Oct. 31, 1933. J. A. SARGENT 1,933,188

COLD ROLLING COATED STRIPS

Filed March 17, 1932

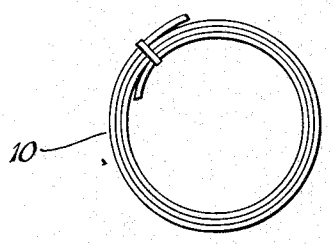


Fig. 1

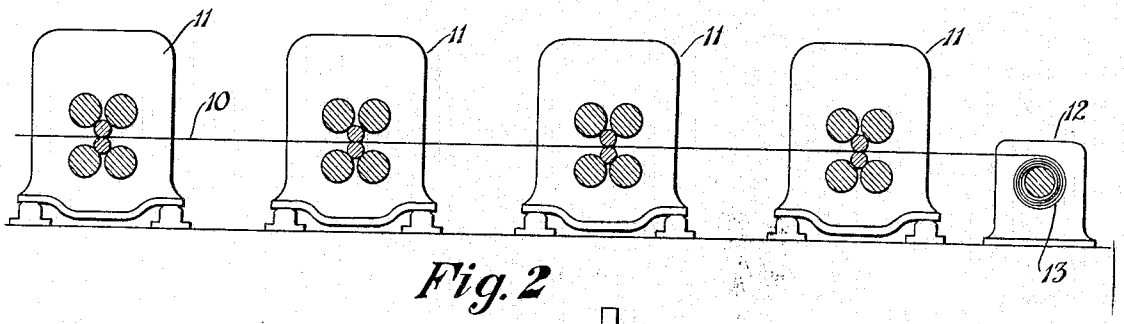


Fig. 2

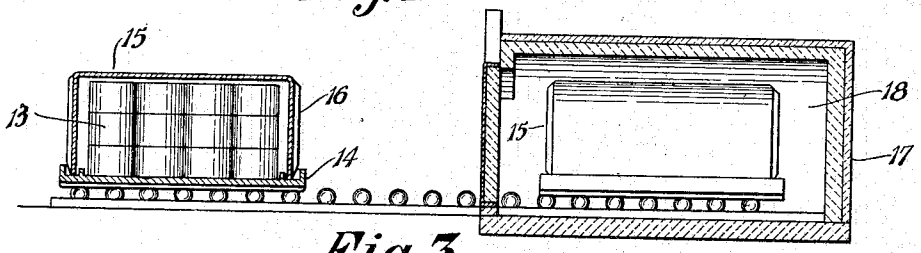


Fig. 3

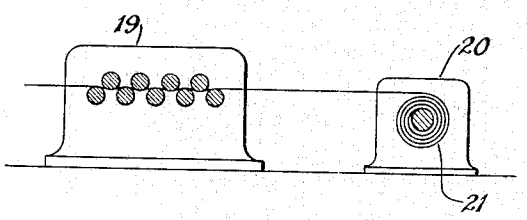


Fig. 4

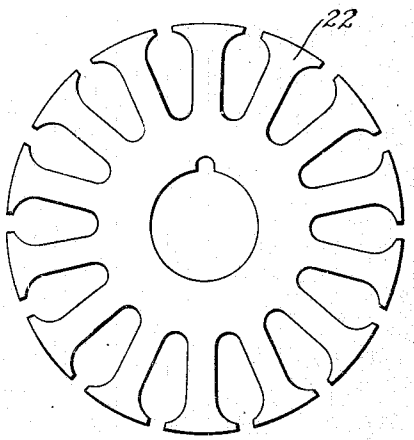


Fig. 6

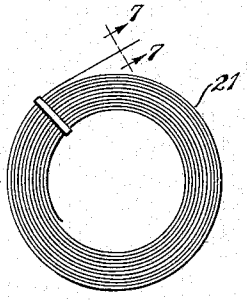


Fig. 5

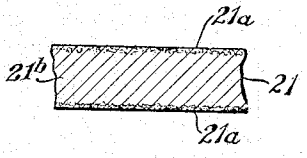


Fig. 7

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COLD ROLLING COATED STRIP

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3 Claims. (Cl. 175—21)

The invention relates to the manufacture of cold rolled coated steel strips and more particularly to the manufacture of strip steel having satisfactory conducting characteristics, suitable for being used as a magnetic material from which laminated core stampings for armatures, transformers and the like may be made, without requiring the same to be specially provided with a non-conducting coating.

Laminations of magnetic material utilized for making laminated armature cores and the like must be insulated from each other in order to reduce hysteresis and eddy current losses, and to constrain magnetic flux set up in the cores so that it threads through the laminated stampings parallel to their flat sides. Likewise, the material used in such cores should have a high electrical resistance and a low hysteresis constant.

Magnetic material for making laminated cores has been produced by coating sheet steel stampings with a paint, varnish, lacquer, enamel or japan film which provides the necessary insulation coating for the laminations. Likewise, laminated cores have been made utilizing alternate layers of annealed silicon steel and nickel-iron alloy sheet metal stampings. However, the cost of labor and material, either for providing the stampings with a special coating, or for providing special analysis metal from which the stampings are to be made, causes the cost of making satisfactory laminated magnetic cores to be relatively high.

It is therefore an object of the present invention to provide strip steel in the process of rolling the same, with a dielectric coating of insulating material, rendering its conducting properties satisfactory for use in making magnetic core laminations.

It is a further object of the present invention to provide strip steel suitable for use in making magnetic core lamination stampings without requiring a special non-conducting coating to be applied thereto.

It is a further object of the present invention to provide a method of making cold rolled strip steel suitable for making magnetic core lamination stampings at a cost substantially less than that of making full cold rolled strip steel.

And finally, it is an object of the present invention to produce cold rolled strip steel without a lustrous surface at a cost substantially less than that of making full cold rolled strip steel; and to provide a new method of making such non-lustrous strip steel.

I have discovered that cold rolled strip steel having the above characteristics may be produced by hot rolling strips, preferably from thirty foot slabs of low silicon, low carbon steel, or of any other low silicon analysis, to any suitable gauge in the usual manner and coiling the same; then cold rolling the hot rolled strips to the desired gauge and coiling the same; then box annealing the coiled cold rolled strips preferably without maintaining a deoxidizing atmosphere during the annealing operation; then passing the strips through breaker rolls to break the coil set of the annealed material, and to flatten and straighten the strips, or through cold reducing rolls for the same purposes and to reduce the strip thickness; and then coiling the cold rolled strips to facilitate subsequent handling, and to produce cold rolled strips in a suitably coiled form adapted for use in carrying out continuous stamping operations and the like.

The hot rolled coiled strips are cold rolled directly without pickling the hot rolled strips, contrary to universal practice, which requires hot rolled material to be pickled to remove hot roll scale before carrying out a cold rolling operation. It has ordinarily been believed that unsound cold rolled products are produced if hot roll scale is not removed by pickling hot rolled products before cold rolling the same.

However, I have discovered that hot roll scale cold rolled into the surface of cold rolled strips forms a non-conducting or dielectric coating on the surfaces of the strips, so that the cold rolled product has excellent dielectric characteristics suitable for being used for making laminated magnetic core stampings.

The cold rolled coils may have any desired weight up to the weight of a coil produced from a thirty foot slab, the usual material from which hot rolled strips are made; and magnetic core lamination stampings may be readily cut from or punched in such coiled strips in a continuous manner much more readily than the same are now being made from sheet steel according to prevailing practice.

Furthermore, I have discovered that coiled strip steel cold rolled from hot rolled strips without pickling, possesses all of the qualities and characteristics, excepting only a lustrous surface, present in full cold rolled strips, the making of which requires pickling operations. I have likewise discovered that cold rolled strip steel made from hot rolled strips without pickling may be produced at a cost substantially

less than that of producing full cold rolled strip steel.

Accordingly, cold rolled strip steel made in accordance with the present invention, can be used for any purposes which do not require a lustrous or bright surface. Thus such strip steel may be used in making expanded metal lath, light metal building sections, and the like, the manufacture of which is cheapened and facilitated by the utilization of coiled strip steel made in accordance with the present invention, in place of conventional sheet steel used in prevailing practice.

The presence of hot roll scale on hot rolled strips, when the same are being cold rolled, injures the ordinary steel cold rolls to such an extent as to practically prohibit their use. Accordingly, special cold rolls must be provided, and I have discovered that hot roll scale coated strips may be successfully cold rolled by utilizing cast nickel-iron alloy rolls.

The improved method has been successfully carried out in apparatus illustrated diagrammatically in the accompanying drawing in which:—

Figure 1 is a diagrammatic view of a coil of hot rolled hot roll scale coated strip steel;

Fig. 2 is a diagrammatic elevation of a continuous cold rolling mill;

Fig. 3 is a diagrammatic elevation of an annealing box and a box annealing furnace;

Fig. 4 is a diagrammatic elevation of a stand of breaker rolls and a coiler;

Fig. 5 is a diagrammatic view of a coil of improved hot roll scale coated cold rolled strip steel;

Fig. 6 is a plan view of a laminated core stamping made from the improved cold rolled strip; and

Fig. 7 is an enlarged cross section through the improved hot roll scale coated cold rolled strip taken on the line 7—7, Fig. 5.

Similar numerals refer to similar parts throughout the drawing.

In making the improved product by the improved method, slabs preferably of low silicon, low carbon steel are hot rolled on roughing, edging and finishing mills to any suitable gauge in the usual manner, and the hot rolled steel strips are then coiled to produce hot rolled strip steel coils indicated at 10 in Fig. 1. The hot roll scale which forms on the hot rolled strips 10 during the hot rolling operations is permitted to remain on the surfaces of the strips, and the hot rolled steel strips 10 are not pickled.

Hot rolled steel strips 10 with hot roll scale thereon are then passed through a cold rolling mill indicated diagrammatically in Fig. 2, which is preferably a continuous type mill including a plurality of stands of cold rolls indicated generally at 11 and a coiler generally indicated at 12. The presence of the hot roll scale on the strips 10 as the same pass through the cold rolling mill requires the use of special hardened rolls in the cold roll stands 11; and it has been found that cast nickel-iron alloy rolls may be successfully used.

The hot roll scale on the hot rolled strips is cold rolled into the surfaces of the strips to form a cold rolled hot roll scale coating thereon as the strips pass through the cold rolls 11 and are coiled on the coiler 12 to form cold rolled steel strip coils 13.

A suitable number of coils 13 are then placed in tiers on the bottom 14 of a usual annealing box indicated generally at 15, and are covered by the usual annealing box cover 16. The annealing box is then pushed in a usual manner into a usual type of box annealing furnace 17 shown in Fig. 3, and the furnace may preferably include a plurality of chambers 18 which may be alternately charged.

The annealing furnace is brought to the desired temperature after which the box 15 is withdrawn from the furnace and allowed to cool. It is not desired to maintain a deoxidizing atmosphere in the annealing furnace or in the annealing box 15 because it is not intended to prevent the formation of scale on the cold rolled strip coils 13 which already have a substantial coating of hot roll scale thereon.

On the other hand, it is preferred to permit an oxidizing atmosphere to be present in the annealing furnace and in the annealing box 15 so as to prevent the hot roll scale coating on the cold rolled coiled strips 13 from being reduced, and to reduce the cost of the annealing operation.

The annealed coils 13 are then preferably passed through breaker rolls indicated diagrammatically at 19 in Fig. 4, for breaking the set of the coils and for flattening and straightening the strip; or the annealed coils 13 may be passed through another cold reducing mill to further reduce the strip thickness. In any event, the annealed level cold rolled strips with hot roll scale coatings thereon are then coiled on a coiler indicated generally at 20 to produce the finished coiled cold rolled steel product indicated generally at 21 in Figs. 4 and 5.

The cold rolled strip steel coils 21 are in a convenient form for being readily fabricated as by being subjected to continuous punching or stamping operations so that core laminations such as shown in Fig. 6 at 22 may be stamped therefrom for use in making laminated magnetic cores; and the hot roll scale coatings 21*a* on the steel base 21*b* of the strip steel 21 are substantially uniform, have level outer surfaces, and are bonded to the steel base as shown in Fig. 7, and provide suitable non-conducting coatings for the core laminations 22.

It is not intended to limit the scope of the present invention to the manufacture of magnetic core lamination stampings because the improved product made by cold rolling hot rolled steel strips without pickling the same possesses all the characteristics of full cold rolled strip steel excepting only a lustrous surface and may be used for any purpose which does not require the cold rolled strip steel to have a lustrous, bright, or polished surface.

Nor is it intended to limit the scope of the present invention to the manufacture of an annealed coated product, because when a stiff cold rolled product with a coating thereon is desired, or when the strip is not required to be ductile, the annealing step may be eliminated.

The elimination of the step or steps of pickling the strips reduces the cost of making cold rolled scale coated steel strips 21 so that the same is materially less than the cost of producing full cold rolled strip steel which requires pickling operations; and by making the strips out of low silicon steel, having a silicon content of not exceeding .50 per cent, as distinguished from silicon steel which is defined in the books and recognized in the art as steels containing from .50 to 4.50 per cent silicon, the cost of core

stampings and the like is greatly reduced from the cost of making the strips out of silicon steel or nickel-iron alloy.

I claim:—

1. The method of making low silicon steel strips with a dielectric surface coating, which includes hot rolling a steel strip and forming a hot rolled dielectric surface scale thereon, and then cold rolling the hot rolled dielectric scale into the surface of the strip.

2. The method of making low silicon steel strips with a dielectric surface coating, which includes hot rolling a steel strip and forming a hot rolled dielectric surface scale thereon, then cold rolling the hot rolled dielectric scale into the surface of the strip, and then annealing the cold rolled strip in an oxidizing atmosphere.

3. A low silicon steel strip for making cores and the like, provided with a dielectric surface coating of scale cold rolled thereon, the steel having a silicon content of not exceeding .50 per cent.

JAMES A. SARGENT.