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A. E. LUNDBYE

2,361,554

METHOD OF MAKING DOCTOR BLADES

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FIG. 1.

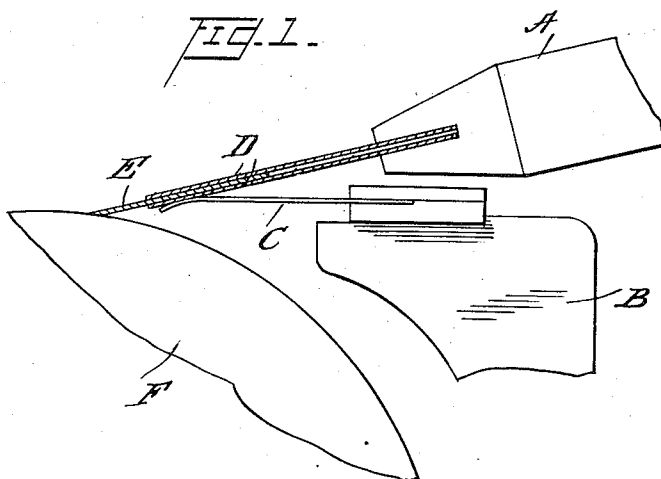


FIG. 2.

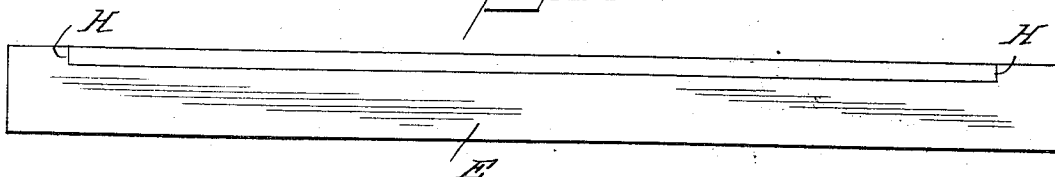


FIG. 3.



FIG. 4.

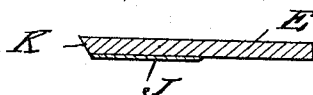
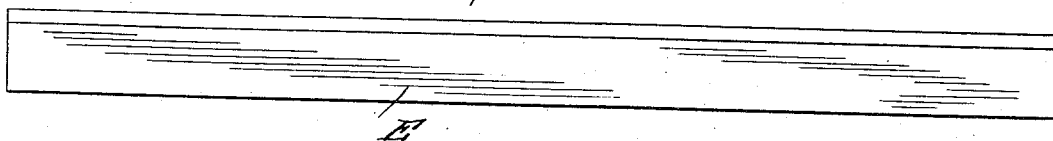


FIG. 5.



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METHOD OF MAKING DOCTOR BLADES

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Application April 1, 1942, Serial No. 437,270

3 Claims. (Cl. 29—148)

My invention relates to new and useful improvements in the method of making doctor blades.

This is a continuation-in-part of application Serial No. 410,205, filed September 9, 1941.

As is well known to those skilled in the art, a doctor blade is a thin steel knife which is used to scrape off the excess ink which is sprayed on an intagliated printing cylinder, commonly known as a "rotogravure printing cylinder."

Heretofore most doctor blades have been made from a high carbon content pure Swedish steel, which at the present time is impossible to secure.

Furthermore, doctor blades made of pure Swedish steel would function for some 70,000 or 80,000 turns of the cylinder. It was then necessary to stop the press and insert a new blade, or a blade that had been resharpened. This changing of the blades often consumed fifteen minutes, which is a serious delay after substantially only 80,000 turns of the cylinder.

Again, with the best suited American steel, it has been found that after the doctor blade has been used for some time—that is, for less than 70,000 or 80,000 revolutions of the cylinder, the edge of the blade would have a tendency to wear unevenly and have rough spots thereon, which rough spots tend to cut fine lines in the thin intaglio copper surface of the cylinder and thus form scratches on the resulting printing.

One of the objects of the present invention, therefore, is to provide a method of making a doctor blade that is so made that it will function well for between 650,000 and 750,000 revolutions of the cylinder before the same has to be removed and a reground blade substituted.

Still another object of the invention is to provide a doctor blade that in reality presents a laminated structure, that is, it is to have a tough steel core and a hard outer surface formed on either one or both sides thereof.

Still another object of the invention is to provide a new and novel method of making a doctor blade that is to be chromium treated, but not throughout its entire length, as doctor blades generally are unsupported near their opposite ends, and the blade about to be described may be somewhat brittle, and is preferably plated, therefore, only throughout its supported portion.

Still another object of the invention is to provide a blade that is plated (flash plated) and

then heat treated as will be hereafter explained, so that the life of the blade is increased practically eight to nine times over the ordinary form of doctor blade.

5 Still another object of the invention is to provide a doctor blade that is so made that the edge will be of hard material and the core of a very tough material, so that even though the blade is used for 650,000 or 750,000 revolutions
10 of the printing cylinder, there will be no tendency for the blade to wear unevenly and thus form spots or edges which tend to scratch the intagliated surface of the cylinder.

With these and other objects in view, my invention consists in certain new and novel steps
15 in the treatment and method of making doctor blades as will be hereinafter more fully described and pointed out in the claims.

Referring now to the drawing showing a preferred embodiment,
20

Figure 1 is a fragmentary view of a doctor blade holder, together with a supported doctor blade therein, and a fragmentary portion of the rotating printing cylinder;

25 Fig. 2 is a view of the preferred form of blade, showing the chromium plating along the one edge and stopping short of the length of the blade;

Fig. 3 is a sectional view showing the chromium plating on both the surfaces of the blade;

30 Fig. 4 is a similar view with the coating shown on just the one surface of the blade; and

Figure 5 is a view similar to Fig. 2 but showing the chromium extending throughout the length of the blade.

35 In describing the invention, the mechanical structure of the blade will first be referred to, after which the method of forming the blade will be set forth.

Referring now more particularly to the several
40 views, and for the moment to Fig. 1, there is fragmentarily shown the doctor blade assembly wherein there is a holder A for the doctor blade and a holder B for the backing blade C, which latter contacts one of the plates D in which plates
45 is secured the doctor blade E.

There may also be seen a fragmentary portion of the rotogravure or intaglio printing cylinder F on which the forward edge of the blade E rests to
50 scrape off the excess ink from the rotating printing cylinder F.

The doctor blade E generally consists of a thin blade of steel of from .002" thickness up to much heavier gauges, and it also varies from narrow strips to a blade a number of inches in width.
55 Also, the length of the blade is usually from three

to six inches longer than the cylinder on which it is to be used.

As mentioned heretofore, a pure Swedish steel has generally been used, but due to the impossibility of now procuring such a steel, the doctor blades of the present day are made from an American steel of about the following chemical analysis:

Rockwell hardness.....	physical..	43 to 45
Carbon.....	per cent.....	.96
Phosphorus.....	do.....	.022
Sulphur.....	do.....	.033
Silicon.....	do.....	.16

This steel, and even the Swedish steel, has a tendency to wear unevenly and the edge, comparatively speaking, is rough, so that this blade, riding against a soft surface—that is, a soft copper shell on which are the intricately etched designs for the rotogravure printing—has a tendency to cut grooves in the copper shell, and even though these grooves and lines are minute and hard to see with the naked eye, they still subtract from the printing value.

It also might be mentioned that when the doctor blades reciprocate on the cylinder, from three to six inches of the blade is usually unsupported by the cylinder on which it rides. Therefore, I preferably plate the blade E as shown in Fig. 2 on its one or both sides at its forward edge and terminate the plating as at H or in other words, short of the ends, so that just the plated portion contacts with the cylinder.

This has a tendency to add to the life of the blade, as the blade may show a tendency to crack when unsupported. Thus, by stopping the chrome plating short of the ends which are not used for the scraping action, there will be no likelihood of the blade fracturing at these unsupported ends.

However, in Fig. 5 I have shown the blade E with the chrome plating extending throughout its length, as it still will function better than the blades now in use.

In Fig. 3 the chromium plating J is shown on the two sides of the blade, whereas in Fig. 4 the chromium plating J is only shown on the one side of the blade. As heretofore mentioned, in Fig. 5 the chromium J extends the entire length of the blade and may, of course, be on either one or both surfaces of the blade.

It will also be noticed that the chromium J extends along the edge and for a relatively short distance beyond the same; that is, the width of the chromium plating may extend for approximately an inch and a half back from the edge; but of course this can be varied to suit conditions.

Also, the edge K is shown with a wiping angle of approximately 20°, although here again this angle may be changed if so desired.

Thus in reality I have formed a laminated blade wherein the core is of steel and either the one or both of the opposite sides will be chrome (which is a very hard metal), and I thus obtain a blade which is far superior to any of the blades that are now in use.

Now referring to the gist of the invention, that is to the method of making the blade, it is believed that when the steel is chromium plated (flash plated) as will be shortly explained, and then heat treated, the molecular structure of the steel is modified.

It is also believed that the heat treatment has a tendency to rearrange the molecules from their original position, or in other words, to a position

which is better than the original position for the purpose for which the blade is to be used.

It is also known that by treating the blade as about to be described, the chromium adds hardness and the steel provides the strength and flexibility to the blade which is necessary in a doctor blade.

For the present blade I utilize American steel, the physical and chemical analysis of which was set out above, and then flash plate it from .0001" to .00014" in thickness with chromium and substantially for an inch and a half of the width of the blade and preferably, as heretofore mentioned, leave the ends unplated.

It is possible that this thickness might be from .003" to about .00001", although the above thickness set out is more desirable.

After the blade has been plated as described, I treat the blade in hot oil. That is to say, I submerge the blade in oil at a temperature of approximately 450 degrees F. and let it remain in the oil from approximately one to three hours. After this treatment it is allowed to cool in the oil to approximately 100 degrees for a short period, then down to room temperature after which the blade is removed from the bath.

Here again it is to be noted that the temperatures and time given have been found the most desirable, but I do not wish to be limited to the exact time or temperatures.

The blade illustrated in the drawing is approximately four inches wide and .006" in thickness.

It may be possible to treat the blades in a higher or lower temperature, and I believe that a coverage of treating either dry or wet from 100° F. to 1200° F. from ten minutes to three hours might still be well below the critical temperature of the steel (the core) and the surface material (chromium) which is the plating.

As heretofore mentioned, I believe that the plating and the heat treatment as above outlined modifies the molecular structure of the steel as the blades when coated and treated as preferably set out have functioned perfectly in the press for between 650,000 and 750,000 revolutions of the cylinder whereas heretofore it has been found necessary to change the blades after the cylinder has made only some 70,000 or 80,000 revolutions.

A blade as above formed has the desired flexibility, hardness and toughness and, although it may be slightly brittle, by leaving the ends unplated, there is no tendency for them to crack at these points.

It will be understood that I can grind the edge after plating, or before plating as the plating does not affect the scraping properties of the blade.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. The method of making a doctor blade for use with printing cylinders, which includes the flash plating with chromium of a relatively thin steel blade having a thin forward edge adapted to engage the surface of a printing cylinder, the thickness of the chromium being from one ten thousandth (.0001") of an inch to fourteen hundred thousandths (.00014") of an inch in thickness, and extending substantially an inch and a half rearward from said forward edge of the blade, heat treating the blade in oil at a temperature of approximately four hundred fifty degrees Fahrenheit (450° F.) for from one to three hours, cooling the blade in the oil to pa-

proximately one hundred degrees Fahrenheit (100° F.), then down to room temperature, removing the blade and grinding the forward edge to remove the chromium plate from said forward edge.

2. The method of making a doctor blade for printing presses, which consists in flash plating with chromium a relatively thin strip of steel having a thin forward edge adapted to engage the surface of a printing element, the chromium plate varying from three thousandths (.003'') of an inch to approximately one hundred thousandth (.00001'') of an inch and covering said forward edge and partially covering the sides of said strip, heat treating the plated steel by immersing it in a heated oil bath for a period of time from ten minutes to three hours, said oil bath having a temperature to maintain said plated steel well below the critical temperature of the steel and the chromium plate, cooling and

then grinding said forward edge of the blade to remove the chromium plate from said forward edge.

3. The method of making a doctor blade for rotating printing cylinders, which consists in grinding an edge of a relatively thin strip of steel, then flash plating the sides of said strip adjacent to said edge with chromium to provide a chromium plate about .0001 to .00014'' in thickness, the plate stopping short of the respective ends of the blade and extending for a relatively short distance back of the cutting edge of the blade, treating the plated blade in oil at a temperature of approximately four hundred fifty degrees Fahrenheit (450° F.) for approximately one to three hours, and then cooling the blade in oil to approximately one hundred degrees Fahrenheit (100° F.) and then down to room temperature.

AXEL E. LUNDBYE.