Aug. 31, 1965 R. J. OUELLETTE 3,204,054

APPARATUS FOR DETECTING METAL BODIES IN FABRICATED MATERIALS

Filed Aug. 18, 1960 2 Sheets-Sheet 1

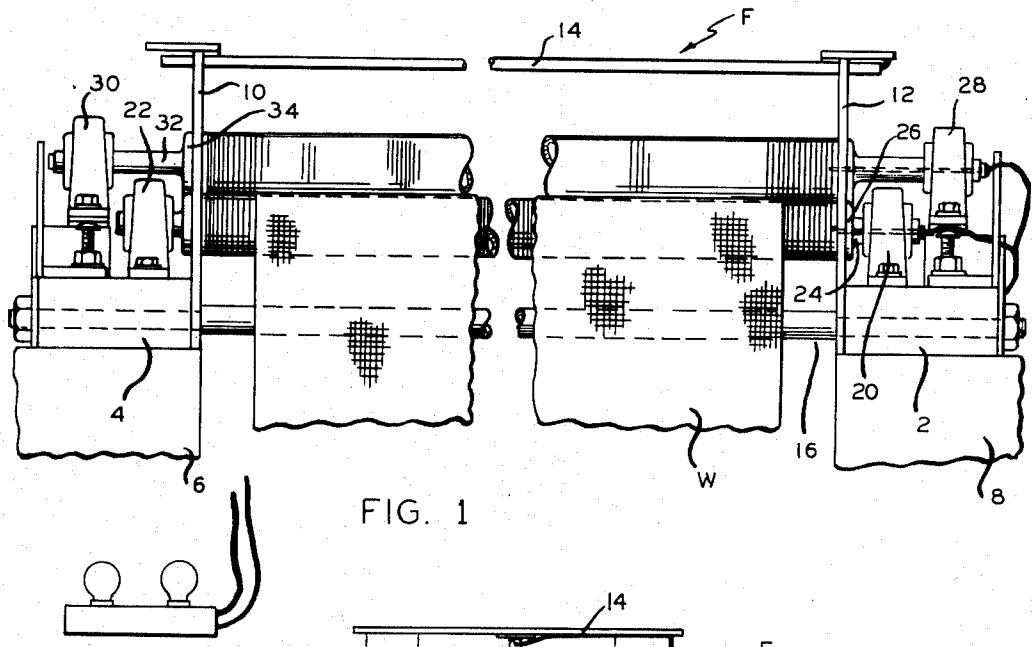


FIG. 1

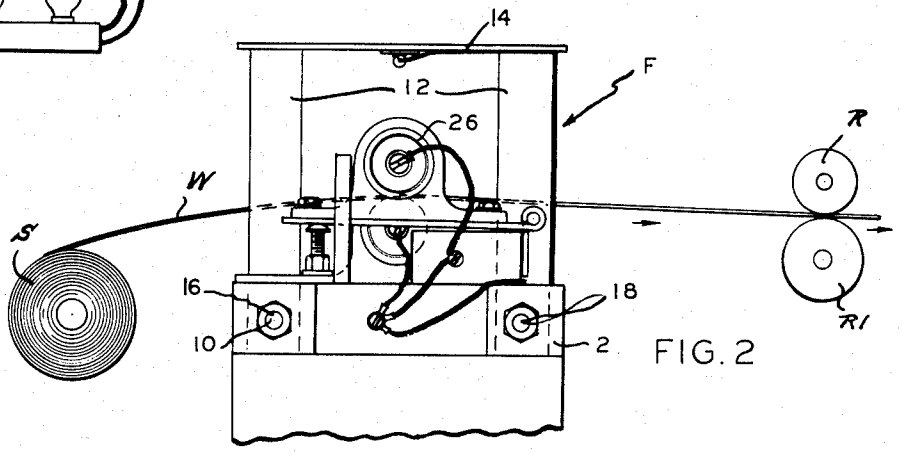


FIG. 2

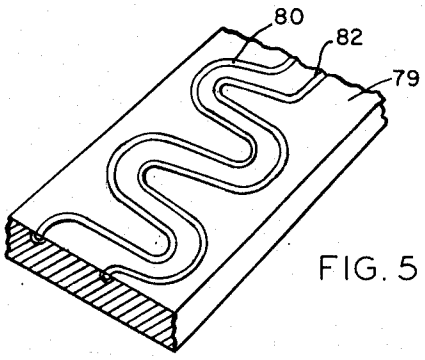


FIG. 5

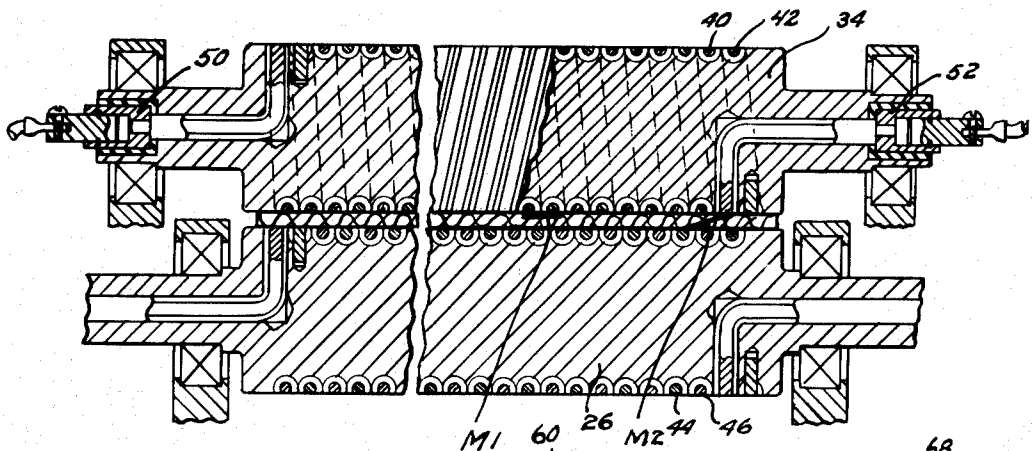
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FIG. 3



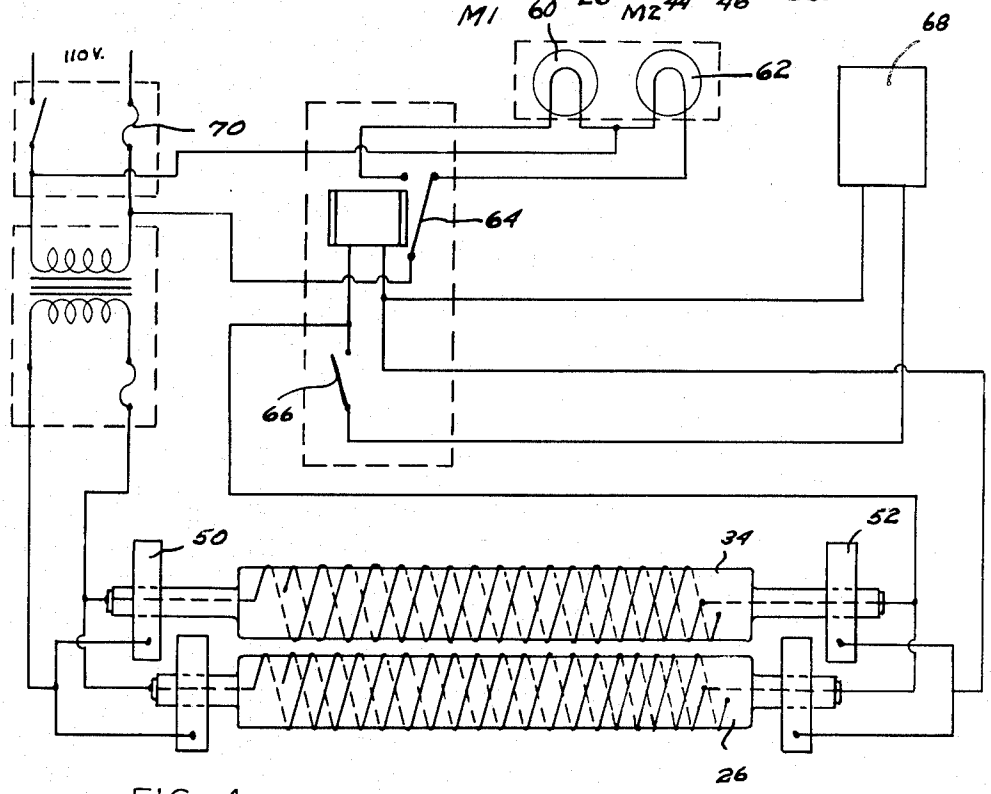


FIG. 4

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APPARATUS FOR DETECTING METAL BODIES IN FABRICATED MATERIALS

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4 Claims. (Cl. 200—61.09)

This invention relates to apparatus for electrically screening a moving web of material to detect the presence of small metal objects. In particular, the invention is concerned with textile webs in which metal objects may have become picked up and carried along in the web in the course of weaving or other handling operations.

The presence of such small metal objects is troublesome. A typical instance where difficulty may arise is in the finishing of a fabric by means of a steam press. This apparatus consists essentially of a heated roll formed with a knurled peripheral surface. Heated iron beds with brass liners are held against the knurled roll by a suitable spring pressure. A web of fabric to be finished is passed around the knurled rolls, driven by the knurled surface, and the heated brass liners press against the outside surface of the fabric with an ironing action which provides the cloth with a smooth finish on one side.

It frequently happens that small metal pieces, such as heddle parts, broken filler wires from the loom, needles and the like may have been picked up in the web and are present at the time the web passes through the finishing rolls. If metal objects of this nature escape notice and pass between the press rolls, severe damage to the surfaces of both the brass liners and the knurled roll may occur. The damaged surfaces of the rolls then tend to transfer their impression to subsequent portions of the web and, therefore, an unsatisfactory product is produced. To correct the difficulty it becomes necessary to stop the machine and replace the brass liner, and repair the surface of the knurled roll, a costly and time consuming operation.

It is a chief object of the present invention to deal with the difficulty indicated, and to devise a method and means for detecting the presence of metal objects in webs of various types, preferably at a point just prior to undergoing the finishing treatment.

Another object of the invention is to provide a device of the character indicated which is especially designed to detect metal objects of varying sizes and shapes disposed in various positions at any point along the web and at either side thereof.

Another object is to provide an apparatus for interrupting travel of a web when a metal object is detected and simultaneously actuating a signal means of some desired form.

Still another object is to provide apparatus for selectively screening a web to detect only those metal objects having predetermined characteristics.

With the above-noted objectives in mind, I have conceived of an electrical screening apparatus by means of which I am enabled to electrically scan a moving web of material and to detect the presence of metal objects in the web. Essentially, my improved scanning apparatus guides a web of cloth between a pair of electrical detector rolls. The detector rolls are provided with exposed electrical detector surfaces occurring in helically arranged pairs so

that a small metal object occurring at any point along the width of the roll will tend to engage the two conductive surfaces of a pair and close an electrical circuit to stop forward travel of the web and also provide a warning signal.

The nature of the invention and its further objects and novel features will be more fully understood and appreciated from the following description of a preferred embodiment selected for purposes of illustration and shown in the accompanying drawings, in which:

FIG. 1 is a front elevational view of the detector apparatus of the invention;

FIG. 2 is a view in end elevation of the structure shown in FIG. 1;

FIG. 3 is an enlarged diagrammatic view further illustrating on a larger scale the electrical circuit components of the apparatus of the invention;

FIG. 4 is a wiring diagram suitable for use with the arrangement shown in FIGS. 1 to 3; and

FIG. 5 is a fragmentary perspective view of a modified arrangement of electrical conductors utilized in accordance with the invention.

In the drawings I have shown one preferred embodiment of the method of the invention. A web of material W is drawn from a supply roll S along a desired path of travel and then through steam press rolls R and R1 to provide a desired finish. Reference is had particularly to a web which, in the course of its manufacture, has passed through textile looms or other machinery where an opportunity is present for particles of metal to be picked up in the web.

In accordance with the invention I subject the web to an electrical scanning step to detect the presence of small metal objects, preferably at a point just prior to entrance of the web between the rolls R and R1. As one desirable means of accomplishing this, I provide a novel metal detecting apparatus which is shown in FIG. 2 and which may be located at some convenient point between the supply roll S and the rolls R and R1, as shown in FIG. 2.

The detector apparatus comprises essentially a frame F; a pair of detector rolls **26** and **34** mounted in the frame, one above another, and electrical means associated with the rolls. In accordance with the invention, I combine with the rolls **26** and **34**, electrical means for continuously screening the web and detecting the presence of metal objects in the web as the latter member is passed through the nip of the rolls.

The electrical means comprises exposed electrical conductor surfaces occurring in helically arranged pairs which extend around each of the rolls in closely compacted relationship throughout the entire length of each roll. One helically arranged pair of exposed electrical conductor elements are wound around the roll **34** and indicated by numerals **40** and **42**, while a second helically arranged pair of electrical conductor elements are wound around the roll **26** and indicated by numerals **44** and **46**.

Each of these helically arranged pairs of electrical conductors, with their exposed surfaces partially covered, are connected to a suitable source of power, such as a source of alternating current as suggested in FIG. 4. The conductors are covered with conventional insulation as shown in FIG. 3 in a manner such that each conductor is prevented from coming into contact with an adjacent conductor, as well as an adjacent surface of the respective supporting roll throughout the entire helical length of these conductors.

A preferred method of providing the helically arranged pairs with exposed surfaces consists in winding the conductors around their respective rolls 26 and 34 and then the insulation on the outermost peripheral surfaces of the helical coils is removed by a suitable machining operation to lay bare the conductive surfaces as shown diagrammatically in FIG. 3.

The ends of the helical coils are attached, as suggested in FIGS. 3 and 4, to suitable electrical brush means mounted on respective roll members. These brushes include the brushes 50 and 52 for roll 34, for example, and similar brushes may be provided at opposite ends of the roll 26.

In connecting the two wires of a helically arranged pair, one of the wires is connected to the live side of the electrical circuit as suggested in FIG. 4 and the other wire to the ground side of the circuit. Preferably, the helically arranged pair for the other roll is connected in such a way that any piece of metal on or in the fabric bridging two adjacent bared wires of either the top or bottom roll will cause current to flow. In FIG. 3 a metal piece M1 is shown bridging wires of the top roll. Also, a metal piece M2 is shown bridging a wire in the top roll and another wire in the bottom roll. Thus a metal piece in any position between the two rolls can produce the desired action. Such a wiring arrangement has been illustrated in FIGS. 3 and 4.

In this normally open circuit, shown in FIG. 4, I further include signal means and a relay device for stopping operation of the steam press rolls. Numeral 60 denotes a blue lamp which is normally maintained in operation. 62 indicates a red lamp which is normally inoperative. However, when a metal object bridges any two exposed wire surfaces of opposite polarity in either the top or the bottom roll, a circuit is closed, which in turn energizes a relay 64. This relay 64 is arranged to open a switch 66 controlling the operation of the steam press rolls through a push button switch 68.

It will be apparent, therefore, that when the finishing rolls come to rest, the web is in a position such that an operator may quickly locate the metal object which has caused the machine to stop running, and thereafter the "stop-start" switch is pressed and the machine operation is again carried on.

I may desire to modify the machine in various respects. For example, I may provide for electrically scanning a fabric which is formed with metallic yarns. In this case it has been found possible, by employing a fuse 70 of suitable size in the detecting circuit, to permit the metallic yarns to pass through the detector rolls without actuating the relay 64, whereas larger metal pieces will cause an interruption of the circuit. Furthermore, this special fuse may be so wired in the circuit that once it has been blown, the machine cannot be started up again until the piece of metal in the cloth has been found and the fuse replaced. Thus it will be apparent that I have disclosed a novel method and apparatus for electrically scanning a web and detecting the presence of small metal objects with material savings in time, equipment, and finished product.

Another modified form of the invention is shown in FIG. 5. In this form a flat detector base 79, shown in FIG. 5, is provided with a pair of exposed conductors 80 and 82. It is contemplated that the web W may be slid across the base.

Various other changes and modifications may be resorted to in keeping with the scope of the invention as defined in the accompanying claims.

I claim:

1. A device for detecting a metal object in a moving web of material comprising a frame having bearing means supported at opposite ends thereof, a pair of rotatable roll members supported in the bearing means to receive the web therebetween in rolling engagement, electrical contact members located in the bearing means adjacent the ends of each of the rolls and connected to an electrical circuit and power source, a pair of electrical conductor members supported on each of said roll members, said electrical conductor members being rotatable with the rolls and engageable with respective electrical contact members, said pairs of electrical conductor means comprising helically arranged pairs of insulation covered wires wound around the rolls to constitute normally open electrical circuits, said wires having outer peripheral portions of their insulation removed to provide exposed helical wire surfaces in which helical turns of exposed conductive material occurs in spaced apart relationship thereby to receive a metal object in the web in bridging relationship.

2. A device for detecting a metal object in a moving web of material, said device comprising a frame having bearing means supported at opposite ends thereof, a pair of rotatable roll members supported in the bearing means to receive the web therebetween in rolling engagement, electrical control means for stopping and starting rotation of the said roll members, electrical contact members located in the bearing means adjacent the rolls and connected to an electrical circuit and power source, electrical conductor means connected to the electrical contact members and supported on said roll members, said electrical conductor means comprising helically arranged pairs of insulated covered wires wound around the rolls to constitute normally open electrical circuits, said wires having outer peripheral portions of their insulation removed to provide helical turns of exposed conductive surfaces, adjacent exposed conductive surfaces of each pair of wires occurring in close proximity to one another to engage with a metal object in vary positions of orientation in the said moving web thereby to close an electrical circuit to the control means for the said rolls.

3. A structure as defined in claim 1 in which the helically arranged pair of wires on the upper rolls is located in staggered relationship with respect to the helically arranged pair of wires on the lower rolls whereby an electrical circuit may be closed by contact of a metal object with a wire in the upper roll and a wire in the lower roll.

4. An apparatus for detecting a metal object in a moving web of material comprising in combination a pair of finishing rolls for receiving the moving web of material therebetween, an electrical circuit for controlling operation of the finishing rolls and an electrical switch for opening and closing said operating circuit, a frame having bearing means mounted at opposite ends thereof, a pair of rotatable detector rolls mounted in the bearing means in close proximity to the said finishing rolls, said detector roll members having electrical contact members mounted in the bearing means adjacent to the ends of the rolls and connected to an electrical circuit and power source, electrical conductor means operatively connected to the electrical contact members and supported on said detector roll members, said electrical conductor means comprising helically arranged pairs of insulated covered wires wound around the detector rolls and having their extremities received through recessed ends of the rolls to constitute a plurality of normally open electrical circuits, said wires having outer peripheral portions of their insulation removed to provide exposed conductive surfaces having two layers of insulation occurring therebetween, said exposed conductive surfaces of one pair of wires occurring in staggered relationship with respect to exposed conductive surfaces of the second pair of wires to engage with a metal object in the moving web in varying positions of orientation in the web thereby to close an electrical circuit through two of the wires, and relay means responsive to closing a circuit through two of the wires for interrupting rotative movement of the finishing rolls.

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