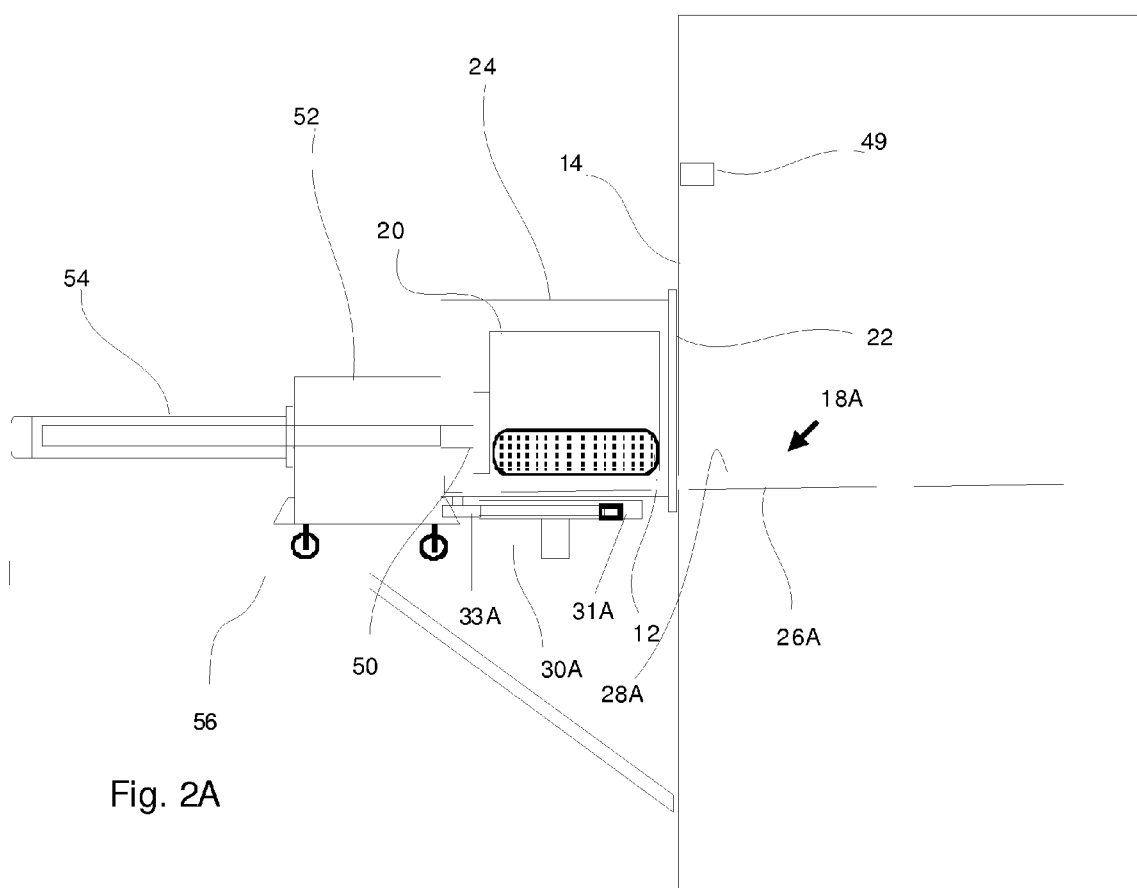


Fig. 1





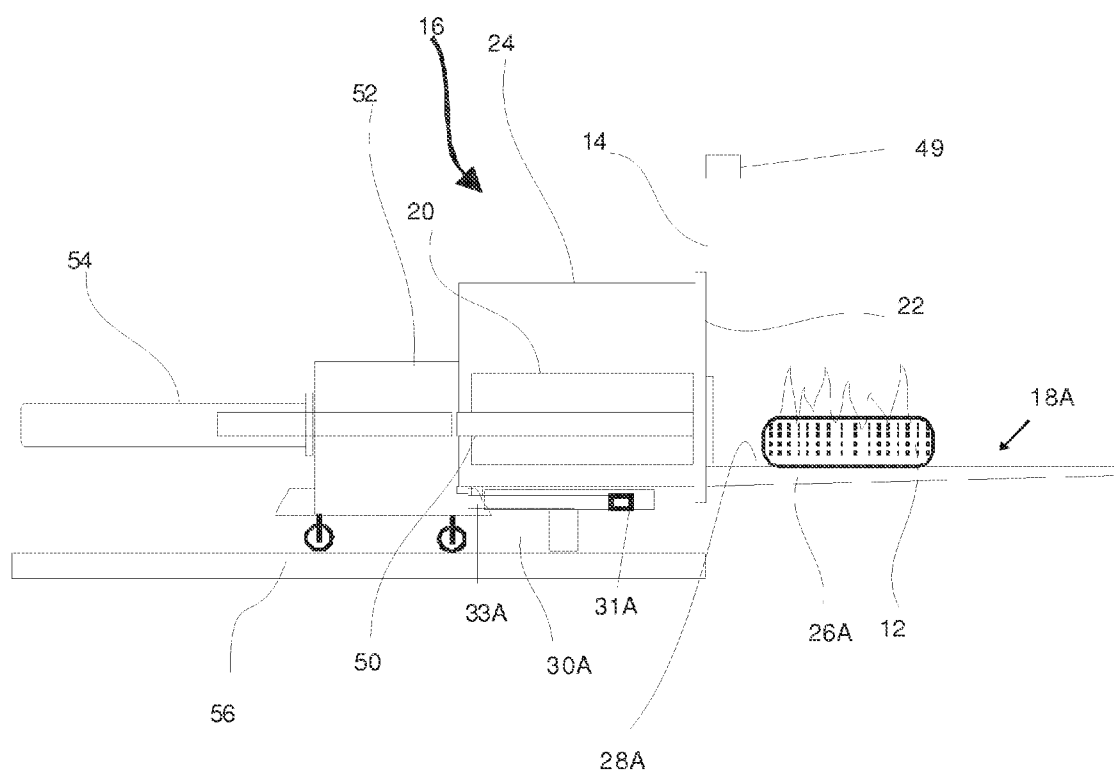


Fig. 2B

Fig. 3A

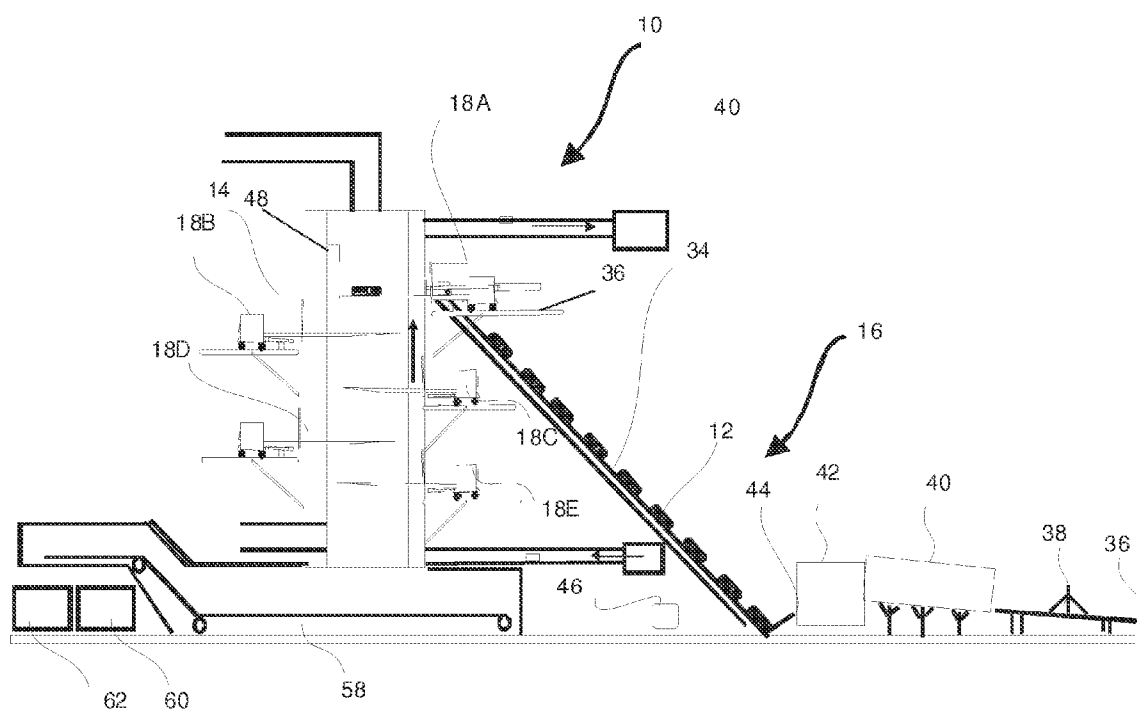


Fig. 3B

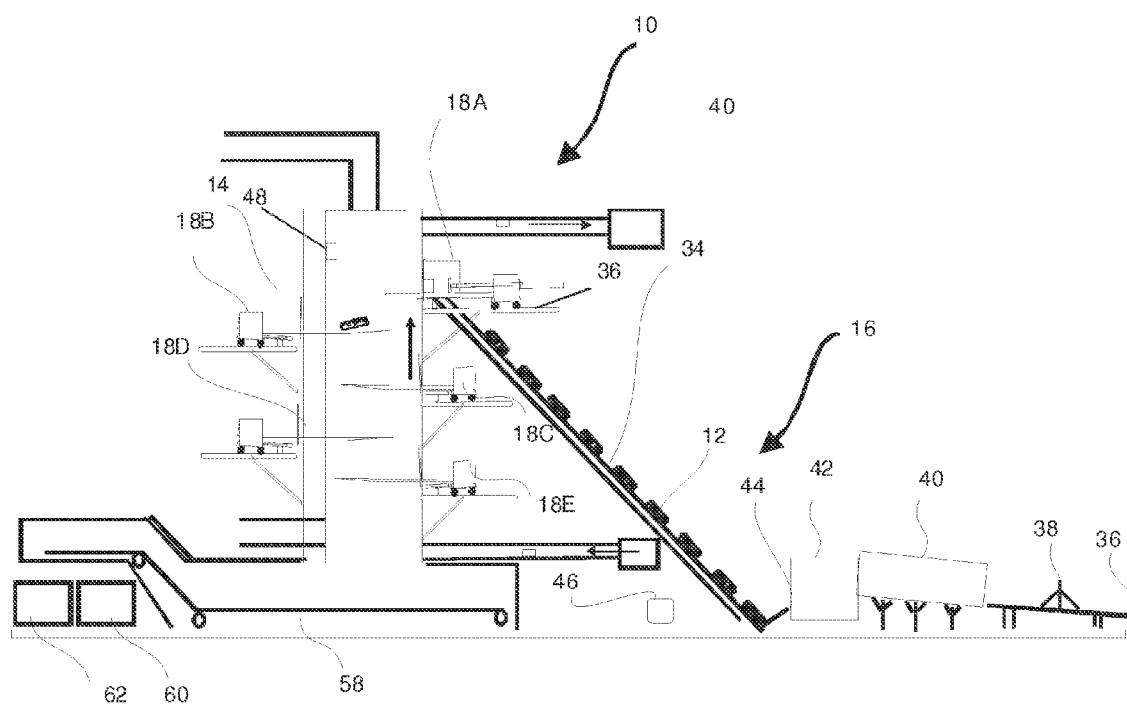
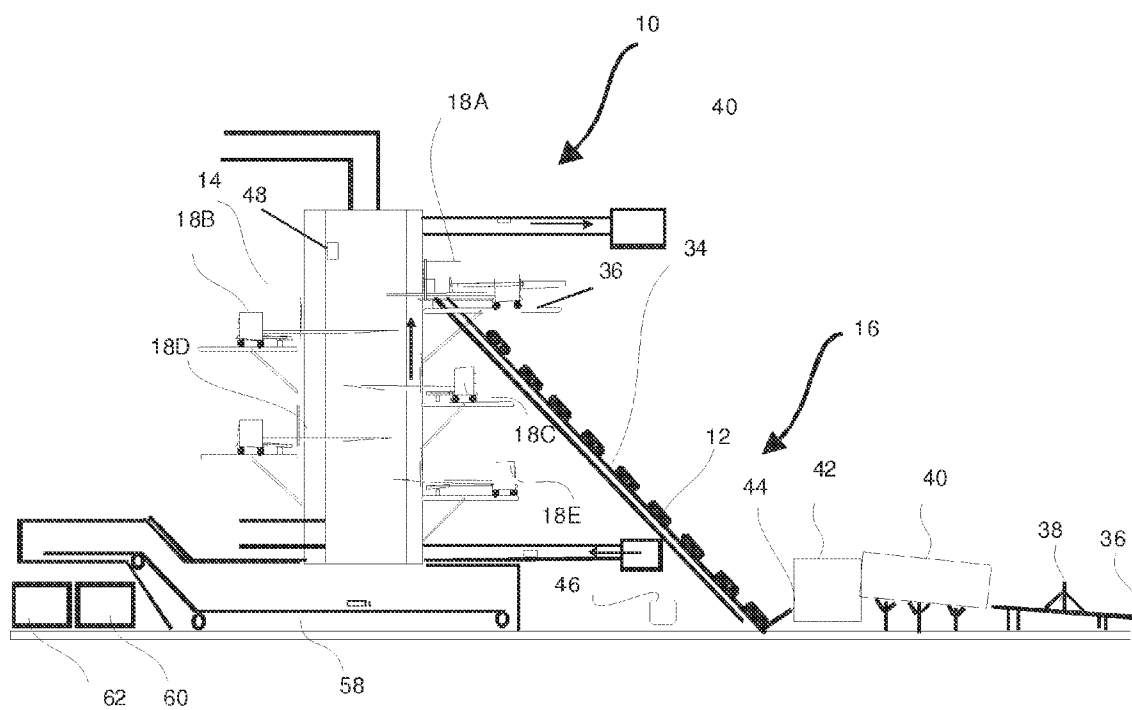
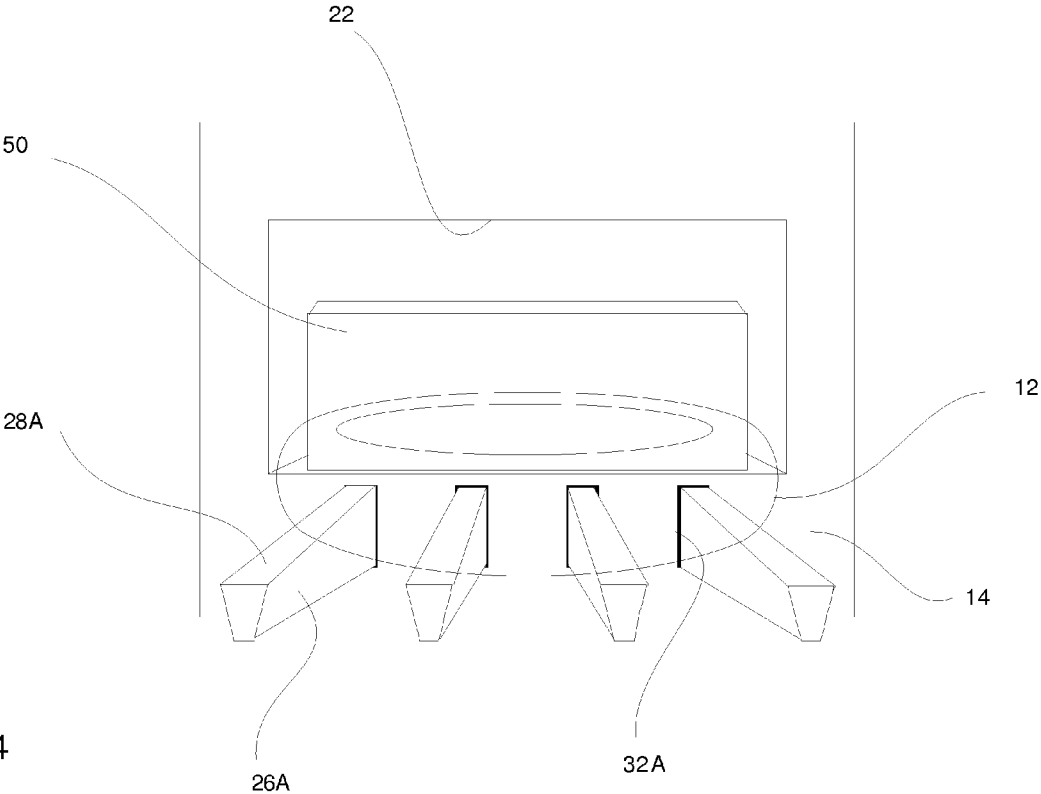
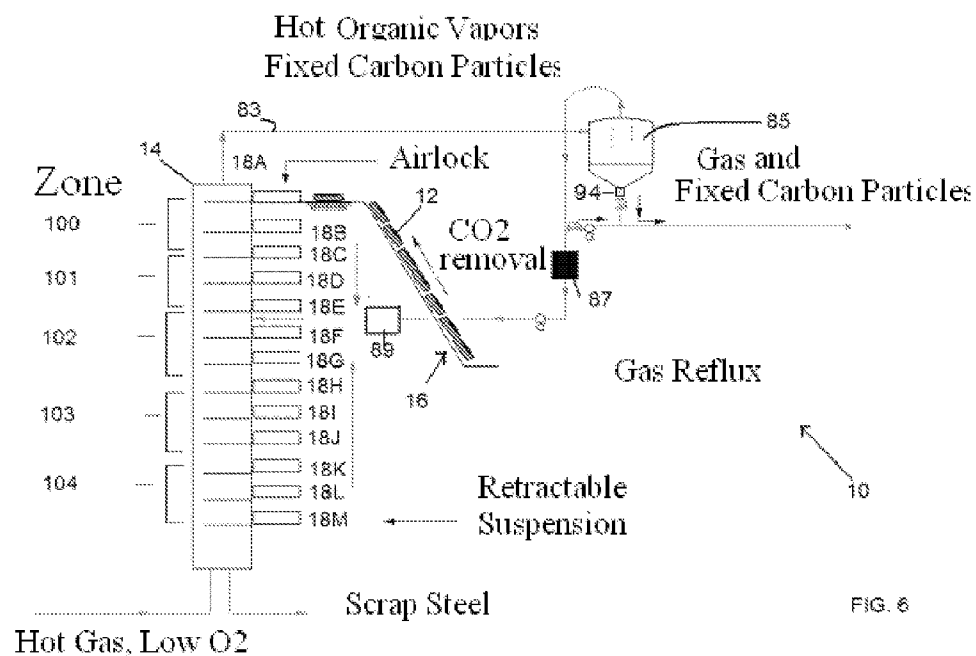
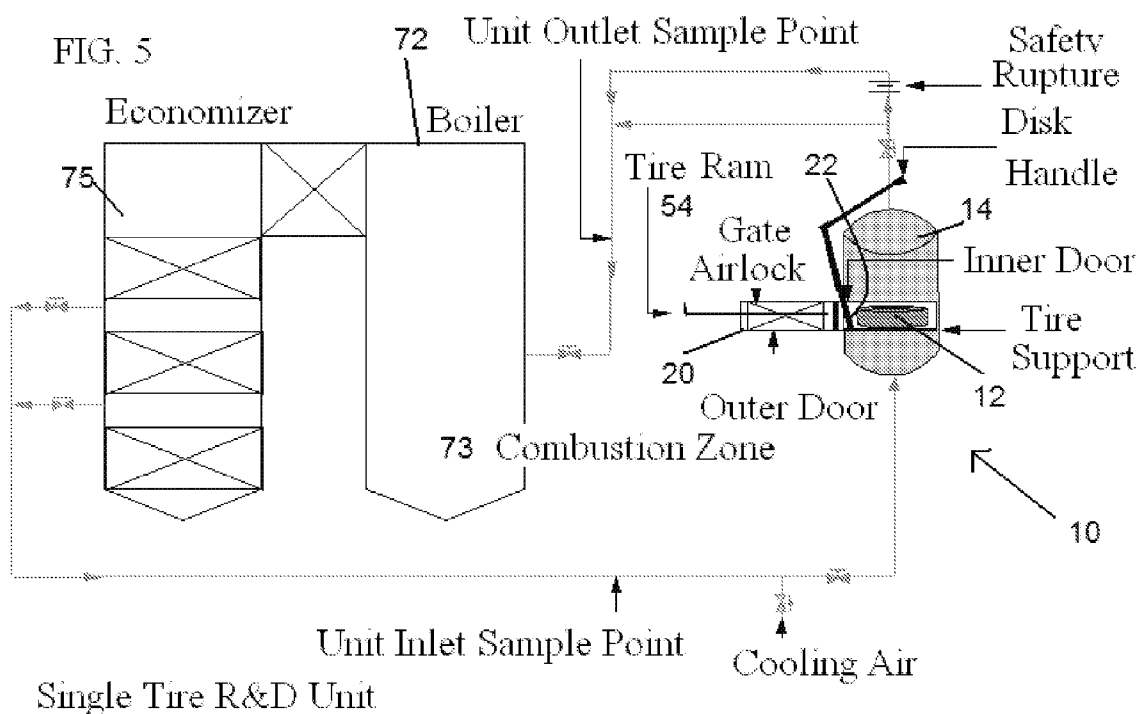
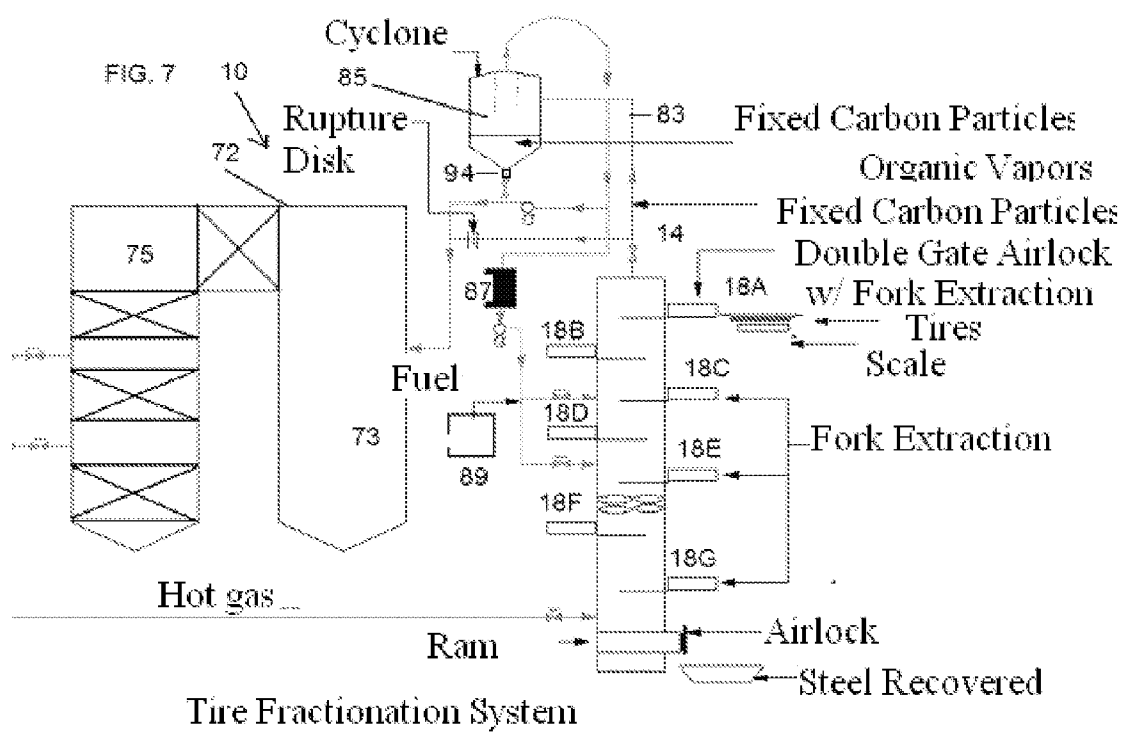


Fig. 3C









ENERGY AND STEEL RECOVERY SYSTEM

[0001] This is a continuation-in-part of U.S. Ser. No. 10/908,525 filed May 16, 2005.

BACKGROUND OF INVENTION

Field of Invention

[0002] This invention relates to improvements in energy and steel recovery systems. More particularly, the invention relates to a system for recovering energy and steel through combustion of tires in suspension in a slipstream of a high energy user. This invention allows an efficient use of the heating power of waste materials, preferably solids such as whole vehicle tires, and also other waste materials in bulk or crushed form to reduce fuel consumption expenses in large capacity boiler systems.

[0003] Alternative waste derived fuels have been operably disposed within a pyrolysis chamber or a riser duct of a kiln. The use of such waste products is a function of the burning environment, for example, the amount of heat required and oxygen content within the chamber or kiln. Tires are currently being made use of alternative fuels to reduce usage of traditional fuels. Tires have been found to be highly suitable. In co-pending U.S. application Ser. No. 10/908,525, there is introduced a concept to inject tires into a column that was located next to a utility steam generator and combust them in a slipstream of gas drawn from the boiler. Tires, while being suspended in the gas stream by a number of forks that would methodically retract, would combust as they progress down the inside of the column, counter current to the gas stream. The heat generated by the tire combustion would then be recovered in the boiler and the steel and any ash would be removed at the bottom of the column for ultimate recycling or disposal.

[0004] There remains a need to improve such technology to provide a highly efficient, easily operated, low cost, system for using such fuels.

SUMMARY OF THE INVENTION

[0005] An object of the invention is to improve energy recovery in the combustion of waste fuel.

[0006] Another object is to improve the method of recovery of energy in combustion of waste fuel in a column through gasification and a controlled movement of vaporized and residual byproducts into a combustion zone of a boiler so that the radiant energy of the waste fuel is recovered in the boiler, thereby eliminating ash in the column and providing a higher quality of steel produced.

[0007] A further object is to provide a system and method for waste fuel fractionation.

[0008] Yet another object of the invention is to improve boiler technology.

[0009] Another object is to improve efficiency of boiler technology.

[0010] Still another objective of this invention is to enhance the process in which waste material is burned within a suspension system.

[0011] Accordingly, the invention is directed to an energy and steel recovery system. The system has a suspension

column and a plurality of suspension burners operably disposed in the suspension column wherein the burners are spaced from one another along the length of the suspension column. The suspension column includes means for receiving the combustible material onto one of the burners and feeding, e.g., via gravity feeding, the combustible material to an adjacent downwardly disposed burner to further combust the combustible material. More specifically, the column is configured to provide for a number of zones including heating, drying, volatilizing, combusting and ashing which are collectively referred to herein as a "fractionation process." A first conduit includes a first end communicably connected to a heated air path of the suspension column and a second end communicably connected to an outflow air path of a boiler wherein air flow passes from the outflow air path of the boiler to heated air flow path of the suspension column. A second conduit includes a first end communicably connected to the heated air flow path of the suspension column and a second end communicably connected to a return air flow path of the boiler wherein air flow passes from the heated air flow path of the suspension column to the return air flow path of the boiler. In this regard, the boiler can include a combustion zone and an economizer with dual economizers feeding heat and oxygen to a lower end of the column. The system further includes means for removing residual combusted and noncombustible waste materials from the suspension column.

[0012] Preferably, the suspension column can be equipped with an outer air passage jacket surrounding an inner column wall to which the first and second conduits are communicably connected. In this way, air or other medium enters the jacket and passes through the jacket being heated from the outer surface of the inner wall without mixing with air from the combustion occurring within the inner wall. Each suspension burner includes a plurality of support fingers each having a waste derived fuel support surface which is removably disposed in the suspension column to provide for self cleaning of the support surface of the fingers upon removal from the suspension column. Preferably, the suspension burner includes means for automatically retracting the fingers from the column. Further, means for automatically feeding the waste material on to the fingers of the suspension burner are provided.

[0013] A conduit 83 can be connected to the upper portion of the column to remove hot organic vapor and fixed carbon particulate to a cyclone which passes gas and fixed carbon particulate to the combustion zone of the boiler. A CO₂ removal apparatus can be operably connected to the cyclone to remove CO₂ from the gas reflux to the column further reducing the emissions of the process.

[0014] The present invention is particularly useful in providing additional heating energy to high energy user systems, such as boilers and using a novel a structure and method and provides an automated feed of waste materials, preferably tires, into a suspension column. Upon burning tires, residual metals from within the tires pass by virtue of their weight and gravity to the residual waste removal means where the metals, i.e., steel wires from tires can be removed. With the use of the invention, it is contemplated that the alternative waste energy including at least partially combustible organic-containing waste can provide a substantial amount of the heat required for heating high energy user systems, such as a boiler. Novelty of the invention will be

apparent hereinafter as discussed more fully below and other objectives and advantages of this invention will be apparent from reading the drawings and description hereinafter.

DESCRIPTION OF DRAWINGS

[0015] FIG. 1 is a side elevation diagrammatic view embodying the invention, especially the suspension column with suspension burners.

[0016] FIG. 2A is a view illustrating a first mode of a burner of the instant invention.

[0017] FIG. 2B is a view illustrating a second mode of the burner of FIG. 2A.

[0018] FIG. 3A is another view illustrating the second mode of the invention.

[0019] FIG. 3B is a view illustrating a third mode of the burner of the instant invention wherein combusted material has moved to a lower burner.

[0020] FIG. 3C is a view illustrating a fourth mode of the burner of the instant invention wherein combusted material has moved to a recovery conveyor.

[0021] FIG. 4 is a perspective view of a burner of the instant invention.

[0022] FIG. 5 is a side elevation diagrammatic view embodying the invention test unit.

[0023] FIG. 6 is a side elevation diagrammatic view embodying another aspect of the invention.

[0024] FIG. 7 is a side elevation diagrammatic view embodying still another aspect of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0025] Referring now to the drawings, an energy and steel recovery system is generally referred to by the numeral 10. The present invention provides an improved way to recover the energy in the waste fuel, such as a tire(s) 12, by gasifying the tire and moving both the tire's vaporized organics and fixed carbon into the combustion zone 73 of a boiler 72. Radiant energy of the tire is recovered in the boiler 72 eliminating ash in a column 14 and a higher quality of steel is produced. The column 14 is configured to provide for a number of zones 101, 102, 103, 104 and 105 including heating, drying, volatilizing, combusting and ashing, respectively. The present invention coins the process described herein as "tire fractionation." Tires 12 can be fractionated under low oxygen, high velocity and high temperature, i.e., approximately 1,100° F. conditions, producing a gaseous and solid fuel for the boiler 72 while producing no negative effects to the boiler 72 and generating a high quality of residual recyclable steel from the tire 12.

[0026] A sample of ash produced by the process was collected and analyzed. It contained no detectable Mercury, 12,300 mg/Kg of Zinc and conformed to ERA standards for metals, VOC and SVOC TCLP testing. Because tires, with the provision of a higher BTU value and a higher Zinc content, compare favorable with coal, Tire Derived Fuel (TDF) can be utilized worldwide as a supplemental fuel in coal burning operations.

[0027] The energy and steel recovery system is generally referred to by the numeral 10. The alternative fuel, which can preferably be combustible waste tires 12, is fed to a suspension column 14 by feeding means 16. The suspension column 14 can preferably include and one or more, preferably a plurality of suspension burners 18A, 18B, 18C, 18D, 18E, 18F, 18G, 18H, 18I, 18J, 18L, 18M which are operably disposed in the suspension column 14 wherein the suspension burners 18A, 18B, 18C, 18D, 18E, 18F, 18G, 18H, 18I, 18J, 18L, 18M are spaced from one another along the vertical length of the suspension column 14. The number of suspension burners 18A, 18B, 18C, 18D, 18E, 18F, 18G, 18H, 18I, 18J, 18L, 18M and spacing therebetween can be varied to accommodate the length and size of the suspension column 14 as well as the material to be combusted and to accomplish fractionation. For example, spacing can be to provide that the tires 12 be readily removable from an upwardly disposed suspension burner 18A to burner 18B and so on. Each of the suspension burners 18A, 18B, 18C, 18D, 18E, 18F, 18G, 18H, 18I, 18J, 18L, 18M can be similar in design and operation and like numbers are intended to describe like parts with the exception that burner 18A is connected to additional components described hereinafter.

[0028] In this regard, suspension burner 18A connects to housing 24 which includes an exterior gate 20 and an interior gate or door 22 which provide an airlock during injection of tire 12 into the suspension column 14. The exterior gate 20 is opened while the interior gate 22 is closed to pass waste derived fuel material into a burner housing 24. The exterior gate 20 is closed while the interior gate 22 is opened to pass tires 12 from burner housing 24 into the suspension column 14. This is illustrated in FIGS. 2A-4.

[0029] The suspension burner 18A includes a plurality of support fingers 26A each having a waste support surface 28A which are removably disposed in the suspension column 14 through slotted open surface 32A to provide for self cleaning of the support surface 28A of the fingers 26A upon removal from the column 14. In this regard, slotted surfaces 32A can be formed in a face of the column 14 through which the fingers 26A move back and forth to effect the removal of the residual waste 13.

[0030] Preferably, the suspension burner 18A includes means 30A for automatically retracting the fingers 26A from the column 14. The means 30A can include a motor 31A and a linear actuator 33A which is operably interconnected to the movable housing 52 and fingers 26A. The means 30A sit on a platform 56.

[0031] As for the feeding tires 12, means 16 are provided for automatically feeding the tires 12 to the burner 18A onto the fingers 26A of the suspension burner 18A. Feeding means 16 can include an inclined elevator belt 34 wherein the tires 12 are placed and elevated thereby to the housing 24 through gate 20. A truck ramp 36 is operably disposed adjacent a trailer tipper 38 for enabling dumping tires 12 into a hopper 40. A rotating disk tire separator 42 is operably disposed to the hopper 40 and separates tires 12 into an accumulator 44 for inspection. Unsuitable tires can be rejected onto a reject conveyor belt (not shown), while accepted tires 12 are fed onto the inclined conveyor belt 34. Such feed is controlled by means of a controller 46 which is operably connected to a sensor 48 located in the suspension column 14 to sense when the conditions are suitable for combustion to take place for the next in line tire 12.

[0032] As seen in FIGS. 2A and 2B, a linear actuated ram 50 is partially operably disposed in housing 52 and casing 54 connected to the housing 24 and is controllably moved back and forth through burner housing 24. The controller 46 receives a signal to feed a tire 12 and initiate the ram 50 to push the tire 12 from the burner housing 24 into the suspension column 14 and onto the suspension fingers 26A. The tire 12 is burned within the suspension column 14. Tires 12 may also be introduced mechanically onto the suspension burner 18A by other means such as a screw feed or other similar device (not shown).

[0033] In this regard, the boiler 72 can include combustion zone 73 and an economizer zone 75 with dual economizers feeding heat and oxygen to a lower end of the column 14. Boiler 72 can be equipped with one or more slip streams of hot gases taken from economizer zone 75 of boiler 72 and introduced into a lower end of the column 14 as seen in FIG. 7. The tire(s) 12 is exposed to the hot gas stream until the rubber is gasified and subjected to the fractionation process. As seen in FIG. 6 and FIG. 7, a vent 82 from the column 14 can be routed back to the boiler combustion zone 73 as a fuel supplement. This is accomplished by providing conduit 83 which can be connected to the upper portion of the column 14 to remove hot organic vapor and fixed carbon particulate to a cyclone 85 which passes gas and fixed carbon particulate to the combustion zone 73 of the boiler 72. A CO₂ removal apparatus 87 can be operably connected to the cyclone 85 to remove CO₂ from the gas reflux 89 to the column 14 further providing lower emissions for the boiler 72. The fuel stream from the gasification of the tire 12 was sampled and analyzed for flow rate (velocity), temperature, moisture, molecular weight, heat content, gas density, semi-volatile organics speciation, volatile organics speciation, hydrogen sulfide (H₂S), carbon monoxide (CO), carbon dioxide (CO₂), nitrogen oxides (NO_x), total organic carbon (TOC), oxygen (O₂), and absolute pressure under varying scenarios. The inlet of the chamber was monitored for flow rate (velocity), temperature, and O₂.

[0034] FIGS. 3A-3C show several of the steps of wherein the tires 12 are burned and residual of tires 12 is further gravity fed, such as to a lower burner 18B and ultimately dispensed onto a drop-out conveyor 58 which can be a chain drag out assembly operably disposed in a vessel 59. A water seal 61 can be provided by virtue of inner column wall 80 of column 14 extending below water level. In this way, the introduction of tramp air is isolated from entering the combustion zone and the system 10 only introduces slip stream air from boiler 72 as is apparent herein. A steel or metal roll-off container 60 and residual ash roll-off container 62 are provided wherein the conveyor 58 can be equipped to automatically separate the residual ash and metal, such as via incorporating a magnetic conveyor.

[0035] As generally conceived, first conduit 64 includes a first end 66 which can be communicably connected to a heated air flow path defined by an annular jacket 68 of the suspension column 14 and a second end 70 communicably connected to an outflow air path of a high energy consumption device, such as a boiler 72, wherein air flow passes from the boiler 72 to the jacket 68. A second conduit 74 includes a first end 76 communicably connected to the heated air flow path of the jacket 68 and a second end 78 communicably connected to a return air flow path of the boiler 72 wherein air flow passes from the jacket 68 to the boiler 72. It is contemplated that the column 14 and jacket 68 can be used for hot air, steam or hot oil to recover heat generated.

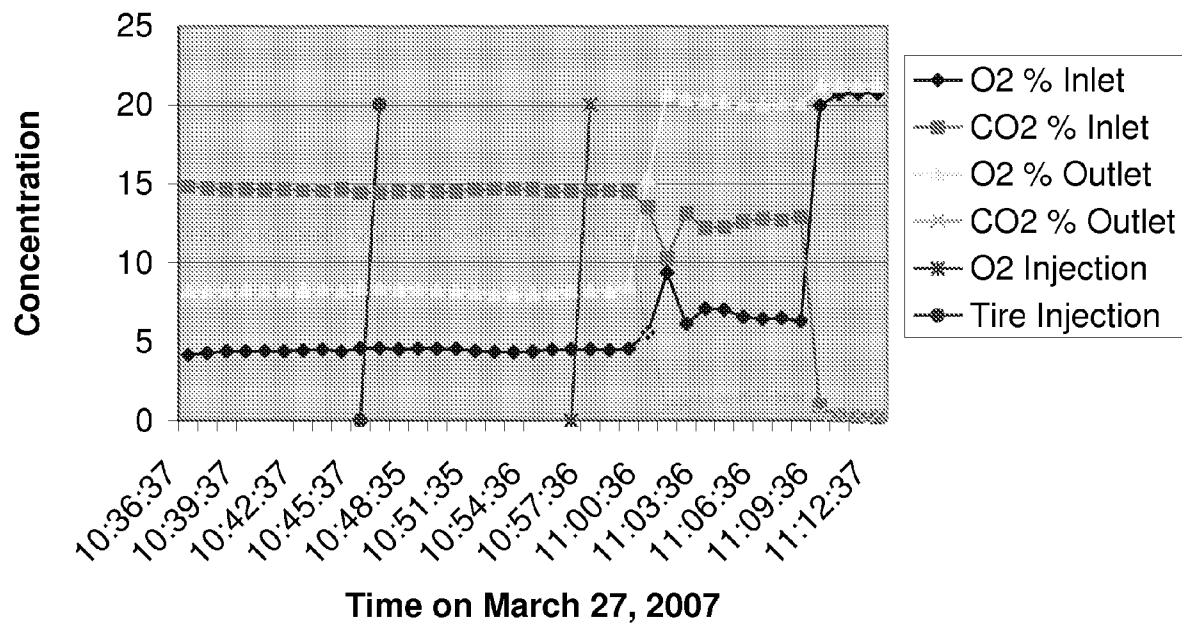
[0036] The embodiment shown in FIG. 1 shows that the suspension column 14 can be equipped with the outer air passage jacket 68 surrounding an inner column wall 80, although it is envisioned that other air channels can be configured. In this way, the air enters the jacket 68 and passes therethrough being heated from the outer surface of the inner wall 80 without mixing air from combustion occurring within the inner wall 80. The system 10 includes air blowers 81 of the type known to circulate air through the described air flow path. Also, vent 82 is provided on the column 14 and conduit 83 connects through jacket 68 to column 14. In this regard, a slip stream of the boiler 72 combustion gases can be fed through conduit 83 and fed back to the boiler 72 as described. Thus, heat is recovered from the jacket 68 as well as boiler 72 through reintroduction of combustion gases and there provides a heat recovery boiler.

[0037] Samplings were performed under three different process conditions. The first condition consisted of the introduction of a quarter tire into the gasification unit under a high temperature, low oxygen and high velocity condition. The second condition consisted of the introduction of a whole tire into the tire gasification unit under the same high temperature, low oxygen and high velocity settings conducted during the first condition. The third test condition consisted of the introduction of one whole tire into the unit under high temperature, low oxygen and low airflow conditions. After the first tire was gasified, a second tire was immediately introduced into the unit.

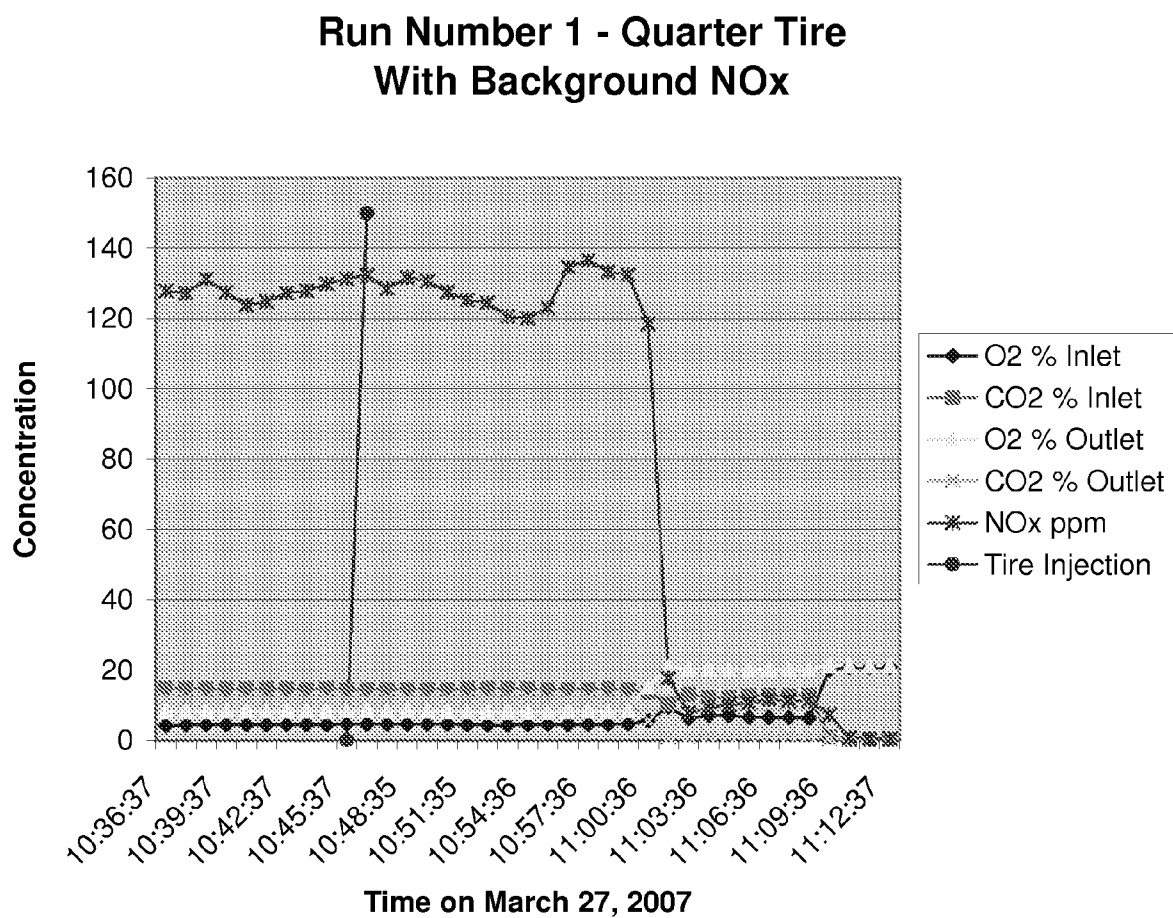
[0038] The tire gasification inlet stack was sampled for stack gas velocity, temperature, O₂ and CO₂ content. The tire gasification outlet stack was sampled for stack gas velocity, temperature, semi-volatile organic compounds, volatile organic compounds, hydrogen sulfide, fuel density, heat content, and gaseous pollutants (O₂, CO₂, NO_x, CO, VOC). Results of the test are as follows.

GRAPH 2-1A CHAMBER INLET MINUTE-BY-MINUTE AVERAGES
QUARTER TIRE TEST

Run Number 1 - Quarter Tire

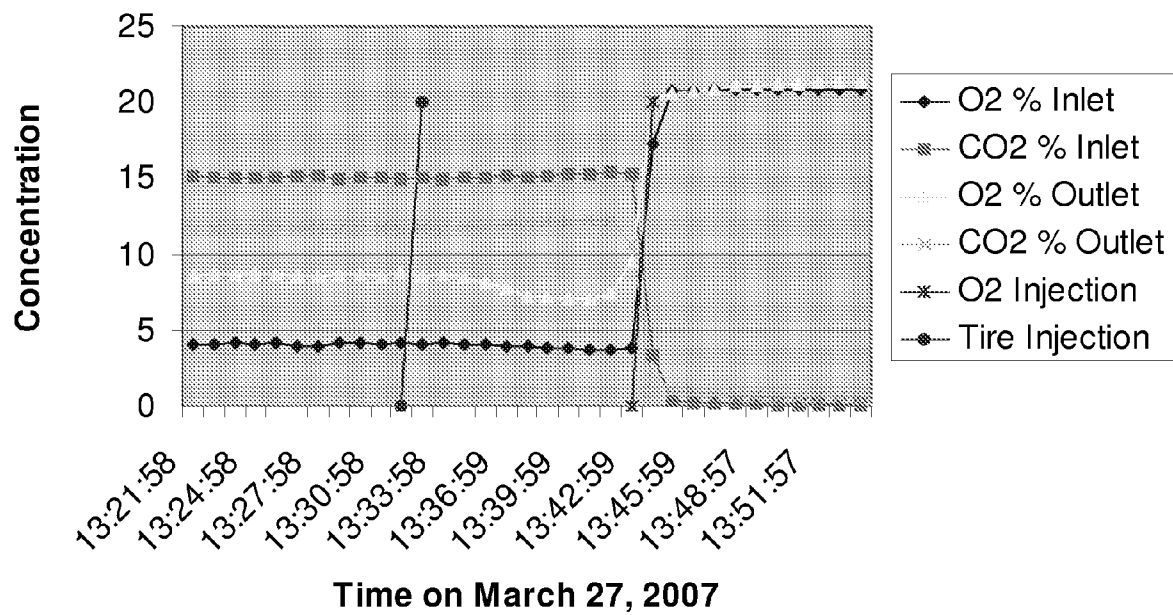


GRAPH 2-1 B CHAMBER INLET MINUTE-BY-MINUTE AVERAGES
QUARTER TIRE TEST WITH NO_x

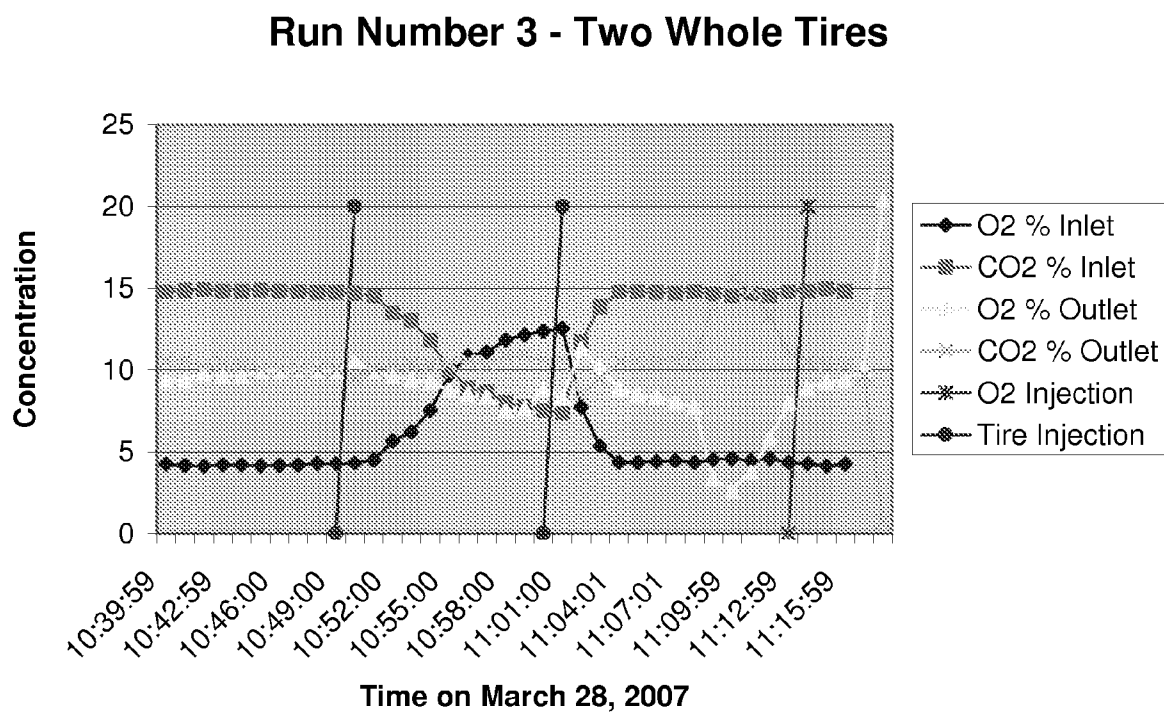


GRAPH 2-2 CHAMBER INLET MINUTE-BY-MINUTE AVERAGES
WHOLE TIRE TEST

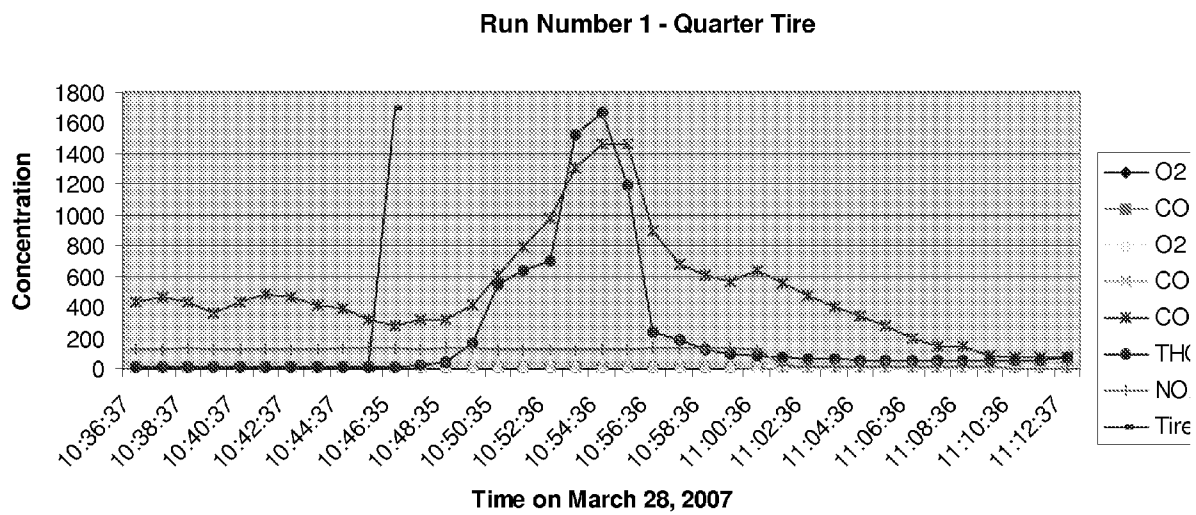
Run Number 2 - Whole Tire



GRAPH 2-3. CHAMBER INLET MINUTE-BY-MINUTE AVERAGES
WHOLE TIRE SECOND TEST DAY

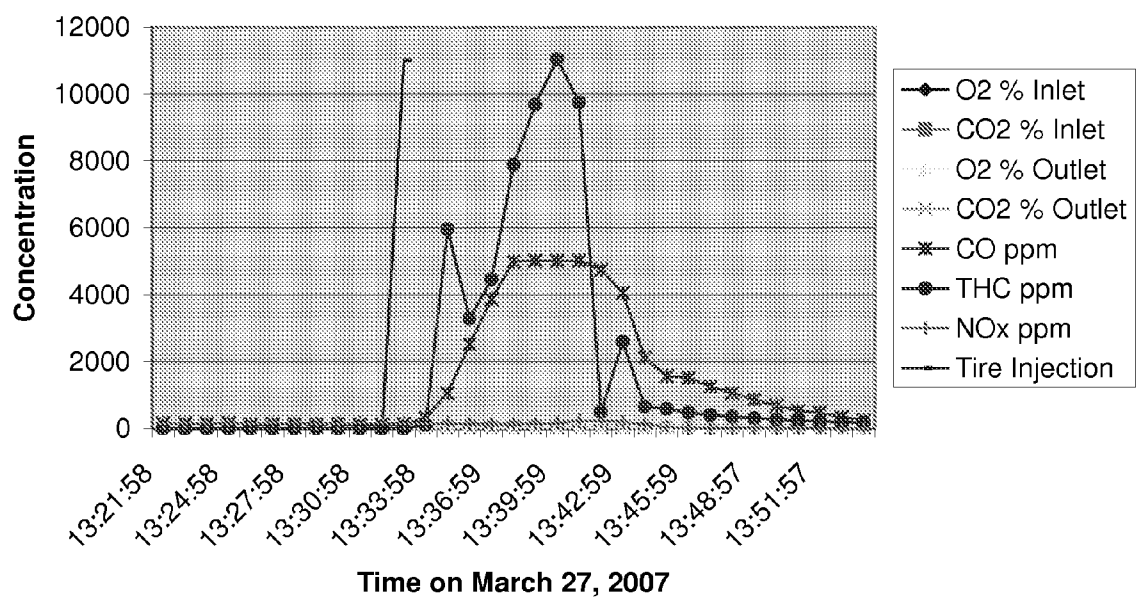


GRAPH 2-4. CHAMBER OUTLET GASEOUS POLLUTANTS MINUTE-BY-MINUTE AVERAGES
QUARTER TIRE TEST



GRAPH 2-5. CHAMBER OUTLET GASEOUS POLLUTANTS MINUTE-BY-MINUTE AVERAGES
WHOLE TIRE TEST

Run Number 2 - Whole Tire



[0039] The invention thus provides for recovery the energy in the tire via gasification of the tire under low oxygen, high velocity and approximately 1,100° F. conditions. The present system 10 can extract the slip stream gas from the boiler's economizers 75 at one or more points in order to be able to temper the inlet temperature and use the waste heat and low oxygen of the existing process to supply the operating conditions desired. An induced draft fan 77 can be installed where needed, e.g., on the exit side of the single tire column, to pull the hot gasses through the column and force the fuel gas and fixed carbon into the combustion zone 73 of the boiler 72.

[0040] Several tests were performed. The first day of operation the unit was run in a high velocity mode. The second day, the velocity was reduced in order to collect data on how important the velocity was to the process.

[0041] With a quarter tire weighing 3.6 pounds, under 4% oxygen and a gas stream of 1,149° F., the tire was reduced to 0.40 pounds of steel (88.88% reduction) in 10 minutes. All of the heat value of the tire was passed into the boiler's combustion zone including both the vapor and fixed carbon.

[0042] A whole tire weighing 18.68 pounds was then introduced into the unit and under 4% oxygen and a gas stream of 1,168° F., it was reduced to 1.96 pounds of steel (92.40% reduction) in 9 minutes. The ashing of the rubber was stopped and 1.42 pounds of ash was collected and analyzed. The heat value of the ash was 4,867 BTU/pound.

[0043] The next day two tires, totaling 37.48 pounds, were introduced 11 minutes apart into 4% oxygen and 1,181° F. conditions. The two tires were reduced to 3.72 pounds of steel (90.07% reduction) in 23 minutes.

Observations

[0044] It is found that the low oxygen conditions did not allow for the combustible products in the tires 12 to burn. It is also found that the elevated temperatures were adequate to vaporize the organic volatile component in the rubber. Finally, it is found that high velocities were necessary in order to draw the fixed carbon component of the tires 12 off of the tire wire, out of the single tire test column 14 and into the combustion zone 73 of the boiler. Thus the radiant energy of the tire was recovered in the boiler 72, no ash was left in the column 14 and a higher quality of steel was produced. The invention thus provided a new process "tire fractionation." It was also observed that the process proceeded in five individual steps:

[0045] 1) HEAT→2) DRY→3) VOLATILIZE→4) COMBUST→5) ASH

[0046] It is determined that under the correct conditions the rate at which the tires 12 fractionate are independent of their weights. (In other words, the quarter tire broke down in the same amount of time as the whole tire.) In general they follow the following timings:

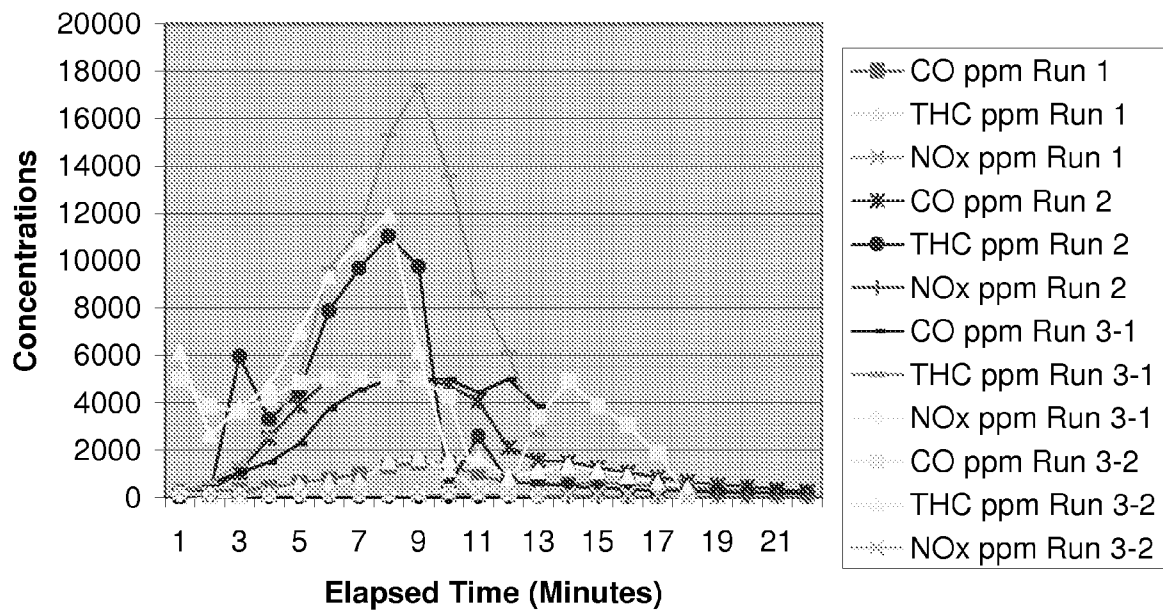
Heat	1 Minute
Dry	1-2 Minutes
Volatilize	2-3 Minutes
Combust	4 Minutes
Ash	1 Minute
Start to Finish	9-11 Minutes

[0047]

Start to Finish

9-11 Minutes

Time Line For All Tire Injections



[0048] Also a sample of the ash produced by the process was collected and analyzed. It contained no detectable Mercury, 12,300 mg/Kg of Zinc, as expected, and conformed to EPA standards for metals, VOC and SVOC TCLP testing. No apparent reason exists that this ash added to the boiler's ash would be detrimental to the boilers operation such as a slagging factor.

[0049] This test showed that tires **12** can be fractionated under low oxygen and high temperature, approximately 1,100° F. conditions, producing a gaseous and solid fuel for the boiler while producing no negative effects to the boiler and generating a high quality of recyclable steel.

[0050] In one aspect of the invention, the gasses generated from the tires **12** are concentrated by refluxing a portion of the overhead stream back into the vaporization zone **102** of the column **14**. Also, the fixed carbon fraction is separated from the overhead stream by an inline cyclone **85** and then reintroduced into the fuel feed duct **92** to the boiler **72**. A delumper or grinder **94** will be located at the bottom of the cyclone **85** in order to size the solids before they are sent to the boiler **72** for optimum combustion.

[0051] Because tires **12**, with the exception of a higher BTU value and a higher Zinc content, compare favorable with coal, Tire Derived Fuel (TDF) is being successfully utilized worldwide as a supplemental fuel in coal burning operations.

[0052] The above described embodiments are set forth by way of example and are not for the purpose of limiting the present invention. It will be readily apparent to those skilled in the art that obvious modifications, derivations and variations can be made to the embodiments without departing from the scope of the invention. Accordingly, the claims appended hereto should be read in their full scope including any such modifications, derivations and variations.

What is claimed is:

1. An energy recovery system for waste fuel, which includes:

a suspension column;

a plurality of means for suspending waste fuel in said suspension column;

means for receiving the waste fuel onto one of said suspension means upwardly disposed within said column and feeding said combustible waste material to an adjacent downwardly disposed suspending means; and

means operably connected to said suspension column for gasifying the waste fuel.

2. The energy recovery system for waste fuel of claim 1, which further includes means operably connected to said suspension column for performing fractionation on the waste fuel.

3. The energy recovery system for waste fuel of claim 2, wherein said performing fractionation means includes a cyclone operably connected to said column.

4. The energy recovery system for waste fuel of claim 3, wherein said performing fractionation means includes a carbon dioxide removal device operably connected to said cyclone and said column.

5. The energy recovery system for waste fuel of claim 2, wherein said performing fractionation means includes a

boiler having a combustion zone and an economizer zone, said boiler operably connected to said cyclone and said suspension column.

6. The energy recovery system for waste fuel of claim 1, wherein said suspending means are spaced from one another along a length of said suspension column.

7. The energy recovery system for waste fuel of claim 1, which further includes a fan operably connected to said gasifying means for affecting gas flow rate.

8. The energy recovery system for waste fuel of claim 1, wherein said gasifying means includes a first conduit having a first end communicably connected to a heated air path of said suspension column and a second end communicably connected to an outflow air path of a high energy consumption device wherein air flow passes from said outflow air path of said high energy consumption device to heated air flow path of said suspension column, and a second conduit having a first end communicably connected to said heated air flow path of said suspension column and a second end communicably connected to a return air flow path of said high energy consumption device wherein air flow passes from said heated air flow path of said suspension column to said return air flow path of said high energy consumption device.

9. The energy recovery system for waste fuel of claim 1, further including means for removing residual combusted and noncombustible waste materials from said suspension column.

10. The energy recovery system for waste fuel of claim 9, wherein said waste removing means includes a conveyor system downwardly disposed in said suspension column.

11. The energy recovery system for waste fuel of claim 10, wherein said conveyor system includes a magnetic conveyor.

12. The energy recovery system for waste fuel of claim 8, wherein said suspension column includes an outer air passage jacket surrounding an inner column wall to which said first and second conduits are communicably connected such that said air enters said jacket and passes through said jacket being heated from an outer surface of said inner wall without mixing with air combustion occurring within said inner wall.

13. The energy recovery system for waste fuel of claim 1, wherein each suspending means includes a plurality of support fingers each having a waste derived fuel support surface which is removably disposed in said suspension column to provide for self cleaning of said support surface of said fingers upon removal from said suspension column.

14. The energy recovery system for waste fuel of claim 13, wherein said suspending means includes means for automatically retracting said fingers from said column.

15. The energy recovery system for waste fuel of claim 1, which further includes means for automatically feeding waste material onto said suspending means.

16. The energy recovery system for waste fuel of claim 1, which further includes means for circulating said air through said air paths.

17. A method of producing energy recovery, comprising:

(a) delivering waste fuel onto an upwardly disposed suspension device which is operably disposed in a suspension column, wherein said suspension column includes a plurality of suspension devices operably disposed in said suspension column wherein said suspension devices are spaced from one another along the length of said suspension column;

(b) performing a step in a fractionation process on said waste fuel and feeding said waste fuel onto to an adjacent downwardly disposed suspension device further combust said combustible material; and

(c) capturing energy liberated from performing said fractionation step.

18. The method of claim 17, wherein said step in said fractionation process includes one of heating, drying, volatilizing, combusting and ashing.

19. The method of claim 18 which is characterized to include the steps of heating, drying, volatilizing, combusting and ashing.

20. The method according to claim 17, wherein said waste fuel includes tires having steel.

21. The method according to claim 20 which includes removing residual steel matter.

22. The method according to claim 17, which further includes forming an air path across a surface of said suspension column and directing said air path to a high energy use device.

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