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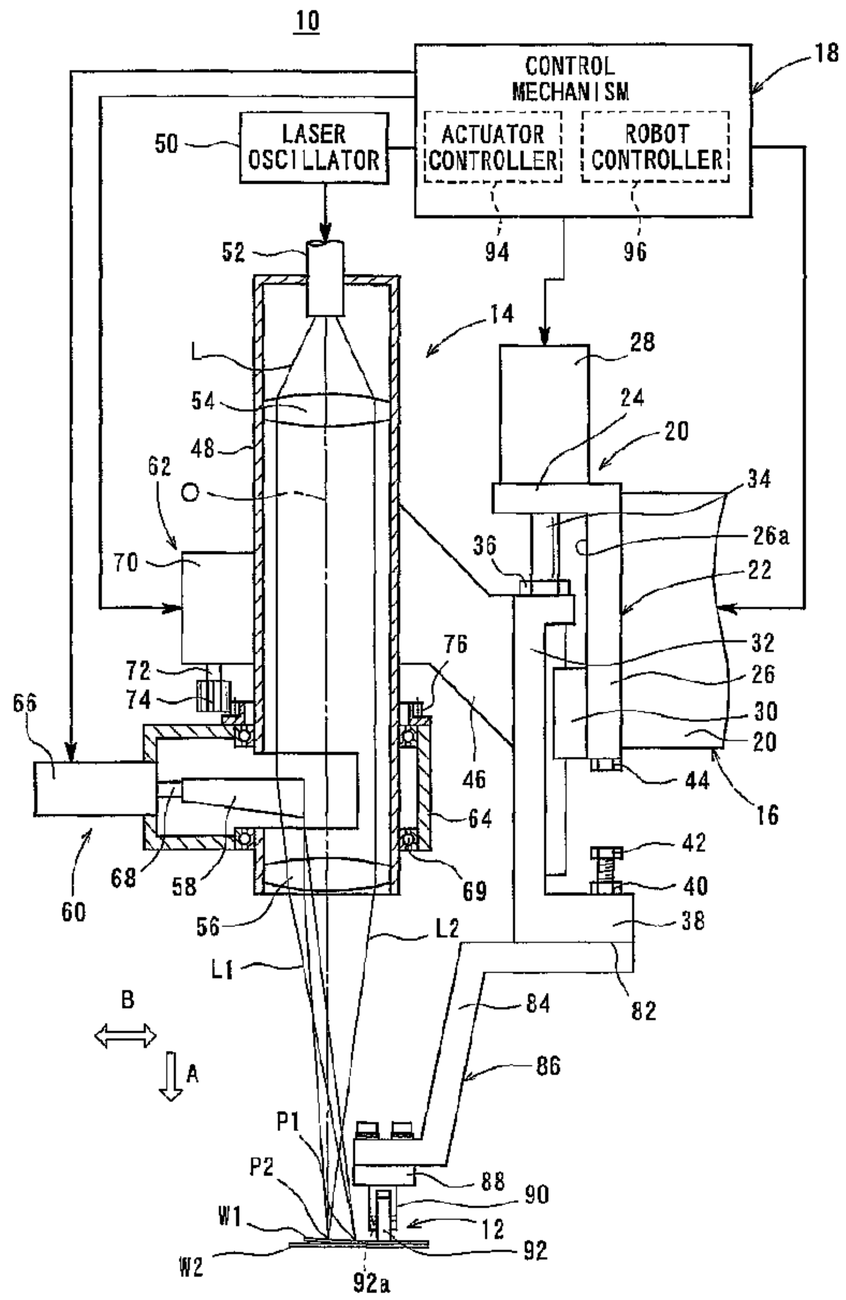
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(54) Titre : APPAREIL ET METHODE DE SOUDAGE AU LASER
(54) Title: LASER BEAM WELDING METHOD AND APPARATUS




(57) Abrégé/Abstract:
While steel sheets, overlapping each other, (W1, W2) are positioned and held by a holding mechanism (12), a first laser beam (L1) is applied to a heating region (P1) of the steel sheet (W1) to space the steel sheet (W1) from the other steel sheet (W2) by a predetermined distance. A second laser beam (L2) is applied to a welding region (P2) to weld the steel sheets (W1, W2) and is moved the welding direction in synchronism with the first base beam (L1). An amount of heat applied by the first laser beam (L1), a moving speed of the first laser beam (L1), and a focused spot diameter of the first laser beam (L1) are set to keep the sheet (W1) irradiated with the first laser beam (L1) in an unmelted state and plastically deform the sheet (W1).

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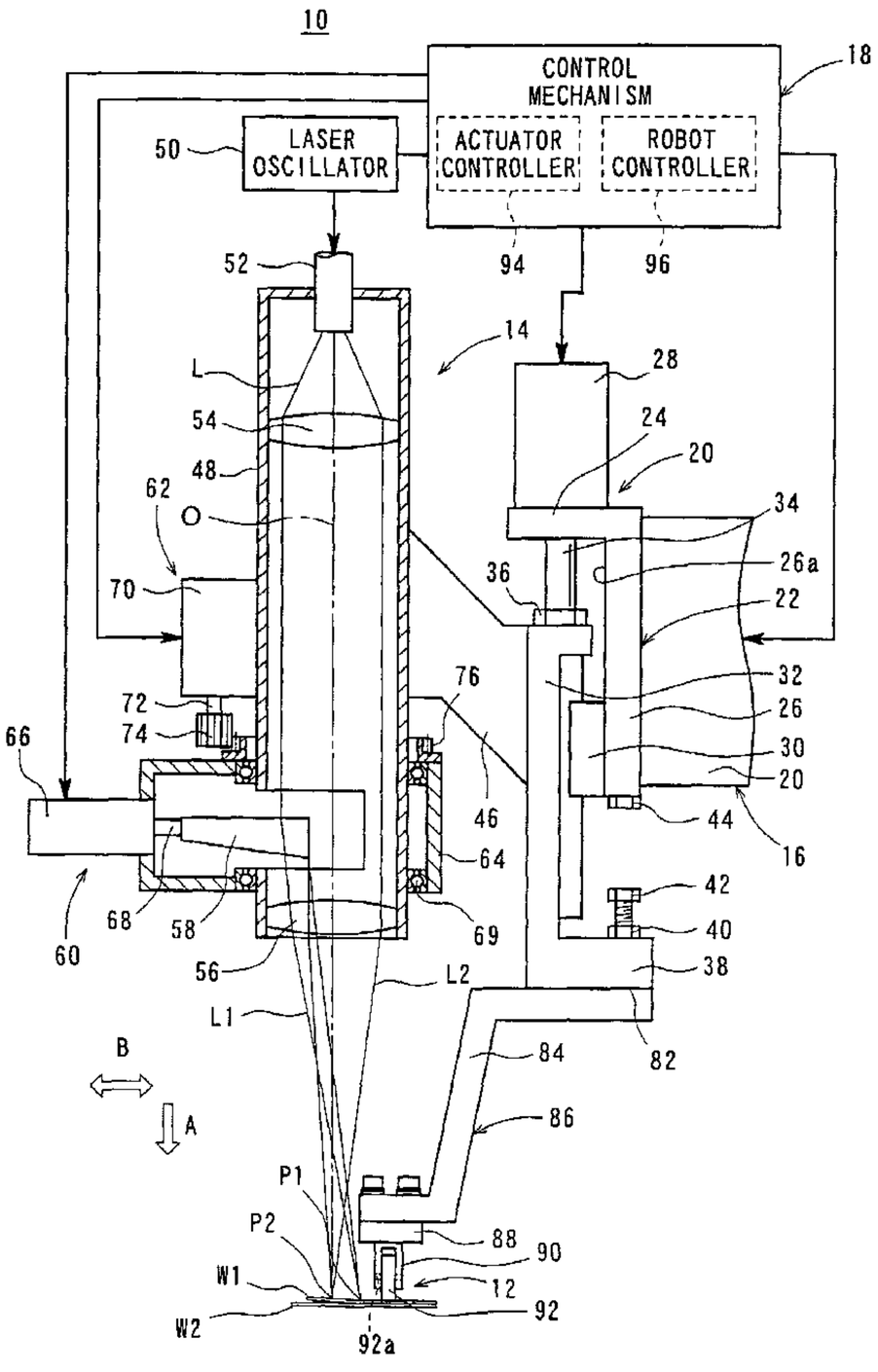
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*[Continued on next page]*

(54) **Title:** METHOD AND APPRATUS FOR LASER BEAM WELDING OF OVERLAPPING SHEETS




**(57) Abstract:** While steel sheets, overlapping each other, (W1, W2) are positioned and held by a holding mechanism (12), a first laser beam (L1) is applied to a heating region (P1) of the steel sheet (W1) to space the steel sheet (W1) from the other steel sheet (W2) by a predetermined distance. A second laser beam (L2) is applied to a welding region (P2) to weld the steel sheets (W1, W2) and is moved the welding direction in synchronism with the first base beam (L1). An amount of heat applied by the first laser beam (L1), a moving speed of the first laser beam (L1), and a focused spot diameter of the first laser beam (L1) are set to keep the sheet (W1) irradiated with the first laser beam (L1) in an unmelted state and plastically deform the sheet (W1).

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The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method of welding overlapping regions of first and second sheets, each having a base metal covered with a layer of a metal whose melting point is lower than the melting point of the base metal, to each other by applying laser beams to the overlapping regions, the method comprising the steps of:

positioning and holding a welding region of the first and second sheets with a holding mechanism, and applying a first laser beam to the first and second sheets near the holding mechanism to heat the first and second sheets for thereby spacing the first and second sheets from each other by a predetermined distance;

applying a second laser beam to a region of the first and second sheets which is spaced from said first laser beam by a predetermined distance, thereby to weld the first and second sheets to each other; and

setting an amount of heat applied by said first laser beam, a moving speed of said first laser beam, and a focused spot diameter of said first laser beam to keep the first sheet irradiated with said first laser beam in an unmelted state.

2. A method according to claim 1, wherein said holding mechanism presses the overlapping regions of the first and second sheets for thereby positioning the welding region of the first and second sheets.

3. A method of welding overlapping regions of a first sheet and a second sheet, each having a base metal covered with a layer of a metal whose melting point is lower than

the melting point of the base metal, to each other by applying laser beams to the overlapping regions, the method comprising the steps of:

positioning and holding a welding region of the first and second sheets with a holding mechanism, and applying a first laser beam to the first and second sheets near the holding mechanism to heat the first and second sheets and simultaneously moving said first laser beam in a welding direction for thereby spacing the first and second sheets from each other by a predetermined distance; and

applying a second laser beam to a region of the first and second sheets which is spaced from said first laser beam by a predetermined distance, and simultaneously moving said second laser beam in said welding direction in synchronism with said first laser beam thereby to weld the first and second sheets to each other.

4. A method according to claim 3, wherein said second laser beam is spaced from said first laser beam by said predetermined distance which ranges from 0.5 mm to 20 mm at least downstream in said welding direction.

5. A method according to claim 3 or 4, wherein said holding mechanism presses the first and second sheets near the welding region thereof for thereby positioning the welding region of the first and second sheets.

6. An apparatus for welding overlapping regions of first and second sheets, each having a base metal covered with a layer of a metal whose melting point is lower than the melting point of the base metal, to each other by applying laser beams to the overlapping regions, the apparatus comprising:

a holding mechanism for positioning and holding a welding region of the first and second sheets;

a laser beam applying mechanism for applying a first laser beam to the first and second sheets near said holding mechanism to heat the first and second sheets, and applying a second laser beam to a region of the first and second sheets which is spaced from said first laser beam by a predetermined distance, thereby to weld the first and second sheets to each other;

a moving mechanism for moving said first and second laser beams in a welding direction in synchronism with each other; and

a control mechanism for controlling the amounts of heat applied by said first and second laser beams.

7. An apparatus according to claim 6, wherein said second laser beam is spaced from said first laser beam by said predetermined distance which ranges from 0.5 mm to 20 mm at least downstream in said welding direction.

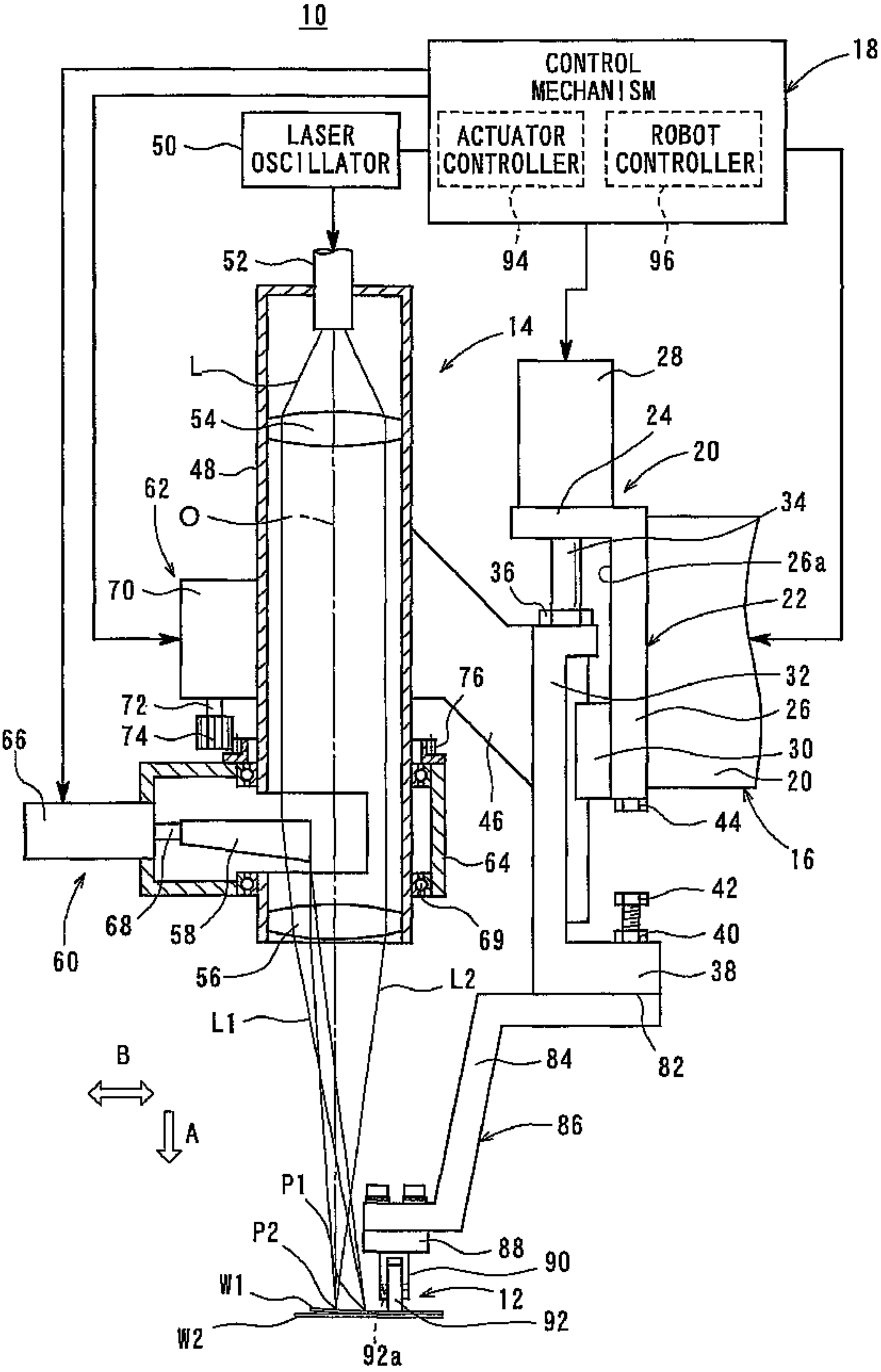
8. An apparatus according to claim 6 or 7, wherein said holding mechanism comprises a rotatable roller for pressing the sheets near the welding region thereof.

9. An apparatus according to any one of claims 6 to 8, wherein said laser beam applying mechanism comprises:

a prism for dividing a primary laser beam introduced into a casing into said first and second laser beams;

linearly moving means for moving said prism toward and away from an optical axis of said primary laser beam to adjust the output ratio of said first and second laser beams; and

rotating means for rotating said prism with respect to said casing to adjust the relative positions of said first and second laser beams.


10
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CONTROL MECHANISM
ACTUATOR CONTROLLER
ROBOT CONTROLLER
50
LASER OSCILLATOR
52
94
96
14
28
24
20
34
26a
36
22
32
26
30
20
44
16
L
54
48
62
O
70
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L2
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P1
P2
W1
W2
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