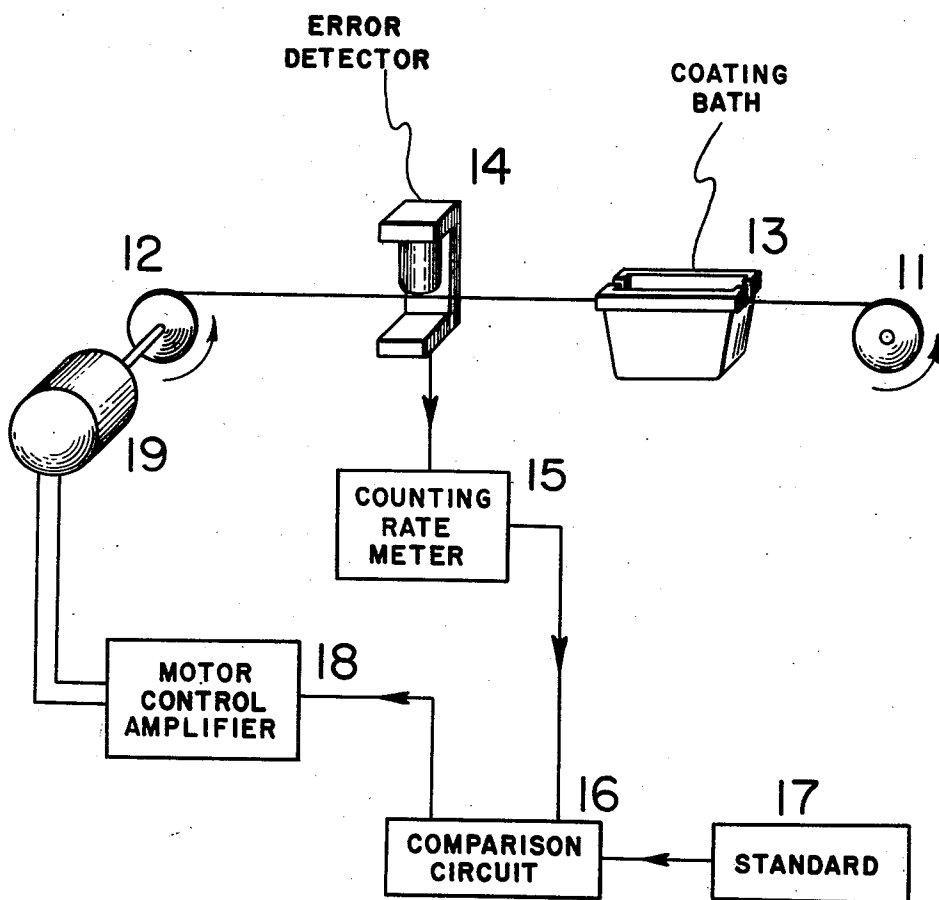


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J. F. ROCKETT, JR
COATING CONTROL SYSTEM
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COATING CONTROL SYSTEM

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This invention relates in general to methods for control of coatings being applied to objects and in particular to a method for maintaining desired characteristics in such coatings.

In many manufacturing processes it is desirable or necessary to provide a coating on an object for protective, ornamental, or functional purposes. In the case of functional coatings as, for example, when cathodes or heaters are being coated with materials having insulating or electron emitting properties, it is often necessary to hold the coating to a precise thickness or weight after it has been applied to the wire. Obviously, to obtain uniform characteristics in the finished product, it is important that the coating solution be maintained at the proper temperature, viscosity, or density depending upon the method being used to apply the coating. Also, the speed of passage of the uncoated wire through the coating station must be controlled to insure uniformity.

In the past, mechanical measurements with micrometers, calipers, depth gauges and the like have been widely used to check the thickness of the coating after application to a surface. These techniques often required a periodic sampling of the output of the coating device with the usual disadvantages of wasted material and interruption of continuous production. Optical systems, for example, comparators and photoelectric devices have also been used fairly effectively where the shape of the surface permits a true indication of thickness to be obtained in that manner. Here, however, a troublesome element is usually encountered which limits the usefulness of optical devices, especially when thin wire or ribbon is being checked. When such material is continuously moving between reels or through other mechanical devices to pass it before the light source of the optical arrangement, a certain amount of vibration is usually present giving a false reading on thickness, the apparent thickness being larger because the vibrating material blocks a greater area of light than would a stationary member of similar thickness.

Therefore, it is an object of the present invention to provide an automatic monitoring system and method for accurately gauging the thickness per unit length of coating material being applied to a member.

It is a further object of the present invention to provide a method and a control system for maintaining a desired thickness of coating in response to the output of a monitoring device.

In general, the present invention consists in a

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system for passing a member consecutively through a coating station and a monitoring station. The coating material includes a minute amount of radioactive tracer material, and the basic element of the monitoring device is a counting rate-meter. Information obtained from the counting rate-meter is then fed back to the coating material station or to the drive for the member being coated and one or the other is varied as required to maintain the desired conditions in the coated member. For a better understanding of the invention together with other and further objects, features, and advantages which will become apparent, reference should be made to the following description which is to be read in connection with the accompanying drawing, the single figure of which is a block diagram of a drag coating system embodying several of the principles of the present invention.

Referring now to the drawing, there is illustrated a system for applying a controlled coating to a continuously moving wire. A supply reel 11 carries the uncoated wire which is drawn therefrom by a wind-up reel 12. As the wire is drawn from supply reel 11 it passes through a drag coating bath 13. Coating bath 13 contains the coating solution and a small amount of distributed radioactive material. The contents of coating bath 13 are maintained within ranges of temperature, density and viscosity which are suitable to provide approximately the desired coating on the wire. As the wire emerges from coating bath 13 it passes before a counting tube 14, the output of which is then displayed on a counting rate-meter 15 and also fed to a comparison circuit 16. The output of counting tube 14 then varies with the amount of radiation from the wire passing before it.

A standard source 17 provides a second input to comparison circuit 16 and the two inputs are continuously checked against each other to provide an output error voltage to a motor control amplifier 18. The output from motor control amplifier 18 is then applied to a drive motor 19 which determines the speed at which the wire is drawn through coating bath 13, thereby determining the thickness of coating being applied to the wire. Although the present embodiment of the invention utilizes the radiation from the coating material to control speed, it is obvious that other parameters could be controlled in similar fashion. For example, the wire could be drawn at uniform speed and the density of the solution could be controlled by suitable solenoid valves triggered by the amplified output

of the comparison circuit. Numerous applications of the concepts of the present invention to coating processes where control of one or more parameters is desired will suggest themselves to those skilled in the art since the invention lends itself to incorporation in any closed-loop circuit wherein an error voltage is developed and used to diminish the conditions giving rise to the error voltage.

For purposes of protection of personnel, the radioactive material placed in coating bath 13 is preferably one having a short half-life. Although a single reel of radioactive wire would constitute no hazard, the accumulation of reels in continuous processing could provide sufficient emanation to reach the danger point. By using material having a short half-life, this result is avoided since all harmful radiation disappears in a short time from such substances. Radioactive barium and strontium compounds are suitable for use as tracers and are entirely adequate for the required accuracy even when used with conventional commercial detection instruments.

Although the invention has been illustrated and described in connection with its incorporation in a cathode or heater wire coating device, the principles of operation are equally applicable to any process wherein a member is to be coated, painted or otherwise covered with a material capable of carrying a distributed tracer. By a simple arrangement of controls or the addition or reorientation of counting devices control of diverse types of applying mechanisms can be achieved.

For the above noted reasons the invention should not be limited to the embodiment shown which is merely for purposes of explanation but only by the appended claims.

What is claimed is:

1. The method of maintaining uniform thickness of a coating being applied to a moving wire which comprises the steps of adding a relatively small amount of radioactive material having a relatively short half-life to the coating substance, applying the radioactive coating to the moving wire, detecting the radiation from the coated wire as it passes by a point, comparing the detected radiation with that from a standard source and varying the speed of said moving wire in accordance with the difference between the radiation from said standard source and the amount of radiation detected.

2. Coating control apparatus comprising, a first reel holding uncoated wire, a coating bath containing coating material and a minute quan-

tity of radioactive tracer material having a short half-life, a radiation detecting device, a wind-up reel to draw said uncoated wire from said first reel and consecutively through coating bath and past said detecting device, a motor for driving said wind-up reel, a standard source of radiation, and means responsive to the difference between radiation from said standard source and that detected by said radiation detecting device for varying the speed of said motor.

3. Coating control apparatus comprising, a first reel holding uncoated wire, a coating bath containing coating material and a minute amount of radioactive tracer material having a short half-life, a counting tube for detecting the strength of radiation, a wind-up reel, means for driving said wind-up reel, means for passing said uncoated wire from said first reel through said coating bath and past said counting tube to said wind-up reel, and means for controlling the speed of said driving means in response to the output of said counting tube.

4. Apparatus for coating a wire comprising, a supply reel for holding a quantity of uncoated wire, a coating bath containing coating material and a minute amount of distributed radioactive tracer having a half-life of the order of magnitude of several hours, a radiation detecting counting tube, a wind-up reel, a motor for driving said wind-up reel whereby said wire is drawn from said supply reel, through said coating bath and past said counting tube, a standard source for providing a predetermined amount of radiation, a comparison circuit for comparing the difference between the outputs of said counting tube and said standard source, and a motor control amplifier for continuously amplifying the output of said comparison circuit, the output of said motor control amplifier being applied to said motor to control its speed and thereby the rate of travel of said wire, the amount of coating picked up by said wire being maintained substantially constant.

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References Cited in the file of this patent UNITED STATES PATENTS

Number	Name	Date
2,264,725	Shoupp et al.	Dec. 2, 1941
2,415,644	Leonhard et al.	Feb. 11, 1947

OTHER REFERENCES

Radioactive Isotopes as Tracers, Kramer Power Plant Engineering, November 1947, pgs. 105-108.