Jan. 24, 1967 S. ALLAN ETAL 3,300,200

SELF-SIZING THERMOCHEMICAL SCARFING

Filed May 3, 1965 3 Sheets-Sheet 1

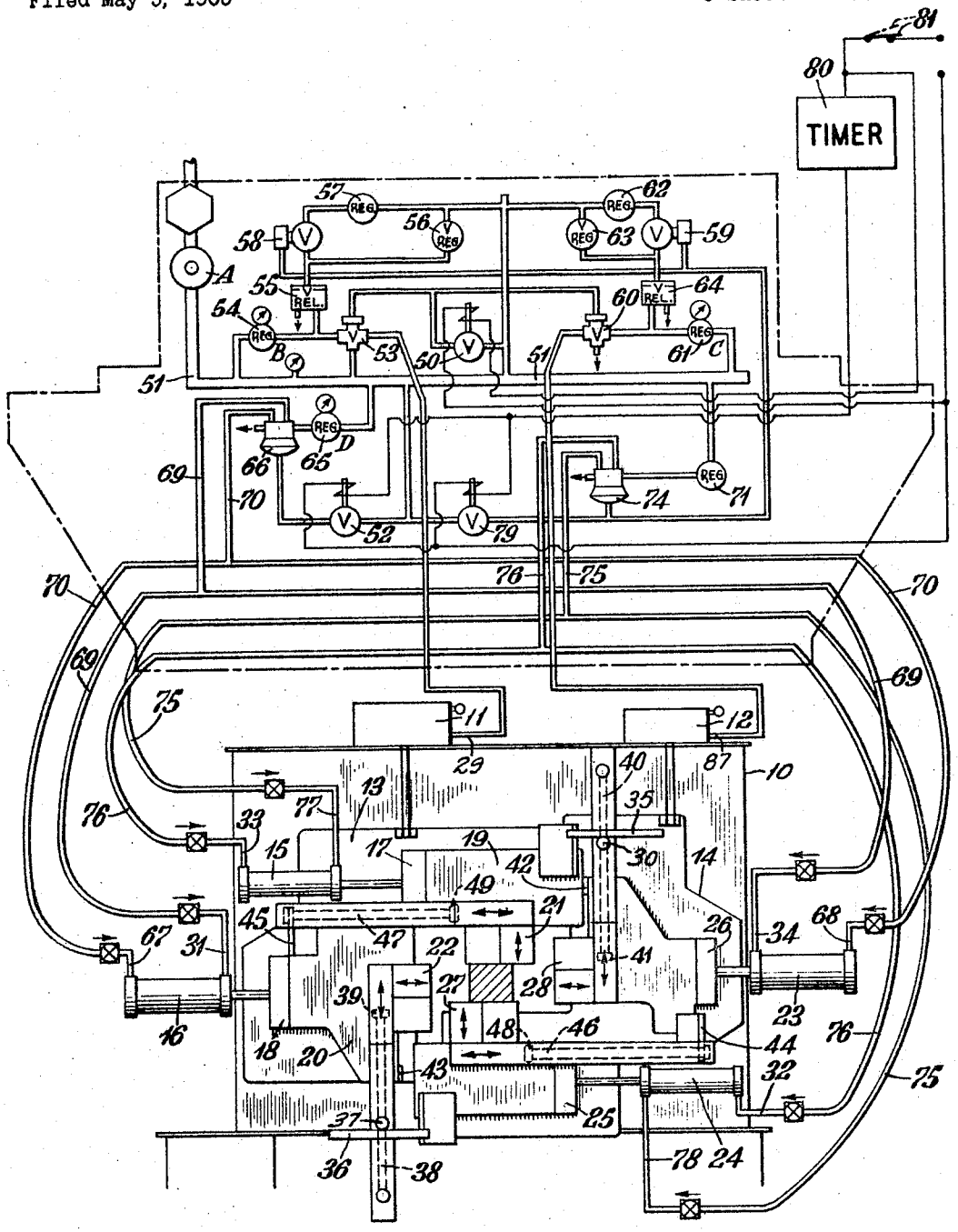

Fig. 1

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Filed May 3, 1965 3 Sheets-Sheet 2

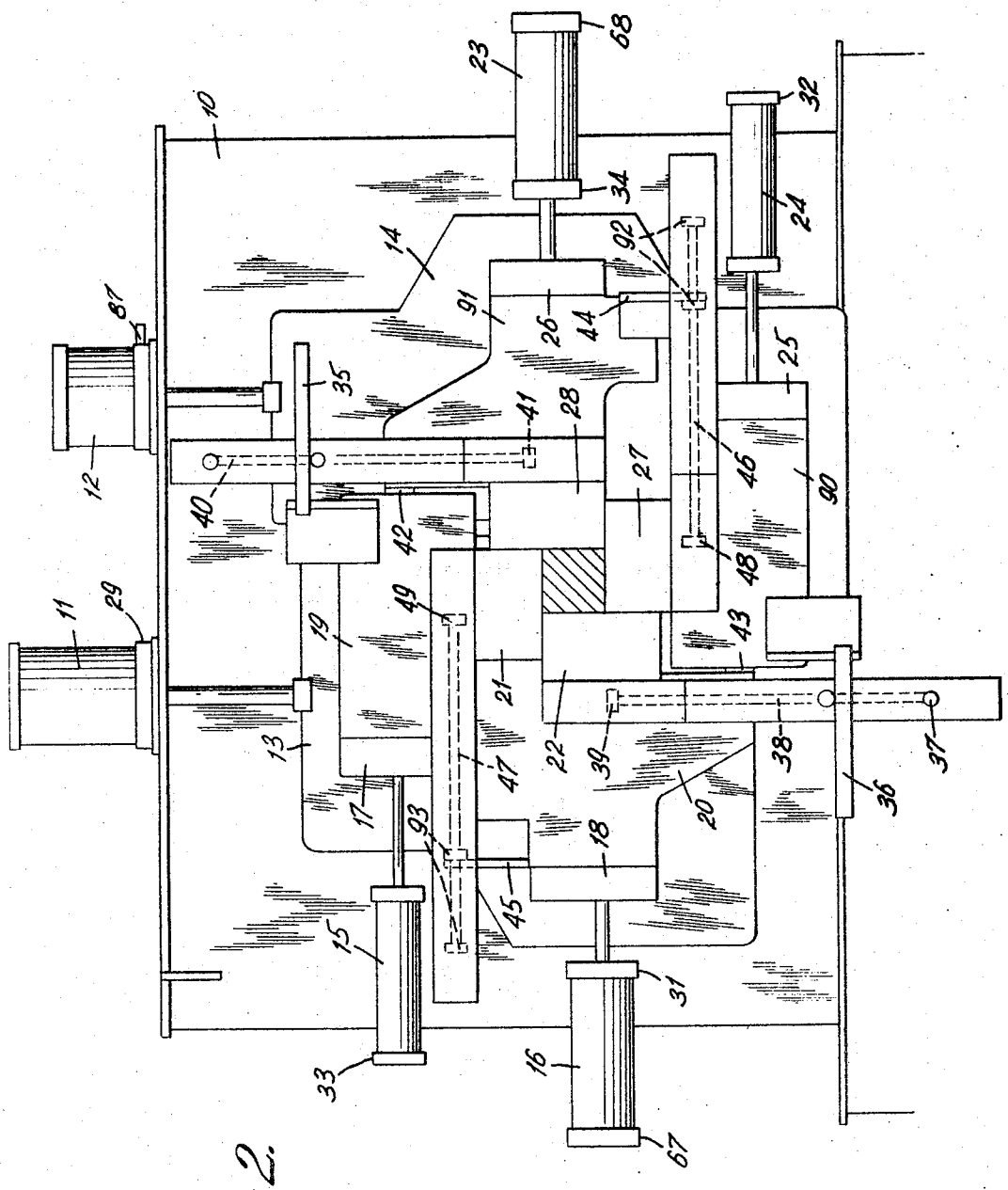

Fig. 2.

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Filed May 3, 1965 3 Sheets-Sheet 3

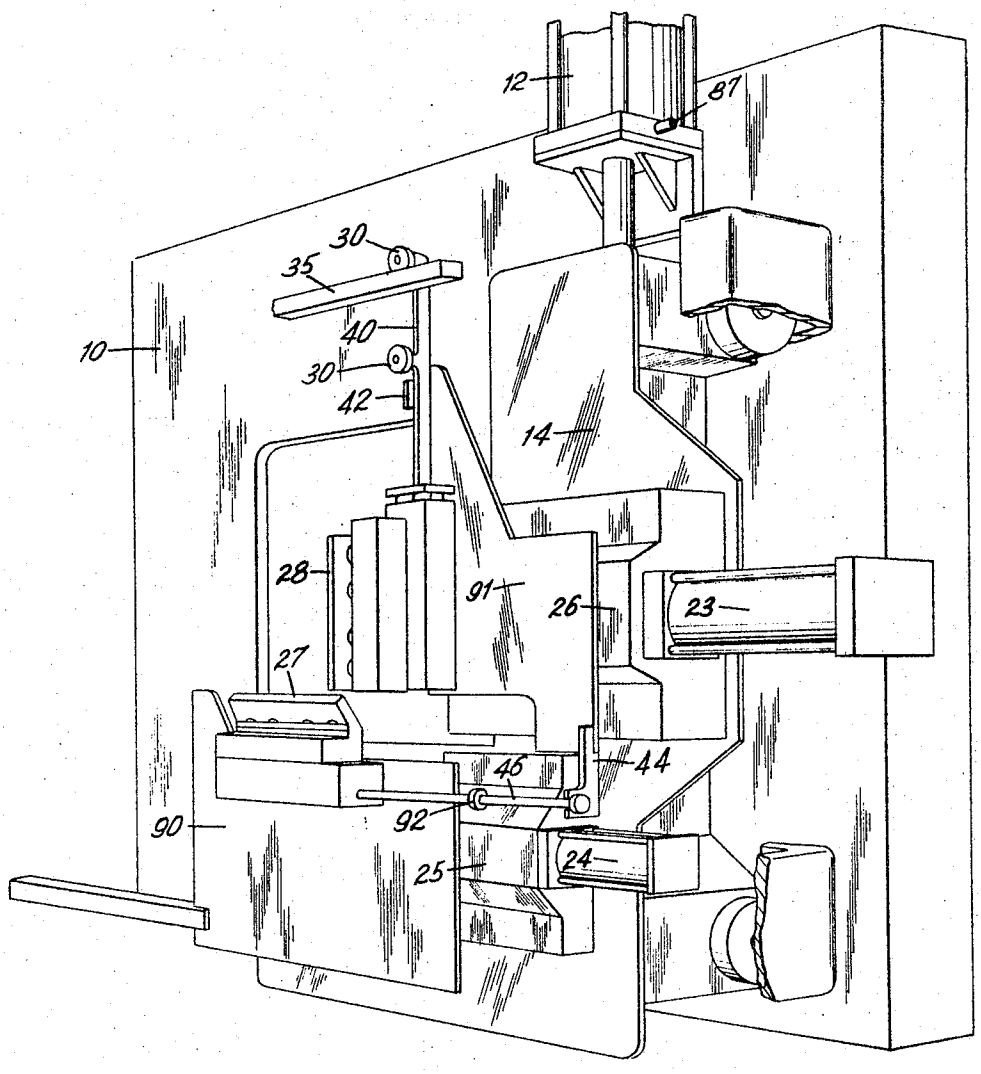

Fig. 3.

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United States Patent Office 3,300,200 Patented Jan. 24, 1967

3,300,200

SELF-SIZING THERMOCHEMICAL SCARFING

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Filed May 3, 1965, Ser. No. 456,886
7 Claims. (Cl. 266—23)

This application is a continuation-in-part of application Serial No. 180,785, filed March 19, 1962, now abandoned.

This invention relates to the thermochemical scarfing of ferrous metal bodies, and more particularly to an apparatus which is automatically self-adjusting to scarf the four sides of any size rectangular workpiece presented for conditioning. As long as the overall size of the workpiece is smaller than the maximum size which the machine is designed to process, the actual cross-sectional dimensions thereof need not be known by the operator of the machine.

During the production of steel shapes in a rolling mill, it is customary to condition the surfaces of the steel bodies at an intermediate stage of the rolling steps. The purpose of such conditioning is to eliminate surface defects such as cracks, seams and slag inclusions that would produce defects in the finished products if not removed. It has been found economical to eliminate such defects by thermochemically removing an entire surface layer of one or more longitudinal surfaces of the body to be conditioned by the use of a suitable machine preferably interposed in the mill conveyor line between roll stands such as after the blooming mill rolls. In this way, the steel shapes may be conditioned while hot and without interrupting continuous production of steel.

In many instances, the steel mill does not roll merely one size of billet or bloom, and often many different sizes are rolled in the same blooming mill; it is common practice to change sizes between alternate blooms in some mills. It is therefore desired to provide a conditioning machine which can be automatically self-adjusting to accept successively different sizes of blooms or billets, particularly different sizes of square and other rectangular cross-sectional shapes.

Since the advent of mechanical machine scarfing, improvements were developed to enable the operator to more rapidly effect adjustment of the machine in order to scarf different size sections of steel. Originally, the operator had to manually and laboriously adjust the setting of the scarfing units by jack screws, to suit the size of section to be processed. This operation was time-consuming and was not well adapted for an automated processing operation. This disadvantage led to the use of air motors which simplified machine adjustment to a degree. The air motors were controlled by opening and closing several air valves such that machine adjustment was facilitated. Further progress was achieved by adding Selsyn motors to the mechanical selection drives on the machine, and then, by observing calibrated dials in the operator's pulpit which were driven by slave Selsyn motors, the operator's depressing of either "increase" or "decrease" pushbuttons provided remote control size selection.

It was soon found, however, that as higher production was required by a mill, the scarfing station frequently became the major bottleneck, particularly when the frequency of variation of billet or bloom size increased, as the increased number of machine adjustments required often caused the operators to adjust the machine incorrectly. Sometimes these errors resulted because the operator received incorrect size information from the rolling schedule or from mill operators. Errors in size adjustment of the machine can result in damage to the machine,

in poorly scarfed product, or in safety hazards in the improper adjustment of the gas selector valves.

The foregoing problems prompted consideration of the possibility of eliminating manual requirements and operator-error almost entirely through the development of a scarfing apparatus which would be self-sizing. Such an apparatus should preferably require an operator only to energize a master switch so as to initiate operation of the machine, which in turn would automatically adjust itself rapidly to suit the bloom size and to select the proper gas valving to process any section of steel presented thereto.

The main object of this invention is to provide an improved machine for thermochemically scarfing the four longitudinal surfaces of any of a succession of different sized rectangular metal bodies, which machine has scarfing heads that adjust themselves automatically so that the size and shape of the opening provided by the heads, and the effective widths of the gas passages, corresponds to the size and shape of the workpiece to be processed. The invention proposes a method of sizing which is not only rapidly accomplished but does not require the operator to keep informed of the dimensions of each incoming workpiece to be scarfed.

According to the invention, a scarfing machine is provided for thermochemically conditioning the longitudinal surfaces of successive rectangular metal workpieces having different cross-sectional dimensions when such workpieces are longitudinally propelled through the apparatus, said apparatus being entirely self-sizing to automatically adjust itself to suit any size rectangular section to be processed, said apparatus having top, first side, bottom and second side scarfing units, each unit being adapted for scarfing a corresponding surface of the metal workpiece. Each scarfing unit has a gas selector valve assembly associated with it for opening and closing off gas ports along the respective working surface thereof so that the operating width of each unit can be adjusted to correspond to the size of the workpiece. Means are provided for lowering the top and first side scarfing units simultaneously until the top unit contacts the top surface of the workpiece. Means are also provided for concurrently raising the bottom and second side scarfing units simultaneously, until the bottom unit contacts the bottom surface of the workpiece. Means responsive to such vertical movement are provided for adjusting the gas selector valves associated with the first side and second side scarfing units so that their operating width correspond to the thickness of the workpiece. Means are provided for laterally moving the first side and top scarfing units simultaneously, until the first side unit contacts the side of the workpiece. Means operating concurrently therewith are provided for laterally moving the second side and bottom units simultaneously, until the second side units contacts the opposite side of the workpiece. Finally, the gas selector valves associated with the top and bottom units are adjusted by means responsive to such laterally movement so that their operating width corresponds to the width of the workpiece.

A basic difference between the present apparatus and apparatus of the prior art is that according to our invention the operator does not pre-adjust the machine ahead of time and thereafter insert the workpiece into the mouth of the machine. Instead, the apparatus is so constructed that the workpiece is fed into the mouth of the machine while all of the scarfing units are in a completely retracted position. Then, upon the closing of a master switch, the scarfing units move toward the workpiece until they become completely closed around it. At this point the scarfing cycle is automatically initiated through an appropriate system of timers. All four scarfing units are automatically adjusted by the energizing of one master

switch, and the operator of the machine need neither know the size of the workpiece, nor be in the vicinity of the scarfing machine during any part of the scarfing cycle.

All of the prior art scarfing machines for scarfing all four sides of a rectangular metal workpiece require the operator to pre-set the scarfing units ahead of time to scarf a workpiece of known dimensions. The operator must know the size of the workpiece in advance before he can pre-set the machine. Usually, this requires the operator to make four separate adjustments, one for each scarfing unit. Even with the more recent machines employing remote controlled motorized drives for adjusting each scarfing unit, the process remains quite time-consuming and constitutes a real bottleneck in a mill producing billets or blooms over a size range.

Because of the intense heat and molten steel and slag spatter which exists adjacent the scarfing area, the operator's pulpit must be located a good distance away from the machine. This would make it impractical, if not impossible, for an operator to attempt visually to adjust any prior art machine to scarf a workpiece whose exact dimensions are not known to him.

In the drawings:

FIGURE 1 is a front elevational view of a self-sizing scarfing apparatus including a control system therefor, the apparatus being shown at a point in the overall cycle wherein the top and left side and bottom and right side scarfing units have already moved vertically until the top and bottom units have contacted the workpiece;

FIGURE 2 is a front elevational view similar to FIGURE 1, in which the control system is not reproduced, but showing the relative position of the apparatus after all of the scarfing units have sized themselves about the workpiece, and

FIGURE 3 is an isometric elevational view of part of the apparatus shown in FIGURE 1, this view illustrating only the bottom and right side scarfing units, shown in completely retracted position.

The self-sizing scarfing machine consists essentially of a main frame **10** to which are mounted vertical acting air cylinders **11** and **12** respectively. These cylinders serve to raise and lower the left hand mounting plate assembly **13** and the right hand mounting plate assembly **14** respectively which ride in vertical roller ways (not shown) in frame **10**. The left hand mounting plate assembly **13** includes air cylinders **15** and **16**, upper horizontal slide assembly **17**, edge horizontal slide **18**, and carrier plate assemblies **19** and **20** respectively. Mounted on the carrier plate assemblies **19** and **20** are scarfing units **21** and **22** respectively. The scarfing units may be of the type disclosed in Patent No. 2,838,431.

Carrier plate assemblies **19** and **20** are connected to horizontal slides **17** and **18** respectively which ride in horizontal roller ways (not shown) in the left hand mounting plate assembly **13**. The horizontal slides **17** and **18** are connected to, and thus motivated by, the air cylinders **15** and **16** respectively. Effectively then, the scarfing units **21** and **22** are horizontally movable by air cylinders **15** and **16** respectively. The right hand mounting plate **14** is similarly assembled with air cylinders **24** and **23** horizontally motivating the lower slide assembly **25** and edge slide assembly **26** respectively, which horizontally moves scarfing units **27** and **28** mounted upon carrier plates **90** and **91** which in turn are respectively connected thereto.

With the scarfing units in the normally retracted position, pressure is applied through port **29** to air cylinder **11** which retains the left hand mounting plate assembly **13**, in a stopped "up" position. Air cylinder **12** is not pressurized and thus the right hand mounting plate assembly **14** remains in a stopped "down" position. Pressure applied through ports **31** and **34** to air cylinders **16** and **23** respectively maintains the horizontal slide assemblies **18** and **26** respectively in a stopped "out" position. Pressure applied through ports **33** and **32** to air cylinders **15** and **24** respectively maintains upper horizontal slide assembly **17** and lower horizontal slide assembly **25** in a stopped "out" position. The vertical distance between scarfing units **21** and **27** as well as the horizontal distance between scarfing units **22** and **28** are such as to provide a maximum machine opening.

The scarfing cycle begins with the scarfing units in completely retracted position. The bloom or billet to be scarfed is rolled up to the machine so that its end enters the mouth of the machine, and is then stopped in that position between the four scarfing units. The workpiece remains stationary in this position until the scarfing cycle has begun. All phases of the scarfing cycle are initiated by the closing of a master switch **81**. When the master switch **81** is closed, air cylinders **11** and **12** respectively cause the upper scarfing unit **21** and the lower scarfing unit **27** to move vertically until they contact the upper and lower surfaces respectively of the metal workpiece. In so doing, sizing arms **35** and **36** move vertically therewith into engagement with stops **30** and **37** respectively, which in turn move piston rods **40** and **38** so that their respective pistons **41** and **39** are positioned such that the gas ports within scarfing units **28** and **22** will correspond to the thickness of the workpiece to be scarfed. The pistons **41** and **39** moving within manifolds connected to each scarfing unit form a gas selector valve assembly, which may be of the type shown in U.S. Patent No. 3,016,947, issued to S. Allan.

As soon as the scarfing units **21** and **27** contact the upper and lower surfaces respectively of the workpiece, the air cylinders **16** and **23** cause scarfing units **22** and **28** respectively to close upon the edges of the workpiece. In so doing, the pusher plates **42** and **43** which are welded to carrier plates **91** and **20** respectively come into contact with and horizontally shift the carrier plates **19** and **90**. Scarfing units **21** and **27** mounted respectively on the carrier plates **19** and **90** are moved therewith horizontally so that their working surfaces correspond to the width of the workpiece. At the same time, sizing arms **44** and **45** moving horizontally with carrier plates **91** and **20** to which they are respectively attached, engage stops **92** and **93**, respectively and move the piston rods **46** and **47** so that their respective selector valve pistons **48** and **49** are positioned wherein the gas porting in the scarfing units **27** and **21** corresponds to the width of the workpiece.

Upon scarfing units **28** and **22** contacting the edges of the metal body, the gases necessary for scarfing, such as fuel gas and oxygen, are immediately turned on by the timer operated automatic control system, and scarfing of the metal body, now moving through the machine, takes place. Opening of the master switch shuts off the gases used for scarfing and moves all the scarfing units to their fully retracted position.

The control system forms a particularly valuable part of the present invention, which enables the machine to size itself rapidly for scarfing any size rectangular metal body presented thereto. During sizing the left hand mounting plate assembly **13** and consequently scarfing unit **21** moving therewith is lowered until said scarfing unit contacts the surface of the metal body, by reducing the pressure applied through port **29** of air cylinder **11**. Simultaneously, the right hand mounting plate assembly and therefore scarfing unit **27** moving therewith is raised until said scarfing unit contacts the lower surface of the metal body by applying air pressure through port **87** to air cylinder **12**.

In order to achieve a smooth rapid movement during vertical sizing, it is necessary to apply a greater pressure to air cylinder **12** than is necessary to merely overcome the weight of the right hand mounting plate assembly **14** in addition to the frictional force. Similarly, it is necessary to amply reduce the pressure to air cylinder **11** in order to smoothly and rapidly lower the left hand

mounting plate assembly **13** until the scarfing unit **21** rests upon the upper surface of the metal body.

When upper scarfing unit **21** and lower scarfing unit **27** contact the metal body they would tend to hug it with such force as to make it extremely difficult for the pusher brackets **42** and **43** to horizontally shift scarfing units **21** and **27** so as to expose a working surface corresponding to the width of the metal body. To overcome this problem, the control system serves to increase the pressure through port **29** to air cylinder **11** while causing a decrease in the pressure applied through port **87** to air cylinder **12** as soon as scarfing units **21** and **27** contact the upper and lower surfaces respectively of the metal body. In this way, there is a reduced riding force of scarfing units **21** and **27** acting upon the upper and lower surfaces respectively of the metal body. Scarfing units **21** and **27** are now substantially more free to be shifted horizontally as the edge scarfing units **22** and **28** approach the edge surfaces of the metal body.

Complete vertical movement of all scarfing units is achieved through the left hand vertical and right hand vertical subsystems which make use of a common solenoid valve **50** and a common primary air supply **51**. Complete horizontal movement is similarly attained through the left hand horizontal and right hand horizontal subsystems which make use of a common solenoid valve **52** as well as the common primary air supply **51**.

The left hand vertical control subsystem closes and retracts the air cylinder **11**. It consists of a pilot operated 3-way valve **53** operatively connected to port **29** of air cylinder **11**, a pressure reducing regulator **54** connected to the inlet of 3-way valve **53**, and a diaphragm type pilot operated relief valve **55** connected in parallel between regulator **54** and 3-way valve **53**, the pilot operated relief valve **55** being operatively connected to a regulator **56** supplying a loading pressure to the pilot side of relief valve **55** and a second regulator **57**, supplying a higher pressure than said loading pressure, connected to a normally closed pilot operated valve **58**, the outlet of which is also connected to the pilot side of pressure relief valve **55**.

The right hand vertical control subsystem closes and retracts the air cylinder **12**. This subsystem is identical to the left hand vertical subsystem above described except that the pilot loading pressure to relief valve **64** is applied through a normally open pilot operated valve **59**. As shown, the 3-way valve **60** has one port open to discharge to the atmosphere while the other outlet is connected to port **87** of air cylinder **12**. The system also includes regulators **61**, **62** and **63**.

The edge horizontal control subsystem closes and retracts air cylinders **16** and **23**. This subsystem comprises a pressure reducing regulator **65** connected from the primary air supply line **51** to a pilot operated 4-way valve **66**. The 4-way valve has one outlet which is always open to the atmosphere. One of the remaining outlets is connected via lines **69** to ports **31** and **34** of air cylinder **16** and **23** respectively. The other outlet from the 4-way valve **66** is connected via lines **70** to ports **67** and **68** of air cylinders **16** and **23** respectively.

The 4-way valve is actuated by solenoid valve **52** which is normally closed when the scarfing units are in retracted position and therefore the outlet of said valve connected to lines **70** will be closed off while the outlet to lines **69** will be open.

The top and bottom horizontal control subsystem only closes and retracts air cylinders **15** and **24**. This subsystem comprises a pressure reducing regulator **71** connected from the primary air supply line **51** to a 4-way valve which has one outlet always open to the atmosphere. One of the remaining outlets is connected via lines **76** to ports **32** and **33** of cylinders **24** and **15** respectively. The other outlet from said 4-way valve **74** is connected via lines **75** to ports **78** and **77** of air cylinders **24** and **15** respectively.

Said 4-way valve is actuated by solenoid valve **79** which is normally closed when the scarfing units are in retracted position, and therefore the outlet of said valve connected to lines **75** will be closed off while the outlet to lines **76** will be open.

With the metal body positioned in the machine, all scarfing units in completely retracted position, the operator merely closes a scarfing switch **81**. Closing of the scarf switch energizes solenoid valve **50** which opens, whereupon pressure from line **51** is applied to valve **53**, thereby closing off its lower port such that the primary air pressure previously applied to air cylinder **11** through port **29** is now cut-off. At the same time, reduced pressure delivered by regulator **54** is allowed to pass through valve **53** to port **29** of air cylinder **11**. Relief valve **55** relieves the high pressure within the air cylinder **11** when such pressure is equal to or greater than the pressure delivered by regulator **54**. Said relief valve **55** has been set by means of a loading pilot regulator **56** to relieve at a pressure equal to that achieved by regulator **54**. This causes the piston within air cylinder **11** to lower, thereby lowering frame **13** and scarfing units **21** and **22** which are connected thereto.

At the same time, the solenoid valve **50** having been energized by the closing of the scarf switch **81**, also causes pressure to be applied from main line **51** to valve **60**, thereby closing off its lower port, such that pressure delivered by regulator **61** is allowed to pass through valve **60** to port **87** of air cylinder **12**.

This causes the piston within air cylinder **12** to rise, thereby raising frame **14** and scarfing units **27** and **28** which are connected thereto. Relief valve **64** has been set by means of a loading pilot regulator **62** to relieve at a pressure equal to that delivered by regulator **61**. At this point in the cyle, scarfing units **21** and **27** are moving into contact with the upper and lower surfaces respectively of the metal body.

Closing of the scarf switch **81** also starts timer **80** which is set to energize solenoid valves **52** and **79** at a predetermined interval after the solenoid valve **50** has been energized. When solenoid valve **52** then becomes energized, pressure is applied from line **51** to valve **66** which changes its porting such that pressure is no longer delivered to lines **69** but instead is delivered to lines **70**. This reversal of porting in valve **66** causes the piston in each of air cylinders **16** and **23** to move scarfing units **22** and **28** respectively to contact the metal body.

Upon solenoid valve **79** being energized by timer **80**, pressure is applied from line **51** to valve **74** which changes its porting such that pressure is no longer delivered to lines **76** but instead is delivered to lines **75**. This reversal of porting in valve **74** allows the piston in each of air cylinders **15** and **24** and scarfing units **21** and **27** mounted on carrier plates **90** and **91** which are connected thereto, to be more easily shifted horizontally by pusher plates **43** and **42** respectively so that the working surfaces of such scarfing units correspond to the width of the metal body to be scarfed. It is particularly important to point out that pressure delivered through solenoid valve **79** in addition to being applied to valve **74**, also is applied to valve **58** thus opening this normally closed valve, thereby allowing pressure delivered from regulator **57**, which is greater than that already delivered from regulator **56**, to shut off the bleed on the pancake relief valve **55**. When the normal bleed on said relief valve is cut off, it will naturally cause an increased pressure buildup to port **29** of air cylinder **11**, thus reducing the riding force of scarfing unit **21** upon the upper surface of the metal body. This will allow scarfing unit **21** to be shifted across the upper surface of the metal body with a minimum of friction.

Similarly, pressure delivered through solenoid valve **79** is also applied to valve **59**, thus closing this normally open valve, and preventing pressure delivered from regulator **62**, which is greater than that delivered by regulator **63**, from loading the pancake relief valve **64**, with the result

that more air is bled off by such relief valve. This causes a decrease in pressure to port 87 of air cylinder 12, thereby reducing the riding force of scarfing unit 27 upon the lower surface of the metal body. This will similarly permit scarfing unit 27 to be shifted across the lower surface of the metal body with a minimum of friction.

Another timer (not shown) is preset to turn on the process gases to all scarfing units at a time immediately after all sizing has taken place. When this occurs, an electrical disconnecting means such as, for example, a pressure switch in the process gas lines (not shown) de-energizes solenoid valve 79; pressure is no longer applied to valves 59, 58 and 74 and thus the pressure conditions are established for normal scarfing operation.

Opening of the scarf switch shuts off the scarfing gases and returns the units to the fully retracted position.

Although the preferred embodiment of this invention has been described in detail, it will be appreciated that modifications may be made and that some parts may be used without others, all within the contemplation and spirit of the invention. For example, the top scarfing unit and the right side scarfing unit could have been mounted upon the upper carrier plate, while the bottom and left side scarfing units were mounted upon the lower carrier plate, by obvious modification to the control system disclosed and by appropriate mechanical changes. Also, while the scarfing units and gas selector valve assemblies moving therewith are motivated by pneumatic control means, a mechanical gearing system interconnecting such parts for synchronizing their movement with one another could be substituted therefor.

What is claimed is:

1. An automatic self-sizing thermochemical scarfing apparatus for scarfing successive rectagnular metal workpieces having different cross-sectional dimensions, although such dimensions are not known to the scarfing machine operator, said apparatus having top, first side, bottom and second side scarfing units, each of said units being adapted for scarfing a corresponding surface of a metal workpiece; a gas selector valve assembly associated with each of said scarfing units for opening and closing off gas ports along the respective working surface thereof; means for lowering the top and first side scarfing units simultaneously, until the top scarfing unit contacts the top surface of the workpiece; means operating concurrently therewith for raising the bottom and second side scarfing units simultaneously, until the bottom scarfing unit contacts the bottom surface of the workpiece; means responsive to such vertical movement for adjusting the pieces having different cross-sectional dimensions, algas selector valves associated with said first side and second side scarfing units so that their operating width corresponds to the thickness of the workpiece; means for laterally moving said first side scarfing unit and said top scarfing unit until the first side scarfing unit contacts a side of the workpiece; means operating concurrently therewith for laterally moving said second side scarfing unit and said bottom scarfing unit simultaneously until the second side scarfing unit contacts the opposite side of the workpiece; and means responsive to such lateral movement for adjusting the gas selector valve assemblies associated with said top and bottom scarfing units so that their operating width corresponds to the width of the workpiece.

2. An automatic self-sizing thermochemical scarfing apparatus for scarfing successive rectangular metal workpieces having different cross-sectional dimensions, although such dimensions are not known to the scarfing machine operator, said apparatus having top, left side, bottom and right side scarfing units, each of said units being adapted for scarfing a corresponding surface of a metal workpiece; a gas selector valve assembly associated with each of said scarfing units for opening and closing off gas ports along the respective working surface thereof; means for lowering the top and left side scarfing units simultaneously, until the top scarfing unit contacts the top surface of the workpiece; means operating concurrently therewith for raising the bottom and right side scarfing units simultaneously, until the bottom scarfing unit contacts the bottom surface of the workpiece; means responsive to such vertical movement for adjusting the gas selector valves associated with said left side and right side scarfing units so that their operating width corresponds to the thickness of the workpiece; means for laterally moving said left side scarfing unit and said top scarfing unit until the left side scarfing unit contacts a side of the workpiece; means operating concurrently therewith for laterally moving said right side scarfing unit and said bottom scarfing unit simultaneously until the right side scarfing unit contacts the opposite side of the workpiece; and means responsive to such lateral movement for adjusting the gas selector valve assemblies associated with said top and bottom scarfing units so that their operating width corresponds to the width of the workpiece.

3. Apparatus as claimed in claim 1 including control means for returning all of said scarfing units to their origial completely retracted position upon completing the scarfing of each successive workpiece, said control means being energizable by a single master switch.

4. An automatic self-sizing thermochemical scarfing machine for scarfing successive rectangular metal workpieces having different cross-sectional dimensions, although such dimensions are not known to the operator of such machine, said machine comprising a main frame; upper and lower complementary carrier plates carried by said frame and movable vertically therein; a top scarfing unit and a first side scarfing unit carried by said upper carrier plate and slidably mounted thereon for lateral movement with respect thereto, each of said scarfing units having a gas selector valve assembly associated therewith for opening and closing off gas ports along the respective working surface thereof to adjust the width of each gas stream issuing therefrom to correspond to the surface to be scarfed thereby; a bottom scarfing unit and a second side scarfing unit carried by said lower carrier plate and slidably mounted thereon for lateral movement with respect thereto, said bottom unit and said second side unit each having a gas selector valve assembly associated therewith for opening and closing off gas ports along the respective working surface thereof to adjust the width of each gas stream issuing therefrom to correspond to the surface to be scarfed thereby; means interconnecting each of said side scarfing units with a respective gas selector valve associated with each vertically movable scarfing unit such that lateral movement of each side scarfing unit produces a responsive movement of the respective gas selector valve associated with each vertically movable scarfing unit; and means interconnecting each of said vertically movable top and bottom scarfing units with a respective gas selector valve associated with each of said side scarfing units such that vertical movement of said top and bottom units produces a responsive movement of the respective selector valve associated with each of said side scarfing units.

5. An automatic self-sizing thermochemical scarfing machine for scarfing successive rectangular metal workpieces having different cross-sectional dimensions, although such dimensions are not known to the operator of such machine, said machine comprising a main frame; upper and lower complementary carrier plates carried by said frame and movable vertically therein by vertical pneumatic cylinders secured to said frame; a top scarfing unit and a first side scarfing unit carried by said upper carrier plate and slidably mounted thereon for lateral movement with respect thereto, each of said scarfing units having a gas selector valve assembly associated therewith for opening and closing off gas ports along the respective working surface thereof to adjust the width of each gas stream issuing therefrom to correspond to the surface to be scarfed thereby; a bottom scarfing unit and a second side scarfing unit carried by said lower carrier plate and slidably mounted thereon for lateral movement

with respect thereto, said bottom unit and said second side unit each having a gas selector valve assembly associated therewith for opening and closing off gas ports along the respective working surface thereof to adjust the width of each gas stream issuing therefrom to correspond to the surface to be scarfed thereby; horizontal pneumatic cylinders secured to said frame and operatively connected to said scarfing units to provide for the said lateral movement thereof; means interconnecting each of said side scarfing units with a respective gas selector valve associated with each vertically movable scarfing unit such that lateral movement of each side scarfing unit produces a responsive movement of the respective gas selector valve associated with each vertically movable scarfing unit; and means interconnecting each of said vertically movable top and bottom scarfing units with a respective gas selector valve associated with each of said side scarfing units such that vertical movement of said top and bottom units produces a responsive movement of the respective selector valve associated with each of said side scarfing units.

6. Apparatus as claimed in claim 5 including timer means connected by circuitry with solenoid valve control means for applying air pressure in sequence, first to said vertical pneumatic cylinders for moving said top and bottom scarfing units into contact with the surfaces of the workpiece, and thereafter to said horizontal pneumatic cylinders for moving said side scarfing units into contact with the workpiece, and a master scarf switch connected by circuitry to said timer for actuating same.

7. Apparatus as claimed in claim 6 including pressure regulating valves in circuitry with said timer and solenoid valve control means for controlling the pressure to said vertical pneumatic cylinders so as to reduce the frictional forces to be overcome by said horizontal pneumatic cylinders in shifting said top and bottom scarfing units laterally as said side scarfing units are moved thereby into contact with the workpiece.

References Cited by the Examiner

UNITED STATES PATENTS

2,276,329	3/1942	Miller et al.	266—23
2,290,271	7/1942	Buchnam	266—23
2,308,646	1/1943	Celborg	266—23
2,323,977	7/1943	Celborg et al.	266—23
2,392,806	1/1946	Bucknam et al.	266—23
2,429,326	10/1947	Miller et al.	266—23
2,447,081	8/1948	Miller et al.	266—23
2,448,657	9/1948	Bucknam	266—23
2,479,624	8/1949	Jones et al.	266—23
2,513,425	7/1950	Logosco	148—9.5
2,515,301	7/1950	Hughey	158—27.43
2,568,938	9/1951	Tyrner	266—23
3,061,297	10/1962	Gordon	148—9.5

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PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,300,200 Dated January 24, 1967

Inventor(s) S. Allan and W.C. Weidner

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In claim 1, line 49, cancel the entire line, namely

"pieces having different cross-sectional dimensions, al-"

SIGNED AND
SEALED
OCT 20 1970

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents