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METHOD OF SEPARATING WIRE AND ITS CASING

Filed Nov. 28, 1960

FIG. 1

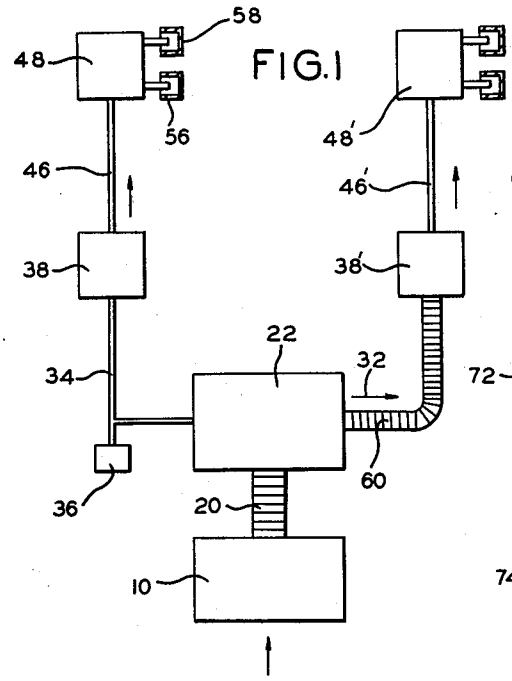


FIG. 3

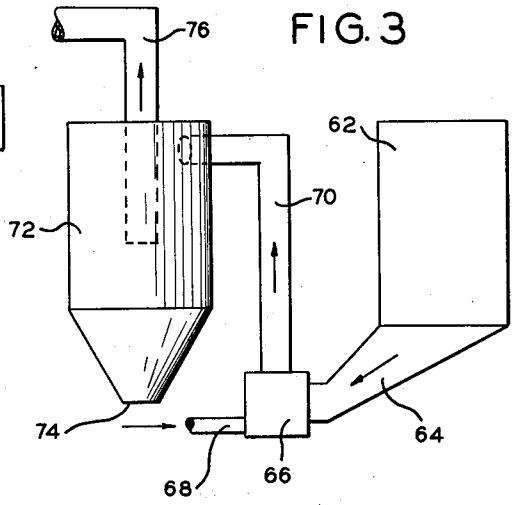
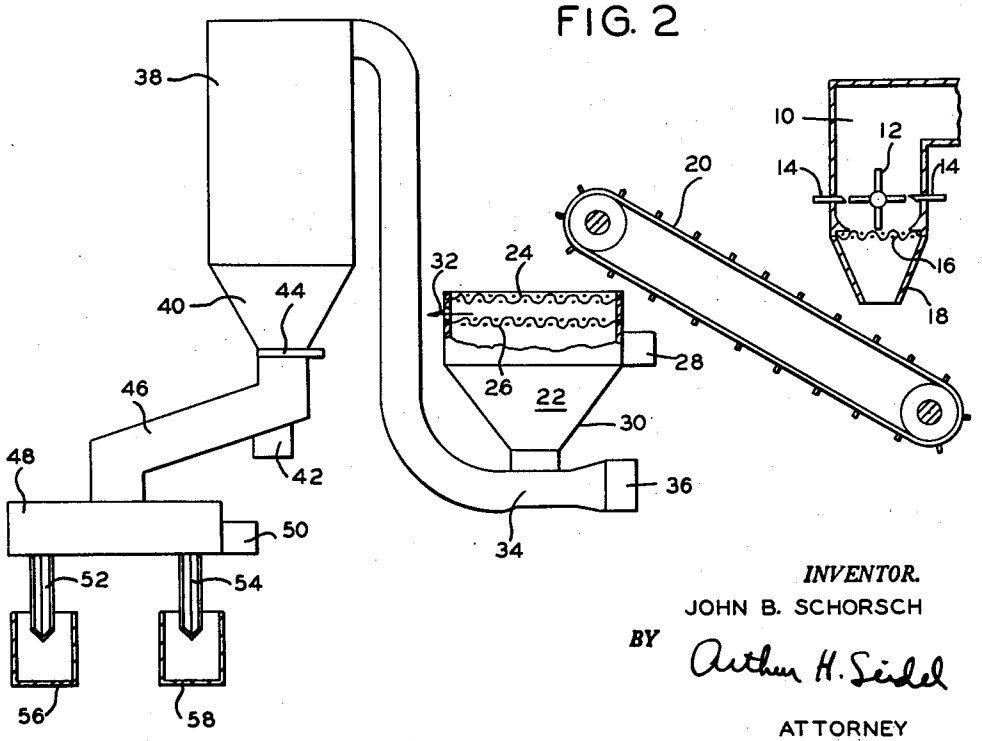


FIG. 2



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METHOD OF SEPARATING WIRE AND ITS CASING

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This invention relates to the method of separating metallic wire from its external casing.

Various methods have been proposed heretofore for separating metallic wire from its external casing. These methods are usually time consuming since they involve a great deal of manual labor or utilize a burning process wherein the casing is either destroyed or rendered useless. In many forms of specialized circuitry, the external casing on a metallic wire is much more expensive than the wire itself. Accordingly, the present invention is directed to a non-destructive method of separating the metallic wire from its external casing thereby salvaging the casing as well as the wire. Many wires commercially available are provided with a casing comprising a multilayer laminated structure. Generally, the layers in the casing are made from different types of plastic. It is within the scope of the present invention to separate the wire from its casing and then separate the various constituents of the casing.

It is an object of the present invention to provide a novel method of separating wire and its external casing.

It is another object of the present invention to provide a method of separating metallic wire from its casing in a manner which salvages both the wire and the casing.

It is another object of the present invention to provide a novel method of separating a wire from its multilayer casing and then separate the various constituents of the casing.

It is another object of the present invention to provide a novel method of separating wire and its casing which is more economical and efficient than methods known heretofore.

Other objects will appear hereinafter.

For the purpose of illustrating the invention there is shown in the drawings forms which are presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIGURE 1 is a block diagram of the process of the present invention.

FIGURE 2 is a schematic view of the apparatus utilized in a substantial portion of the process of the present invention.

FIGURE 3 is a schematic view of the apparatus utilized in a portion of the process of the present invention.

Referring to the drawing in detail, wherein like numerals indicate like elements, there is shown in FIGURE 1 a block diagram of the process of the present invention for separating a metallic wire from its external casing.

In accordance with the present invention, the first step in the feeding of encased wire into the cutting machine **10**. The wire is fed into the cutting machine **10** in various lengths regardless of bends or kinks in the wire. The cutting machine **10** is provided with a rotating multiblade cutter **12** which is provided with an axle rotatably mounted in a horizontal plane. The blades of the cutter **12** cooperate with a pair of fixed blades **14** to chop the encased wire into granulated form. The cutting machine **10** includes a horizontally disposed screen **16** which is

spaced from the outermost edge of the blades on the cutter **12** by a short distance. The interior of the machine **10** is contoured so that chopped pieces of wire are continually moved by the blades of the cutter **12** until said pieces are chopped fine enough so as to pass through the screen **16** and the hopper or funnel bottom **18** on the machine **10**.

A mixture of middlings, granulated wire, and granulated casing material are continuously deposited onto the endless conveyor **20** from the hopper **18**. The endless conveyor **20** is provided with a plurality of spaced projections which cause the set mixture to be conveyed from right to left in FIGURE 2 in an inclined direction. Said mixture is delivered by the endless conveyor **20** onto the uppermost screen **24** of a separator **22**. The middlings from said mixture are separated from the granulated wire and casing material at this point. The granulated wire and casing material passes through the screen **24** onto the screen **26**. As used hereinafter, the term middlings is to be interpreted as having its usual connotation given by those skilled in the art. That is, middlings is a small piece of chopped or granulated wire which still maintains its external casing.

The screen **26** is provided so that the granulated wire will pass therethrough while preventing the passage of the casing material. From actual experience, I have found that approximately 75–80 percent granulated wire and 20–25 percent granulated casing material passed through the screen **26** into the funnel bottom **30** on the separator **22**. The separator **22** is provided with a vibrator **28** which causes the remaining 20–25 percent granulated wire and 75–80 percent granulated casing material to be delivered off the screen **26** in the direction of arrow **32**. The disposition of the material delivered in the direction of arrow **32** will be made clear hereinafter.

The mixture of 75–80 percent granulated wire and 20–25 percent granulated casing material is delivered from the funnel bottom **30** into a horizontal portion of conduit **34**. One end of the conduit **34** is connected to a fan **36** while the other end of the conduit **34** is connected to the uppermost portion of a storage bin **38** having a hopper **40** thereon. Said last mentioned mixture is delivered to a venturi portion of the conduit **34** so that the fan **36** provides a stream of pressurized air which conveys said last mentioned mixture into the storage bin **38**. The storage bin **38** is provided with a perforated top or is otherwise open so as to provide an escape passage for the pressurized air which conveys said last mentioned mixture to the storage bin **38**.

The hopper **40** is provided at its lowermost portion with a selectively operable gate valve **44**. When the gate valve **44** is in its open position, the mixture will fall through gravity into the conduit **46**. As shown more clearly in FIGURE 2, the conduit **46** is angled with the lefthand end of the conduit lower than the righthand end which is in communication with the hopper **40**. The conduit **46** is provided with a selectively operable vibrator **42** which when operating causes the granulated mixture to flow from the hopper **40** onto a separator table **48**. The separator table **48** is a commercially available separator of the specific gravity type. The material to be separated is delivered onto a reciprocating deck in the separator table **48**. The deck is covered with a porous cover through which air is blown. The air is used to float the material in such a way that it will be stratified, the granulated wire settling and the lighter granulated casing material rising to the top of the bed. The deck is recipro-

cated by means of the vibrator 50. The motion of the separator deck, the volume of the air, the speed of oscillation, and the side and end slopes of the deck all combine to cause the heavier particles to settle and travel further along the deck than the lighter particles. The granulated wire particles travel along the deck in the direction of its motion and are discharged through the chute 54 into the barrel 58. The granulated casing material is lighter and therefore is floated by the air and travels across the line of motion of the deck and is discharged through the chute 52 into the barrel 56.

In order to have an accurate control over the separation of the mixture by the separator table 48, the separator table 48 should be of the type which provides for adjustment of the rate of feed, quantity of the air, lateral inclination of the deck, longitudinal inclination of the deck, and the speed of oscillation. I have used a commerically available separator table of this type and have found that the table is practically 100 percent effective in separating the granulated wire from the granulated casing material.

Referring to FIGURES 1 and 3 in particular, the mixture which is delivered from the separator 22 in the direction of arrow 32 is received by an inclined endless conveyor 60. The endless conveyor 60 delivers the mixture to the top of a storage bin 38' which is identical with the storage bin 38. The mixture from the storage bin 38' is delivered to a separator table 48' by means of a conduit 46'. The conduit 46' and the separator table 48' are identical with the conduit 46 and separator table 48 respectively. I have found that the efficiency of the separator tables 48 and 48' are substantially greater when the mixture is separated by the separator 22 into two batches wherein one batch is substantially granulated wire and the other batch is substantially granulated casing material.

If the casing material on the wire was initially a multilayer casing of different materials, the barrels of casing material will then be fed into the tank 62 shown in FIGURE 3. A conventional type of encased wire includes a first casing of polyethylene around the wire and a second casing of polyvinyl chloride around the polyethylene casing. In order to reuse the casing materials, it is necessary to separate the polyethylene material from the polyvinyl chloride material.

A mixture of polyvinyl chloride and polyethylene casing material in granulated form is deposited into the tank 62. The casing material passes from the tank 62 through the hopper 64 partially as a result of gravity and partially as a result of a venturi effect provided within the pump 66. The pump 66 is provided at its inlet port with a conduit 68 having water flowing therethrough. The water from the conduit 68 is forced by the pump 66 through the conduit 70. As the water passes through the pump, it is mixed with the casing material. Therefore, the conduit 70 is conveying a slurry of water and casing material. The slurry in the conduit 70 is delivered into the cyclone separator 72.

The cyclone separator 72 is provided with an outlet conduit 76 which extends from a point above the cyclone separator 72 to a point intermediate the top and the hopper outlet 74 as shown in phantom in FIGURE 3. Since polyvinyl chloride is approximately fifty percent heavier than polyethylene, the polyvinyl chloride will be discharged from the cyclone separator 72 through the hopper outlet 74, while the polyethylene will be removed from the cyclone separator 72 by way of the outlet conduit 76. The polyethylene and polyvinyl chloride casing materials are then separately dried and separately stored for reuse.

It is to be emphasized that the means for conveying the granulated mixture from the separator 22 to the storage bins 38 and 38' may be either an endless conveyor or a conduit having a pressurized fluid therein. Preferably, the pressurized fluid should be a gas such as air. While the multi-layer casing material has been discussed above as being polyethylene and polyvinyl chloride, it will be appreciated that the process of the present invention may be utilized whenever the casing is provided with a plurality of layers with each layer being of a different specific gravity. While the process of the present invention is not limited to any specific type of metallic wire, it is at present being utilized to salvage wires of copper and aluminum. Once the wire has been separated from its casing, the wire and the casing may then be remelted and reused.

The middlings which are accumulated on screen 24 are reprocessed by depositing them in the cutting machine 10. When reprocessing middlings, a screen 16 of smaller size is used. I have found that the amount of middlings is extremely small as compared to the amount of granulated wire and casing material. That is, I have found the middlings to be less than one percent of the mixture.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

I claim:

1. In a process for separating a metal wire from its casing comprising the steps of chopping said wire and its casing so as to produce a mixture of granulated wire, middlings and casing material, then separating the middlings from the mixture of granulated wire and casing material, then separating the granulated wire from the granulated casing material, and then collecting the granulated wire and granulated casing material in separate receptacles.

2. In a process for separating a metal wire from its casing comprising cutting said wire and its casing so as to produce a mixture of granulated wire, granulated casing material and middlings, conveying said mixture to a separator, separating said middlings from said mixture by means of a screen on said separator, separating the granulated wire from the granulated casing material, and then collecting the granulated wire and granulated casing material in separate receptacles.

3. In a process in accordance with claim 2 wherein said granulated wire is separated from said granulated casing material on the basis of specific gravity.

4. In a process for separating a metal wire from its casing comprising chopping said wire and its casing so as to produce a mixture of granulated wire and granulated casing material, conveying said mixture to a separator, dividing said mixture in said separator into a first batch which is approximately seventy-five percent granulated wire and a second batch which is approximately seventy-five percent granulated casing material, conveying said batches to separate separator devices, separating each batch separately at the separator devices into granulated wire and granulated casing material, and then collecting said granulated wire and granulated casing material in separate receptacles.

5. In a process in accordance with claim 4 wherein at least one of said batches is conveyed away from said separator by means of a pressurized fluid.

6. A process in accordance with claim 4 wherein the granulated wire is separated from the granulated casing material in said separator devices on the basis of specific gravity.

7. In a process of separating a metal wire from a multilayer casing wherein each layer of the casing is a different material having different specific gravities which comprises the steps of cutting said wire and its casing so as to produce a mixture of granulated wire and granulated casing material, separating the granulated wire from the granulated casing material on the basis of specific gravity, then collecting the granulated wire and granulated casing material in separate receptacles, then separat-

ing the granules of the various components of the multi-layer casing on the basis of specific gravity.

8. In a process in accordance with claim 7 wherein the granules of the various components of the multi-layer casing are separated from one another in a cyclone separator into which the granules are fed in the form of a water slurry, and then drying the respective granules.

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