TECHNICAL INFORMATION

Böhler Thyssen
WELDING

SC-110

SOUDOMETAL

ELECTROSLAG STRIP CLADDING

A PRACTICAL GUIDE

FOR WELDERS

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WHAT IS ELECTRO-SLAG STRIP CLADDING

MELTING OF A STRIP ELECTRODE VIA ***A CONDUCTIVE SLAG*** AND DEPOSITED ONTO A STEEL BASE.

Electroslag fluxes produce a conductive slag

Slag protects the molten metal from the air

WHAT IS SUBMERGED ARC STRIP CLADDING

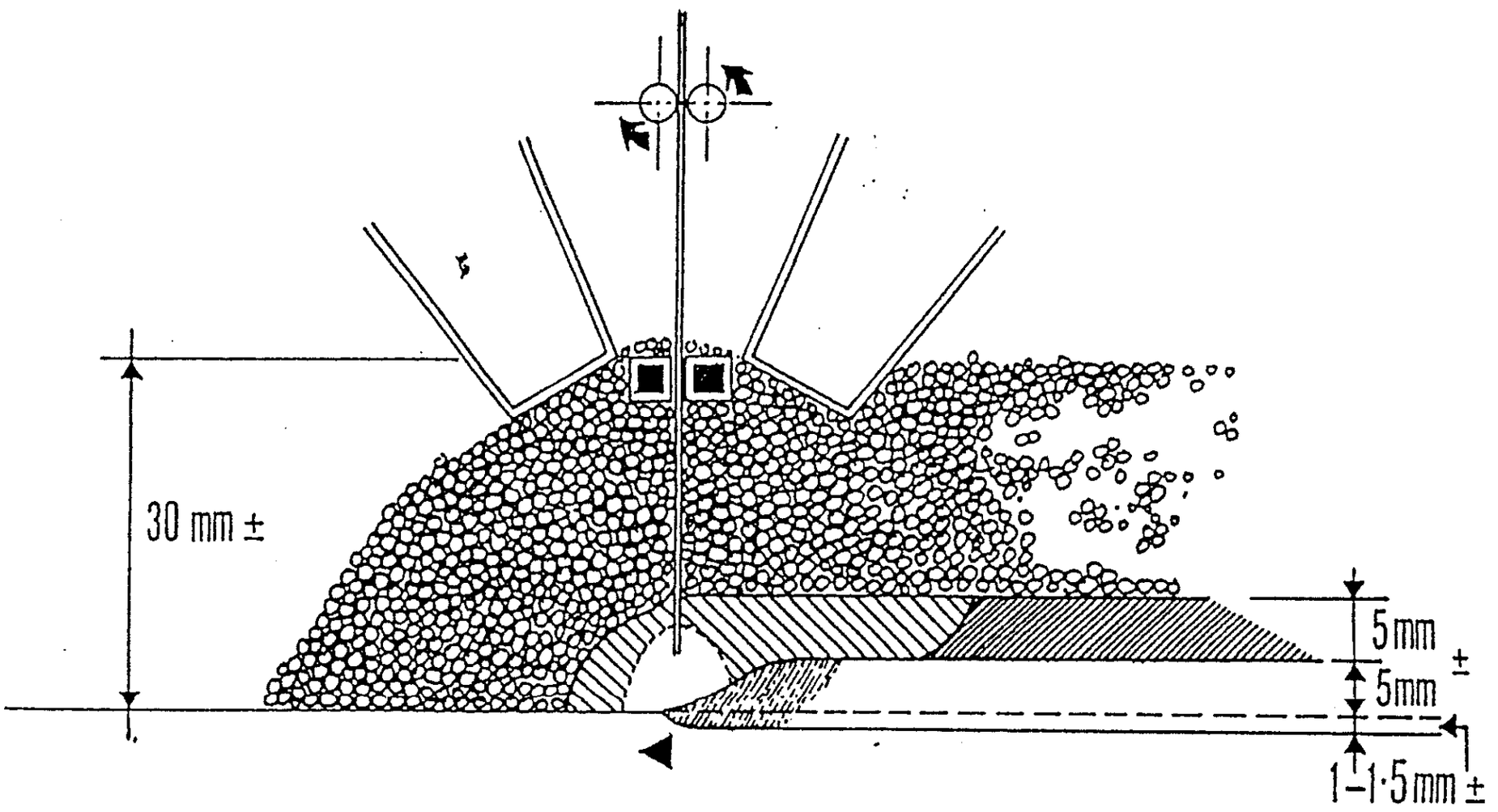
MELTING OF A STRIP ELECTRODE VIA ***A NON CONDUCTIVE SLAG*** AND DEPOSITED ONTO A STEEL BASE

Submerged arc fluxes produce a non conductive slag

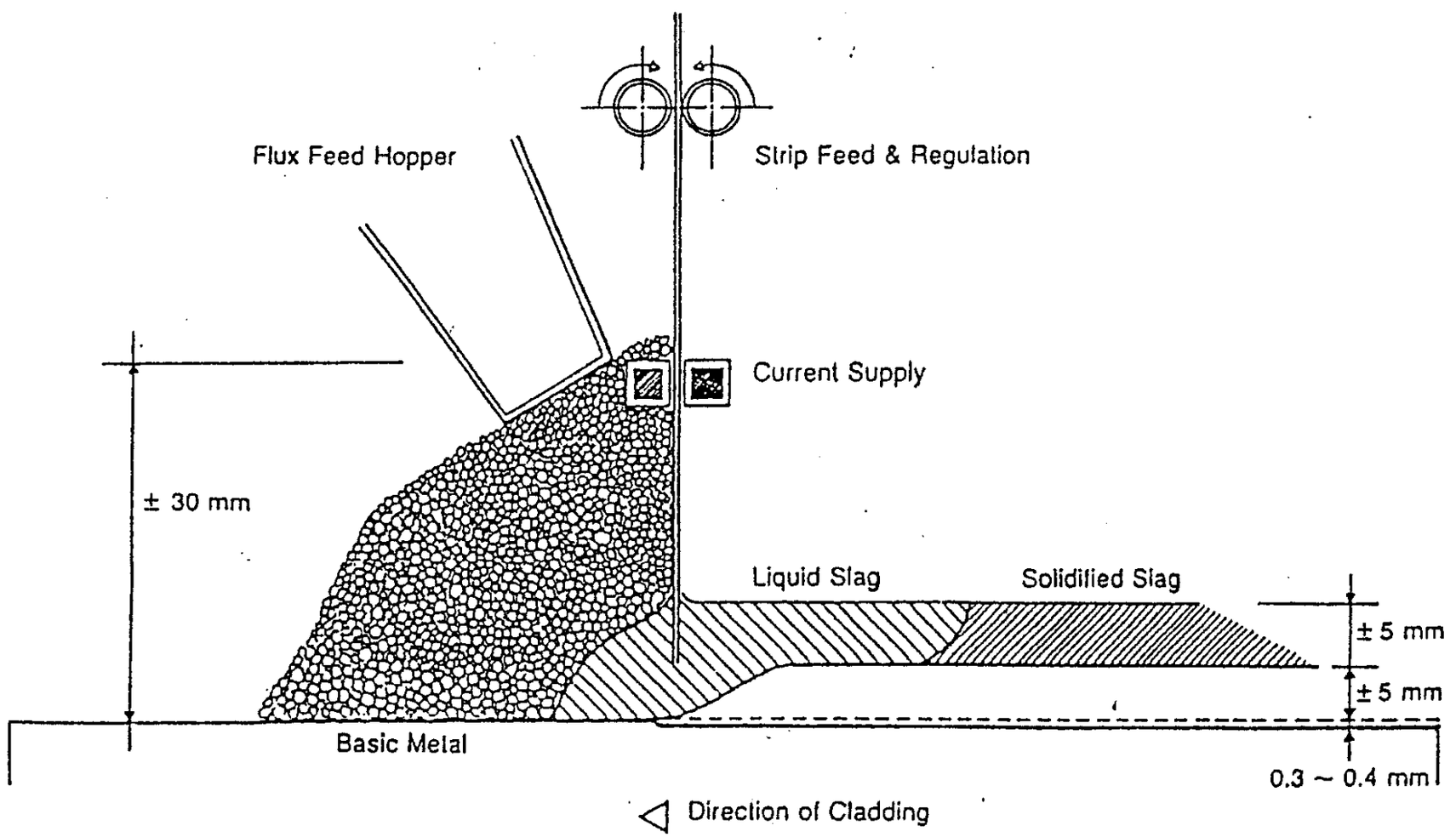
gases protect the molten metal from the air

fig 1

SUBMERGED ARC STRIP CLADDING.



ELECTROSLAG STRIP CLADDING

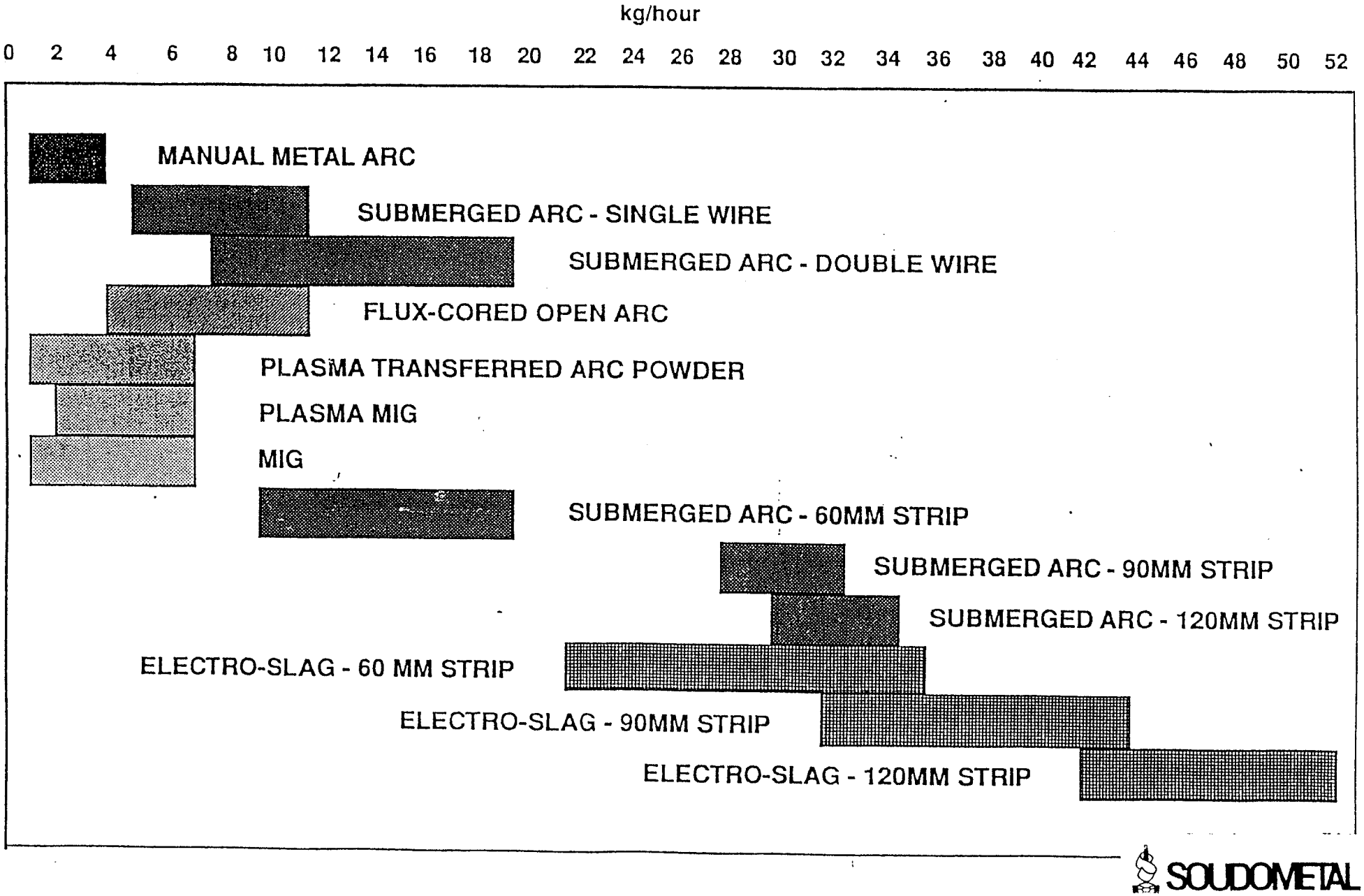


ADVANTAGES OF ELECTROSLAG

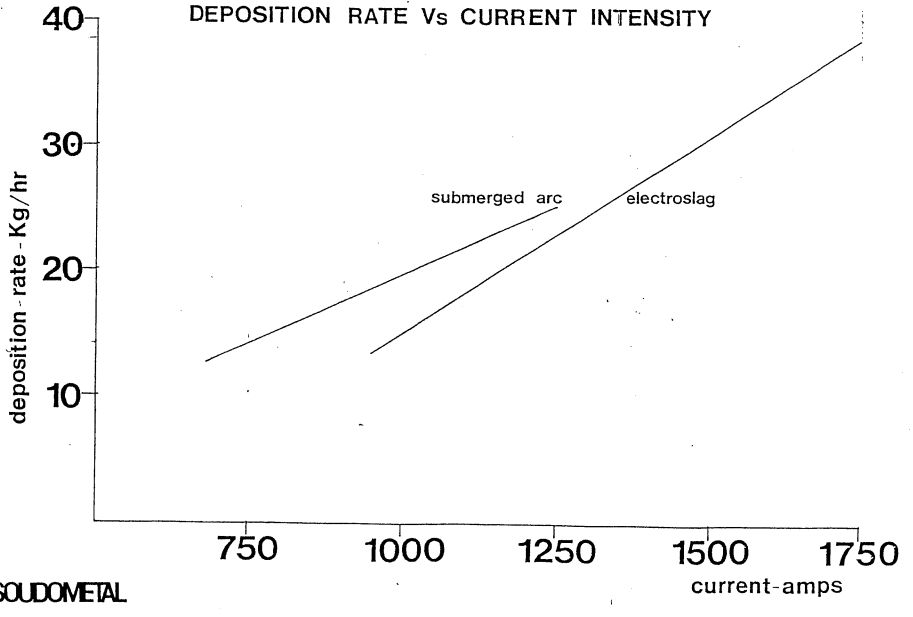
(1) TWICE AS FAST AS SUBMERGED ARC STRIP CLADDING

(2) HALF OF THE DILUTION OF SUBMERGED ARC STRIP CLADDING

Comparison of Deposition rates in kg/hour for different welding processes



SOUDOMETAL


DEPOSITION RATE Vs CURRENT INTENSITY
40
30
20
10
deposition - rate - Kg/hr
submerged arc
electroslag
750
1000
1250
1500
1750
current-amps

SOUDOMETAL

WHAT IS DILUTION

THIS IS THE PERCENTAGE OF THE BASE METAL WITHIN THE WELD

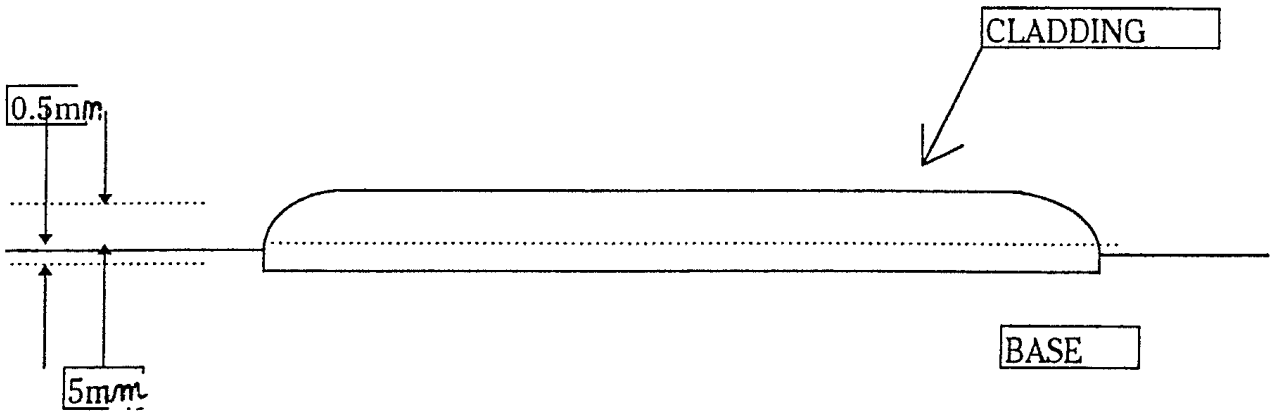
10%DILUTION

=10%OF THE BASE METAL MIXED WITH 90%OF THE ELECTRODE

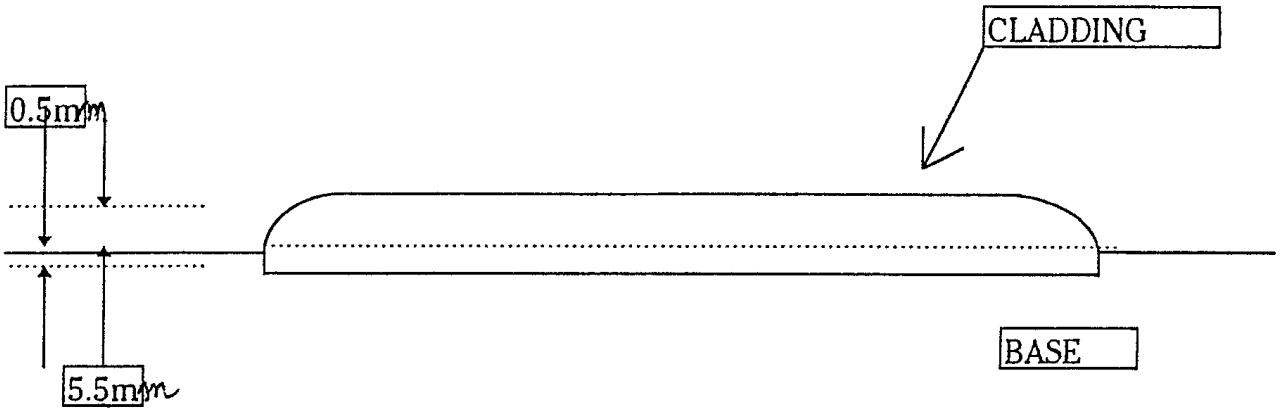
20%DILUTION

=20% OF THE BASE METAL MIXED WITH 80%OF THE ELECTRODE

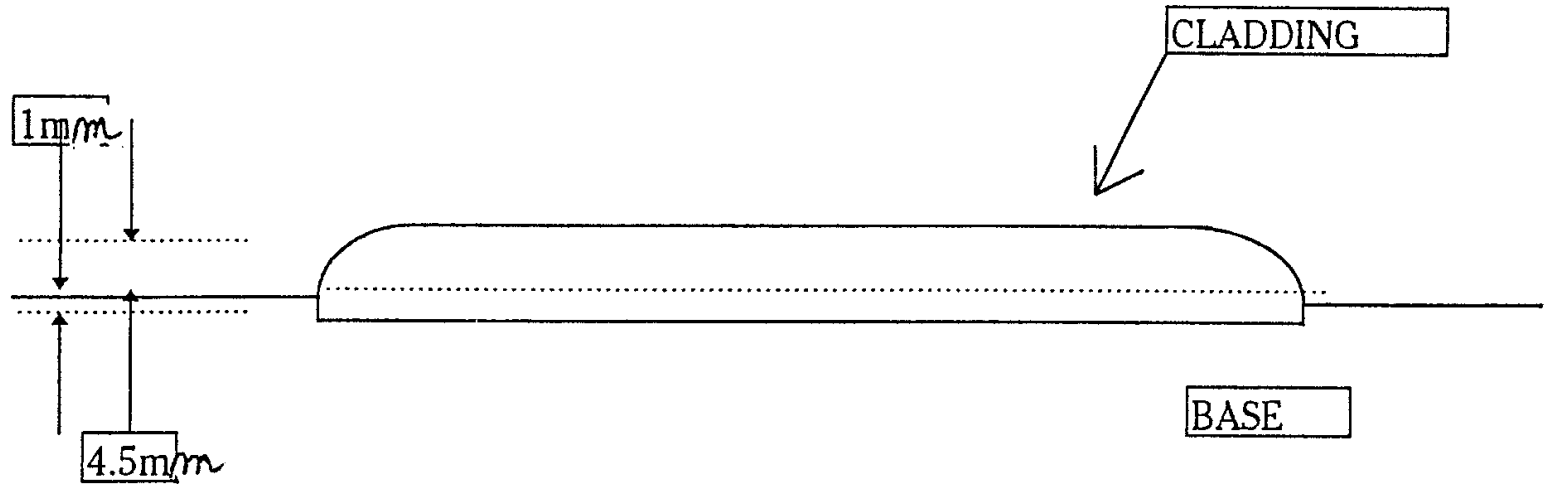
DILUTION



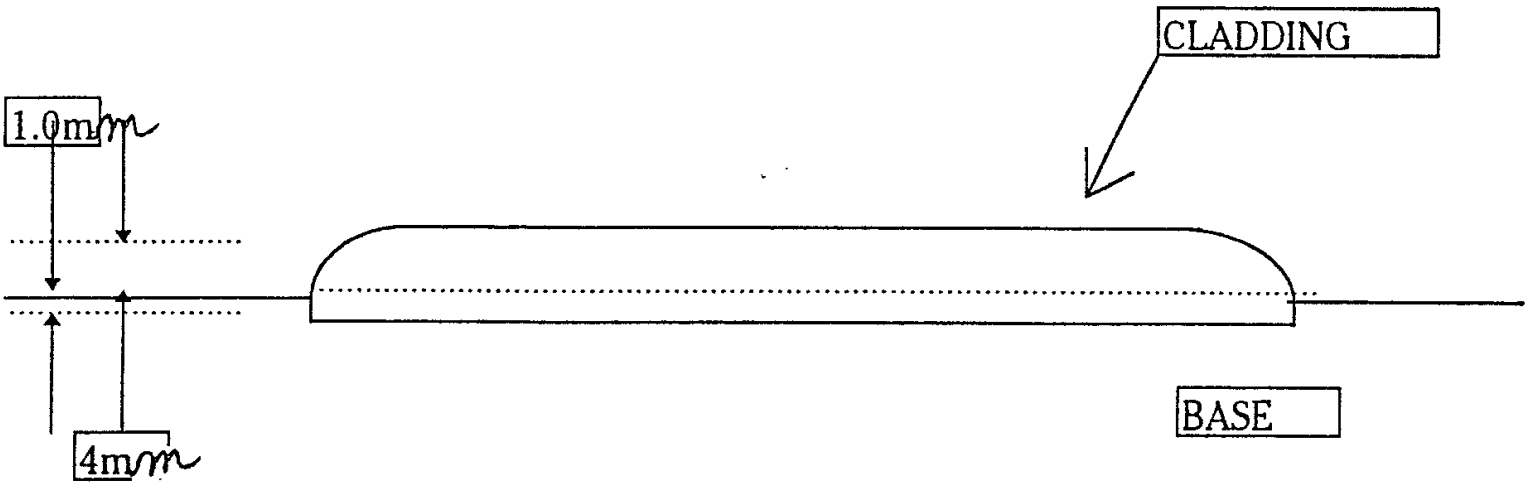
TOTAL THICKNESS=5.5mm (0.5/5.5x100)= 9%DILUTION



TOTAL THICKNESS=6.0mm (0.5/6.0x100)8.3%DILUTION



TOTAL THICKNESS=5.5mm (1/5.5X100=0.5/5.5x100= 18%DILUTION



TOTAL THICKNESS=5.0mm (1.0/5.0x100= 20%DILUTION

ELECTROSLAG STRIP CLADDING
TRAVEL SPEED

PENETRATION INTO THE BASE METAL IS ALMOST ALWAYS 0.5mm

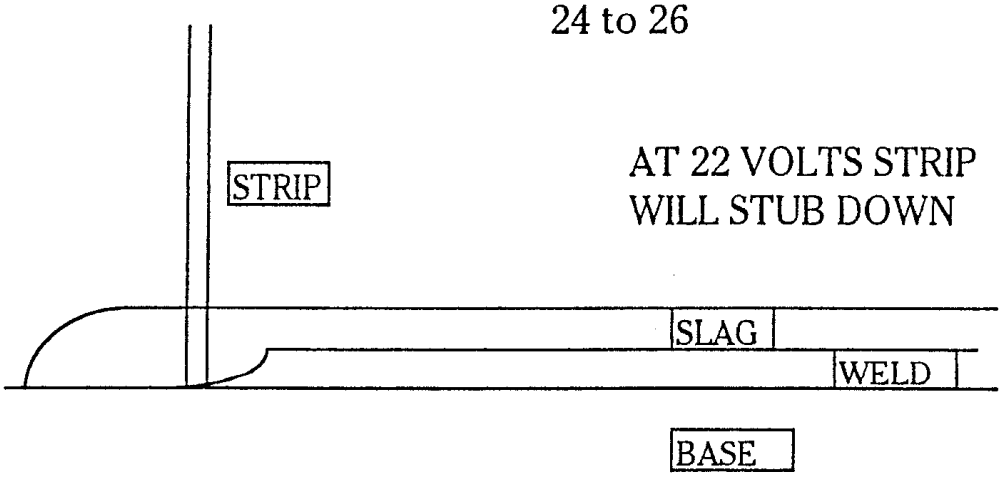
TRAVEL SPEED HAS THE GREATEST AFFECT UPON WELD THICKNESS

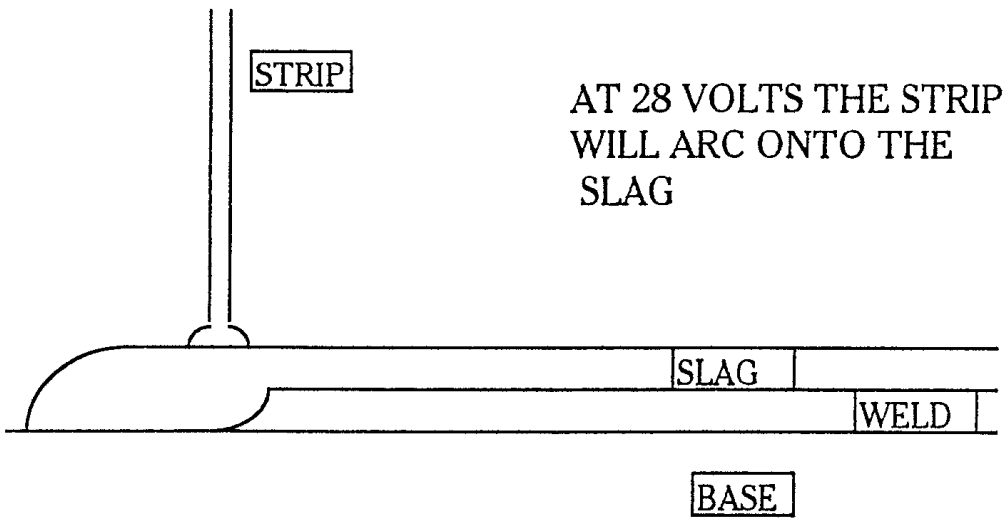
THEREFORE THE GREATEST AFFECT UPON DILUTION

ELECTROSLAG STRIP CLADDING
VOLTAGE

VOLTAGE AFFECTS THE DISTANCE OF THE END OF THE STRIP FROM THE WORK.

THE DEPTH OF THE SLAG IS 5mm THEREFORE IT IS IMPORTANT TO MAINTAIN THE VOLTAGE BETWEEN
24 to 26



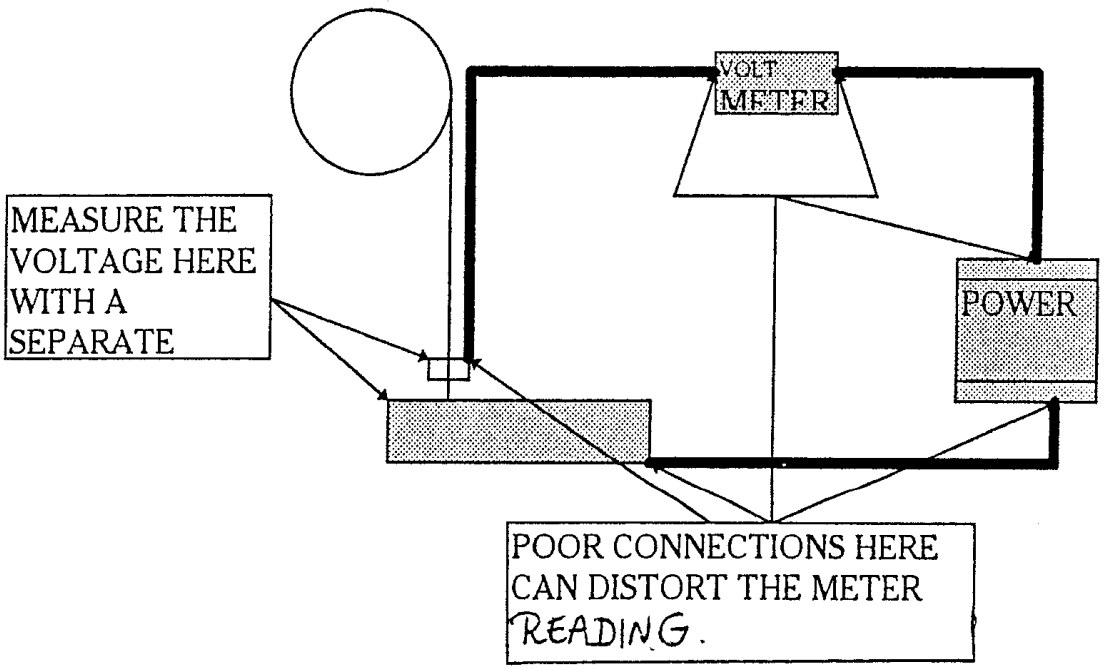


VOLTAGE

SHOULD THE VOLTMETER ON THE EQUIPMENT BE TRUSTED

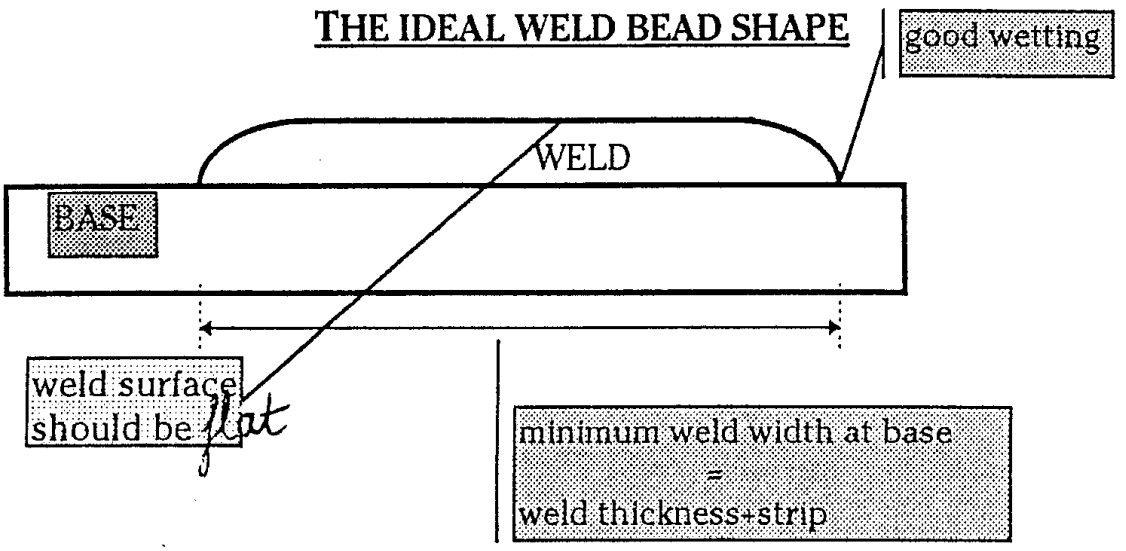
NO

THIS METER SHOWS THE VOLTAGE DROP ACROSS THE WHOLE WELDING CIRCUIT
AND THIS CAN VARY DUE TO BAD EARTH OR CABLE CONTACTS



ONE BAD CONNECTION CAN RESULT IN A 2 OR 3 VOLTS DROP THEREFORE A METER READING OF 25 VOLTS COULD MEAN A WORKING VOLTAGE OF ONLY 22 VOLTS

WELD BEAD SHAPE



WELD THICKNESS

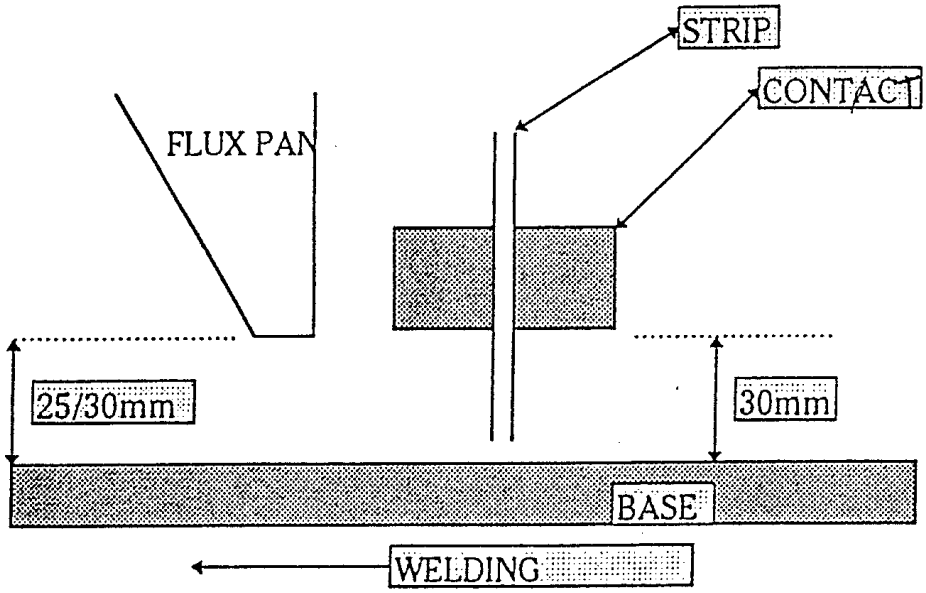
IMPORTANT AS THIS AFFECTS DILUTION

WELD EDGES

IMPORTANT AS THIS AFFECTS
SLAG ENTRAPMENT

FLUX BURDEN

THE DEPTH OF FLUX SHOULD BE
25 mm TO 30 mm FOR STAINLESS AND NICKEL ALLOYS
20 mm TO 25 mm FOR COBALT ALLOYS



SET THE FLUX PAN 30mm ABOVE THE WORK

WHEN WELDING YOU SHOULD BE ABLE TO SEE A BAND OF WHITE HOT SLAG ,NO LESS THAN 25mm WIDE

NEVER ADD FLUX BEHIND THE STRIP
(EXCEPT WHEN FIRST STARTING THE WELD)

THE WEIGHT OF FLUX WILL ALTER THE SHAPE OF THE WELD
CAUSE " ROLL OVER " AT THE EDGES
AND SLAG TRAPS WHEN OVERLAPPING WITH THE NEXT WELD.

WELDING CURRENT

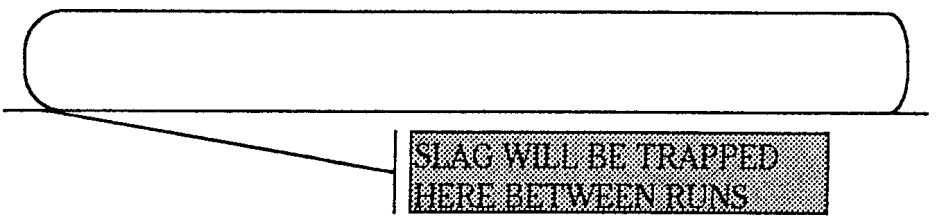
THIS AFFECTS THE SPEED OF THE STRIP
HIGHER CURRENT = MORE STRIP = HIGHER DEPOSITION

ALWAYS KEEP THE CURRENT TO +/- 5%

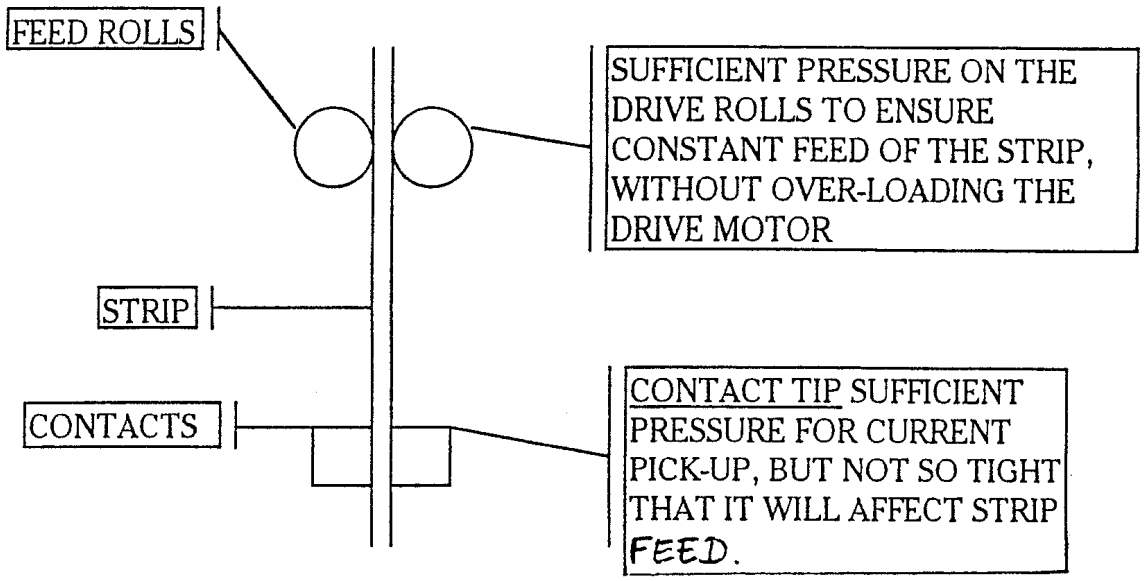
IF CURRENT IS INCREASED AND ALL OTHER SETTINGS REMAIN CONSTANT,

THE INCREASED WELD METAL WILL CAUSE " ROLL OVER " OR STEEP SIDED

WELDS



ADJUSTMENT OF THE STRIP NOZZLE



TIPS WHEN SETTING UP

1 THE SPOOL OF STRIP SHOULD BE POSITIONED TO FEED INTO THE NOZZLE WITHOUT TWISTING AND WITHOUT EXCESSIVE BRAKING ON THE SPOOL HOLDER.

2 WITH THE PRESSURE OFF THE ROLLS AND THE TIP ,THE STRIP SHOULD RUN FREELY THROUGH THE GUIDE AND NOZZLE.

3 THE SIDEWAYS MOVEMENT OF THE STRIP SHOULD BE NO MORE THAN 0.5mm.

4 PUT PRESSURE ON THE CONTACT TIP BEFORE THE FEED ROLLS,
THE STRIP SHOULD STILL BE ABLE TO BE PUSHED BY HAND THROUGH THE NOZZLE AND TIPS RELATIVELY FREELY.

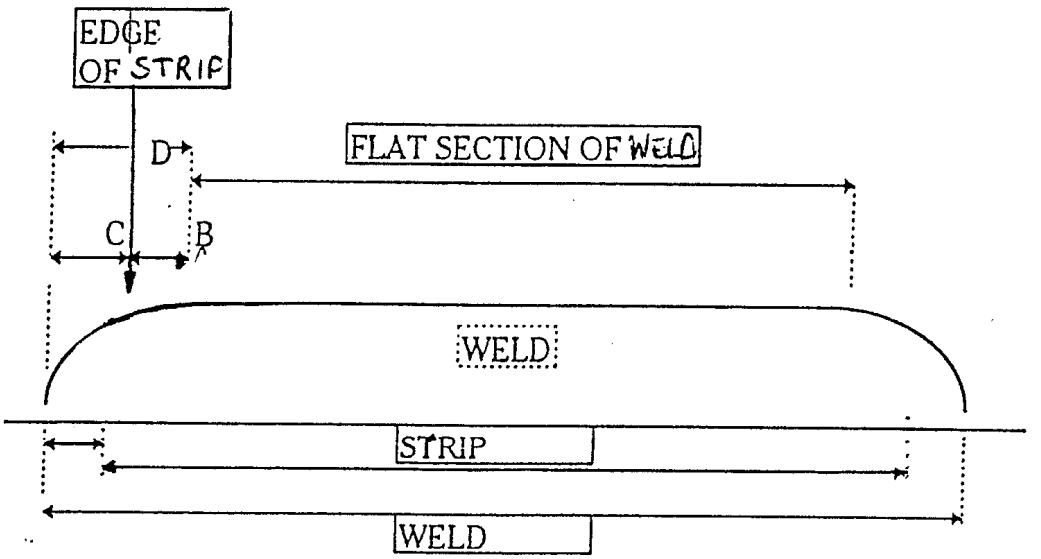
5 APPLY PRESSURE TO THE FEED ROLLS, JUST SUFFICIENT!
TEST BY TRYING TO HOLD THE STRIP BEFORE IT GOES INTO THE NOZZLE, IF YOU CAN STOP IT THEN APPLY MORE PRESSURE, A LITTLE AT A TIME.

WELD OVERLAP

THIS IS IMPORTANT
TO MAINTAIN A CONSTANT THICKNESS
AND
AVOID SLAG ENTRAPMENT

OVER LAP WILL ALMOST ALWAYS BE BETWEEN
4 TO 7 mm

HOW TO DETERMINE OVERLAP



1 THE DISTANCE "B" SHOULD EQUAL (A+1mm)
2 YOU WILL FIND THAT "A" IS NEARLY ALWAYS 3 mm.
3 THEREFORE "B" WILL NEARLY ALWAYS BE 4mm

EXAMPLE

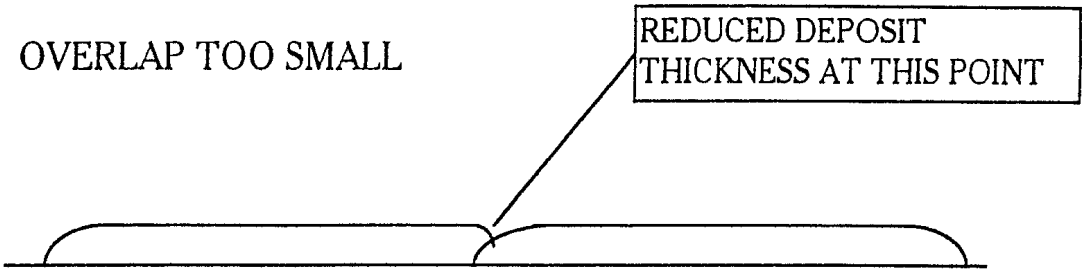
IF THE STRIP = 60 mm
WELD = 66 mm
FLAT SECTION=48 mm

THEN

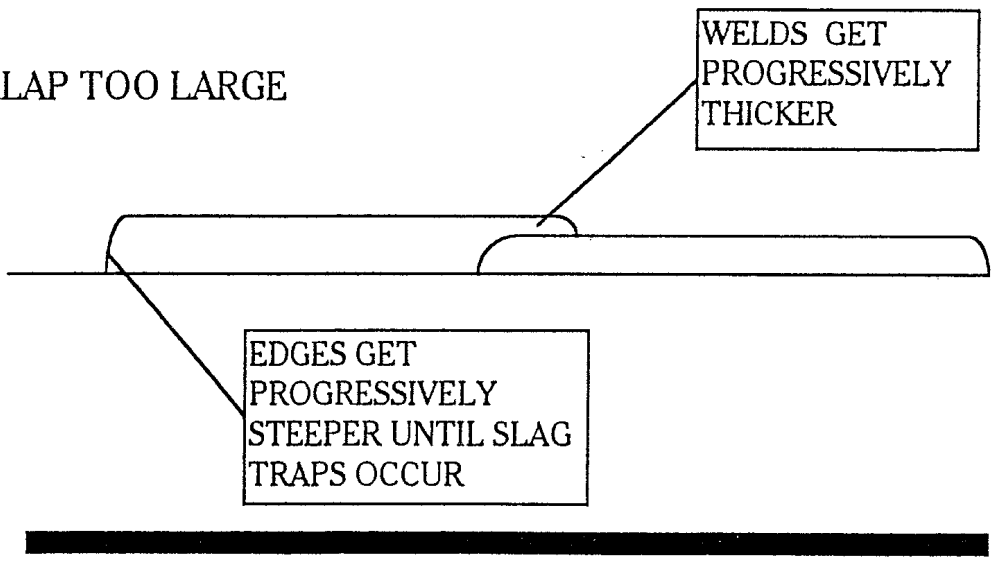
"A" WILL EQUAL 3 mm
"B" WILL EQUAL 4 mm
"D" WILL EQUAL 9 mm
THEN "C" WILL EQUAL 5 mm

WHAT HAPPENS IF THE OVERLAP IS WRONG

OVERLAP TOO SMALL



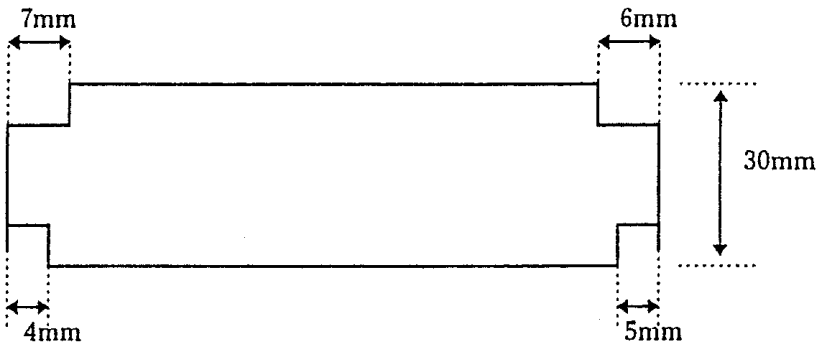
OVERLAP TOO LARGE



MEASURING OVERLAP

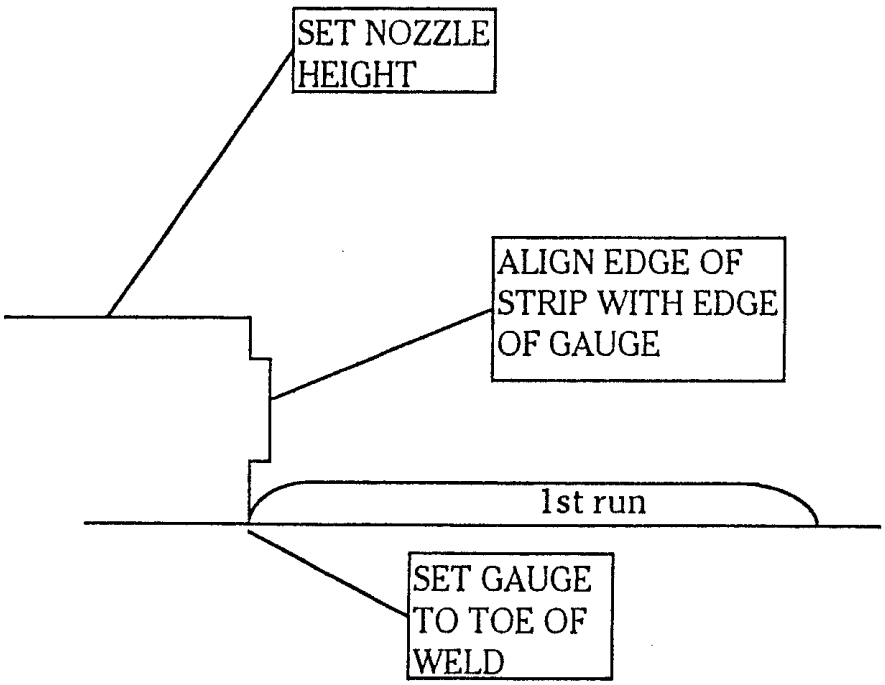
DON'T USE A TAPE MEASURE ,IT IS DIFFICULT TO BE CONSISTENT

USE A GAUGE OR TEMPLATE
A SIMPLE ONE MAY BE MADE FROM A PIECE OF STRIP



This can be used to set "stick out" and 4 different overlaps

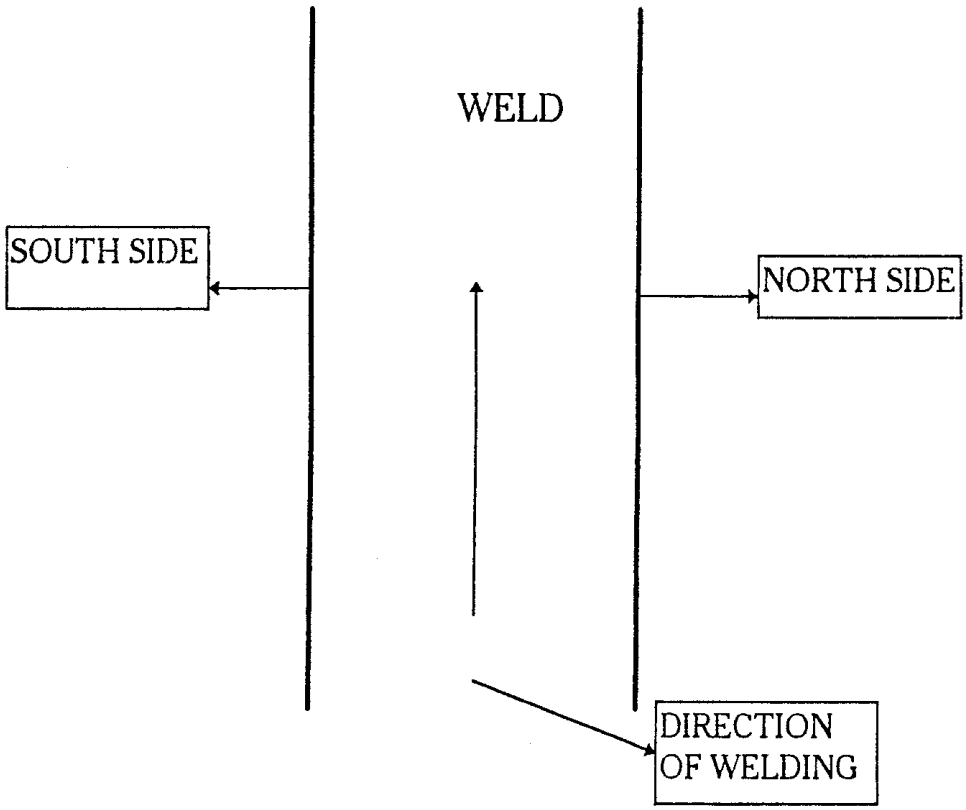
SETTING THE WELD OVERLAP

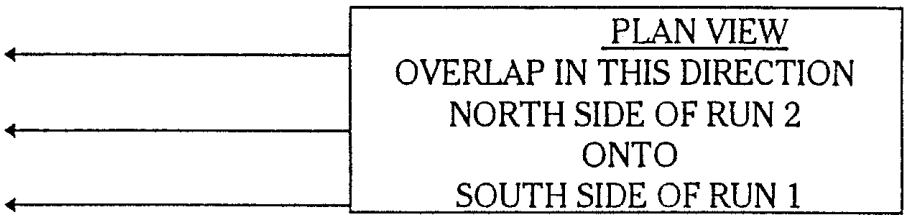


ALWAYS OVERLAP IN THE SAME DIRECTION
(where possible)

WELD WITH THE NORTH SIDE ONTO THE SOUTH SIDE

ALWAYS IMAGINE THAT YOU ARE WELDING FROM **EAST** TO **WEST**
THEREFORE NORTH WILL BE THE RIGHT HAND SIDE OF THE WELD
AND SOUTH THE LEFT HAND SIDE.





STARTING AND STOPPING THE WELD

STARTING

IT IS USUALLY BETTER TO" SCRATCH START"

THIS AVOIDS HEAVY BUILD UP AT THE START AND REDUCES THE NEED FOR GRINDING.

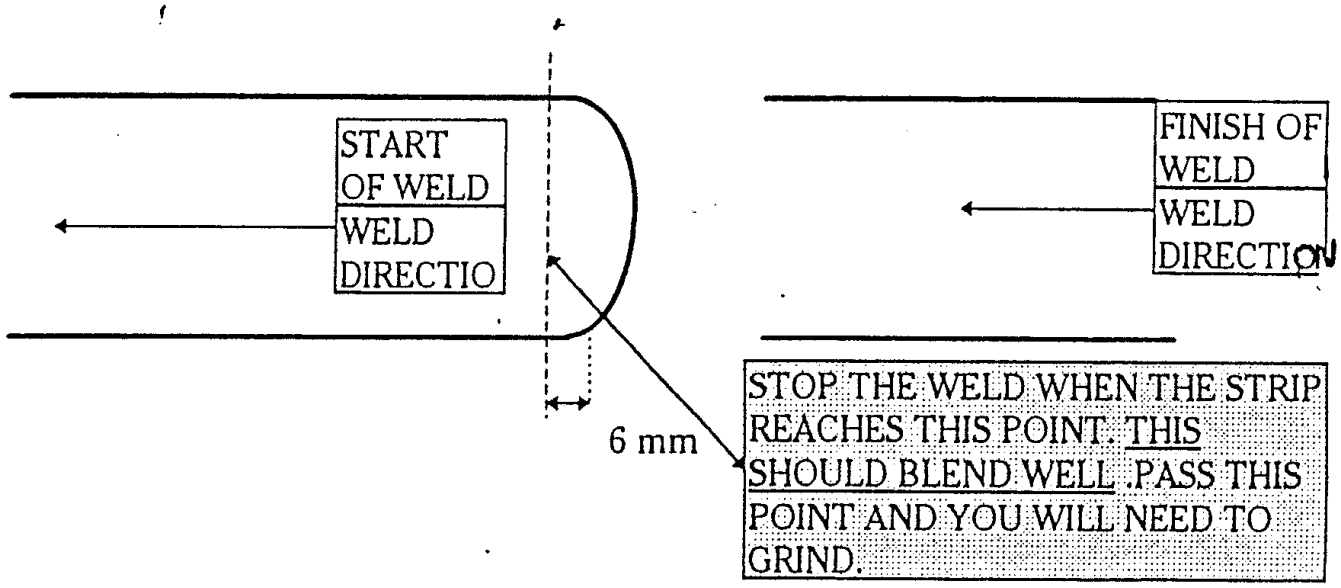
CUT THE STRIP AT AN ANGLE FOR EASIER STARTING

WHEN OVERLAPPING THE POINT OF THE STRIP SHOULD NOT BE STARTED ON THE PREVIOUS WELD ,BUT ONTO THE BASE METAL OR THE PREVIOUS LAYER

STOPPING

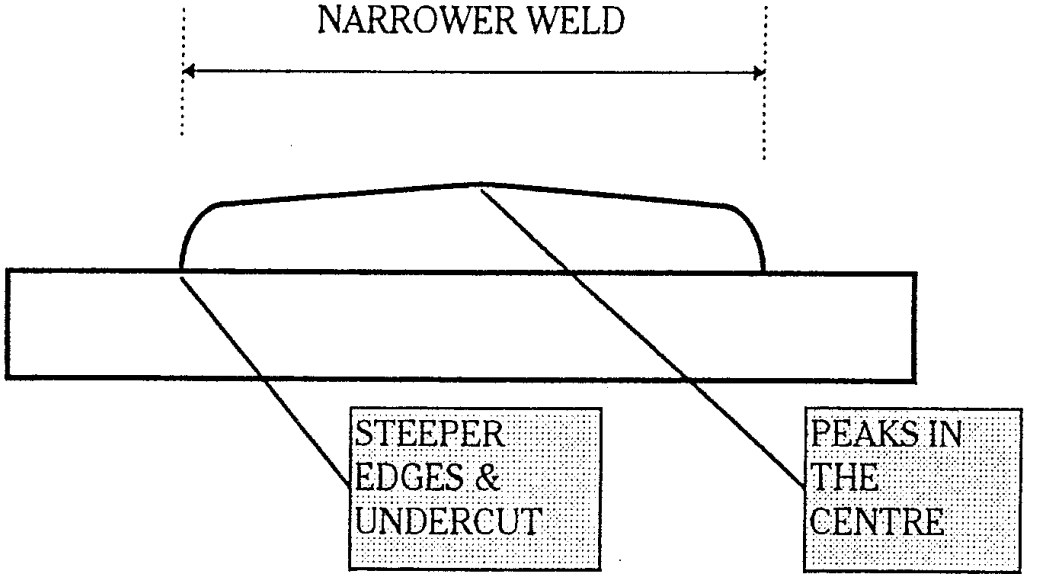
IT IS USUALLY BETTER TO CUT THE WELDING POWER BEFORE STOPPING THE TRAVEL SPEED

WHEN WELDING CIRCUMFERENTIALLY DON'T OVERLAP THE START OF THE WELD BY TOO MUCH, TO AVOID GRINDING



WHY IS MAGNETIC STEERING NECESSARY

AT HIGHER CURRENTS (60 mm STRIP & ABOVE) A MAGNETIC FIELD IS SET UP WHICH IS STRONG ENOUGH TO ACT UPON THE MOLTEN POOL OF METAL AND SLAG, DRAWING WELD METAL TOWARDS THE CENTRE OF THE WELD.

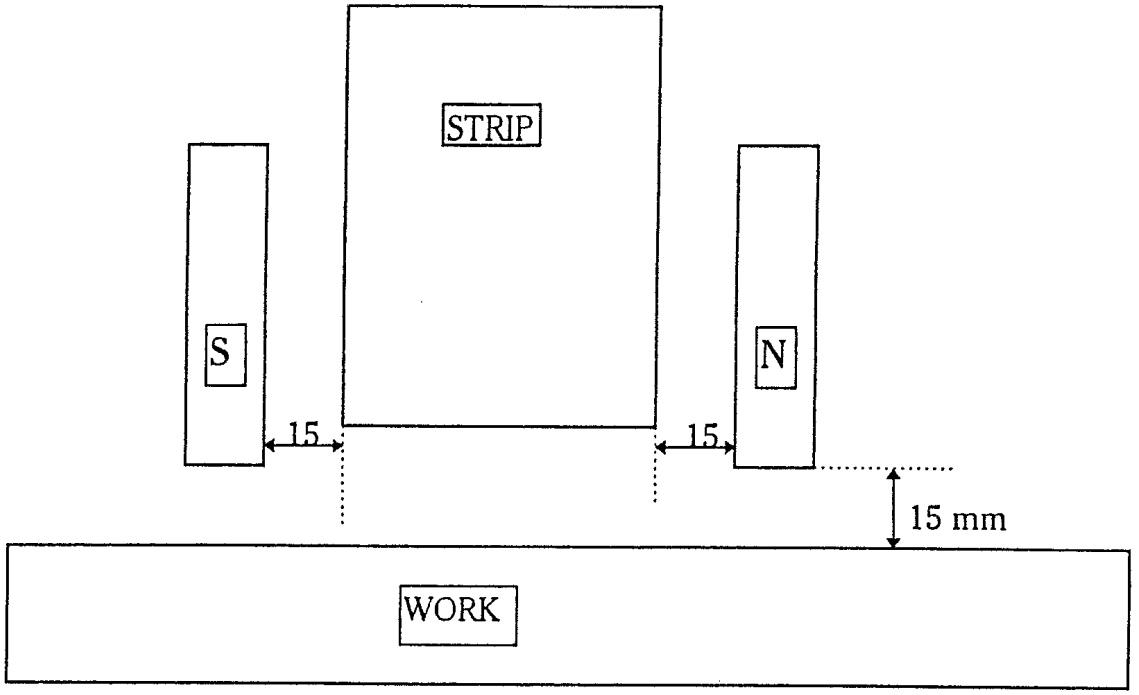


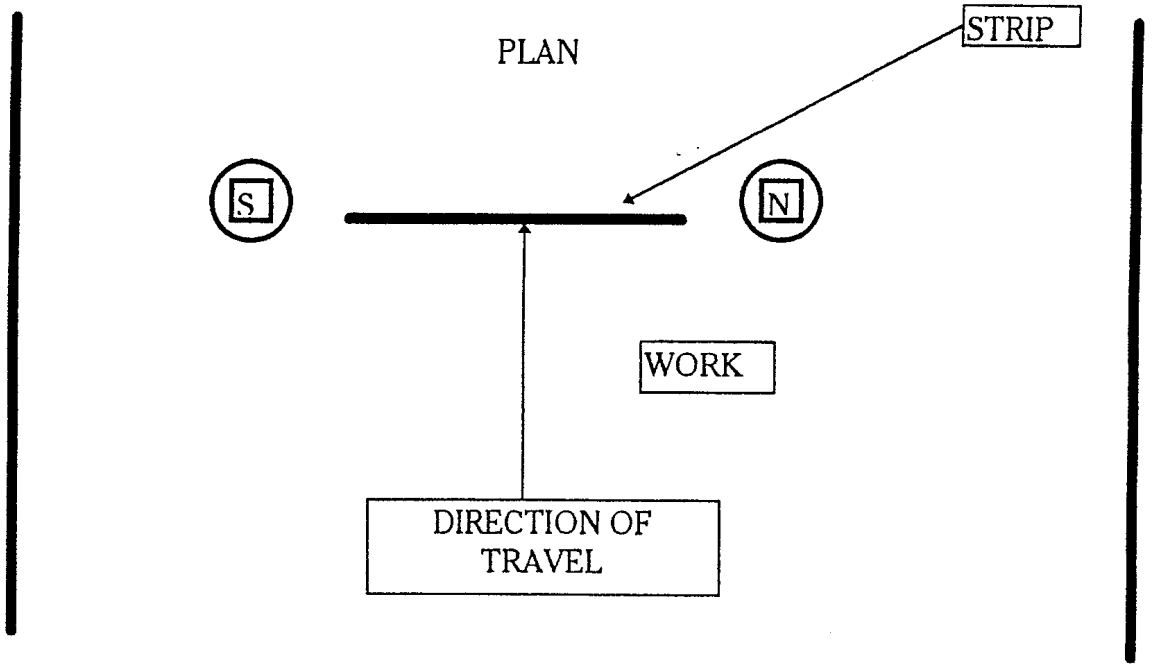
WHAT DOES MAGNETIC STEERING DO

THE MAGNETIC UNIT CREATES A MAGNETIC FORCE OPPOSITE TO THAT SET UP BY THE WELDING CURRENT ,CANCELLING ITS EFFECT.

SETTING THE MAGNETIC STEERING
POSITIONING OF THE MAGNETS

BOTH MAGNETS SHOULD BE PLACED AN EQUAL DISTANCE FROM THE STRIP AS FOLLOWS:-





ALWAYS IMAGINE THAT YOU ARE WELDING FROM EAST TO WEST
THEREFORE NORTH IS ON THE RIGHT

MAGNETIC STEERING

INTENSITY SETTINGS

ALWAYS SET THE NORTH MAGNET 0.5 TO 1 amp HIGHER THAN THE SOUTH

IT IS SUGGESTED THAT YOU START AT
3.5 amp NORTH
3.0 amp SOUTH

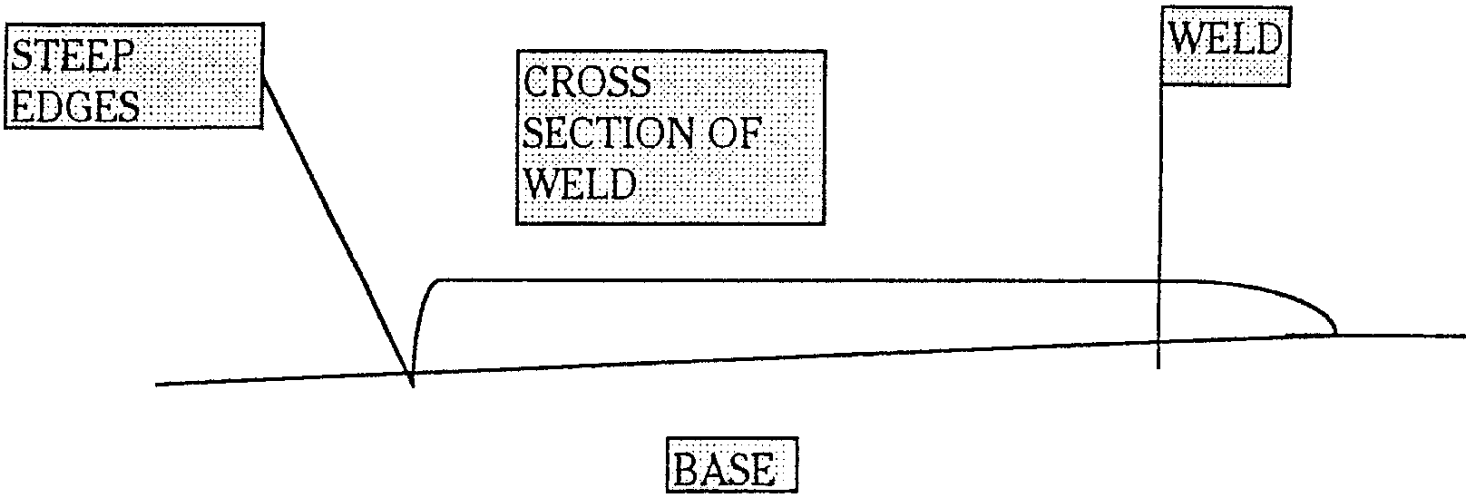
IT IS UNLIKELY THAT YOU WILL NEED TO ALTER THE SETTING FROM DAY TO DAY, PROVIDING THAT THE POSITION OF THE MAGNETS REMAINS THE SAME

SETTING TOO HIGH?
THE WELD WILL BE TOO WIDE AND DIP IN THE MIDDLE

SETTING TOO LOW ?
THE WELD WILL BE NARROWER AND WILL PEAK IN THE MIDDLE

INCLINED WELDMETAL
(SIDE TO SIDE)

THE BASE ON WHICH YOU ARE WORKING SHOULD BE FLAT. ELECTROSLAG WELDMETAL IS DEPOSITED LEVEL BY GRAVITY



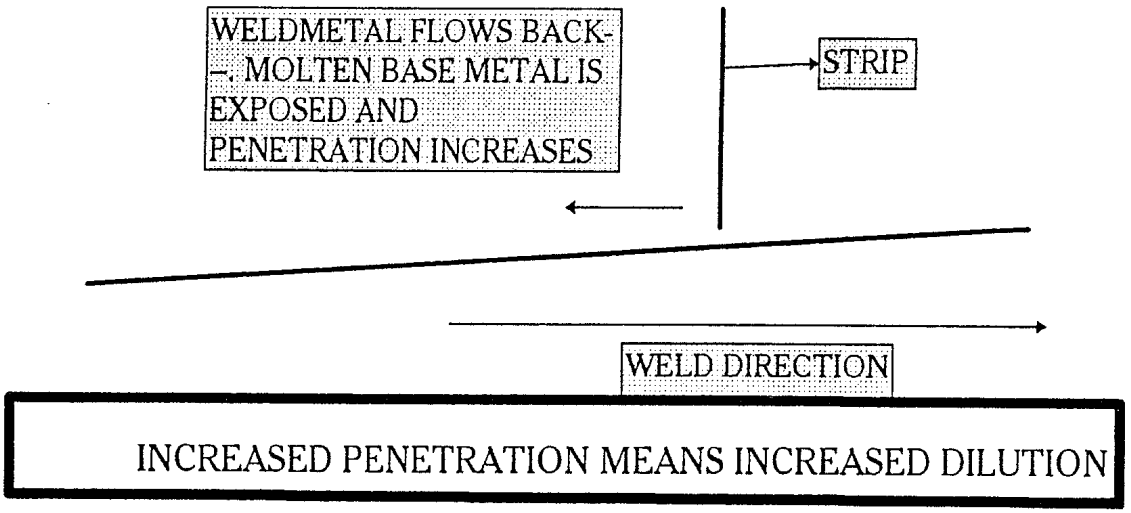
THE WELD WILL BE THICKER ON THE LOWER SIDE WITH A STEEPER EDGE WHICH COULD RESULT IN SLAG ENTRAPMENT WHEN OVERLAPPING
MAXIMUM INCLINE SHOULD BE 2 DEGREES

INCLINED WELD METAL

WELDING UPHILL OR DOWN HILL
AGAIN THE MAXIMUM SUGGESTED INCLINE IS 2°

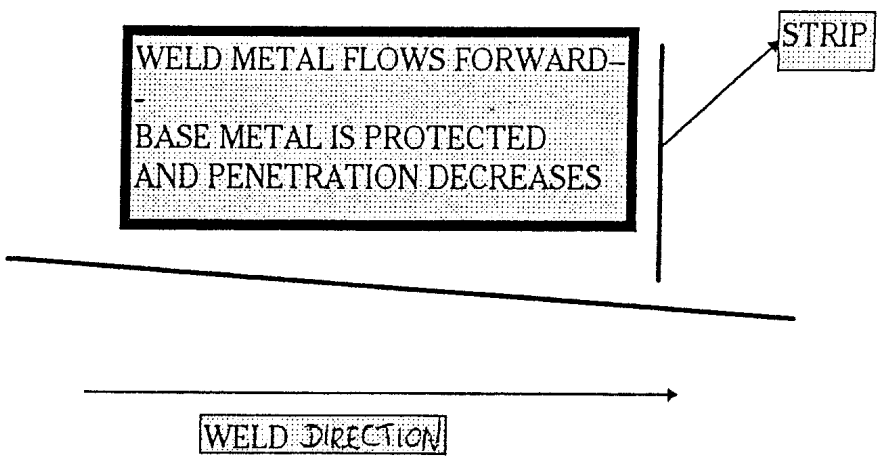
WELDING UPHILL

THE SLAG AND WELD METAL WILL TEND TO RUN BACK AWAY FROM THE WELD.
THIS WILL INCREASE DILUTION



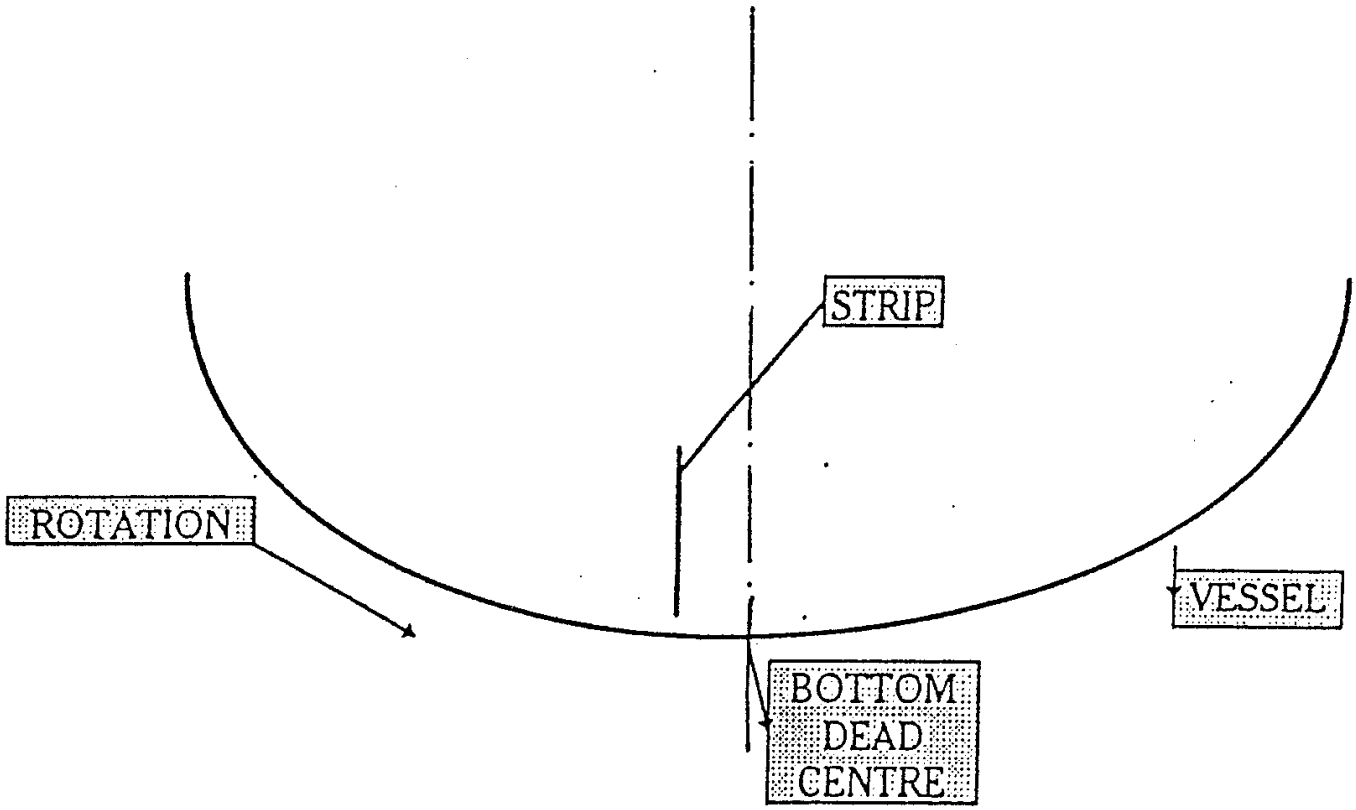
INCREASED PENETRATION MEANS INCREASED DILUTION

WELDING DOWN HILL



DECREASED PENETRATION MEANS DECREASED DILUTION

WELDING ON A CURVED SURFACE (INSIDE A VESSEL)



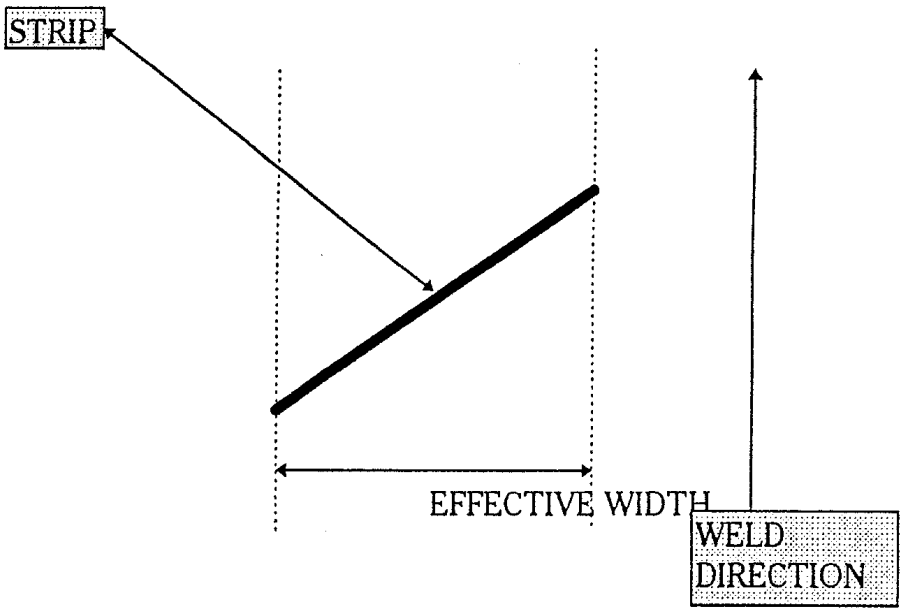
POSITION THE STRIP HALF OF THE LENGTH OF THE WELD POOL INFRONT OF" BOTTOM DEAD CENTRE" THIS WILL NORMALLY BE APPROX 50 mm . ALWAYS MAINTAIN THE SAME POSITION AS THIS WILL AFFECT DILUTION i.e. WELDING UPHILL OR DOWNHILL

VARYING THE WELD WIDTH

IT WILL SOMETIMES BE NECESSARY TO PRODUCE A NARROWER WELD.

(1) THE LAST WELD ON A VESSEL
(2) LANE CLOSING (CLADDING OVER WELDED JOINTS)

THIS MAY BE PRODUCED BY CLADDING WITH THE STRIP AT AN ANGLE TO REDUCE THE EFFECTIVE WIDTH OF THE STRIP.



THE GREATER THE ANGLE OF THE STRIP THE NARROWER THE WELD WIDTH

IT IS IMPORTANT TO MAINTAIN THE SAME WELD THICKNESS AND DILUTION , THIS IS ACHIEVED BY INCREASING THE SPEED **ONLY**

TO CALCULATE THE NEW SPEED

STRIP WIDTH MULTIPLIED BY THE ORIGINAL SPEED DIVIDED BY THE EFFECTIVE WIDTH OF THE STRIP.

EXAMPLE:- STRIP WIDTH = 60mm
ORIGINAL SPEED = 180mm/min
EFFECTIVE STRIP WIDTH = 48mm

$$\frac{60 \times 180}{48}$$

NEW SPEED = 225mm/min

LANE CLOSURES

THE WIDTH OF THE LANE SHOULD IDEALLY HAVE BEEN DESIGNED TO ACCEPT A SINGLE RUN OF WELD WITH THE STRIP AT 90 DEGREES.

IF NOT IT MAY BE NECESSARY TO ANGLE THE STRIP AS PREVIOUSLY DISCUSSED