Discussion of Jenkin's Paper

Mr. Jenkins (upon the conclusion of the showing of the film): I certainly am very grateful to you for your patience and your kindness. I don't usually apologize, but I am very much disappointed at the lack of electrical voltage here. I am now going to do the best I can to show you what we have in the way of mechanical difficulties, which have been apparently easily overcome. May I say, please, that we have two forms of camera; one is the prismatic section ring, which up to the present time we have not been able to get more than 350 to 400 pictures per second from, and we have here a camera that is built a little differently, giving continuous motion, wholly continuous motion.

This camera consists of a lens carrier in the shape of a rotating disc, and it carries a plurality of lenses moving past a fixed aperture in the front of the camera-box. We don't know that there is any limit to the number of pictures per second that can be made with that mechanism.

The operator is going to run films through here at a rate which will give us about 820 to 850 pictures per second. You notice that I am talking in seconds rather than in r.p.m., and the reason is we cannot get film enough to last a minute. We have made pictures at the rate of 2,000 a second. I did not bring any samples, because we only had just the one time when we did that. Last week, the week we expected to prepare for this affair here, it rained every day, and we didn't get any pictures at all.

(At this point, a demonstration of the continuous motion picture camera was had.)

Mr. Jenkins: There is nothing strange about the film, either as to size or sensitiveness or anything else. We employed a B. & L. lens, lenses that Bausch & Lomb have been making for me up to this time, standard lenses, put in a special mount.

A Member: What do you run that into when you are taking pictures?

Mr. Jenkins? Into a magazine.

A Member: Can you wind it up that fast?

Mr. Jenkins: Oh, yes, the mechanism is on top, and the receiving mechanism is on the inside. It is the usual arrangement in that form. I shall be very glad to tell you anything that I can, that I have not thought of.

A Member: Is there any static?

Mr. Jenkins: Not a bit. We open the box, wide open. The aperture of the box through which the film moves is about 2½ inches wide—it is a little more than that. We have done away with tension entirely, in the sense that the term is usually used; that is, tension pulls. We do try to give it a little tension by crooking the film, making the film run in a crooked line at the top of the aperture, and that gives us the equivalent of a tension, because as you see, when it shot out here, in the room, a moment ago (at a disappoint-

ingly slow speed), it shot straight out, and as long as you get it to go straight, there is no friction, if you put a kink in it, there is friction. I don't know whether it is the friction of the air, or a change of the material in the film, but we do find that is a very good scheme. We run it down through a narrow channel, but it doesn't touch the film.

Mr. Kramer: Were these pictures we saw here taken with this type of camera?

Mr. Jenkins: Yes, sir; part of them with that very camera.

Mr. Mayer: Does the absence of tension on the film disturb the sharpness at any time?

Mr. Jenkins: No, I don't think so. The channel is about 7/1000 thick, for a 5/1000 film—

Mr. Mayer: That is 2/1000 difference?

Mr. Jenkins: Yes. I think I see what you have in mind, what you are getting at, which is when you have a splice. In the first place, we don't have a splice if we can avoid it. In the second place, there is a spring member.

Mr. Mayer: You have a slight tension at the aperture?

Mr. Jenkins: No, sir; only when a splice goes through. It is just a narrow channel about 2/1000 thicker than the film itself, and that is at the perforations. Now, it is still thicker, and a still larger channel, behind the lens.

Mr. Mayer: That permits of a certain curvature of film, which would disturb its sharpness?

Mr. Jenkins: Not if we get a curve within its length. In other words, this thing (demonstrating), if I bend it this way, keeps a perfectly straight line across here.

Mr. Mayer: Yes.

Mr. Jenkins: And that is what we need. If you curve it a little, it will stay flat, and especially at these high speeds. These high speeds have brought to our attention phenomena of film in high speed movement which we had not suspected. When we think about it, of course, they have been there all the time.

Mr. Mayer: Do you believe that the lack of sharpness in the pictures which you have shown, is essentially due to the crude construction of the mechanism?

Mr. Jenkins: Oh, yes, the lack of sharpness comes from, we are pretty confident, the inability up to now of exactly focusing all these lenses, and at the same time making them exactly the width of the field, and at the same time making them exactly optically centered. It is one interminable job.

Mr. Mayer: In what way is the lack of sharpness, as shown, explained?

Mr. Jenkins: I think that is due to crudity of construction, in this camera and lack of skill in grinding and polishing glass in the other. Those two plates you saw, one you saw at Montreal, and the other here, are absolutely the only two prismatic plates ever made—cracked that it could not be used.

oh, no; I am wrong; there was one other which was so chipped and

Mr. Mayer: They must run absolutely true?

Mr. Jenkins: Unfortunately, for your argument, we find we can throw them out of position 45 degrees.

Mr. Mayer: I didn't refer to that. I referred to the maintaining of the disc perpendicular to the axis, so that there is no oscillation of the disc, like a loose wheel on a flivver.

Mr. Jenkins: I don't think that ever entered my mind.

Mr. Mayer: Don't you think a slight oscillation there would cause a considerable disturbance in sharpness?

Mr. Jenkins: No, that would not affect the sharpness at all, but the lack of high polish on the working surface of the glass disc is what does it, and the way we found out, was to stop it and hold it still and project through the discs without movement. We did that in our laboratory by scratching a piece of mica with a light scratch with a needle, that is projected through there, and it makes a black line on the screen because it disturbs the light. We can leave that stand in the aperture without ignition.

Mr. Mayer: And you get a much sharper image by holding your disc still?

Mr. Jenkins: We do, and we do not. What I mean to say is that the high polish of the ring, all the way round, is not the same quality in all places. We have not yet learned how to do it, but will, doubtless.

Mr. Richardson: In a machine of that kind, what effect is there corresponding to back-lash in shutters? I assume these two discs are together. What effect will the necessary back-lash, due to wear, have?

Mr. Jenkins: I don't think it makes any difference, because it never has had. There is a permissible lack of phase. In other words, we can take these discs and throw them out of phase 45 degrees, and still get a picture that is acceptable.

Mr. Richardson: From what you have already seen of these experiments you have made, do you believe that when the machine goes out into the hands of the men it will have to go out into, it will be difficult to maintain perfect results?

Mr. Jenkins: I don't think so. In fact, I would rather expect it to be otherwise, because the intermittent mechanism today is certainly a wonderful piece of work, and to keep that so that it will project pictures which are steady on the canvas requires care and attention.

Now, I don't think the care and attention necessary to keep the same quality of picture on the canvas would be required in continuous motion picture mechanisms.

Mr. Kramer: Which looks better, the disc machine, or the multiple lens machine?

Mr. Jenkins: The multiple lens machine is only for cameras, but for high speed cameras, I am inclined to think we will never get anything that will give us as high speed as a plurality of lenses. I cannot think of any scheme but one, and that is purely a theory yet. The other will give us better quality, I feel sure of that, although I

think we will get an analysis of at the rate of only 350 to 500 exposures a second, and that will be the limit, but we will get a very high degree in quality.

I have in my hand a lens which the Bausch & Lomb people were kind enough to send down, and when I get this ring skilfully made, I believe that with this lens we can take care of any condition we are likely to be confronted with, and that we will be able to take a picture that will be superior to any picture we will be able to get with a multiple lens. But with a multiple lens camera you can get any rate of speed you wish.

If you just stop a moment and think, you will see that you have no shutter at all in either machine, which means that if we increase the arc of lens travel, until it doesn't depart too far from a straight line, i. e., the straight line in which the film moves, we can keep on exposing that lens as long as we want to. In other words, the picture impinges on the film, and if we can keep it from departing from the spot initially taken on the film, we can move it down and keep on exposing it as long as we like. In other words, we can expose 150% of the time on a lens, if you can conceive of such a paradoxical phrase. In other words, we will have two lenses working on the film at the same time.

I believe that is all right, particularly for extreme high speeds, perhaps speeds that we do not need at all. I am hoping and really believe that a speed of 350 to 500 per second will cover most all of the problems that will be met, but now and then we may want one for the bursting of shells against a plate, or something of that kind, when 2000 p.p.s. will be required.

The Ordnance Department has written me about the advisability of going over to Aberdeen and photographing the flight of a shell. I don't see any trouble about that. As I remember it offhand, the flight of a shell from some of the guns they wish me to test out is about 2,500 feet per second. Now, if a shell is 18 inches long, and we make 2,000 pictures per second, we will have nothing but one black streak, when we project the picture, because there has been no division of exposure. Each shell is overlapped, overlapped on the exposure that immediately preceded it.

I argue that 2,000 per second for a shell traveling at 2,500 feet per second is too many. One doesn't get any analysis at all. It is at too high a speed.

But, it would be useful, for instance, when a balloon bursts. When a balloon bursts, what happens? We don't know. Most of us beat it for the woods, but what else happens? Nobody knows. It may be in such cases as that, that we may need a very high speed, but I believe that they are the exceptional cases.

I am ready to impart to anyone who wants it, such information as I have, or am ready to sit down and discuss it with anyone. We have now learned to take the number of pictures per second that the conditions require. I will sit down with any of you and tell you just how we do it, and, bless you, if you want to tackle the problem alone, go to it. If I can help you, I will be glad to do that, too.

(Applause.)