

PATENT SPECIFICATION

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(21) Application Nos. 32600/75 (22) Filed 4 Aug. 1975 (19)
32601/75

(23) Complete Specification filed 4 Aug. 1976

(44) Complete Specification published 27 Sept. 1978

(51) INT. CL.² B21K 25/00 B21J 13/03

(52) Index at acceptance
B3H 5C2B

(72) Inventors HUGH JEREMY WILLIS EDWARDS and
CEDRIC GEORGE BIRKS



(54) IMPROVEMENTS IN OR RELATING TO A SWAGING PRESS

(71) We, CCL SYSTEMS LIMITED, of Cabco House, 296—304 Ewell Road, Surbiton, Surrey, England, a British company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a press for use in swaging a metal sleeve on to a concrete-reinforcing bar or wire rope. In one specific example, the press can be used to splice together pairs of reinforcing bars in end-to-end or side-by-side relation even when numerous bars are closely packed together in an array. The press is particularly useful in confined spaces such as can occur in applications in the civil engineering and mining industries, and in marine engineering.

According to this invention, a press for use in swaging a metal sleeve on to a concrete reinforcing bar or wire rope, comprises a piston reciprocable in a cylinder, two arms extending from one end of the cylinder on opposite sides of the piston, the distance between the outer surfaces of the arms being less than the outer diameter of the cylinder, a first die part secured to an exposed end of the piston, and a co-operable second die part secured to a bridging member, the bridging member being dimensioned and arranged to bridge the arms and being detachably engageable upon the arms.

Preferably, the arms each have an inwardly-directed flange and the bridging member has corresponding lateral recesses, whereby the bridging member may be held in engagement with the side arms. In an especially preferred form of the press, these flanges and recesses are arranged to engage in wedging manner.

The cylinder and arms are suitably formed of one piece of metal.

According to an especially preferred embodiment of the invention, a press for use in swaging a metal sleeve on to a concrete-reinforcing bar or wire rope, comprises:

a fluid pressure cylinder closed at one end

and having an apertured wall at its other end,

a piston working in the cylinder and having a portion of reduced diameter which extends outwards through the aperture in the end wall of the cylinder, two arms which extend from the end wall of the cylinder on opposite sides of the aperture therein, the distance between the outer surfaces of the arms being less than the outside diameter of the cylinder,

a bridging member which can be detachably engaged between the arms in spaced relation from the end wall of the cylinder, the distance between the outer surfaces of the bridging member also being less than the outer diameter of the cylinder,

and a pair of co-operating die parts disposed between the arms, the first die part being secured to the reduced diameter portion of the piston and the second die part being secured to the bridging member.

Although the press according to the invention may incorporate any suitable swaging dies, the press is particularly effective when used with and including swaging dies comprising a pair of opposed co-acting high strength metal members each provided with a longitudinally extending recess having a ribbed portion upon which at least two longitudinally extending ribs are upstanding, the ribs being positioned such that when the two metal members are in contact the ribs are equally spaced one from another around the conjoined recesses.

Each ribbed portion is preferably generally semi-cylindrical, and may contain two, three or four ribs. The lands between the ribs may be generally concave. Preferably a semi-frusto-conical portion is provided at each end of the ribbed portion in the recess, opening outwardly into a semi-cylindrical portion, the outermost edge of which is chamfered.

The bars or ropes to be joined may have plain or ribbed surfaces. The sleeve is pressed on to the bars or ropes in a single pressing direction, thus avoiding the two

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successive pressing operations in two mutually perpendicular directions necessary with some known swaging dies.

The ribs on the dies cause indentations in the swaged sleeve, ensuring an efficient distribution of metal during the swaging operation. The swaging dies may be used in any suitable swaging press, but are especially effective when used in the press according to the invention.

An embodiment of the invention is illustrated in the accompanying diagrammatic drawings, in which:

Figure 1 is a perspective view of part of a press, the bridging member being separated from the arms;

Figure 2 is a perspective view of the whole press, parts having been cut away;

Figure 3 is a view of one end of the cylinder assembly of the press illustrated in Figure 2;

Figure 4 is an end elevation of a pair of co-acting swaging dies;

Figure 5 is a longitudinal sectional view of the dies of Figure 4;

Figure 6 is a perspective view showing a sleeve to be swaged to bars by the dies of Figures 4 and 5; and

Figure 7 is a perspective view corresponding to Figure 6, but showing the swaged joint.

Referring to Figures 1 to 3, the apparatus comprises a cylinder 1 and a bridging member, or cap, 2, both formed of steel. The cylinder 1 carries two upstanding arms 3 which at their free ends have integral flanges 4 which project both inwardly towards each other and upwardly from the ends of the arms. As shown best in Figure 3, the portion of each flange 4 projecting upwardly from the arm 3 increases progressively in width from its forward end 4a to its rearward end 4b. The opposed inner faces of the two flanges are parallel and the underside 4c of each flange 4 is parallel sided. The arms 3 are integrally formed with a cylinder top 5, forming an upper end wall to the cylinder; as shown in Figure 2 the top 5 is screw-threaded at 6 into the body of the cylinder 1, but for constructional simplicity, the cylinder top 5 may be formed integrally with the body of the cylinder 1. The cylinder houses a stepped piston 7 which contains a return plate spring 8 engaged between a shoulder 9 in the piston base and the end 10a of an internal spring guide 10 in the cylinder. An annular seal 11 engages the smaller diameter portion of the piston and the larger diameter portion of the piston carries sealing rings 12. The lower end of the cylinder is closed by a plate 13 through which extend ports (not shown) for the passage of operating fluid.

A die seating 14 is located on and secured to the upper face of the piston 7 between the

arms 3. The seating may receive a first die part according to Figures 4 to 7, or may itself be shaped to constitute the said die part.

The bridging member or cap 2 comprises a block 15 constituting a second die part having a large flat top 16 from two sides of which depend flanges 17. The lower side portions of the block 15 have side flanges 18. The flanges 17 are of tapering form and dimensioned and arranged to complement the shape of the top part of the projections 4 on the arms 3 of the cylinder 1. The upper shoulders of the flanges 18 are arranged to complement the underside 4c of the flanges 4. The lower end of the block 15 is shaped at 19 to constitute a die seating which may receive a die part to co-operate with that secured to the piston, or may itself constitute the die part.

In use, the cap 2 is slid on to the cylinder assembly to cause the flanges 18 to engage under the surfaces 4c, the movement being limited by the wedging action of the flanges 17 on the upstanding parts of the flanges 4. A sleeve (not shown) together with a reinforcing bar or wire rope to which it is to be spliced is located in the space between the dies at 14 and 19, suitably before assembly of the cap upon the arms. The piston 7 is actuated by hydraulic or pneumatic pressure to move the lower die part towards the cap to compress the sleeve onto the bar. In use the operating pressure of the fluid will be of the order of 600—1000 bars. This pressure is resisted by the engagement of flanges 18 with the surfaces 4c, while the wedging action of the flanges 17 safeguards against the cap being moved out of engagement with the cylinder.

The press may be made in relatively small size; for example in a press intended for use in splicing concrete-reinforcement bars of 25mm or 32mm diameter the cylinder can measure from 340 to 380 mm high and 150—180 mm wide. Commonly, many such bars are arranged in close proximity to one another, the spacing between individual bars being perhaps as little as 50 mm and it is required to splice an additional bar on to the end of one of the bars in the array. In such a case the ends of the two bars to be connected and the splicing sleeve are assembled in the desired positions and the two arms 3 of the press are located on opposite sides of this assembly. The cap is then slid on to engage the arms, following which the piston is actuated to press the splice onto the bars. The piston is retracted by the plate spring. After completion of the splice, the cap is disengaged from the arms and the press is withdrawn.

Referring now to Figures 4 to 7, swaging dies 21 comprise a pair of opposed metal die parts 22 each securable in a press, for



example such as illustrated in Figures 1 to 3. Each die part has a recess 23 (Figure 5) comprising a substantially central semi-cylindrical portion 25, opening into a further semi-cylindrical portion, the extreme end of which, at the side of the die part, is chamfered as at 26. A die half 27 is constituted by the inner surface of portion 24 of each die part. The die half has four ribs 28 spaced equidistantly apart, so that the total die is of octagonal shape. The lands 29 between adjacent ribs 28 are generally arcuate in cross section, as shown.

The die parts are located in a press, preferably according to Figures 1 to 3. As shown in Figure 5, screw holes 30 are provided in the die parts for connecting the die parts to such a press, the upper die part constituting the block 15 and flanges 18 of the bridging member or cap, while the lower die part constitutes the member 14.

Figures 6 and 7 show the press being used to secure together two reinforcing bars 31 by means of a splice tube 32. One bar 31 is placed in one end of the tube and then the two parts are swaged together in the press. The second bar is then located in the other end portion of the tube. The connection is made by swaging along the length of the splice tube in successive bites. In each case the metal of the splice is deformed into tight engagement with the bar, with little or no elongation of the splice. As a consequence the number of bits necessary to secure a splice to the bars can be reduced to a minimum. The lands 29 between the ribs caused the formation of ribs 33 in the formed connection. In an evaluation a mean tensile strength in excess of that required was achieved with little significant difference between maximum and minimum values.

Reference is made to our copending Application 52516/77 (Serial No. 1526222).

45 WHAT WE CLAIM IS:—

1. A press for use in swaging a metal sleeve on to a concrete-reinforcing bar or wire rope, comprising a piston reciprocable in a cylinder, two arms extending from one end of the cylinder on opposite sides of the piston, the distance between the outer surfaces of the arms being less than the outer diameter of the cylinder, a first die part secured to an exposed end of the piston, a co-operable second die part secured to a bridging member, the bridging member being dimensioned and arranged to bridge the arms and being detachably engageable upon the arms.

2. A press according to Claim 1, in which the arms each have an inwardly-directed flange and the bridging member has corresponding lateral recesses whereby the bridging member may be held in engagement with the side arms.

3. A press according to Claim 2, in which the flanges and recesses are arranged to engage in wedging manner.

4. A press according to any preceding claim, in which the cylinder and arms are formed of one piece of metal.

5. A press for use in swaging a metal sleeve on to a concrete-reinforcing bar or wire rope, comprising:

a fluid pressure cylinder closed at one end and having an apertured wall at its other end,

a piston working in the cylinder and having a portion of reduced diameter which extends outwards through the aperture in the end wall of the cylinder, two arms which extend from the end wall of the cylinder on opposite sides of the aperture therein, the distance between the outer surfaces of the arms being less than the outside diameter of the cylinder,

a bridging member which can be detachably engaged between the arms in spaced relation from the end wall of the cylinder, the distance between the outer surfaces of the bridging member also being less than the outer diameter of the cylinder,

and a pair of co-operating die parts disposed between the arms, the first die part being secured to the reduced diameter portion of the piston and the second die part being secured to the bridging member.

6. A press for use in swaging a metal sleeve on to a concrete-reinforcing bar or wire rope, substantially as described with reference to Figures 1 to 3 of the accompanying drawings.

7. A press for swaging a sleeve on to a concrete-reinforcing bar or wire rope according to any preceding claim, including, swaging dies comprising a pair of opposed co-acting high strength metal members each provided with a longitudinally extending recess having a ribbed portion in which at least two longitudinally extending ribs are upstanding, the ribs being positioned such that when the two metal members are in contact the ribs are equally spaced one from another around the conjoined recesses.

8. A press according to Claim 7, in which each ribbed portion is generally semi-cylindrical.

9. A press according to Claim 7 or 8, in which three ribs are provided on each ribbed portion.

10. A press according to Claim 7 or 8, in which four ribs are provided on each ribbed portion.

11. A press according to any of Claims 7 to 10 in which the lands between each pair of adjacent ribs are generally arcuate in cross section.

12. A press according to any of Claims 7 to 11 in which each recess has a semi-frusto-conical portion at either side of the



example such as illustrated in Figures 1 to 3. Each die part has a recess 23 (Figure 5) comprising a substantially central semi-cylindrical portion 25, opening into a further semi-cylindrical portion, the extreme end of which, at the side of the die part, is chamfered as at 26. A die half 27 is constituted by the inner surface of portion 24 of each die part. The die half has four ribs 28 spaced equidistantly apart, so that the total die is of octagonal shape. The lands 29 between adjacent ribs 28 are generally arcuate in cross section, as shown.

The die parts are located in a press, preferably according to Figures 1 to 3. As shown in Figure 5, screw holes 30 are provided in the die parts for connecting the die parts to such a press, the upper die part constituting the block 15 and flanges 18 of the bridging member or cap, while the lower die part constitutes the member 14.

Figures 6 and 7 show the press being used to secure together two reinforcing bars 31 by means of a splice tube 32. One bar 31 is placed in one end of the tube and then the two parts are swaged together in the press. The second bar is then located in the other end portion of the tube. The connection is made by swaging along the length of the splice tube in successive bites. In each case the metal of the splice is deformed into tight engagement with the bar, with little or no elongation of the splice. As a consequence the number of bites necessary to secure a splice to the bars can be reduced to a minimum. The lands 29 between the ribs caused the formation of ribs 33 in the formed connection. In an evaluation a mean tensile strength in excess of that required was achieved with little significant difference between maximum and minimum values.

Reference is made to our copending Application 52516/77 (Serial No. 1526222).

WHAT WE CLAIM IS:—

1. A press for use in swaging a metal sleeve on to a concrete-reinforcing bar or wire rope, comprising a piston reciprocable in a cylinder, two arms extending from one end of the cylinder on opposite sides of the piston, the distance between the outer surfaces of the arms being less than the outer diameter of the cylinder, a first die part secured to an exposed end of the piston, a co-operable second die part secured to a bridging member, the bridging member being dimensioned and arranged to bridge the arms and being detachably engageable upon the arms.

2. A press according to Claim 1, in which the arms each have an inwardly-directed flange and the bridging member has corresponding lateral recesses whereby the bridging member may be held in engagement with the side arms.

3. A press according to Claim 2, in which the flanges and recesses are arranged to engage in wedging manner.

4. A press according to any preceding claim, in which the cylinder and arms are formed of one piece of metal.

5. A press for use in swaging a metal sleeve on to a concrete-reinforcing bar or wire rope, comprising:

a fluid pressure cylinder closed at one end and having an apertured wall at its other end,

a piston working in the cylinder and having a portion of reduced diameter which extends outwards through the aperture in the end wall of the cylinder, two arms which extend from the end wall of the cylinder on opposite sides of the aperture therein, the distance between the outer surfaces of the arms being less than the outside diameter of the cylinder,

a bridging member which can be detachably engaged between the arms in spaced relation from the end wall of the cylinder, the distance between the outer surfaces of the bridging member also being less than the outer diameter of the cylinder,

and a pair of co-operating die parts disposed between the arms, the first die part being secured to the reduced diameter portion of the piston and the second die part being secured to the bridging member.

6. A press for use in swaging a metal sleeve on to a concrete-reinforcing bar or wire rope, substantially as described with reference to Figures 1 to 3 of the accompanying drawings.

7. A press for swaging a sleeve on to a concrete-reinforcing bar or wire rope according to any preceding claim, including, swaging dies comprising a pair of opposed co-acting high strength metal members each provided with a longitudinally extending recess having a ribbed portion in which at least two longitudinally extending ribs are upstanding, the ribs being positioned such that when the two metal members are in contact the ribs are equally spaced one from another around the conjoined recesses.

8. A press according to Claim 7, in which each ribbed portion is generally semi-cylindrical.

9. A press according to Claim 7 or 8, in which three ribs are provided on each ribbed portion.

10. A press according to Claim 7 or 8, in which four ribs are provided on each ribbed portion.

11. A press according to any of Claims 7 to 10 in which the lands between each pair of adjacent ribs are generally arcuate in cross section.

12. A press according to any of Claims 7 to 11 in which each recess has a semi-frusto-conical portion at either side of the

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ribbed portion and opening outwardly thereof.

- 5 13. A press according to Claim 12, in which each semi-frusto-conical portion opens into a semi-cylindrical portion, the outermost edge of which is chamfered.

14. A press including swaging dies for use in swaging a sleeve on to a concrete-reinforcing bar or wire rope, substantially

as described with reference to Figures 4 to 7 10 of the accompanying drawings.

By:

KINGS PATENT AGENCY LTD.,

146b, Queen Victoria Street,
London, EC4W 5AT.

B. T. KING,

Registered Patent Agent.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1978.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY
from which copies may be obtained.