United States Patent [19]

Keller et al.

[11] **3,817,459**

[45] **June 18, 1974**

[54] **DEVICE AND PROCESS FOR RECLAIMING USED WOOD**

[76] Inventors: **David Keller,** 7601 14th Ave., Sacramento, Calif. 95820; **Henry Keller,** Rt. 1, Box 188A, Sacramento, Calif. 95632

[22] Filed: **Jan. 2, 1973**

[21] Appl. No.: **320,274**

[52] **U.S. Cl.** **241/20,** 241/24, 241/28, 241/38, 241/79.1

[51] **Int. Cl.** **B02c 21/00**

[58] **Field of Search** 241/20, 24, 25, 28, 30, 241/38, 68, 77, 79.1

[56] **References Cited**

UNITED STATES PATENTS

3,660,038	5/1972	Brewer	241/24 X
3,720,380	3/1973	Marsh	241/20
3,741,863	6/1973	Brooks	241/28

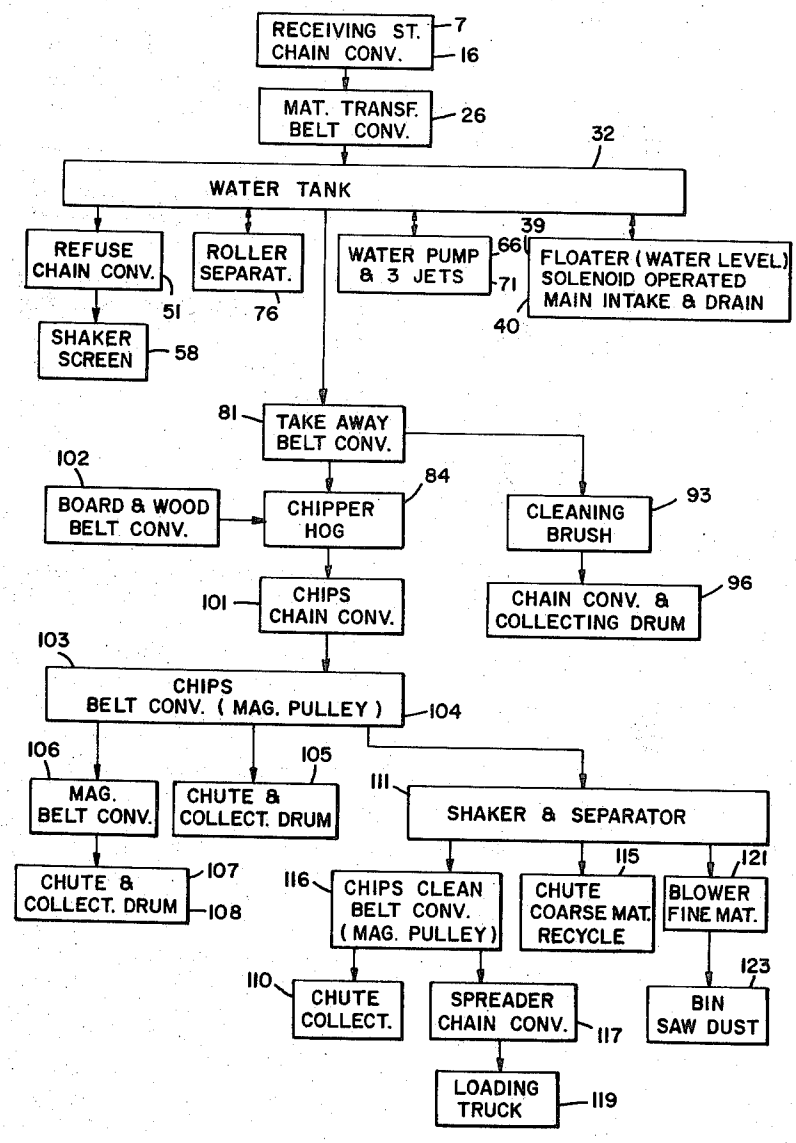
Primary Examiner—Granville Y. Custer, Jr.

Attorney, Agent, or Firm—Lothrop & West

[57] **ABSTRACT**

A used wood reclaiming device has a receiving means for material including miscellaneous used wood pieces and accompanying debris. The received material is conveyed to a water tank to effect a separation of floating material from sinking material. The sinking material is conveyed away from the tank while the floating material is conveyed to a wood mill shredding the wood pieces into small particles. Metal is magnetically removed. The remaining shredded wood is then carried to a sizing device from which the smaller particles are sent to storage while the larger particles are carried away.

9 Claims, 10 Drawing Figures



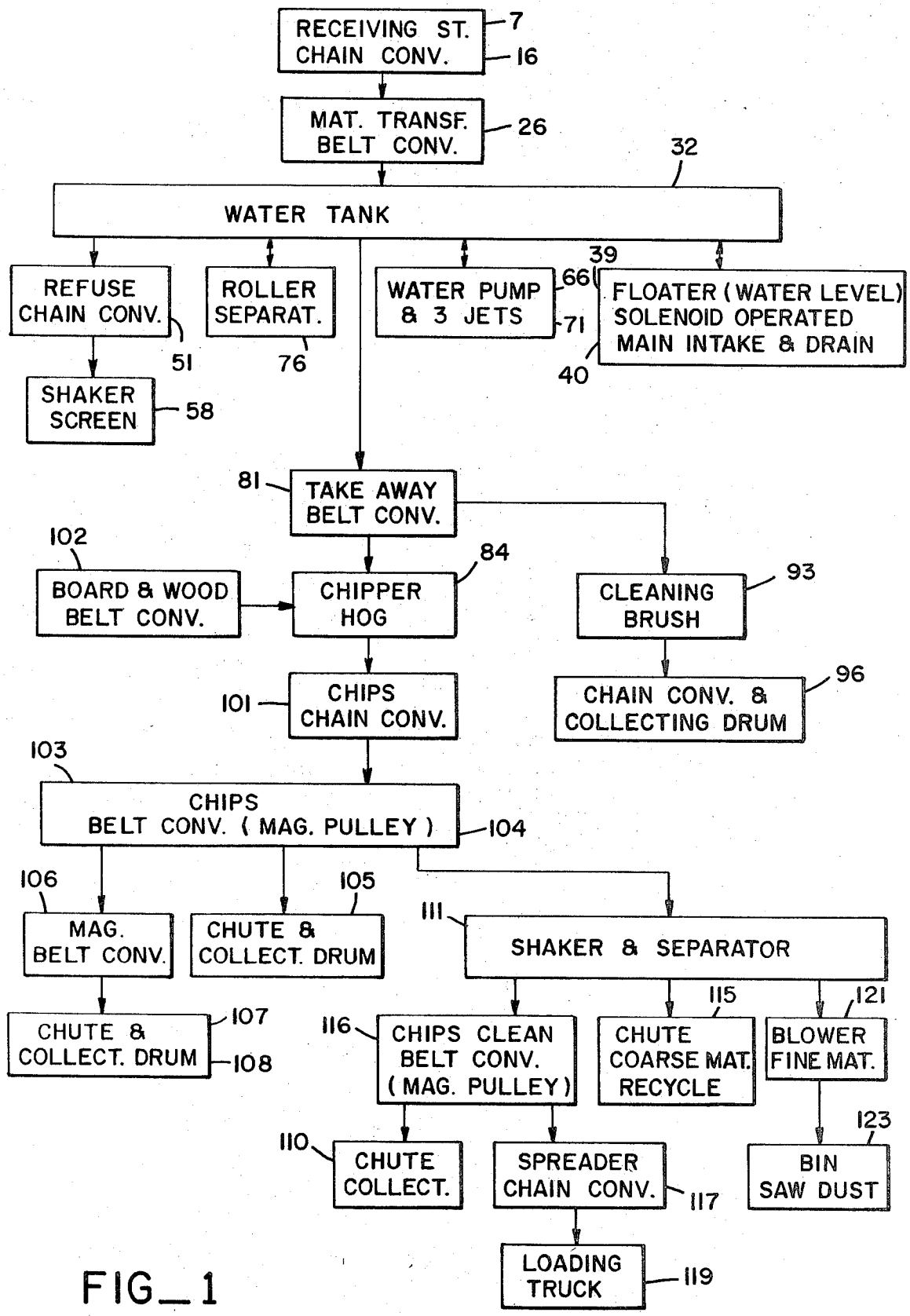

RECEIVING ST. CHAIN CONV.
7
16
MAT. TRANSF. BELT CONV.
26
32
WATER TANK
REFUSE CHAIN CONV.
51
ROLLER SEPARAT.
76
WATER PUMP & 3 JETS
66
71
39
FLOATER (WATER LEVEL) SOLENOID OPERATED MAIN INTAKE & DRAIN
40
SHAKER SCREEN
58
81
TAKE AWAY BELT CONV.
102
BOARD & WOOD BELT CONV.
CHIPPER HOG
84
CLEANING BRUSH
93
101
CHIPS CHAIN CONV.
CHAIN CONV. & COLLECTING DRUM
96
103
CHIPS BELT CONV. (MAG. PULLEY)
104
106
MAG. BELT CONV.
CHUTE & COLLECT. DRUM
105
111
SHAKER & SEPARATOR
CHUTE & COLLECT. DRUM
107
108
116
CHIPS CLEAN BELT CONV. (MAG. PULLEY)
CHUTE COARSE MAT. RECYCLE
115
BLOWER FINE MAT.
121
123
110
CHUTE COLLECT.
SPREADER CHAIN CONV.
117
BIN SAW DUST
LOADING TRUCK
119

FIG_1

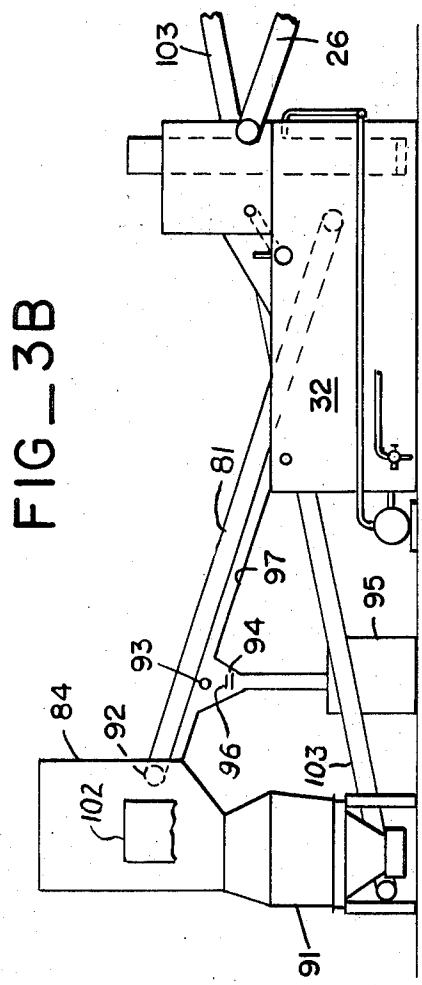

103
26
32
81
97
95
93
94
84
92
96
103
102
91

FIG_3B

13
6
13
7
12
21
16
9
11
11
22
12
26
123
121
122
122
28
119
117
118
110
116
120
107
108
106
105A
103
119

FIG_2A

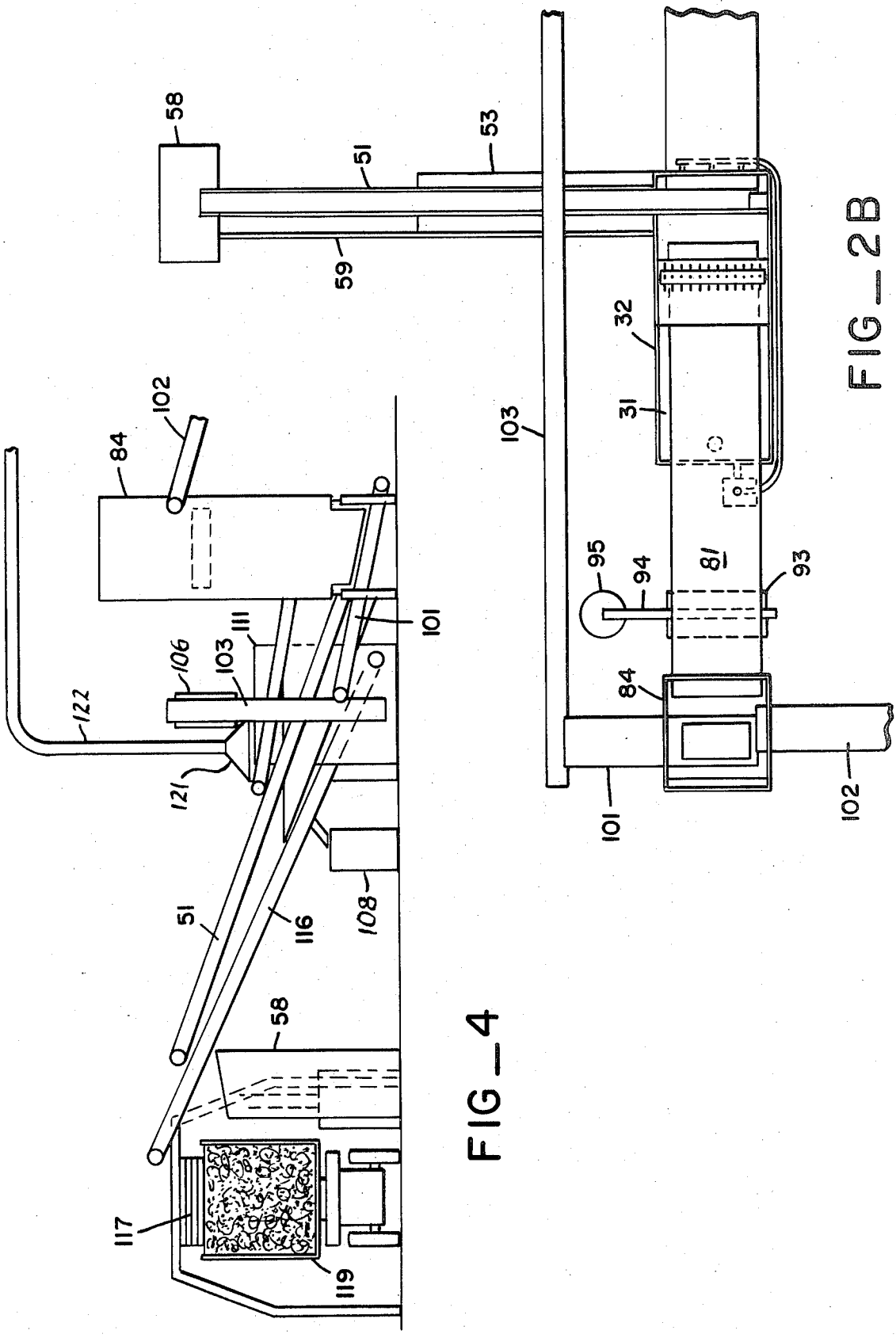

58
51
53
59
32
31
103
102
84
95
94
81
93
101
111
106
103
122
121
108
116
51
58
117
119

FIG_2B

FIG_4

FIG_3A

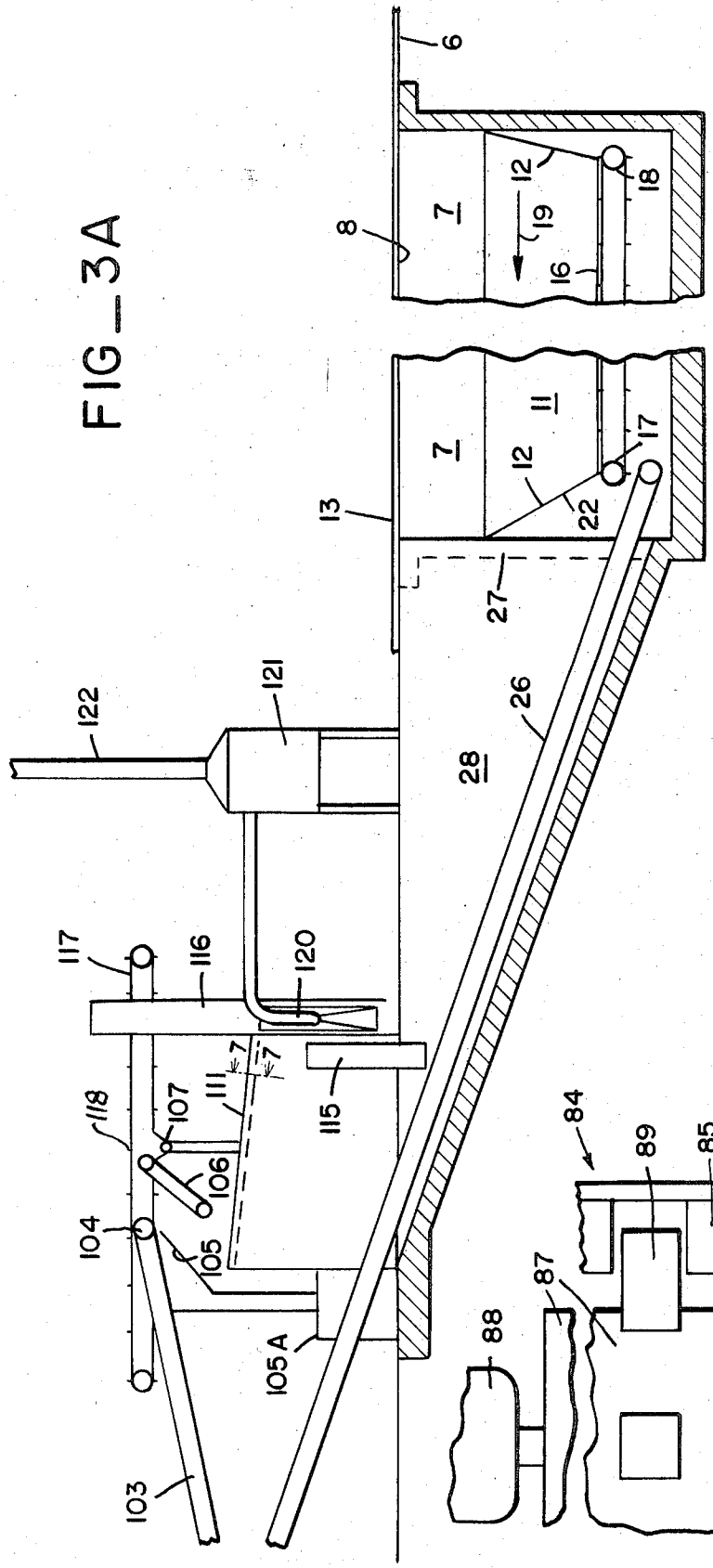


FIG_7

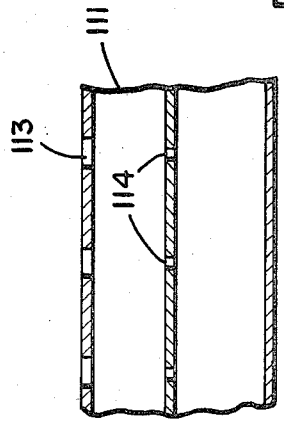


FIG_8

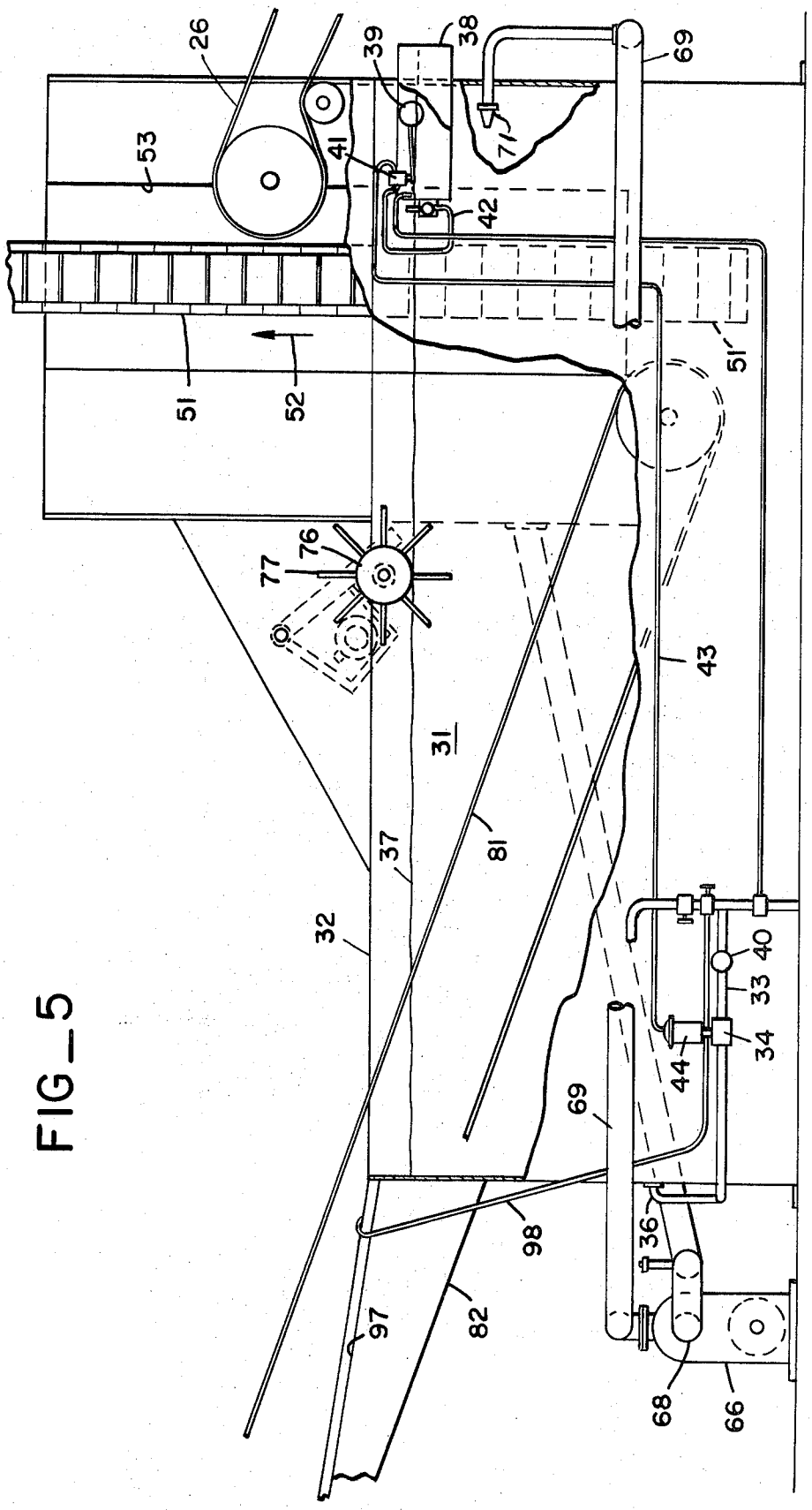

26
39
38
69
53
41
71
42
51
52
51
77
76
43
31
37
81
32
40
33
34
44
69
36
98
97
82
68
66

FIG_5

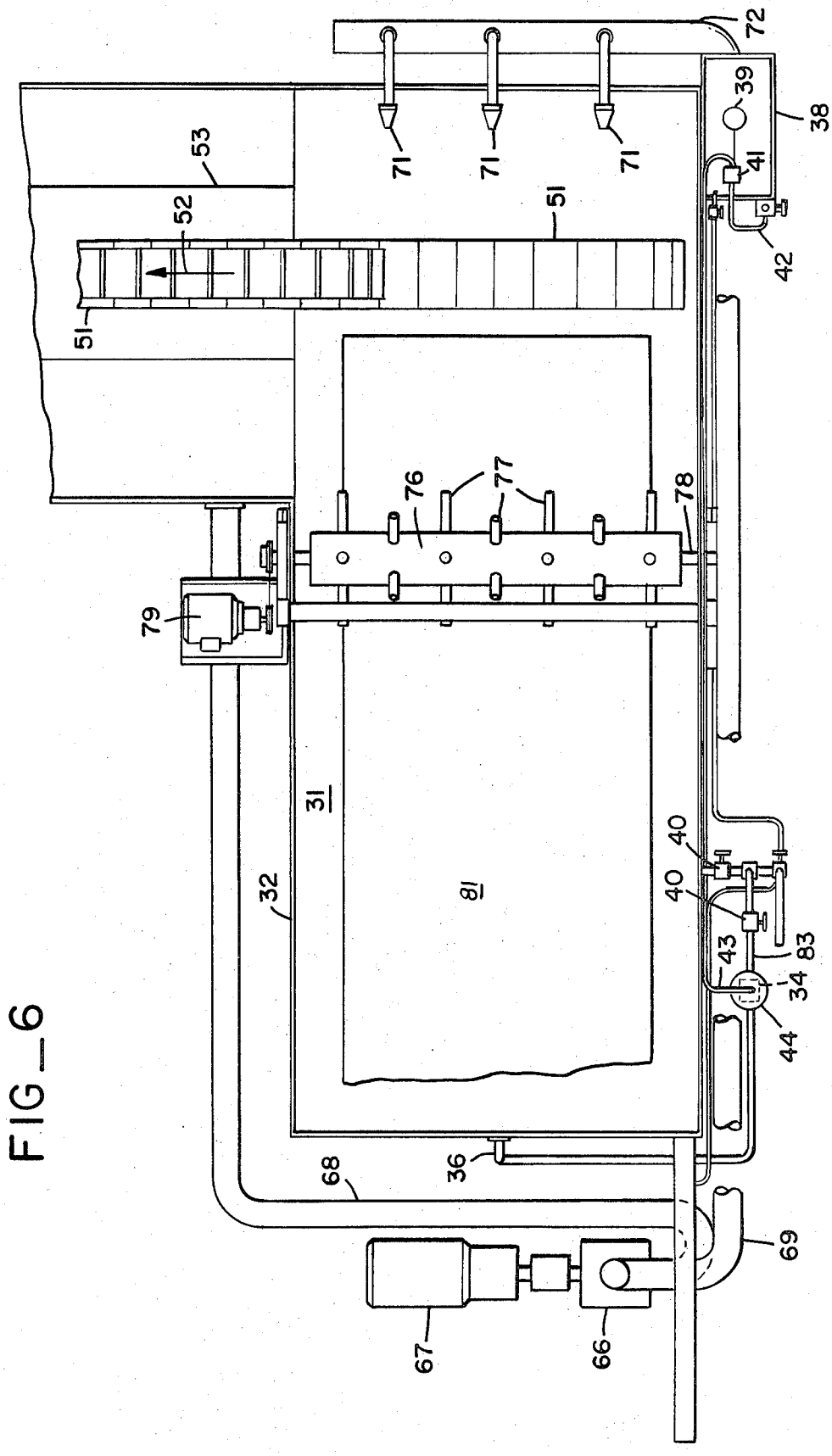

72
39
38
71
71
71
41
53
52
51
51
42
51
76
77
78
79
31
81
32
40
40
43
83
34
44
68
36
69
67
66

FIG_6

DEVICE AND PROCESS FOR RECLAIMING USED WOOD

The value of wood products, particularly old lumber, parts of wrecked buildings, boxes and the like, is presently of sufficient economic importance and worth to justify reclaiming the material. Hand labor for this purpose is prohibitive in cost. Furthermore, available used material of this nature is often of widely variant wood sizes, shapes and conditions. Particularly, the wood is intermixed with all sorts of debris, such as concrete, brick, glass, metal, nails, cans, paper, fiber and comparable items. Mass handling of such used material in an economic and satisfactory fashion is a very difficult problem although a solution thereto is highly desirable from the standpoint of improved ecology and conservation of natural resources.

It is therefore an object of the invention to provide a machine and method for taking used wood material and its accompanying or associated debris in virtually any condition, i.e., as found after the demolition of buildings, the unpacking of goods and the like and treating such used wood material to afford a further usable and economic wood product. Usable by-products such as metal and the like may also be recovered.

Another object of the invention is to provide a device for effectively and economically reclaiming used wood from debris.

A further object of the invention is to provide an effective method for reclaiming used wood from debris.

A further object of the invention is to provide a plant that will handle very large quantities of used wood and debris with only a small amount of manual supervision and labor to afford an acceptable and reusable wood product.

Another object of the invention is in general to provide a way of treating for reuse used wood contaminated with debris.

Other objects, together with the foregoing, are attained in the embodiment of the invention described in the accompanying description and illustrated in the accompanying drawings, in which:

FIG. 1 is a diagram showing a flow chart of the machine operation and the process pursuant to the invention;

FIG. 2A is a plan of one portion of a device or plant constructed to reclaim used wood material;

FIG. 2B is a plan of the remaining portion of the plant of FIG. 2A;

FIG. 3A is a side elevation of the portion of the plant shown in FIG. 2A;

FIG. 3B is a side elevation of the remaining portion of the plant of FIG. 3A;

FIG. 4 is an elevation of one end of the plant shown in FIG. 2A;

FIG. 5 is a side elevation to an enlarged scale of a water bath utilized in the plant and process, portions being broken away;

FIG. 6 is a plan of the water bath shown in FIG. 5, certain portions being broken away;

FIG. 7 is a fragmentary, enlarged cross-section, the plane of which is indicated by the line 7—7 of FIG. 3A; and

FIG. 8 is a fragmentary view showing some of the interior construction of the wood mill.

While the used wood reclaiming device can be embodied and the process can be practiced in a large number of different ways, depending upon the particular requirements at a particular area, a protracted operation in the form illustrated herein has been conducted with considerable success. In this instance there are received wooden crates with banding straps, miscellaneous materials from demolished buildings, wood scraps from lumber yards and various other wood materials which have been used or have been discarded. Normally, these have no further economic utility and represent only a burden or waste. With such wood material there is usually intermixed all sorts of debris, particularly in connection with the substance of demolished buildings. The debris may be in the nature of cement, plaster, miscellaneous plumbing, wire, bottles, paper, cloth, tar, roofing, bricks and comparable non-wood items.

The plant or device for carrying out the present reclaiming process is situated in an appropriate area on the ground **6** at a convenient point for access. There is a sunken receiving pit **7** having an open top **8** near a discharging area **9.** Within the pit there is preferably provided downwardly converging side walls **11** and end walls **12** and also side guard rails **13** at the ground level. The arrangement is such that trucks or other carriers can utilize the area **9** to approach the rails **13** and dump their burden of used materials into the pit **7** by gravity. In one example, the pit is approximately 16 feet deep, about **60** feet long and about **20** feet wide.

Near the bottom of the pit and at the converging portion of the walls **11** and **12** there is provided a receiving conveyor **16** conveniently trained over rollers **17** and **18.** At least one of these is power driven, in the direction of the arrow **19.** The conveyor **16** conveniently includes chains spanned by transverse rails or cleats **21** so that material dumped into the pit along its length is conveyed toward the left end thereof, as seen in FIGS. **2A** and **3A.** The end wall **12** at the left end is interrupted to provide an opening **22** at the end of the receiving conveyor **17.** All the material on the conveyor **16,** which usually is in the nature of wood, tramp metal and other debris, is dumped by gravity through the opening **22** onto a "first" conveyor **26.**

The conveyor **26** is preferably a plain belt conveyor ascending at a gradual angle from a point near the bottom of the pit through an opening **27** in the end wall of the pit **7.** The conveyor **26** rises to and above the level of the ground **6** in a trough **28,** in effect a continuation of the pit. The first conveyor **26** extends to a satisfactory height above the level of the ground **6** and thereat discharges all of the conveyed material over the upper end of the conveyor **26** into a water bath **31.**

As shown to a large scale in FIGS. **5** and **6,** the water bath is confined in a metal tank **32** having the customary bottom, sides and ends and left open at the top. Water is supplied to the tank through a supply line **33** from any appropriate source through a regulating valve **34** and enters the tank through a fitting **36.** Water rises in the tank until it achieves an approximate level **37** which is especially regulated. Adjoining and communicating with the tank **32** is a quiet tank **38** disposed at one end of the tank **32** and containing a small volume of water at approximately the level **37.** The tank **38** has a float **39** actuating an air valve **41** receiving air through a supply line **42.** The air valve controls air flow through a line **43** to an air responsive controller **44** for

the water valve **34.** When the level **37** in the tank **32** and correspondingly in the quiet tank **38** falls and permits the float **39** to drop, the air valve **41** is correspondingly opened thus actuating the regulator **44** so that water flows in from the line **33** to the valve **34** and through the fitting **36** to add water to the bath **31.** When the level is sufficiently high, the float **39** rises, cuts off the air and correspondingly cuts off the addition of water.

Periodic draining of water and sludge and refilling of the tank with fresh water can be accomplished through solenoid controlled valves **40.**

Used wood and debris falling by gravity from the upper end of the first conveyor **26** (FIG. **5**) drops into the water bath **31.** Much of that material is much heavier than water and so falls by gravity or settles out in the bath **31** and tends to fall toward the bottom of the tank **32.** This debris includes not only heavy metal bodies, concrete, plaster, glass and items of that sort, but also sometimes may include extra heavy pieces of wood which might have become waterlogged, saturated with heavy fluid or encased with heavy material. All heavy components fall and tend to congregate on the bottom of the tank **32.** Virtually all of the heavy, non-wood debris falls by gravity and separates from the floating wood in the water bath **31.** Such heavy materials, as is particularly apparent from FIGS. **5** and **6,** in dropping toward the bottom of the tank tend to lodge upon a conveyor belt **51.** This has its upper run traveling in the direction of the arrow **52** in FIGS. **5** and **6** and ascends from a position near the bottom of the tank through an attached lateral trunk tank **53** to a level above that of the water bath level **37.**

Particularly as shown in FIG. **2B,** the debris is carried to a conventional shaker screen separator **58** or the like. Therein much of the entrained water is shaken off and drained and returns to the water tank through a duct **59.** Debris separated from water or dewatered at the elevated shaker **58** falls by gravity into a suitable receptacle (not shown) for ultimate discharge.

This miscellaneous heavy material at the present time has little or no economic value. If it happens to contain a substantial portion of metal the shaker separator **58** or the upper pulley for the conveyor **51** can incorporate a magnetic separating means to segregate the metal from the remainder of the debris. In most instances, however, there is little or no material worth reclaiming in the wet debris on the belt **51.** In this fashion much of the entering debris accompanying the used wood is immediately removed from the necessity for further handling and is taken away from the water bath and separately disposed of.

Material remaining in the water bath is largely flotsam disposed near the water level **37.** It enters the tank **32** near one end. Means are provided for impelling such flotsam toward the other end of the tank. For that reason there is provided a circulating pump **66** (FIGS. **5** and **6**) driven by an electric motor **67** and having an intake line **68** connected to the trunk tank **53** at a convenient point below the water level therein. The pump **66** also has a discharge line **69** for pressure fluid which extends to the intake area of the tank **32.** The line **69** is connected to a plurality of horizontal nozzles **71** mounted on a pipe manifold **72** and positioned to discharge horizontally away from the intake end of the tank at a height slightly below the water level **37.**

When the pump **66** is operating water is removed from the trunk tank **53** and is projected with considerable velocity from the nozzles **71** so as to impel an upper level current of water to flow along the top of the tank from the right end toward the left end, as seen in FIG. **6.** This water current tends to advance floating and nearly floating wood toward the left in the tank.

Should there be an excessive pile up of wood shapes near the top of the tank due to intermittent discharge from the first conveyor **26** or for other causes, the arriving floating material is spread and somewhat evened or dispersed by the operation of a roll **76** having a plurality of radial arms **77** thereon and mounted on a shaft **78** for rotation about a transverse horizontal axis just above the water level in the tank. The roll is driven by an electric motor **79** (FIG. **6**) in a counter-clockwise direction, as seen in FIG. **5,** to act as a spreader and separator so that the net effect of the operation of the water jets **71** and of the counter-rotating fingers **77** is to provide a reasonably uniform, slightly subaqueous flow of used wood, separated from the debris, toward the left in FIG. **6** and just above and onto a second conveyor **81.** The upper run of this second conveyor **81** travels from right to left in FIG. **6** and emerges from the bath **31** at a gentle incline. The return run of the belt conveyor **81** reenters the tank through a trunk **82** adjoining the discharge end thereof.

The flotsam or supernatant or light, wood material on the upper run of the conveyor **81** continues in a generally upward direction from the water bath **31** to a wood mill **84** often referred to in the lumber and associated industries as a "chipper hog." This is an enclosure in which there is a concave plate **86** with inwardly projecting teeth **85** and a rotor **87** driven by an electric motor **88,** the rotor having radially projecting teeth **89** intermeshing with the concave teeth **85.** Wood shapes such as boards, beams, planks, panels and the like introduced into the wood mill **84** and worked upon by the rotor teeth **89** and concave teeth **85** emerge as wood splinters or slivers and finer particles. The wood received is, in effect, disintegrated or divided into relatively small particles of varying sizes. These particles for the most part fall by gravity into a receiving chamber **91.**

Some of the particles, because of the wet nature of the material and because of their adhesive characteristics, tend to adhere to the conveyor belt **81** and even round the upper pulley **92** at the wood mill and tend to return on the lower run of the conveyor. Much of such material is not advantageously returned to the water bath and so there is in contact with the lower or return of the belt **81** a brush **93.** This is propelled by a suitable electric motor and is effective to wipe off or scrape off any adherent material from the belt and to deposit such material in a trough **94.** Near the bottom of the trough **94** is a transverse chain conveyor **96** extending laterally and conveying the received material away from the trough **94** to a collecting drum **95.** Liquid and finely dissolved material brushed off by the brush and not large enough to be carried away by the conveyor **96** is taken back by a flume **97** returning to the water bath. To make sure that such returned material does not adhere to the flume but flows freely to the water bath, there is a jet spray from the end of a water pipe **98.** This extends from the supply pipe **33** and washes the return material into the bath from which it is discharged ultimately on the cross conveyor belt **51.** Alternatively, if

the material is extremely fine it is drained out with the periodic drainage of the water bath.

In some areas, there is available additional wood material which does not need to be treated in the water bath. For example, there may be clean wood shavings and the like or discard small wood from a lumber mill. This uncontaminated wood can be deposited from outside directly onto an auxiliary conveyor **102** leading into the upper portion of the mill **84** and discharged therefrom in disintegrated form. All of the finely divided material from the wood mill falls by gravity onto a chain conveyor **101.** It is then transferred onto a conveyor **103** extending from a relatively low point near the ground and curved around a drum **104** at a relatively high point.

At this location all of the material on the belt **103** is discharged by gravity. Material discharging from the end of the conveyor **103** and rounding the drum **104** may be subjected to magnetic attraction in the drum. If so, while the other, non-magnetic material and larger metal parts may discharge off the end of the conveyor, some small metallic particles adhere to the return run of the belt for a short distance due to the influence of the magnetized drum **104.** Such metal may fall into a chute **105** leading into a suitable receptacle for small metallic particles. Falling material from the conveyor **103** is dropped onto a special belt conveyor **106** provided with means for establishing a magnetic field at the conveyor. The magnetic field causes any larger metallic items, such as wire bits, nails, screen shreds or the like to travel upwardly on the conveyor belt **106** and to discharge into a transverse trough **107** in turn leading to a discharge collector **108.** Here the metallic material is released into a collecting drum or other suitable container so that any accompanying tramp metal is at this point finally removed from the treated wood. The recovered metal may be further processed by removal of the container **108.** Material transferred to the belt **106** and of a non-magnetic nature, such as wood, falls eventually into a relatively large shaker and separator **111.**

The separating device **111** includes a number of inclined plates or tables, as shown in FIG. **7.** The upper plate has a series of relatively large openings **113** therein. An intermediate plate has a number of intermediate size openings **114** therein and the lowest plate has no openings therein. The device **111** includes a shaker or vibrator impelling the tables to shake or vibrate. Received materials are first directed through the openings **113** if their size is appropriate. Material which does not go through the openings **113** is discharged into a chute **115** onto the first conveyor for recycling. Material that does go through the openings **113** into the intermediate plate but not through the openings **114** travels over the lower edge of the intermediate table onto a conveyor **116** leading up to a loading and distributing conveyor **117** that extends generally horizontally at a substantial elevation. There are cleats **118** on the conveyor **117** to advance the conveyed material. The conveyor **116** discharges over its high end and deposits the conveyed material into a vehicle **119** stationed on the ground below. The operator of the vehicle **119** drives it forward slowly as the conveyor **117** operates and in that fashion gets a substantially uniform lading of his vehicle. This lading is the finished, fragmented, used wood of relatively large size. To make sure that no tramp metal is released into the truck **119,** the upper pulley for the conveyor **116** may be magnetic and may discharge into a metal collection chute **110.**

Material which passes through the table openings **114** and is of smaller size then is discharged from the separator **111** and sucked into a duct **120** leading through a blower **121** and discharged by the blower through a pipe **122** into a storage bin **123.** The result of this operation is that fine particles such as sawdust or comparably sized material is well separated from the larger material going to the truck **119** and is carried ultimately to storage. In one instance, the larger materials carried away by the truck **119** go to a paper manufactory for pulping, whereas the smaller particles that are carried to storage **123** are periodically removed therefrom in order to be further processed as fine particle wood.

In this fashion, there is provided a mechanism and method for taking at random miscellaneous and heterogeneous used wood of various shapes, sizes and kinds accompanied by debris and contaminating matter of all sorts and ultimately supplying separate wood particles of relatively large size useful in the manufacture of paper pulp and of relatively small size utilized in connection with other products. The final wood products are devoid of metal, separated and sold for reuse, and devoid of cement, sand and glass, and other materials of that nature. These have no present economic use but are segregated and can be taken away from the site as a separate entity.

The method employed includes taking in the initial used wood and debris, separating the wood and some debris in the water bath, then grinding or milling the wood into myriad small particles, dewatering it, separating any entrained tramp metal from the wood particles for separate disposition and finally sizing the treated wood particles into those of larger size and those of smaller size and taking the separated wood sizes to other sites for further utilization.

What is claimed is:

1. A used wood reclaiming device comprising:

a. means for receiving material including miscellaneous wood pieces and accompanying debris;

b. a water tank;

c. a first conveyor for transferring said material to said water tank;

d. a wood mill for reducing wood pieces to particles;

e. a second conveyor for carrying floating material from said tank to said mill;

f. a third conveyor for carrying sinking material from said tank;

g. means for separating the reduced wood pieces emergent from said mill at least into a first portion of one size particles and a second portion of another size particles;

h. a fourth conveyor for carrying said reduced wood pieces from said wood mill to said separating means;

i. means associated with said fourth conveyor for removing magnetically responsive metal from said reduced wood pieces;

j. a loading means;

k. means for carrying said first portion from said separating means to said loading means;

l. a storage means; and,

m. means for carrying said second portion to said storage means.

2. A device as in claim 1 including means for urging floating material in said tank toward said second conveyor.

3. A device as in claim 1 including means for maintaining a predetermined level of water in said tank.

4. A device as in claim 1 including means in said loading means for distributing said first portion over a predetermined area.

5. A device as in claim 1 including means associated with said separating means for directing oversize material from said separating means to said first conveyor.

6. A device as in claim 1 in which said first conveyor is a belt having an upper run and a lower run and including means for removing adhering material from said lower run.

7. A used wood reclaiming process comprising subjecting received material containing wood pieces and debris to a water bath in one area in which one part of said material floats and another part of said material sinks, removing said one part from said water bath area, then comminuting said one part, and then sizing said one part at least into large pieces and small pieces.

8. A process as in claim 7 including the step of removing said other part from said water bath area.

9. A process as in claim 7 including the step of subjecting said one part to a magnetic field.

* * * * *