

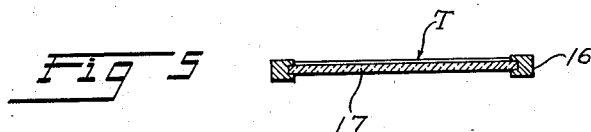
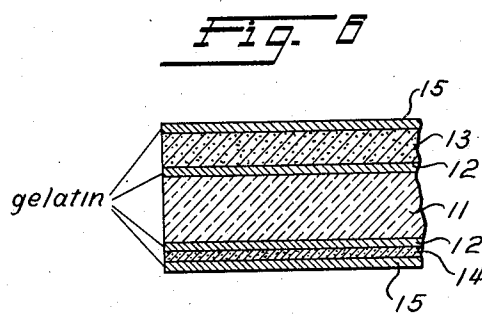
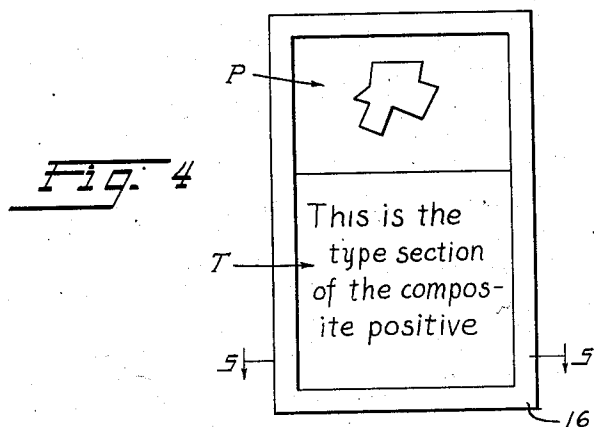
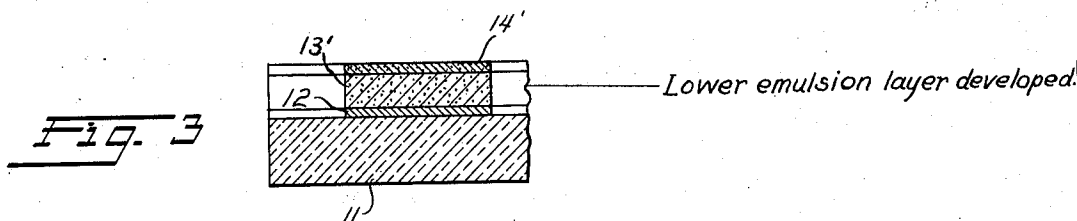
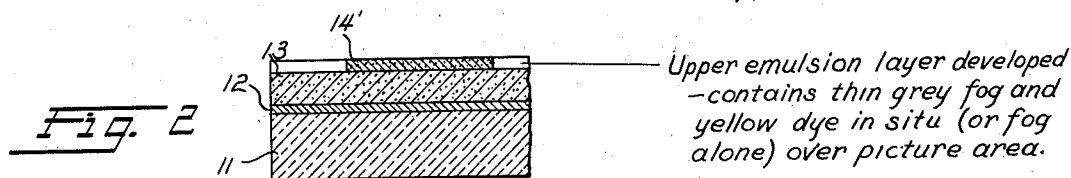
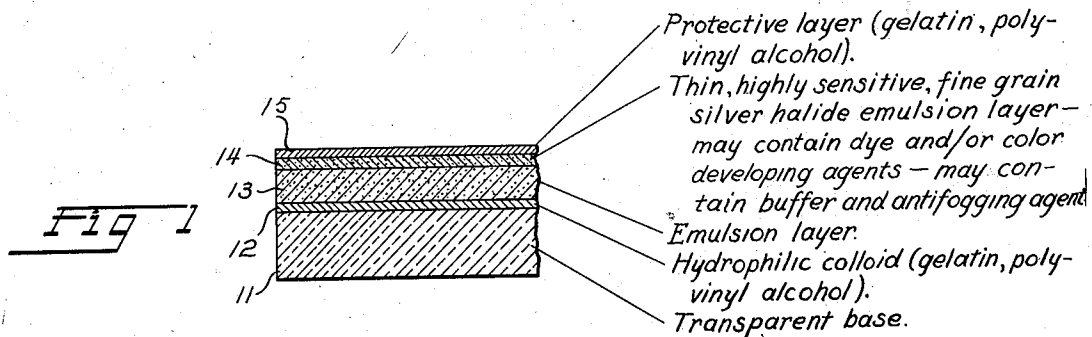
April 17, 1945.

K. WOLFSON

2,373,732

PRINTING AND PROCESS AND DEVICE

Filed Jan. 21, 1941



Inventor

Kurt Wolfson

Strauch & Hoffman

Attorneys

By

UNITED STATES PATENT OFFICE

2,373,732

PRINTING PROCESS AND DEVICE

Kurt Wolfson, Springfield, Mass.

Application January 21, 1941, Serial No. 375,321

11 Claims. (Cl. 95—8)

This invention relates to intaglio printing and more particularly to photographic processes and devices employed in the manufacture of intaglio printing cylinders and like elements.

Generally, in making intaglio printing surfaces, a photographic positive of the material to be printed is prepared and light is projected through the positive onto a light sensitive coating, e. g. carbon tissue, to be transferred onto a metal surface to be later etched for printing. It was early discovered that, where both picture and type matter are embodied in the material to be printed, difficulties in obtaining proper exposure of the light sensitive coating are encountered, as employment of sufficient light for properly printing both picture and type usually resulted in poor contrast between the background and the finest pictorial tone values, which caused a premature etching of said background in the region of those finest pictorial tone values.

A proposed solution for the difficulty was to prepare a separate positive of the picture matter on yellow tinted film base, and a separate positive of the type matter on the usual colorless base, combine the two into a single positive and print photographically therefrom as usual. The tinted picture region reduced the exposure of the picture, thereby obtaining balanced exposure of the whole page of material to be printed.

This solution was satisfactory where the pictures were square, circular, rectangular, elliptical or of any other simple geometrical outline; but was not satisfactory for silhouetted pictures of irregular outline intended to be printed for example against a page as a background.

It was later proposed to produce positives embodying such irregular outline pictures by first preparing the usual colorless background positive of the whole page and then overlaying the picture with a suitable hand-cut piece of yellow Cellophane or the like of proper outline. But this method is time-consuming, inaccurate and costly, and hence not satisfactory.

Another proposed method has been to prepare a positive of the whole page having a yellow tinted back coating, mask out the picture area of that coating with a suitable waterproof lacquer, and then bleach the remainder of the background of the positive. A further variation of this principle was to prepare a colorless positive film, mask out all except the picture area with waterproof lacquer, and then dye the picture area yellow. These two methods involved much artistic and careful handwork and consequent expense and were not

reliably accurate, and hence have not been satisfactory.

With the above state of the prior art in mind, it is a major object of the invention to provide a novel speedy, accurate and inexpensive process for simultaneously etching type matter and pictorial matter of any outline on an intaglio printing surface.

A further object of the invention is to provide a novel speedy and inexpensive process for making a photographic positive suitable for simultaneously accurately photo-etching type matter and pictorial matter of any outline on an intaglio printing surface.

A further object of the invention is to provide a novel composite photographic positive having an actinic ray transmitting background on which is disposed type matter and pictorial matter of any outline, the picture areas being selective to screen actinic light rays to thereby control and provide balanced exposure conditions during photo-etching operations; and novel methods of making the positive. To secure this desired screening, the picture areas are preferably tinted and/or shaded, as by dyeing, during development.

A further object of the invention is to provide a novel method of making a photographic picture positive for use in photo-etching wherein an actinic ray blocking screen is formed coextensively with the picture area or areas by photochemical operations. Preferably this screen is formed during development on the same or opposite sides of the film base or plate carrying the picture.

A further object of the invention is to provide a novel photo-sensitive film or plate having two or more emulsion layers of different thickness and different optical and chemical sensitivities, adapted upon exposure and development to produce a screened picture positive suitable for use in photo-etching operations for simultaneously etching both pictorial and type matter on an intaglio printing surface.

Further objects of the invention will presently appear as the description thereof proceeds in connection with the appended claims and the annexed drawing in which:

Figure 1 is an enlarged section illustrating the structure of a photo-sensitive element of a preferred embodiment of the invention;

Figure 2 illustrates the element of Figure 1 after exposure and development of the special thin emulsion layer;

Figure 3 illustrates the element of Figure 1 after further development to final form;

Figure 4 is a diagrammatic view illustrating how the picture positive of Figure 3 is combined with a positive containing associated type matter for simultaneous optical printing during photo-etching of the intaglio printing surface;

Figure 5 is a section along line 5-5 of Figure 4; and

Figure 6 is a section illustrating a photosensitive element wherein the emulsion layers are on opposite sides of the base.

Briefly my invention contemplates improving and speeding up present processes for simultaneously photo-etching picture and type matter on intaglio printing surfaces by producing, photographically and photochemically and without hand work, photographic positives wherein the picture areas are correctly tinted or shaded, and using such positives in optical printing operations involved in the photo-etching processes.

To this end, I first make a special photo-sensitive element to be exposed and developed to produce an actinic light modifying picture positive. This element comprises a transparent plate or film having one or more conventional-type emulsion layers and a special highly sensitive emulsion layer which upon exposure and development of the film forms a color selective screen for the picture area. Substances for dyeing or otherwise coloring or shading the picture area may be embodied wholly in the thin emulsion layer, partly in the thin emulsion layer and in a suitable developing bath, or wholly in the developing bath as desired. Preferred specific methods of preparing such picture positives are herein later described.

Preferably the picture area screen or screens are so tinted as to reduce the amount of actinic light which can pass therethrough to the normally blue or actinic light sensitive material commonly employed as the photo-sensitive coating on the surface to be etched, and are therefore tinted yellow or otherwise arranged to reduce actinic light.

After being prepared as above, the tinted picture positive is combined with a photographic positive of the type matter with which it forms a complete page assembly to be printed, and both picture and type matter are optically printed onto the surface to be etched in the usual manner.

As the preferred specific embodiment of my invention, I prepare the picture and type sections of my new composite picture positive separately and independently.

For preparing the picture section of the composite positive, I preferably employ the special sensitive film illustrated in Figure 1. This film comprises a colorless transparent base 11 which may be of glass, cellulose ester or any suitable substance.

Base 11 has on its upper surface a thin layer 12 of a hydrophilic colloid, such as gelatin or polyvinyl alcohol. Layer 12 has high affinity for water and serves to closely bind base 11 to an overlying layer of silver halide emulsion 13.

Emulsion layer 13 is of the same thickness, sensitivity and other characteristics as the emulsion layer usually employed on film employed in photogravure photo-etching operations. Emulsion layer 13 is therefore of comparatively slow speed and, like the usual photographic emulsion employed in photogravure work, predominantly blue sensitive. Emulsion layer 13 of course contains no coloring material and is adapted to pro-

duce upon exposure and development a conventional "black and white" picture positive as in the usual photogravure process.

In practice, I have found it very satisfactory and inexpensive to simply employ an ordinary commercially available sensitive film of the type commonly employed in photogravure work as that part of the sensitive element designated by numerals 11, 12 and 13 in Figures 1 and 5.

Completely and directly overlying emulsion layer 13 is a second thinner silver halide emulsion layer 14 of special characteristics. Layer 14 is only about one third as thick as layer 13, being of the same order of thickness as a single color sensitive emulsion layer of ordinary Kodachrome film.

Layer 14 has extremely high sensitivity and speed, and has a high concentration of very fine silver halide grains. I have found it very satisfactory to employ an emulsion having a speed of about 50 Weston and a sufficient concentration of fine silver halide grains to produce a maximum density of .15 to .20 in the positive.

Layer 14 is essentially of such different exposure characteristics from layer 13 that when the latter is properly exposed under the usual exposure light conditions encountered in making photographic positives for use in intaglio printing and subsequently developed, screen area 14' of uniform transmission is produced in layer 14 overlying the entire picture area in layer 13. Screen area 14' is a uniform transmission light filter containing no image details within its outline.

Layer 14 is also preferably predominantly sensitive to the yellow and orange regions of the visible spectrum, so that it requires less exposure to light from an ordinary incandescent electric lamp than the blue sensitive emulsion layer.

Layer 14 preferably has imbedded therein dyestuff and color developing agents which produce a dyed picture section at layer 14 upon exposure and development. I preferably employ such materials as will dye the picture section yellow so as to predominantly reduce actinic light.

Briefly, layer 14 contains imbedded dyestuff intermediates which are of such high molecular weight as to be fast to diffusion, i. e. they do not wander from the emulsion and are not removed by mechanical operations such as washing during developing. An example of a suitable dyestuff material found very satisfactory for purposes of the invention for producing a yellow dye is p-aminobenzoyl-2-chloroacetanilide-p-carboxylic acid which can be alkylated in the NH_2 group by a long chain carbon radical such as palmityl, or two molecules of it can be coupled by reaction with phosgene, to obtain molecules of sufficient heaviness.

Layer 14 also preferably contains salts of coupling developers, or color developing agents, which are temporarily inactive, i. e. inactive until the film is being developed after exposure. These salts may be almost any neutral salts, but preferably comprise neutral double salts of metals such as zinc or cadmium.

As a satisfactory developing agent, I have found it satisfactory to use p-aminodiethylaniline combined with tartaric or glycolic acid, boric acid and zinc chloride. This mixture provides a temporarily inactive double salt of zinc in the emulsion.

In addition to the above, almost any suitable combination of dyestuff and color developing agents commonly employed in color photography

may be incorporated in emulsion layer 14. It is not material to the invention what specific agents are employed. It is only important that that portion of layer 14 which remains after exposure and development be suitably tinted or shaded to reduce actinic light.

A buffer material is also incorporated in either or both emulsion layers or the gelatin layer to maintain the pH of the system comparatively constant and prevent such changes in pH as would alter the sensitivity of the emulsions. In practising the invention, I have found a mixture of citric acid and sodium diphosphate to comprise a satisfactory buffer, and I place the mixture in layer 14. The acids in the color developing agents must be considered in providing a buffer since these acids have some buffer function in the system.

I have also found that most satisfactory results are obtained by employing a common anti-fogging agent, such as nitrobenzimidazole, preferably in emulsion layer 14.

As a protection for emulsion layer 14, I provide an antistatic, antifriction overlayer 15 of gelatin, polyvinyl alcohol or like hydrophilic colloid material which prevents scratches and other physical injuries to the thin emulsion layer.

The above described photo-sensitive element, as shown in Figure 1, is ready for use in the photo-etching process and is exposed through emulsion layer 14, i. e. the light strikes layer 14 first, usually by optical printing from a photographic negative of the picture to be printed. After sufficient exposure to properly expose the less sensitive emulsion layer 13, the element is placed in a weak alkaline bath for a short period, preferably for about one or two minutes. This bath may comprise weak solutions of potassium or sodium hydroxide, organic bases, or ammonia, but preferably comprises a weak solution of borax. This bath sets free and activates the color developing agents in overexposed emulsion layer 14, and development of that layer proceeds.

This developing operation is accompanied by concomitant chemical formation of a yellow dye, and the developed overexposed layer 14 emerges from the developing bath as a thin gray-toned fog layer overlying the lower emulsion layer and having a yellow dye in situ. Layer 14 is sufficiently overexposed to include no details of the picture except outline.

If no dye were present, the picture area would be covered by the thin grey silver fog layer only. For some purposes, such a fog is sufficiently dense and color selective to reduce transmission of actinic light sufficiently for purposes of the invention as will appear, but for most purposes it is desirable to produce a yellow tinted fog layer such as shown at 14' in Figure 2.

In any event the fog layer, with or without the dye, provides a light reducing filter or screen permanently and precisely coextensive with the picture area.

The chemical reactions involved in the above-described color development are the same as in the usual color photography processes involving color developing agents and need not be described in detail for an understanding of the invention.

The partially developed element is then placed in a developing bath of the type usually employed for ordinary photogravure process film, thereby developing lower layer 13 and completing development of the element to the condition shown in Figure 3. A suitable fixing operation completes production of the picture positive P.

Picture positive section P comprises a transparent base 11 carrying a developed picture portion 13' overlaid by a dyed actinic light reducing filter layer or screen 14' of uniform transmission throughout its area, and is ready for use in the optical printing phase of the photo-etching process.

I preferably assemble picture positive section P with a photographic positive section T, containing the associated type matter to be printed on the same page with the picture, on a layout comprising a colorless mirror glass plate 17 on which the composite page is held by means of a suitable adhesive. Type section T contains the type matter on a colorless film or pellicle and is made in a conventional manner.

Picture section P and type section T are of regular outline and can be easily fitted together in desired page assembly on the layout.

The composite positive on the layout reveals a colorless transparent background for the page to be printed, with the type matter standing out clear and sharp and with the picture precisely covered with a screening layer of thin gray fog having a yellow tint.

The composite positive is placed in the usual optical printing apparatus whereby the picture and type matter for a page are simultaneously projected on the carbon tissue or other sensitized coating of the surface to be etched. The non-actinic layer 14' blocks out a suitable amount of the actinic light in the printing light, and the arrangement therefor provides more exposure for the background than the picture during such optical printing. After development and etching, the intaglio printing surface so produced is of such quality that in the printed page the page background stands out as in relief against the lightest tones of the picture.

My above described process is speedy, and the results are accurate and permanent. The picture area is completely uniformly and precisely screened in the positive, and its outlines are therefore printed sharp and distinct.

Further embodiments and variations

While, as above set forth, I prefer to make the picture and type positive sections on separate plates or films and then combine them in inter-fitting relation on a suitable layout, I have also found it satisfactory to produce both positive sections on the same transparent film or plate. To accomplish this I mask out a selected portion of the film or plate according to Figure 1, so that the remainder of the plate is suitably reserved for the production of a type matter positive by double exposure or an equivalent operation.

It is immaterial in this embodiment of the invention that the type section of the film or plate has formed thereover the same screening fog layer as the picture section, because this factor can easily be compensated for by shortening exposure of the type section to allow for the additional density of the type matter section produced by the screening layer.

The term "composite positive" employed in the claims includes assembly of physically separate type and picture positive sections, as on the layout above described, as well as the permanent location of both sections on the same film or plate base.

In producing the picture positive, a variation in the above described process consists in providing the color developing agents in the developing solution instead of in the thin emulsion layer 14.

Under such circumstances, I employ a regular color developer solution of the type commonly used in color photography to obtain the tinted layer at 14'.

It is further within the scope of the invention to omit both the dyestuff intermediates and the color developing agents from emulsion layer 14. Under these circumstances, after exposure of the sensitive element of Figure 1, I treat the exposed film to a bath containing a solution of an organic base and a water- or alcohol-soluble coupling agent such as acetoacetic-2-5-dichloroanilide with the usual addition of small amounts of sodium sulfite and sodium carbonate as developing agents and a suitable amount of a chemically inactive substance, e. g. dextrose, glycerine and the like, to enhance the viscosity of the developing solution, which by virtue of said high viscosity will only give a development of the surface layer 14 without penetration into the lower layers. This is a color developing bath which develops layer 14 and provides a developed yellow screen layer 14' equivalent to that above described.

I then follow with the usual further development and fixing operations described above in connection with Figure 3.

Under certain conditions and for printing pages where the pictorial matter shows comparatively fuller tone values, I have found it satisfactory to omit the color producing and developing agents entirely and produce a picture positive wherein the picture area is covered only by the thin gray fog of overexposed and developed layer 14. In this process I do not employ the color developing solution described immediately above, and simply develop both emulsion layers simultaneously in a conventional developing bath.

This fog contains a high concentration of very fine silver halide grains having a density between .15 and .20 and is sufficiently color selective to reduce the actinic printing light to the desired extent and provide balanced simultaneous exposure of the pictorial and type matter in the photo-etching process.

The emulsion layers may be provided on the same or opposite sides of the plate or film, the latter being illustrated in Figure 6. Exposure of the sensitive element of Figure 6 is made through emulsion layer 14 to insure overexposure, and the element is developed in any of the manners above described.

It is important, where the emulsion layers are on opposite sides of the base, that the color developer employed be of very low reduction potential to prevent it from injuriously attacking the thicker emulsion layer 13 during color development.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A photo-sensitive element, adapted to produce upon exposure and development a photographic positive for use in simultaneously etching pictorial and type matter on an intaglio printing surface, comprising a transparent support, a layer of slow speed predominantly blue sensitive emul-

sion, and a coextensive relatively very thin filter-forming layer of high speed emulsion containing predominantly yellow dye-coupling components, said second layer having such a concentration of fine silver halide grains that its maximum density is only a small fraction of that of said first layer and being of such higher speed and of such different exposure characteristics than said first layer that, when said element is exposed under the usual exposure light conditions encountered in making positives for intaglio printing to properly expose said slow speed emulsion, said second layer is sufficiently over exposed so as to embody substantially no image details except outline and on development provides a predominantly yellow uniform and high transmission contrast reducing filter area permanently and precisely coextensive only with the image area of said slow speed emulsion.

2. A photo-sensitive element, adapted to produce upon exposure and development a photographic positive for use in photo-etching for intaglio printing and the like, comprising a support, an image-forming light sensitive emulsion layer on said support, and a relatively very thin filter-forming light sensitive emulsion layer coextensive with said image-forming layer; said filter-forming layer having such a concentration of fine silver halide grains that its maximum density is only a small fraction of that of said image-forming layer and being of such higher speed and sensitivity and of such different exposure characteristics than said image-forming layer that, when said element is exposed under the usual exposure light conditions encountered in making positives for intaglio printing to properly expose said image-forming layer, said filter-forming layer is sufficiently overexposed to include substantially no image details except outline, and upon development provides a uniform light and contrast reducing filter area permanently and precisely coextensive only with the image area of said image-forming layer and of uniform and high transmission over said image forming layer.

3. The photo-sensitive element defined in claim 2, wherein said filter-forming layer contains dyestuff intermediates of such nature as to produce a non-actinic color in said filter area upon exposure and development.

4. The photo-sensitive element defined in claim 2, wherein said filter-forming layer contains dyestuff intermediates and temporarily inactive color developing agents adapted to react with said dyestuff intermediates during development.

5. The photo-sensitive element defined in claim 2, wherein said filter-forming layer overlies said image-forming layer.

6. The photo-sensitive element defined in claim 2, wherein said support is transparent, and said filter-forming layer is on the opposite side thereof from said image-forming layer.

7. The photo-sensitive element defined in claim 2, wherein said filter-forming layer is in the order of one-third as thick as said image-forming layer.

8. The photo-sensitive element defined in claim 2, wherein said filter-forming layer comprises a fine grain silver halide emulsion of such concentration as to provide maximum density of about 0.20 in the developed positive.

9. The photo-sensitive element defined in claim 2, wherein said image-forming layer comprises the usual slow speed emulsion commonly used in photogravure work, and said filter-forming layer has a speed of about 50 Weston.

10. A photo-sensitive element, adapted to produce upon exposure and development a photographic positive for use in photo-etching for intaglio printing and the like, comprising a relatively slow sensitive film or plate of the type normally employed in photogravure work having an additional coextensive relatively very thin layer of high speed fine grain emulsion; said layer having such a concentration of fine silver halide grains that its maximum density is only a small fraction of that of said film or plate and being of such higher speed and sensitivity than said film or plate that, when said film or plate is exposed under the usual exposure light conditions encountered in making photographic positives for use in intaglio printing to properly expose said film or plate, said layer is sufficiently overexposed so as to embody substantially no image details except outline and on development provides a uniform high transmission light and contrast reducing filter permanently and precisely coextensive with the image area only of said film or plate.

11. A photo-sensitive element, adapted to produce upon exposure and development a photographic positive for use in photo-etching pictorial matter for intaglio printing and the like, comprising a support, an image forming light sensitive

emulsion layer on said support, a relatively very thin filter-forming light sensitive emulsion layer coextensive with said image-forming layer and having substantially flat gradation, and dye forming material imbedded in said filter-forming layers; said filter-forming layer having such a concentration of fine silver halide grains that its maximum density after exposure of the element under the usual exposure light conditions encountered in making positives for intaglio printing and subsequent development will be only a small fraction of the density obtainable with said image-forming layer under said conditions and being of such higher speed and sensitivity than said image-forming layer and said dye forming material being such that, when said element is exposed to sufficient exposure light to properly expose said image-forming layer, said filter-forming layer is so overexposed as to embody substantially no pictorial image details except outline and upon development provides a uniform and high transmission light-reducing and contrast-reducing non-actinic filter area permanently and precisely coextensive with the pictorial image area only of said image-forming layer.

KURT WOLFSON.