CLAIMS

1. A pre-treatment apparatus for battery recycling, the apparatus comprising:

a base defining a platform thereon;

a support frame mounted to the base and suspended above the platform;

a first jaw and a second jaw movably coupled to the support frame and positioned above the platform, the first jaw and the second jaw being disposed spaced apart from each other along a lateral direction, the first jaw being positioned at a first side of a passage formed between the first jaw and the second jaw, and the second jaw being positioned at a second side of the passage opposite to the first side;

a first cutter disposed at the first side of the passage and offset from the first jaw along a longitudinal direction orthogonal to the lateral direction;

a second cutter disposed at the second side of the passage and offset from the second jaw along the longitudinal direction,

wherein upon a battery being fitted between the first jaw and the second jaw, the first cutter and the second cutter are positioned to partially interfere with the passage such that advancement of the battery towards the first cutter and the second cutter causes an enclosure of the battery to pass through and cut apart by the first cutter and the second cutter.

wherein the first cutter is connected to the second jaw and the second cutter is connected to the first jaw, and wherein a movement of the first jaw and the second jaw away from each other reduces a distance between the first cutter and the second cutter.

2. The apparatus as recited in claim 1, wherein the first cutter is oriented with a first normal direction facing the passage, and the second cutter is oriented with a second normal direction facing the passage, wherein a component of the first normal direction faces the first jaw, and a component of the second normal direction faces the second jaw.

3. The apparatus as recited in claim 1,

wherein a cutting counterforce applied to the first cutter and the second cutter by a battery brought into contact with the first cutter and the second cutter creates a

tendency to cause the first cutter and the second cutter to move away from each other and to cause the first jaw and the second jaw to move towards each other, and

wherein the first jaw and the second jaw are restricted from moving toward each other by the battery whereby the first cutter and the second cutter are maintained to partially interfere with the passage.

4. The apparatus as recited in claim 1, further comprising:

a first resilient member disposed between the support frame and the first jaw to bias the first jaw towards the passage;

a second resilient member disposed between the support frame and the second jaw to bias the second jaw towards the passage,

wherein upon the battery being positioned between the first jaw and the second jaw, the first resilient member and the second resilient member are compressed to maintain the first jaw and the second jaw to abut against the battery.

5. The apparatus as recited in claim 1, further comprising:

a first link bar across the passage and connecting the first jaw to the second cutter;

a second link bar across the passage and connecting the second jaw to the first cutter;

wherein the first link bar and the second link bar are slidably engaged with each other along the lateral direction to prevent a movement of the first jaw and the second jaw relative to each other along the longitudinal direction.

6. The apparatus as recited in claim 5, wherein one of the first link bar and the second link bar has a groove formed thereon along the lateral direction and the other one of the first link bar and the second link bar has a projection formed thereon, the projection extends into the groove to prevent the first link bar and the second link bar from moving relative to each other along the longitudinal direction.

7. The apparatus as recited in claim 5, further comprising a retainer movably connected to the support frame for abutting against the battery received between the first jaw and the second jaw.

8. The apparatus as recited in claim 7, wherein the retainer is movable relative to the support frame towards and away from the passage along a height direction orthogonal to the longitudinal direction and the lateral direction.

9. The apparatus as recited in claim 8, wherein the second link bar is positioned above the first link bar, the apparatus further comprises a support block positioned between the second link bar and the retainer, wherein a movement of the first jaw and the second jaw away from each other carries the support block away from the retainer to allow the retainer to move towards the passage.

10. The apparatus as recited in claim 9, further comprising a third resilient member disposed between the support frame and the retainer to bias the retainer towards the passage, wherein the retainer moves towards the passage after the support block moves away from the retainer.

11. The apparatus as recited in claim 1, wherein the platform comprises a conveyor belt movably positioned underneath the first jaw, the second jaw, the first cutter and the second cutter, wherein the conveyor belt is movable relative to the base for carrying batteries borne on the conveyor belt to pass through the passage along the longitudinal direction such that an enclosure of each of the batteries is carried to slide through and cut apart by the first cutter and the second cutter.

12. The apparatus as recited in claim 11, further comprising an array of studs mounted to the conveyor belt, wherein adjacent two rows of the arrays of studs along the longitudinal direction are positioned spaced apart from each other with a gap therebetween, wherein the gap has a width configured to receive a battery one at a time therein.

13. The apparatus as recited in claim 1, further comprising:

a motor mounted to the base, wherein the motor has a main shaft oriented parallel to the lateral direction;

a driving gear coaxially coupled to the main shaft;

a driven gear rotatably mounted to the support frame and engaged to the driving gear, the driven gear having a driven gear axis oriented perpendicular to the main shaft;

a first driving shaft coaxially coupled to the driven gear and rotatably mounted to the support frame;

a first roller shaft rotatably mounted to the support frame and oriented parallel to the longitudinal direction;

a first driving belt looped between the first driving shaft and the first roller shaft for transmitting rotational motion from the first driving shaft to the first roller shaft;

a plurality of second driving shafts each being rotatably mounted to the support frame and oriented parallel to the first driving shaft;

a plurality of second roller shafts each being rotatably mounted to the support frame and oriented parallel to the first roller shaft;

a transmission belt looped between the first driving shaft and each of the plurality of second driving shafts for transmitting rotational motion from the first driving shaft to each of the plurality of second driving shafts;

a plurality of second driving belts each being looped between one of the second driving shafts and a corresponding one of the plurality of second roller shafts for transmitting rotational motion from the one of the second driving shafts to the corresponding one of the plurality of second roller shafts.

wherein the first roller shaft and the plurality of second roller shafts are rotatable in a same direction.

14. The apparatus as recited in claim 13, further comprising a set of first roller wheels mounted to the first roller shaft and a plurality sets of second roller wheels each being mounted to one of the plurality of second roller shafts, wherein the first roller shaft and the plurality of second roller shafts are arranged relative to each other with an even pitch and the set of first roller wheels and the plurality sets of second roller wheels have a same outer roller diameter such that gaps between adjacent sets of first and second roller wheels have a same width for receiving and contacting batteries of a same outer battery diameter, wherein rotations of the first roller shaft and the plurality of second roller shafts cause the batteries to rotate by frictional force between the batteries and the set of first roller wheels and each set of the second roller wheels.

15. The apparatus as recited in claim 13, further comprising:

a worm rod coaxially mounted to the first roller shaft;

a sleeve shaft rotatably mounted to the support frame above the platform and oriented orthogonal to the first roller shaft,

a worm gear coaxially mounted to the sleeve shaft such that the sleeve shaft passes through the worm gear and that the worm gear being engaged to the worm rod;

an array of brushes mounted to a side surface of the sleeve shaft;

wherein a rotation of the first roller shaft drives the sleeve shaft to rotate the brushes to sweep a top portion of the batteries carried on the platform.

16. The apparatus as recited in claim 15, further comprising a blower and a first pipe having a first inlet connected to the blower and a first outlet opening at a front end of the platform, wherein an air supplied by the blower blows out from the first outlet through the first pipe for carrying battery enclosures cut off from the batteries away from the platform.

17. The apparatus as recited in claim 16, further comprising a second pipe having a second inlet connected to the blower and a second outlet extending into the sleeve shaft, wherein the sleeve shaft has a plurality of perforations formed at a side surface thereof, and wherein an air supplied by the blower flows into the sleeve shaft through the second pipe and blows out from the sleeve shaft through the plurality of perforations.

18. The apparatus as recited in claim 1, further comprising a blower and a first pipe having a first inlet connected to the blower and a first outlet opening at a front end of the platform, wherein an air supplied by the blower blows out from the second outlet through the second pipe for carrying battery enclosures cut off from the batteries away from the platform.