

Feb. 18, 1941.

C. H. HANSEN

2,231,906

CALCULATING SPAN CLEARANCE RULE

Filed April 19, 1940

2 Sheets-Sheet 1

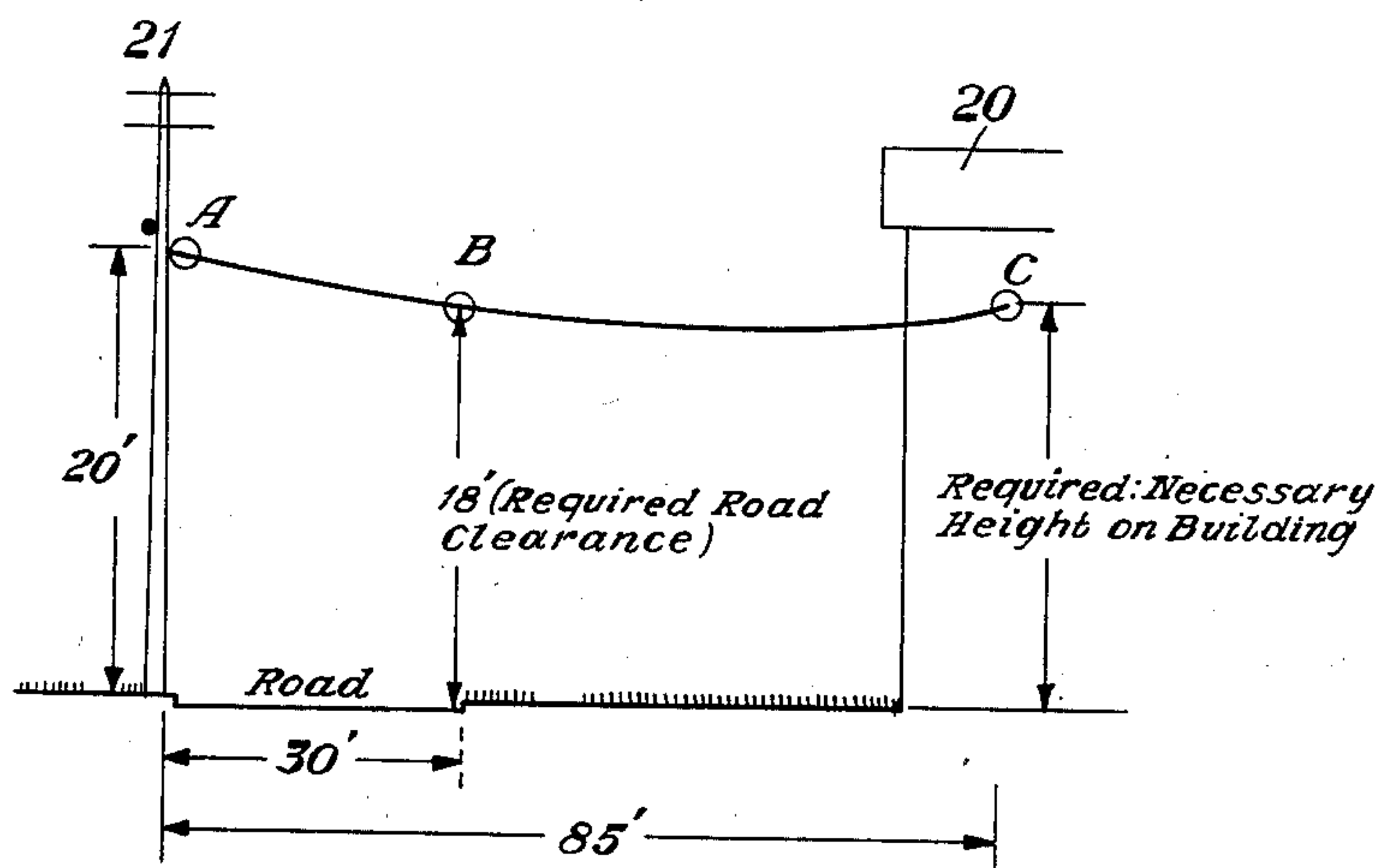


Fig. 1

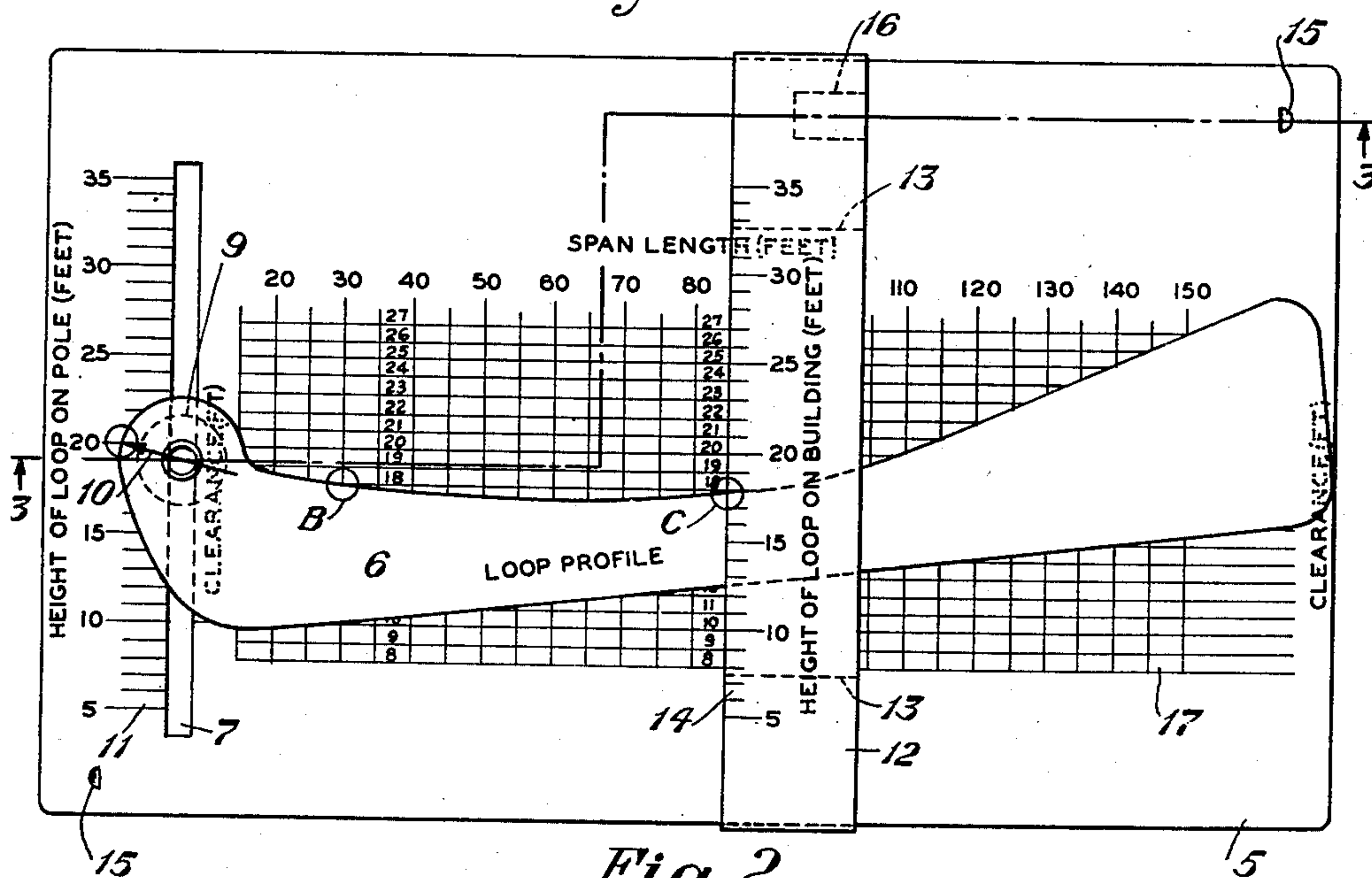


Fig. 2



Fig. 3

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2 Sheets-Sheet 2

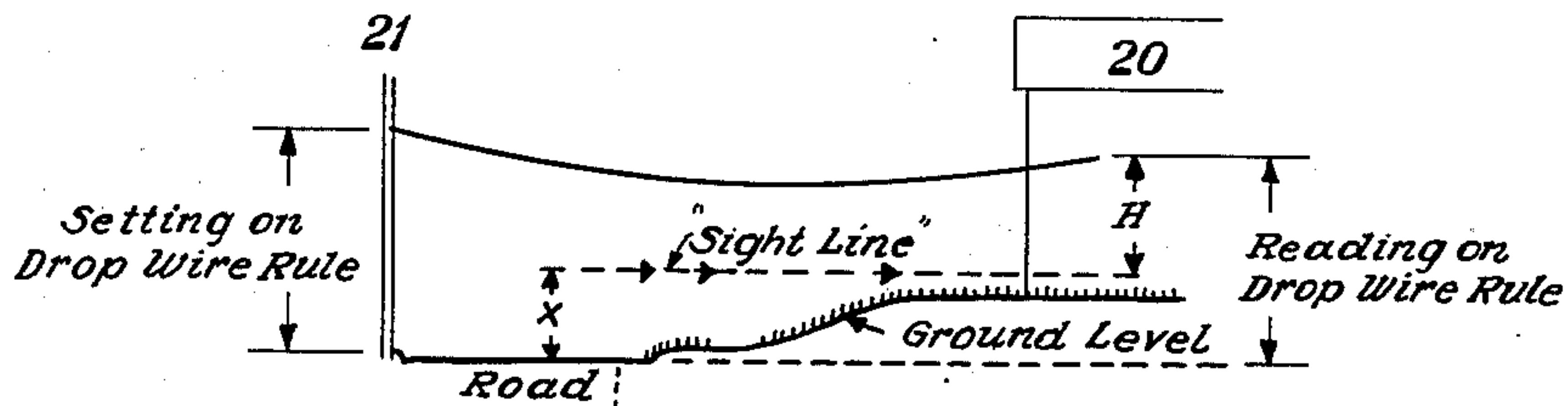


Fig. 4

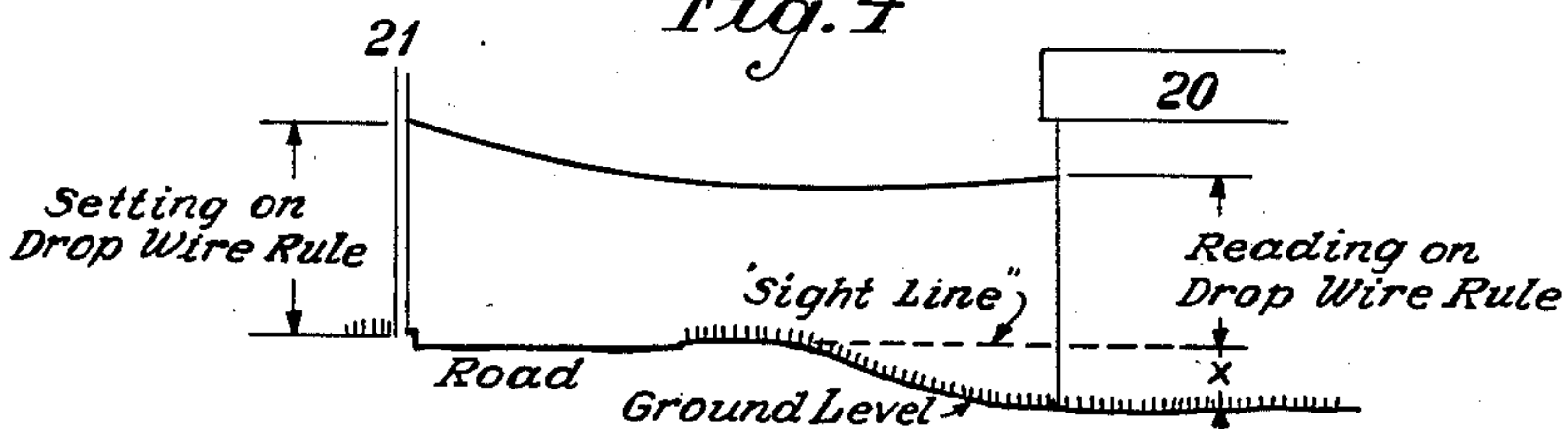


Fig. 5

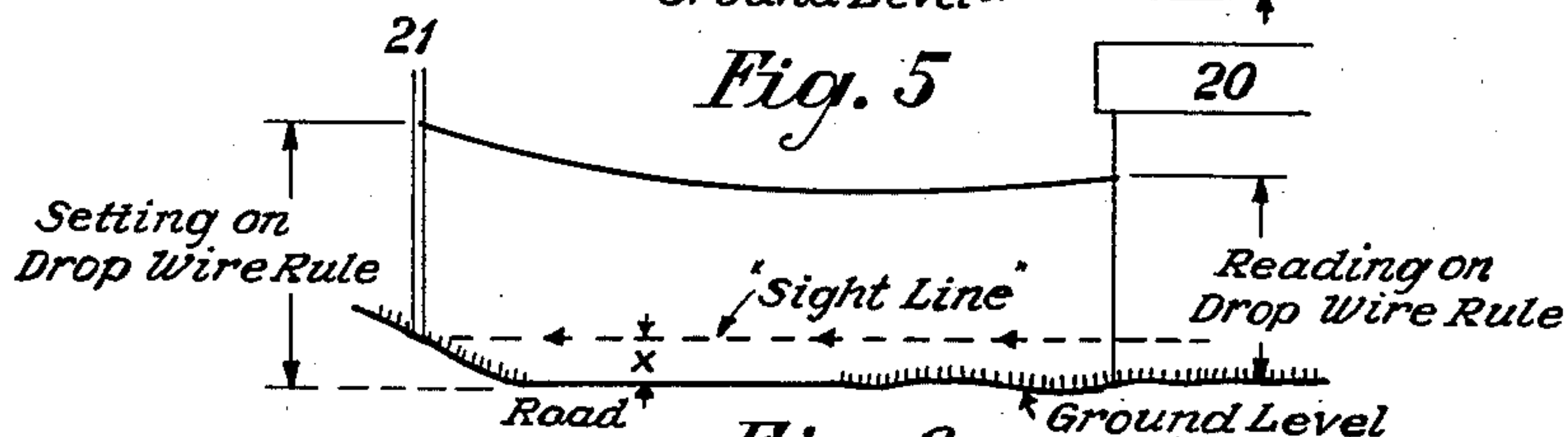


Fig. 6

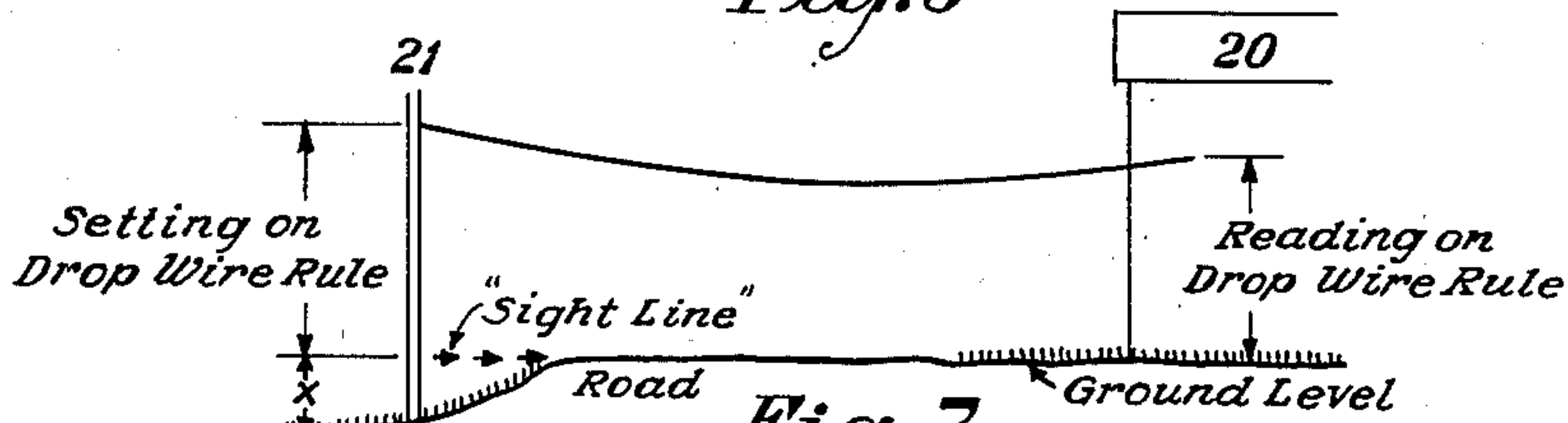


Fig. 7

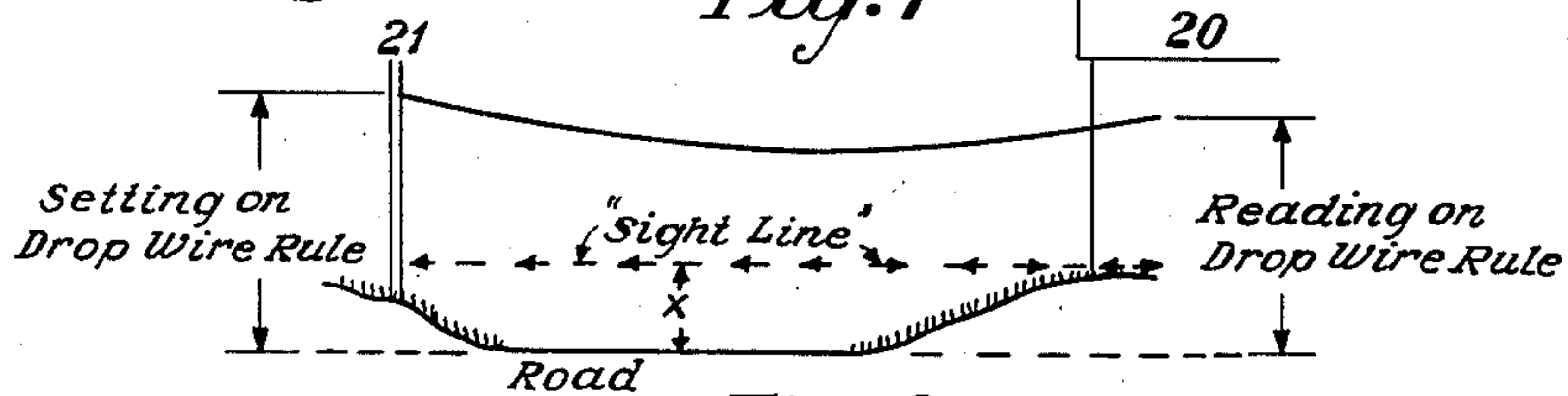


Fig. 8

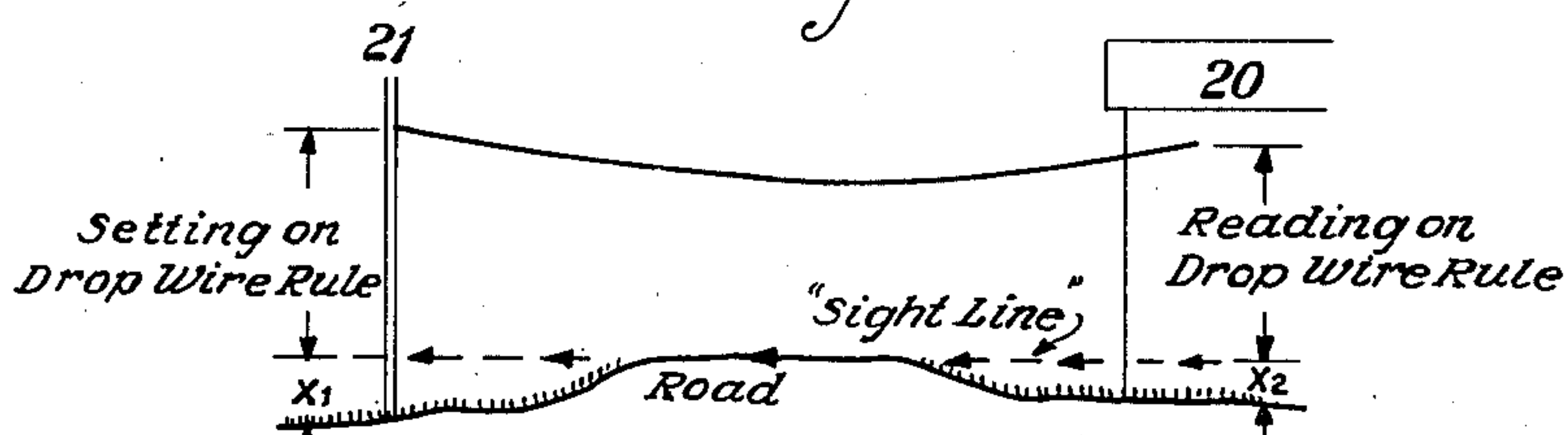


Fig. 9

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2,231,906

CALCULATING SPAN CLEARANCE RULE

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Application April 19, 1940, Serial No. 330,586

3 Claims. (Cl. 33—97)

This invention relates to calculating instru-
ments, and is concerned broadly with a device
for determining the heights of the span supports
which will give the required clearance of a span
or loop of wire over a roadway.

In the connection of telephone, telegraph or
other transmission lines to substations or sub-
scribers' stations it is frequently necessary to
string wires from poles carrying the lines to sta-
tions on the opposite side of the street or road-
way. In the course of stringing these wires, it is
essential that the loop or span of wire shall be
of such height as to provide sufficient clearance
over the street or highway. The height or clear-
ance of a loop or span of wire over a roadway
depends in general upon three factors—the height
at which it leaves the pole, the length of the
span and the height at which it is to be attached
to a building or other structure positioned on the
opposite side of the roadway from the pole. To
accurately calculate the requirements for each
case too much time would be needed, and since
there is an infinite variety of conditions to be
met, it is impossible to have a table previously
prepared to meet all requirements.

It is, therefore, an object of the present inven-
tion to avoid difficulties of the above character
by providing a device which will show at a glance
the measurements necessary to obtain the re-
quired clearance of a span of wire over a road-
way.

The invention will be more fully understood
by reference to the accompanying drawings in
which—

Figure 1 is a view indicating diagrammatically
an example where a condition is assumed where
the height of a loop attachment to a building to
provide the necessary clearance over a roadway
is required.

Fig. 2 is a plan of the improved calculating
device adjusted to give a reading of the require-
ment indicated in Fig. 1.

Fig. 3 is a section taken on the line 3, 3 of
Fig. 2, and

Figs. 4, 5, 6, 7, 8 and 9 are diagrammatic rep-
resentations of the various conditions which may
be met in the use of the device of this invention.

The improved calculating device of this inven-
tion, as shown in Figs. 2 and 3 of the drawings
may be of a card-like structure 5, and may be

made from any suitable material such as Cellu-
loid.

The device includes an arm or "loop profile" 6
which has an upper edge substantially in a form
of a catenary curve. This curve presents in
graphic form a profile which is representative of
typical drop loops or spans of wire. One end of
this arm slidably and pivotally engages in a slot
7 extending parallel to one edge of the device.
This slidable and pivotal connection of the arm
is shown in the present instance as comprising
an eyelet-like arrangement 8 which extends
through the slot 7 and interconnects the arm 6
on one side of the device with a disk-like mem-
ber 9 shown by dotted lines on the other side of
the device. The pivoted end of the arm is provid-
ed with an arrow 10 which is adapted to register
with the various graduations of a scale 11 ar-
ranged along the edge of the slot 7. The point
of registration of the arrow and graduation gives
a reading of the height of a loop attachment on
a pole in the terms of feet. The free end of
the arm 6 may be moved as desired in an obvious
manner, and the function of this arm will pres-
ently appear.

A sliding element 12, which may be made from
a strip of material similar to that of the structure
5, has its ends 13 turn back over the top and bot-
tom edges of said structure so that it may be
moved along the face of said structure with the
top and bottom edges acting as bearings there-
for. The element 12 is provided with a scale 14
arranged along its left edge as shown in Fig. 2.
The graduations of this scale give a reading in
terms of feet representing the height on a build-
ing to which one side of the loop of wire should
be attached. Projections 15 extend from the rear
face of the device 5 and serve as stops for the
sliding element so that it cannot become dis-
placed from the device 5. A cut-away portion
16 on one of the ends 13 permits the sliding ele-
ment 12 to be advanced so that a reading may
be made at the extreme right of the scale 17.

The scale 17 comprises lines extending longi-
tudinally on the face of the card 5 and also lines
extending perpendicularly thereto. A value is as-
sociated with each of the longitudinally extend-
ing lines and also with each of the alternate per-
pendicular lines. The values associated with the
longitudinal lines represent the clearance re-

quired for the span over the roadway in terms of feet, and the values associated with the alternate perpendicular lines represent the length of the span in terms of feet. The lines forming the graduations on the scales 11 and 14 are in alignment with each other and also in alignment with the longitudinal lines of scale 17. Thus when the sliding member 12 is moved across the card 5, the lines or the graduations on each of these scales will register with each other and in conjunction with the profile arm 6 a reading will be obtained indicating the height of the span supports which will give the required clearance of a span of wire over a roadway, as will presently appear.

In accordance with the use of the present invention, the procedure of installing a new loop should be as follows:

1. Determine
 - (a) The span length between the pole and the point of attachment on the building.
 - (b) The distance, from the pole, of the farthest point over which the specified clearance is required (usually the far edge of the road).
 - (c) The height above ground of the desired point of attachment on the pole.
2. On the calculating device:
 - (a) Set the left edge of the slide marked "Height of loop on building" at the span length found in 1(a).
 - (b) Set the arrow 10 on the left end of the "Loop profile" arm 6 at the height found in 1(c).
 - (c) Locate the point corresponding to the distance found in 1(b). Rotate the "Loop profile" arm until its upper edge coincides with the intersection of this point with the required clearance line, keeping the setting 2(b) fixed.

Obviously, if the distance found in 1(b) is greater than half the span length, the lowest point on the upper edge "Loop profile" arm must lie on the required clearance line.

- (d) Where the upper edge of the "Loop profile" arm 6 crosses the left edge of the slide 12 marked "Height of loop on building" read the required height of the first attachment on the building.

Thus—with the height on the pole assumed in 1(c), the height on the building found in 2(c) and the standard sag, the lowest point in that part of the loop which overhangs the road will have the required road clearance.

Examples are given below to show how the calculating device of this invention may be operated to give readings for some of the conditions which may be met in its use.

Assuming the conditions as shown in Fig. 1 where it is desired to find the height of the first attachment C of a loop on a building 20 to provide 18 ft. road clearance B, the other end of the loop being carried on a pole 21 as indicated at A.

The above conditions may be set up on the improved calculating device, as shown in Fig. 2 of the drawings. It will be noted that the required height of the first attachment on the building is indicated at C and is shown on the calculating device to be 18 ft.

The foregoing example assumes level ground under the drop loop. In the diagrams illustrated in Figs. 4, 5, 6, 7, 8 and 9 methods are suggested for dealing with irregular ground contours.

Referring to Fig. 4, it will be assumed that the building 20 is located above road level. The procedure of setting the calculating device under this condition should be as follows:

- (1) Find the required "Height of loop on building" assuming level ground at road level.
- (2) From the road establish a horizontal "sight line" by sighting on some horizontal part of the building, such as a clap board, the bottom of a sill, bottoms of windows, etc.
- (3) Measure the distance "X" from the "sight line" to the road level.
- (4) Subtract the distance "X" from the reading found in (1), which gives the distance H as shown in Fig. 4.
- (5) Locate the first attachment on the building at a height H above the "sight line."

In Fig. 5 of the drawings it is assumed that the building is located below the road level. In this instance the procedure of operating the calculating device should be as follows:

- (1) Find the required "Height of loop on building" assuming level ground at road level.
- (2) Establish a "sight line" at road level by sighting along a horizontal part of the building.
- (3) Locate the first attachment on the building at the distance found in (1) above the "sight line," or add the distance "X" to the distance found in (1) and locate first attachment at this total distance above the ground.

In the diagram illustrated in Fig. 6 it is assumed that the base of the pole 21 is positioned above the road level. In this instance the procedure of setting the calculated instrument should be as follows:

- (1) Determine the distance "X" by establishing a horizontal "sight line" from the house to the base of the pole.
- (2) The setting on the drop wire rule for "height of loop on pole" will be the desired height of the loop on the pole plus the distance "X".
- (3) Proceed to find on the rule the required "height of loop on building."

In Fig. 7 it will be assumed that the base of the pole 21 is below the road level. The procedure in operating the calculating device in this instance should be as follows:

- (1) Determine the distance "X" by sighting horizontally from the pole to the highest point of the road.
- (2) The setting on the drop wire rule for "height of loop on pole" will be the desired height of the loop on the pole minus the distance "X".
- (3) Proceed to find on the rule the "height of loop on building."

Referring to Fig. 8 of the drawings, it is assumed that the pole and building are above the road level. The procedure for such cases is indicated below:

- (1) Establish a horizontal "sight line" from the building to the pole noting its intersection at the pole.
- (2) From the road determine the distance "K" using the same "sight line."
- (3) The setting on the drop wire rule for "height of loop on pole" will be the desired height of the loop on the pole above the "sight line" plus the distance "X".

- (4) Proceed to find on the rule the "height of loop on building."
 (5) Locate the first attachment on the building at a distance above the "sight line" equal to the distance found in (4) minus the distance "X".

The diagram shown in Fig. 9, assumes that the bases of the building and the pole lie below the road level. Under this condition the procedure of operating the calculating rule is as follows:

- (1) From the pole establish a horizontal "sight line" at road level noting the point at which it intercepts the building.
 (2) Determine the distances X_1 and X_2 as shown in the above sketch.
 (3) The setting on the drop wire rule for "height of loop on pole" will be the desired height of the loop on the pole minus the distance X_1 .
 (4) Proceed to find on the rule the required "height of loop on building."
 (5) Locate the first attachment on the building at a distance above the ground line equal to the height found in (4) plus the distance X_2 .

It will be understood that modifications and details herein shown may be made without departing from the spirit of the invention, and that proper substitution of values may be adapted for calculations other than those relating to span loops.

What is claimed is:

1. A calculating device for determining the heights of the span supports which will give the required clearance over a roadway of a span of wire extending from a pole to a building, said device including a card-like member having a plurality of scales thereon with graduations in units of length, one of said scales representing the height of attachment of one end of the span to a pole, another of said scales representing the height of span clearance, and a third scale representing the span length, a sliding member movable along the scale of span length, said sliding member having a scale with graduations representing the height of attachment of the span to a building, and an arm so mounted on the card-like member that one end is movable along the scale representing the point of attachment to a pole and the other end is movable along the scale representing the height of attachment to a building, said arm having an upper edge of such contour that when one end of the arm is brought into registration with the graduation on the scale indicating the height of attachment to a pole, and the sliding member is moved to a position where it registers with the graduation on the span length scale which corresponds to the position of the building, the arm may be moved so that its upper edge registers with the intersection of the span clearance scale and the point on the span length scale at which the clearance is to be measured, whereupon the intersection of the upper edge of the arm with the sliding member will indicate the height of the attachment to the building which will give the required clearance over the roadway.

2. A calculating device for determining the heights of the span supports which will give the required clearance over a roadway of a span of wire extending from a pole to a building, said device including a card-like member having a

plurality of scales thereon with graduations in units of length, one of said scales being associated with a slot extending along one end of said member and representing the height of attachment of one end of the span to a pole, another of said scales representing the height of span clearance, and a third scale representing the span length, a sliding member movable along the scale of span length, said sliding member having a scale with graduations representing the height of attachment of the span to a building, and an arm pivotally and slidably mounted at one end in said slot and having a pointer at said end for registering with the scale representing the point of attachment to a pole and the other end of the arm being movable in an arc along the scale representing the height of attachment to a building, said arm having an upper edge corresponding to the profile of a span so that when the pointer at the end of the arm is brought into registration with the graduation on the scale indicating the height of attachment to a pole, and the sliding member is moved to a position where it registers with the graduation on the span length scale which corresponds to the position of the building, the arm may be moved so that its upper edge registers with the intersection of the span clearance scale and the point on the span length scale at which the clearance is to be measured, whereupon the intersection of the upper edge of the arm with the sliding member will indicate the height of the attachment to the building which will give the required clearance over the roadway.

3. A calculating device for determining the heights of the span supports which will give the required clearance over a roadway of a span of wire extending from a pole to a building, said device including a card-like member having a plurality of scales thereon with graduation in units of length, one of said scales being associated with a slot extending along one end of said member and representing the height of attachment of one end of the span to a pole, another of said scales representing the height of span clearance, and a third scale representing the span length, a sliding member movable along the scale of span length, said sliding member having a scale with graduations representing the height of attachment of the span to a building, and an arm having one end pivotally and slidably mounted in the slot associated with the scale representing the point of attachment to a pole and the other end being movable in an arc along the scale representing the height of attachment to a building, said arm having an upper edge substantially corresponding to a catenary curve so that when one end of the arm is brought into registration with the graduation on the scale indicating the height of attachment to a pole, and the sliding member is moved to a position where it registers with the graduation on the span length scale which corresponds to the position of the building, the arm may be moved so that it registers with the intersection of the span clearance scale and the point on the span length scale at which the clearance is to be measured, whereupon the intersection of the upper edge of the arm with the sliding member will indicate the height of the attachment to the building which will give the required clearance over the roadway.

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