

Dec. 16, 1947.

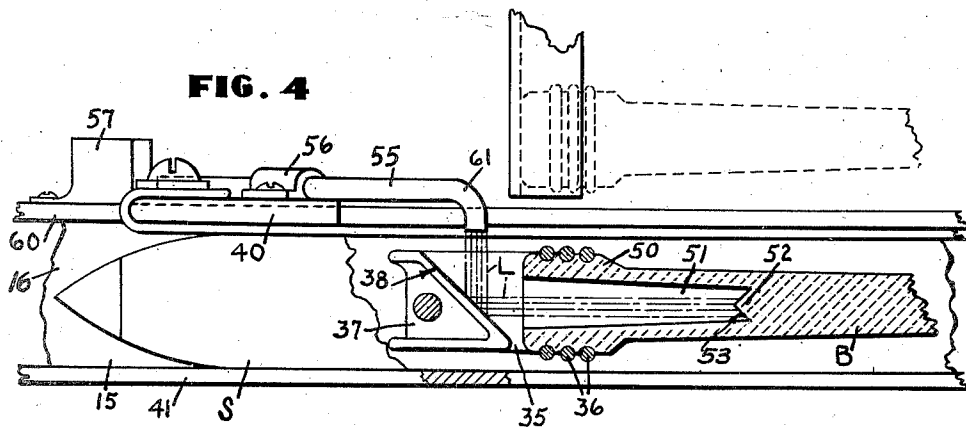
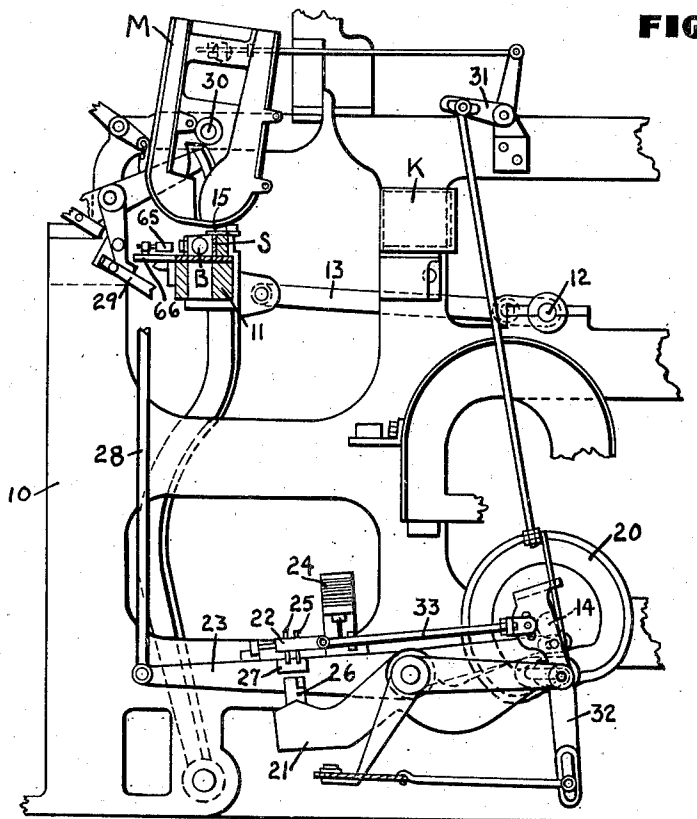
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2,432,793

PHOTOELECTRIC WEFT DETECTOR FOR LOOMS

Filed June 30, 1945

3 Sheets-Sheet 1



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PHOTOELECTRIC WEFT DETECTOR FOR LOOMS

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3 Sheets-Sheet 2

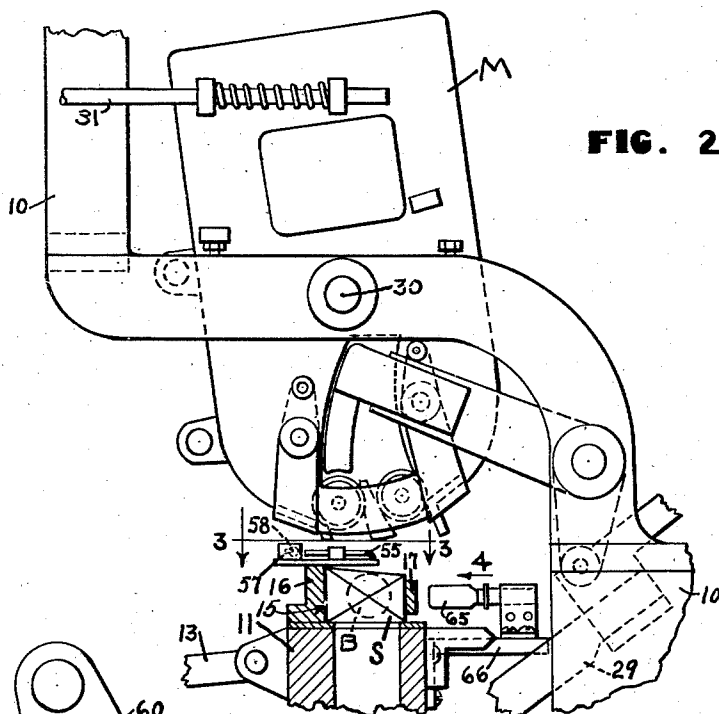


FIG. 2

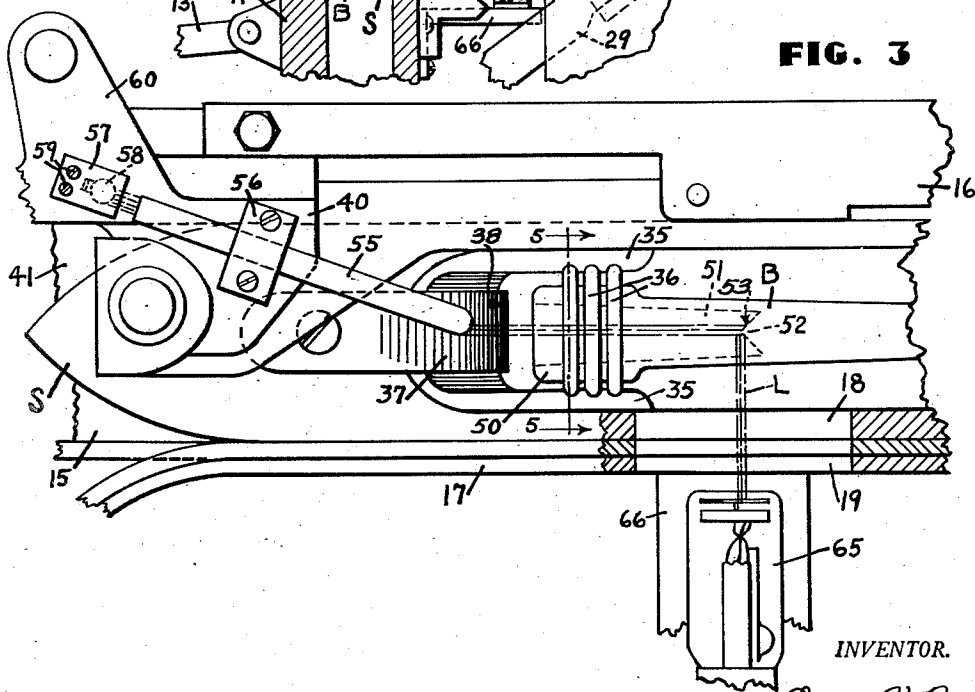


FIG. 3

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3 Sheets-Sheet 3

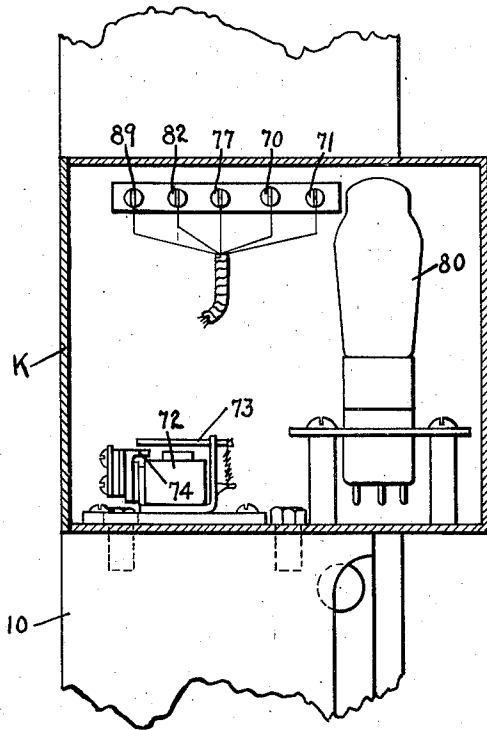


FIG. 6

FIG. 5

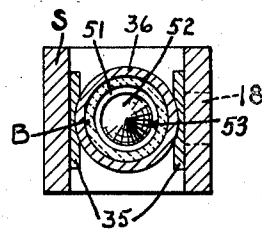
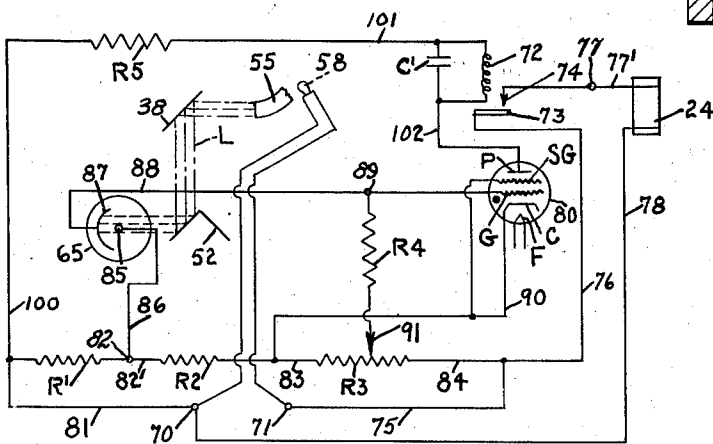


FIG. 7



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PHOTOELECTRIC WEFT DETECTOR FOR LOOMS

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22 Claims. (Cl. 139-273)

1 This invention relates to weft detecting mechanisms for looms and it is the general object of the invention to provide a photoelectrically operating system including a transparent bobbin.

In the weaving of very fine wefts it is desirable to employ a form of weft detector which will cause a minimum of abrasion to the weft during the detecting operation. Photoelectric weft detecting systems have been proposed heretofore, but so far as I am aware they have employed bobbins made of opaque material. It is an important object of the present invention to provide such a detecting system employing a bobbin made of transparent material and so constructed that a beam of light can move outwardly through the bobbin barrel from a point within the bobbin for the purpose of actuating a photoelectric cell when the weft is exhausted.

It is a further object of my present invention to provide a bobbin for a photoelectrically controlled detector system wherein a reflector within the bobbin directs a beam of light outwardly through the transparent bobbin toward a photoelectric cell.

In weft replenishing looms it is customary to employ a shuttle having bobbin holding clips which are adjacent to a bobbin guide having a surface inclined downwardly and toward the longitudinal center of the shuttle. The purpose of this surface is to assist the bobbin to become properly held by the shuttle should the latter be slightly misplaced. It is another object of my present invention to provide the inclined bobbin guide with a reflecting surface which will reflect a beam of light along the axis of the bobbin to the aforesaid reflector. In this connection I provide light source means which causes a beam of light to be projected downwardly against the inclined surface whenever the shuttle is completely boxed. By this latter arrangement the shuttle by its entry into the system moves a part of the optical system including the inclined reflecting surface into operative position.

With these and other objects in view which will appear as the description proceeds, my invention resides in the combination and arrangement of parts hereinafter described and set forth.

In the accompanying drawings, wherein a convenient embodiment of my invention is set forth, Fig. 1 is a side elevation of a loom having my invention applied thereto, the shuttle box and lay being in section,

Fig. 2 is an enlarged side elevation of the reserve bobbin magazine shown in Fig. 1, as viewed

2 from the center of the loom, the lay and shuttle box being in section.

Fig. 3 is a plan view looking downwardly on the shuttle along the line 3-3, Fig. 2 on an enlarged scale, the front wall and part of the shuttle box being in section,

Fig. 4 is a front elevation looking in the direction of arrow 4, Fig. 2, on an enlarged scale, and indicating part of the optical system of the invention, the bobbin being in section,

Fig. 5 is a detailed vertical transverse section on line 5-5 of Fig. 3,

Fig. 6 is a vertical section through the box or casing containing certain of the electrical devices used with the invention, and

Fig. 7 is a diagrammatic view of the electric circuits used with the invention.

Referring particularly to Figs. 1 and 2, I have shown a loom frame 10, lay 11, top shaft 12, lay connector 13 and bottom shaft 14. The lay is provided with a shuttle box 15 to receive a shuttle S which when boxed lies between a box back 16 and shuttle binder 17. The front wall of the shuttle is provided with a horizontal slot 18 which registers with a similar slot 19 in the binder when the shuttle is boxed.

The bottom shaft has secured thereto a cam 20 causing periodic oscillation of a lever 21 which by means of the control mechanism 22 causes rising of the forward end of a lever 23 when the control mechanism has been set for a replenishing operation. The control mechanism includes a solenoid 24 for the purpose of moving indicator fingers 25 from normal to indicating position. Ordinarily these fingers are out of the path of a dog 26 on lever 21 and as the latter rises the dog passes to one side of the fingers. When the solenoid is energized, however, one or the other of the fingers is moved to indicating position, and the next succeeding upward movement of lever 21 causes the dog 26 to engage a lug 27 on lever 23 and lift the forward end of the latter for the purpose of elevating a rod 28. The latter controls the transfer mechanism designated generally at 29.

The magazine M may be of the rocking type and moves about a pivot 30 fixed with respect to the loom frame. Rocking of the lever is effected through mechanism designated generally at 31 and under control of a lever 32 which in turn is controlled by the drop boxes not shown at the opposite end of the loom. Lever 32 is rocked whenever there is a shifting of said boxes at the opposite end of the loom and operates through rod 33 to determine which of the indicator fingers

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25 shall be in position for movement by the solenoid 24 from normal to indicating position.

The shuttle has bobbin holding clips 35 which receive rings 36 on the bobbin designated generally at B. The shuttle also has a bobbin guide 37 fixed thereto and provided with an inclined surface 38 which extends downwardly and toward the longitudinal center of the shuttle. When the shuttle is properly placed as shown in Fig. 4 the selected bobbin in the magazine will move downwardly into the shuttle without engaging the surface 38. Should the shuttle be improperly placed to the right of the position shown in Fig. 4, the bobbin from the magazine will engage and be cammed to the right by surface 38 so that the rings 36 can engage the spring clip 35. The shuttle box includes in its construction a mouth cover 40 extending above the floor 41 of the shuttle box.

The parts thus far described as well as others shown but not specifically mentioned are all of usual construction and except as mentioned hereinafter, particularly the bobbin and the surface 38, may be made and operated in the usual manner.

In carrying my present invention into effect I make the bobbin B of material which is intrinsically transparent, such as a tough glass or plastic. The bobbin has a head 50 carrying the aforesaid rings and also has a short bore 51 extending inwardly from the head. The right end of the bore, see Fig. 4, is provided with a cone 52 having a conical surface 53 which projects toward the head. This surface may be provided in any manner, but as shown in Fig. 4 it is made integral with the bobbin. As shown in Fig. 3 the cone 52 is in alignment with the slots 18 and 19.

The surface 38 on the bobbin guide 37 is preferably prepared in such a way that it will be an efficient light reflector. This result may be accomplished by the use of material inherently capable of taking a high polish, or by coating the surface 38 with some highly reflective metal, or the like.

In order that light may be directed downwardly against the reflector surface 38 I provide a light conducting tube 55 and secure the same as by means of a clip 56 to the cover 40 of the box mouth. The tube may be made of an acrylic plastic known in the trade as "Lucite," a methyl methacrylate. The left end of the tube 55 as shown in Fig. 3 may be located closed to a small container 57 in which is located a source of light designated generally at 58. This source of light may be a small bulb and the container is secured as at 59 to a rearward extension 60 of the box back 16. When the shuttle is properly boxed as indicated in Figs. 3 and 4 a beam of light issuing from the lamp 58 enters the tube 55 and bends around the curved part 61 of the tube and is then directed downwardly toward the reflector surface 38 from which it is reflected longitudinally of the bobbin to the conical surface 53. From the latter surface the light is directed in several directions, one of them being forwardly through the aligned slots 18 and 19 toward a photoelectric tube 65 which is mounted on a small support 66 extending forwardly from the lay.

Under normal operating conditions the lay reciprocates backwardly and forwardly in the usual manner, the shuttle being picked at top center when the lay is approximately one-half way on its backward stroke and entering the

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boy 15 when the lay is advancing. The tube 55, being fixed to the shuttle box, has the lower end of the curved part 61 thereof located slightly above the shuttle to be out of the path of the latter as it is boxed. As soon as the shuttle comes to rest light will be directed along the bobbin bore 51 as already described, and if sufficient weft for continued weaving is present on the bobbin the cone 52 will not be able to reflect light out of the bobbin. If, however, weft exhaustion is approaching and that part of the bobbin adjacent to the cone is uncovered, light will be projected through the slots 18 and 19 to the photocell 65 as indicated in Fig. 3. The beam of light, designated at L, will be sufficiently strong to activate the photocell when the condition shown in Fig. 3 exists.

Fig. 7 shows a circuit which may conveniently be used with my invention. The two binding posts 70 and 71 are supplied with a source of power, preferably a lighting circuit. The solenoid 24 is controlled by a relay 72 having an armature 73 for engagement with a contact 74. When the relay is energized its armature engages the contact 74, whereupon current flows in the following circuit: binding post 71, wire 75, wire 76, armature 73, contact 74, binding post 77, wire 77', solenoid 24, and wire 78 to the other binding post 70. When this circuit is closed the solenoid 24 initiates a replenishing operation of the loom as already described.

The relay 72 is controlled by the joint action of the photoelectric cell 65 and an electronic tube 80, together with resistances and a condenser, as shown in Fig. 7. Three resistances are connected in series across the source of power as follows: binding post 78, wire 81, resistance R', binding post 82, wire 82', resistance R2, wire 83, resistance R3, wire 84, and wire 75 back to the other binding post 71. Resistances R', R2 and R3 may be of the order of 5,000, 4,000 and 1,000 ohms, respectively, and resistance R3 is variable. The anode 85 of the photoelectric cell is connected by wire 86 to post 82, while the cathode 87 of cell 65 is connected by a wire 88 to a binding post 89 electrically connected to the control grid G of the gas filled thyratron electronic tube 80. The cathode C of the tube 80 is connected by wire 90 to wire 83, and the shield grid SG of tube 80 may be connected to wire 90 so that it will be at the same potential as the cathode. Tube 80 is preferably of the indirectly heated type and the filament F for heating the cathode may be heated in any approved manner not indicated in Fig. 7.

A high resistance R4 of the order of 10 megohms is connected between binding post 89 and a sliding contact 91 of resistance R3, and resistance R5 is employed to prevent too large a current from passing through the relay and plate of the tube 80.

The sliding contact 91 is adjusted until the control grid G is just negative with respect to the cathode of tube 80, under the conditions of illumination of tube 65 existing in the loom and without illumination of the cathode 87 by means of the beam of light L. Under these conditions the tube 80 is held inactive and the relay 72 is dead. Whenever the beam of light excites the tube 65, however, as indicated in Fig. 3, there will be a change in the voltage drop across the high resistance R4 with a corresponding change in the grid G, whereupon current can flow through the tube to energize the follow-

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ing circuit: binding post 70, wire 81, wire 100, resistance R5, wire 101, relay 72, wire 102, plate P through the tube to the cathode C, wire 90, wire 83, resistance R3, wire 84, and wire 75 to binding post 71. This circuit will remain activated while the lay is in the forward part of its movement and will be closed long enough to enable the relay to effect complete energization of the solenoid 24.

As shown herein the solenoid 24 is operated directly by power taken from the binding posts 70 and 71, but I do not necessarily wish to be limited to this arrangement, since it has been the practice in the past to energize the solenoid by means of a transformer not shown herein but under control of some such contact means as 73 and 74.

The tube 80 and the relay 72, together with the resistances and the small condenser C' in parallel with the relay to prevent chattering thereof, may be located within a casing or box K mounted as indicated in Fig. 1 on some convenient part of the loom frame. It is not essential that the box K be secured to the loom, and if desired in order to avoid vibration due to loom operation, the box may rest on the floor under the loom.

From the foregoing it will be seen that I have provided a photoelectrically controlled electric detector system for a loom wherein the beam of light for the operation of the cell 65 moves outwardly from a point within a transparent bobbin. It will further be seen that the source of light is directly mounted on the lay in such position that it will cause a beam of light to fall on the cone 52 whenever the shuttle is properly boxed. Furthermore, the inclined guide 37 which is very similar to those heretofore used is provided with a light reflector 38 which is a part of the optical system of the invention. Photoelectric cells ordinarily generate very small currents when stimulated by a beam of light, but I have found with an arrangement such as set forth hereinbefore that such light as gets through the front part of the bobbin and falls on the tube 65 is sufficient to cause a change in the potential of the grid of tube 80 with resultant firing or operation of the latter. The cone 52 need not necessarily be formed exactly as shown in the drawings, nor will it be essential in all uses to which the invention can be put to have the light transmitting tube 55 interposed between the lamp 58 and the reflector surface 38. Also, the photoelectric cell 65 is shown herein as mounted on the lay, but this is not essential. When so located, however, a considerable time is afforded for the energization of the relay.

Having thus described my invention it will be seen that changes and modifications may be made therein by those skilled in the art without departing from the spirit and scope of the invention and I do not wish to be limited to the details herein disclosed, but what I claim is:

1. In a weft detecting system for a loom having means to effect a change in loom operation when a photoelectric cell forming part of the system is energized by a beam of light, a bobbin in detecting position having a zone thereof to be detected formed of transparent material, a source of light, and means within the bobbin on which light from said source parallel to the bobbin axis falls and from which light is reflected through said zone onto said photoelectric cell to energize the latter when said zone is depleted of weft.

2. In a weft detecting system for a loom having means to effect a change in loom operation

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when the photoelectric cell forming part of the system is energized by a beam of light, a bobbin in detecting position having a zone to be detected formed of transparent material, and means within the bobbin adjacent to said zone providing a reflector surface so disposed that a beam of light projected parallel to the axis of the bobbin is reflected laterally of and through said zone of the bobbin onto said photoelectric cell to energize the latter when said zone of the bobbin is depleted of weft.

3. In a weft detecting system for a loom having means to effect a change in loom operation when a photoelectric cell forming part of the system is energized by a beam of light, a bobbin in detecting position having a zone to be detected formed of transparent material, said bobbin having a head and a bore extending thereinto from the head axially along said zone, and means on the bobbin providing a reflector surface located along said zone and at that end of the bore remote from the head, said reflector surface so disposed that a beam of light projected through the bore and onto said reflector surface will be reflected from the latter through said zone of the bobbin onto the photoelectric cell to energize the latter when said zone is depleted of weft.

4. In a weft detecting system for a loom having means to effect a change in loom operation when a photoelectric cell forming part of the system is energized by a beam of light, a bobbin in detecting position having a zone thereof to be detected formed of transparent material, means within the bobbin adjacent to said zone providing a conical reflector surface the axis of which is coincident with the bobbin axis and so disposed that light projected parallel to the axis of the bobbin and impinging on said reflector surface is reflected laterally through said zone onto the photoelectric cell to energize the latter when said zone is depleted of weft.

5. In a weft detecting system for a loom having a shuttle in detecting position, the loom having means to effect a change in loom operation when a photoelectric cell forming part of the system is energized by a beam of light, bobbin holding means in the shuttle, a bobbin formed of inherently transparent material and having a head held by said bobbin holding means, the latter being capable of holding the bobbin in any angular position of the bobbin with respect to the axis thereof, and means within the bobbin from which a beam of light parallel to the bobbin axis can be reflected through the bobbin onto the photoelectric cell to energize the latter when the bobbin is depleted of weft.

6. In a weft detecting system for a loom having a shuttle in detecting position, the loom having means to effect a change in loom operation when a photoelectric cell forming part of the system is energized by a beam of light, bobbin holding means in the shuttle, a bobbin within the shuttle having a head held by said bobbin holding means, the latter capable of holding the bobbin in any angular position with respect to the axis of the bobbin, and means within the bobbin providing a conical reflector surface, said conical surface being so disposed that the beam of light projected parallel to the axis of the bobbin toward said reflector surface will be reflected laterally through the bobbin onto said photoelectric cell to energize the latter when the bobbin is depleted of weft.

7. In a weft detecting system for a loom having a shuttle in detecting position, the loom hav-

ing means to effect a change in loom operation when a photoelectric cell forming part of the system is energized by a beam of light, means providing a reflecting surface carried by the shuttle, a bobbin formed of inherently transparent material held within the shuttle, means within the bobbin providing a reflector surface, and a source of light, said source of light, reflecting surface and reflector surface being so related that light from said source is reflected by the reflecting surface onto said reflector surface and from the latter laterally through the bobbin onto said photoelectric cell to energize the latter when the bobbin is depleted of weft.

8. In a weft detecting system for a loom having a shuttle in detecting position, the loom having means to effect a change in loom operation when a photoelectric cell forming part of the system is energized by a beam of light, an inclined bobbin guide on the shuttle, a bobbin held within the shuttle adjacent to said guide, said guide being formed with a reflecting surface and the bobbin being formed of inherently transparent material and having a reflector surface therein, and a source of light so related to said reflecting and reflector surfaces that light from said source is reflected from said reflecting surface to said reflector and from the latter laterally through said bobbin onto said photoelectric cell to energize the latter when the bobbin is depleted of weft.

9. In a weft detecting system for a loom having a shuttle in detecting position on the loom lay, the loom having means to effect a change in loom operation when a photoelectric cell forming part of the system is energized by a beam of light, a source of light mounted on the lay, a bobbin within the shuttle formed of transparent material and having an internal reflector, and means on the shuttle providing a reflecting surface so related to said source and reflector that a beam of light from said source is projected along the axis of the bobbin to said reflector and from the latter laterally through the bobbin onto said photoelectric cell to energize the latter when the bobbin is depleted of weft.

10. In a weft detecting system for a loom having a shuttle in detecting position, the loom having means to effect a change in loom operation when a photoelectric cell forming part of the system is energized by a beam of light, means on the shuttle providing a combined bobbin guide and reflecting surface, a bobbin in the shuttle having a barrel formed of transparent material, means within the bobbin adjacent said barrel providing a light reflector, and means to direct a beam of light against said reflecting surface, said means, reflecting surface and reflector being so related that light from said means is reflected from the reflecting surface onto said reflector and laterally from the latter through the bobbin barrel onto said photoelectric cell to energize the latter when the bobbin barrel is depleted of weft.

11. In a shuttle and transparent bobbin combination for a weft detecting system including a source of light and a photoelectric cell which when energized by a beam of light effects a change in loom operation, means on said shuttle providing a reflecting surface, and means in the bobbin providing a light reflector, said reflecting surface and reflector being so related that a beam of light from said source falling on the reflecting surface is reflected toward the reflector and from the latter laterally through the bobbin for en-

ergization of the photoelectric cell when the bobbin is depleted of weft.

12. The combination of a shuttle and a bobbin held therein and formed of transparent material, means on the shuttle providing a reflecting surface, and means within the bobbin providing a light reflector so disposed that a beam of light extending from said reflecting surface onto said reflector is reflected laterally through the bobbin.

13. In an electric weft detecting system for a loom having a lay provided with a shuttle box to hold a shuttle in detecting position, a source of light mounted on the lay, a photoelectric cell mounted on the lay and forming part of said system and effective when energized by a beam of light to cause the system to initiate a change in loom operation, a bobbin having a weft carrying transparent zone, and means within the bobbin adjacent to said zone constituting a light reflector, said source, photoelectric cell and bobbin being so related that when the shuttle enters said box and comes to rest relatively to said box in detecting position light from the source will impinge on said reflector and be reflected from the latter through the transparent zone of the bobbin onto said photoelectric cell and energize the latter when said zone is depleted of weft.

14. In an electric weft detecting system for a loom having a lay provided with a shuttle box to hold a shuttle in detecting position, a source of light on the lay, a photoelectric cell forming part of the system and mounted on the lay and effective when energized by a beam of light to cause the system to initiate a change in loom operation, a bobbin in the shuttle having a weft carrying zone thereof to be detected formed of transparent material, a reflector within the bobbin adjacent to said zone, and means on the shuttle provided with a reflecting surface, said source, photoelectric cell, reflecting surface and reflector being so related that when the shuttle enters the box and assumes detecting position a beam of light from said source is directed onto said reflecting surface and from the latter to said reflector in the bobbin and thence outwardly through the bobbin zone to said photoelectric cell to energize the latter if said zone is depleted of weft.

15. In an electric weft detecting system for a bobbin changing loom having a lay provided with a shuttle box to hold a shuttle in detecting position, a source of light mounted on the lay, a photoelectric cell mounted on the lay and forming part of said system and effective when energized by a beam of light to cause said system to initiate a change in loom operation, an inclined bobbin guide on the shuttle having a reflecting surface, a bobbin held within the shuttle and having a weft carrying zone thereof to be detected made of transparent material, and means within the bobbin adjacent to said zone formed as a light reflector, light from said source impinging on said reflecting surface and being reflected therefrom to said reflector and thence laterally through the transparent zone onto said photoelectric cell to energize the latter when the shuttle is in detecting position and said zone is depleted of weft.

16. In an electric weft detecting system for a loom having a lay provided with a shuttle box to receive and hold a shuttle in detecting position, an illuminated electric lamp mounted on the lay and moving therewith, a photoelectric cell mounted on the lay and moving therewith, and forming part of said system and effective when energized by a beam of light to cause said system to initiate a change in loom operation, means

in the shuttle providing a downwardly inclined reflecting surface, a bobbin in the shuttle having a weft carrying zone to be detected made of transparent material, a reflector within the bobbin adjacent to said zone, and a light transmitter on the lay having one end thereof adjacent to said lamp and having the other end thereof directed toward said reflecting surface, light from said lamp passing through said light transmitter and being directed toward said reflecting surface and thence to said reflector and then from the latter through said transparent zone of the bobbin onto the photoelectric cell to energize the latter when the shuttle is in detecting position in said shuttle box and said zone is depleted of weft.

17. A bobbin having a yarn supporting barrel formed of transparent material, and means within the bobbin adjacent to said barrel formed with a reflector so disposed that light projected parallel to the axis of the bobbin toward said reflector is reflected laterally through said transparent barrel.

18. In a bobbin, a head for said bobbin having rings by which the bobbin can be held in any angular position with respect to the bobbin axis, a barrel for the bobbin adapted to receive weft and formed of transparent material, and a conical reflector within the bobbin adjacent to said barrel and so disposed that a beam of light projected parallel to the axis of the bobbin onto said reflector will be reflected laterally through said transparent zone.

19. A bobbin formed with a transparent weft carrying barrel and having an axial bore extending along the barrel, and means at the inner end of said bore adjacent to said barrel formed with a light reflector so disposed that light projected through said bore and onto said reflector is reflected laterally through the barrel.

20. In a weft detecting system for a loom having means to effect a change in loom operation when a photoelectric cell forming part of the system is energized by a beam of light, a bobbin in detecting position having a zone thereof to be detected formed of transparent material, and means within the bobbin from which a beam of light parallel to the bobbin axis is reflected through said zone onto the photoelectric cell to

energize the latter when said zone is depleted of weft.

21. In an electrical weft detecting system for a loom having a lay provided with a shuttle box to receive a shuttle and hold the latter in weft detecting position, a source of light on the lay, a photoelectric cell on the lay forming part of the system and effective when energized by a beam of light to cause said system to initiate a change in loom operation, and light reflecting and transmitting means carried by the shuttle and including two reflectors and a transparent bobbin, said means effective when the shuttle moves to said weft detecting position to complete an optical system between said source and said photoelectric cell including a beam of light between the reflectors parallel to the bobbin axis to energize the photoelectric cell if the bobbin is depleted of weft, to the end that said optical system is operative throughout the time the shuttle with the depleted supply of weft is in said box and in weft detecting position.

22. A bobbin formed of transparent material, and means within the bobbin from which a beam of light within the bobbin and parallel to the bobbin axis is reflected laterally through the transparent bobbin.

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