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Design and fabrication of copper wire stripper and peeling machine

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Abstract: With the development of modern industry and communications industry, a variety of metal wires are used more and more. At the same time, the number of cables required waste recycling is also increasing and the environment pollution has become more serious. Currently, cable for waste recycling technology is mainly as follows: stripping machine technology, mechanical crushing sorting technology, high-pressure water jet recovery technology, chemical processing technology, cryogenic technology, heat recovery technology and ultrasonic separation technology. In this paper, It conducted a comprehensive analysis of various techniques, and conduct research status.

Index words – Metal wires, Recycling, Stripping machine technology

I. INTRODUCTION

This type of wire stripper is used by rotating it around the insulation while applying pressure in order to make a cut around the insulation. Since the insulation is not bonded to the wire, it then pulls easily off the end. This type of wire stripper can be used on wires of any size. Another type of manual wire stripper is very similar to the simple design previously mentioned, except this type has several

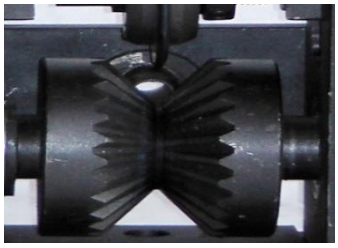

Fig. 1 V-Groove grip and blade setting

notches of varying size. This allows the user to match the notch size to the wire size, thereby eliminating the need for twisting, but can only be used on wire sizes that approximately match one of the notches. Once the device is clamped on, the remainder of the wire can simply be pulled out, leaving the insulation behind.

When engaged, a wire stripper first simultaneously grips the wire in one side and in the other side closes its shaped blades cutting the insulation around the conductor. After the sides have completed their strokes the two sides of the mechanism spread apart to push the cut tube of insulation from the end of the conductor. To use it, one simply places the wire in the jaws at the cutting slot matching the size of the conductor and squeezes

Fig. 1 Copper wire stripper machine

the handles together. This device allows even a novice to strip most wires very quickly. The compound automatic wire stripper's cutter must be short, because it causes the jaws to twist.

All wire strippers are inherently limited to those wire sizes the cutting jaw notches will accommodate. A wire stripper's short cutter limits it to fewer notches and a smaller range of wire sizes than most other types of wire strippers. The accuracy of the cutting blade opening determines the smallest conductor that can be reliably stripped. If the cutter opening is to small it will impinge on the conductor causing excess friction and more tension than the wire can withstand. If the cutter opening is too large the tension required to tear the remaining annulus of uncut insulation may be greater than the wire can withstand. Some models have an adjustable grip tension, to adjust the clamping force of the gripping jaw.

II.LITERATURE SURVEY

This chapter will emphasize on past studies and researches done which relates with wire stripper and recycling activity. The research is focus on recycling method, type of cable, and current product of cable stripping machine. Generally, cable recycling method is quite similar which the cable is combusted. The study of cable type is to gain information about cable's diameter and jacket's width. From current product, the idea to fabricate the wire stripper is obtained. The mechanism of cable stripping also obtains from current product. The source of literature review is taken from journal, article, book and website. Some models have an adjustable grip tension, to adjust the clamping force of the gripping jaw.

Each year, a huge number of cables become obsolete and no longer in use. This is because of several factors such as cable's thief, damage from manufacturing, earth disaster, relocations of cable and etc. The cables consist of one or several metal circuit lines and layers of plastic insulation. The metal is copper, which has high value. The cable's recycling also generates plastic waste (insulation) which approximates has no value.

Mattias Lindahl and Mats Winsnes has written about cable's recycling in their article, "Recycling of Cable Plastics -A Life Cycle Assessment of Several Different Alternatives". The article discusses about seven different recycling alternative of cable waste. Next page gives brief explanations of seven method of recycling cable waste from their article.

III.METALS USED IN FABRICATION

Mild steel or Plain-Carbon Steel:

Plain- Carbon steel is steel in which the main interstitial alloying constituent is carbon in the range of 0.12–2.0%. The American Iron and Steel Institute (AISI) defines that Steel is considered to be carbon steel when no minimum content is specified or required for chromium, cobalt, molybdenum, nickel, niobium, titanium, tungsten, vanadium or zirconium, or any other element to be added to obtain a desired alloying effect; When the specified minimum for copper does not exceed 0.40 percent; or when the maximum content specified for any of the following element does not exceed the percentages noted: manganese:-1.65, silicon:-0.60, copper:-0.60 The term "carbon steel" may also be used in reference to steel which is not stainless steel; in this use carbon steel may include alloy steels. As the carbon percentage content rises, steel has the ability to become harder and stronger through heat treating; however it becomes less ductile. Regardless of the heat treatment, higher carbon content reduces weldability. In carbon steels, the higher carbon content lowers the melting point. Carbon steel is broken down into four classes based on carbon content.

S.No.	Contents	Values
1.	Carbon	0.16 to 0.18 % (maximum 0.25% is allowable)
2.	Manganese	0.70 to 0.90 %
3.	Silicon	0.40% (maximum)
4.	Sulphur	0.04% (maximum)
5.	Phosphorous	0.04% (maximum)

Table. 1 Percentage of metal contents in mild steel

Mild steel, also known as plain-carbon steel, is the most common form of steel because its price is relatively low while it provides material properties that are acceptable for many applications. Mild steel has a relatively low tensile strength, but it is cheap and easy to form; surface hardness can be increased through carburizing. It is often used when large quantities of steel are needed, for example as structural steel. The density of mild steel is approximately 7.85 g/cm3 (7850 kg/m3 or 0.284 lb/in3) and the Young's modulus is 210 GPa (30,000,000 psi).

IV.CUTTING BLADE

A rotary cutter is a tool generally used by quilters to cut fabric It consists of a handle with a circular blade that rotates, thus the tool's name. Rotary cutter blades are very sharp, can be resharpened, and are available in different sizes: usually smaller blades are used to cut small curves, while larger blades are used to cut to straight lines and broad curves. Several layers of fabric can be cut simultaneously with a sharp (fresh) blade, making it easier to cut out patchwork pieces of the same shape and size than with scissors. Quilters use rotary cutters with specially designed templates and rulers made of approximately 1/8-inch thick clear or color-tinted plastic. The first rotary cutter was introduced by the Olfa company in 1979 for garment making, however, it was quickly adopted by quilters. Prior to the invention of the rotary cutter, quilters traced handmade templates of the necessary shapes onto the wrong side of the fabric and added 1/4-inch seam allowances all around. The angle at which the faces meet is important as a larger angle will make for a duller blade while making the edge stronger. A stronger edge is less likely to dull from fracture or from having the edge roll out of shape.

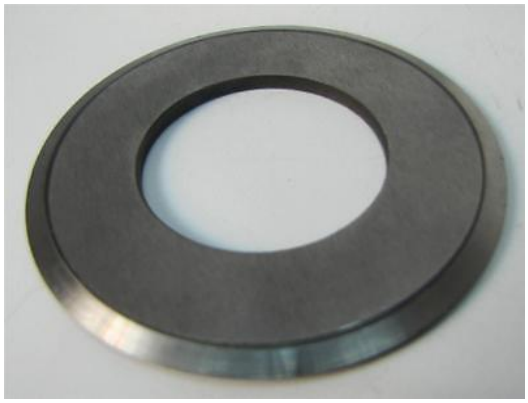

Fig. 3 Rotary Blade

Templates were often handmade of (cereal box type) cardboard and the pencil wore down the edges with repeated tracings, rendering them inaccurate; new templates would be made several times until all the patchwork pieces were cut. Pieces were usually cut one at a time with dressmaking scissors, which were often heavy and had long blades that were designed for cutting large pieces for garments but were cumbersome to use for cutting small pieces for patchwork. The rotary cutter gained almost immediate widespread use among quilters after its introduction and, along with the accompanying development of strip techniques, revolutionized quilting.

V. V-GROOVED GRIP

A V-grooved wheel is used for holding a belt, wire rope, or rope. The grooved wheel spins on an axle or bearing inside the frame of the block. This allows the wire or rope to move freely minimizing friction and wear on the cable. Sheaves can be used to redirect a cable or rope, lift loads, and transmit power. The words sheave and pulley are sometimes used interchangeably.

This is accomplished by constructing the pulley out of several pieces. The two main "halves" of the pulley can be moved closer together or farther apart, thus altering the operational diameter. The usual construction is some sort of locking, one half

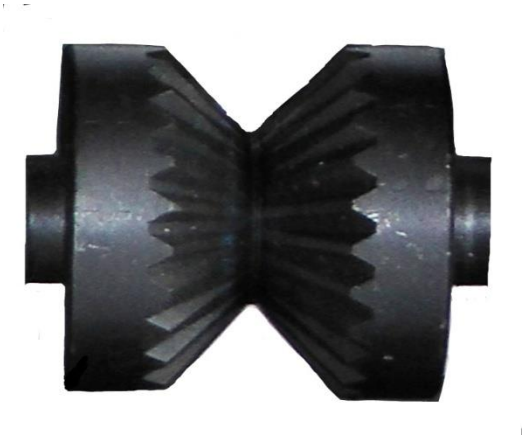

Fig. 4 V-grooved grip

a threaded central shaft and one half with a threaded center. By rotating the components one can "screw" the parts closer together or further apart, thus changing the distance between the two halves and allowing the belt to ride higher or lower in the groove. The adjustments are constrained to a specific range of size and are not limitless.

VI. DESIGN PROCESS

The design process is a methodical series of steps that engineers use in creating functional products and processes. The process is highly iterative - parts of the process often need to be repeated many times before another can be entered - though the part(s) that get iterated and the number of such cycles in any given project may vary. It is a decision making process (often iterative)in which the basic sciences, mathematics, and engineering sciences are applied to convert resources optimally to meet a stated objective

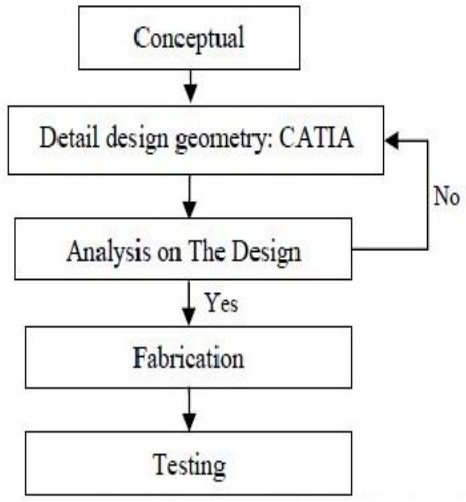

Fig. 5 Flowchart of Design phase for Copper wire Stripper Machine

Among the fundamental elements of the design process are the establishment of objectives and criteria, synthesis, analysis, construction, testing and evaluation.

VII. WORKING OF COPPER WIRE STRIPPER MACHINE

A wire stripper is considered the most versatile; to use it, the user needs to manually rotate it while applying pressure around the insulation in order to cut or adjust the wires. In the case of an automatic wire stripper, one side is held tight and, simultaneously, the other side is cut and removed. A wire stripper first simultaneously grips the wire in one side and in the other side closes its shaped blades cutting the insulation around the conductor. After the sides have completed their strokes the two sides of the mechanism spread apart to push the cut tube of insulation from the end of the conductor. To use it, one simply places the wire in the jaws at the cutting slot matching the size of the conductor and squeezes the handles together. This device allows even a novice to strip most wires very quickly. The addition of a center notch makes it easier to cut the insulation without cutting the wire. This type of wire stripper is used by rotating it around the insulation while applying pressure in order to make a cut around the insulation. Since the insulation is not bonded to the wire, it then pulls easily off the end. This type of wire stripper can be used on wires of any size. Another type of manual wire stripper is very similar to the simple design previously mentioned, except this type has several notches of varying size. This allows the user to match the notch size to the wire size, thereby eliminating the need for twisting, but can only be used on wire sizes that approximately match one of the notches. Once the device is clamped on, the remainder of the wire can simply be pulled out, leaving the insulation behind.

VIII. COMPARISON OF NEW PROJECT WITH THE EXISTING

S.No.	Existing machine	New machine
1.	Uses handle to operate.	Uses motor to operate.
2.	Operation time is more(20-25 sec per meter)	Operation time is less(5-10 sec per meter)
3.	Cost of equipment is high.	Cost of equipment is low
4.	Life time of blade is less.	Life time of blade is more.

Table. 2 Comparison table

VIII. COST ESTIMATION

(1) LABOUR COST:

Lathe, drilling, milling, grinding, gas cutting cost, blackening.

(2) OVERGHEAD CHARGES:

The overhead charges are arrived by "manufacturing cost"

Manufacturing Cost = Material Cost +Labour Cost
= 2500+6500
= Rs. 9000

Overhead Charges = 20%of the manufacturing cost
= 20/100 * 9000
= Rs. 1800

(3) TOTAL COST:

Total cost = Material Cost +Labour Cost +Overhead
= 2500+6500+1800
= Rs. 10800

IX. RESULT AND DISCUSSION

Based on the above analysis of the advantages and disadvantages of several methods to dispose of used wires and cables, the recovery of waste wire processing needs further research and exploration to further reduce copper consumption, while increasing production while also focusing on environmental protection, reduce emissions, improve energy efficiency secondary trends choose recycling method to improve the existing technology continues improve and innovate, but also should learn foreign advanced technology and widely applied to the final of scrap wire and cable treatment projects in the past, for wire and cable treatment and recovery of waste to contribute.

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