EXTRACTOR FOR STRIPPING PIPES AND OTHER HOLLOW PARTS FROM MOULDS AND SIMILAR OPERATIONS

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ABSTRACT
Extractor for extracting pipes from centrifugal casting moulds. The extractor has jaws capable of radially engaging the inner face of the pipe and a fluid-actuated device for urging the jaws into engagement with the pipe in opposition to spring return means. The device is so arranged that each jaw is urged into engagement independently of the other jaws. The device may be a rubber bulb inflated by the fluid or a series of radial piston and cylinder devices communicating with a common supply of fluid under pressure.

9 Claims, 7 Drawing Figures
EXTRACTOR FOR STRIPPING PIPES AND OTHER HOLLOW PARTS FROM MOULDS AND SIMILAR OPERATIONS

The present invention relates to an extractor for stripping hollow parts, and more particularly cast iron pipes and other tubular parts, from a mould of a centrifugal casting machine. 

It is known that centrifugal casting machines afford a high rate of production and the extraction of the still-hot pipes from the mould must be carried out very rapidly and under absolutely safe conditions. The extraction must also be automatic with no loss of time due to faulty extraction. 

Known extractors comprise jaws, clamps or claws arranged around a geometric axis of symmetry and capable of being opened or spread apart from this axis so as to grip or clamp against the inner face of the wall of the pipe to be extracted. The opening or separation of the jaws is effected by a mechanical control device having an axial rod moving in translation, or an eccentric, or a pivoted block. Further, the jaws are capable of rotating about their geometric axis of symmetry. Now, such rigid jaws controlled mechanically and having a perfect symmetry are incapable of perfectly gripping the walls of pipes having irregular surfaces. Consequently, difficulties are experienced in the extraction of the cast pipes. 

The object of the invention is to remove these drawbacks and to provide an improved rotatable extractor which has great flexibility, is easily constructed and enables pipes having an unevenness on the surface or different inside diameters to be extracted in a certain manner with no need for adjustment. 

The extractor according to the invention is of the type having a plurality of jaws carried by a jaw carrier, mounted for rotation about a fixed support having a geometric axis of symmetry, and capable of moving away from said axis in opposition to the action of resiliently yieldable return means, wherein there is fixed on the jaw carrier a device for separating the jaws on which the jaws bear individually under the action of said resiliently yieldable means which is radially expansible, at least in the region of the point at which each jaw bears thereupon, under the action of a compressed fluid. 

Thus it is sufficient to cause the jaw-separating device to cause the individual separation of each jaw in accordance with the space which exists between the retracted jaw and the corresponding portion of the inner face of the wall of the hollow cast part to be extracted from its mould. 

The jaws can therefore separate or spread apart in a symmetrical or in an asymmetrical manner, not as a function of the action of an axial symmetrical mechanical control device, but as a function of defects in the shape of the inner face of the wall of the part to be extracted so that these jaws perfectly adapt themselves to this face. 

According to one embodiment of the invention, the jaw-spreading device is an expansible core. 

Preferably, this core is a hollow bulb having an elastic wall fixed at one end on a plate or end member of a cylindrical carrying body which is rotatably mounted on the fixed axial support of the extractor, said fixed support being hollow so as to define a fluid conduit connected to a source of fluid under pressure. 

According to another embodiment, the jaw-spreading device comprises as many radial piston and cylinder devices as there are jaws, the cylinders of these devices being arranged at the end of the rotatable jaw carrier and the ends of the cylinders communicating in parallel with a single conduit of fluid under pressure located inside said jaw carrier. 

It will be understood that the forces exerted by the jaws on the inner face of the wall of the tubular product to be extracted can be very high, in particular for large pipe diameters, even when employing fluid under pressure of only a few bars, since the forces applied on the jaws are equal to the product of this pressure multiplied by the section of the pistons, which section is much larger than the area of contact of the pistons and of the jaws, whence a multiplication of the force equal to the ratio between this section and this area; the section of the radial pistons can be provided as large as the available space allows for pipes of large diameters. 

Further, even if the extractor is not perfectly centered relative to the shell or mould, the forces respectively exerted by the jaws are equal. 

Further, owing to the fact that the jaws are merely applied against the pistons without being positively connected thereto and that they are, on the other hand, connected to extracting levers, the axial forces of extraction are not born by the radial pistons of the jaws but by the levers so that the pistons have no tendency to seize. 

Further features and advantages of the invention will be apparent from the ensuing description with reference to the accompanying drawings. 

In the drawings: FIG. 1 is an assembly view of a centrifugal casting machine equipped with an extractor according to the invention; FIG. 2 is a longitudinal sectional view of this extractor; FIG. 3 is a diagrammatic view of the extractor engaged in an asymmetrical part to be extracted; FIG. 4 is a diagrammatic assembly view of a centrifugal casting machine equipped with another extractor according to the invention; FIG. 5 is a longitudinal sectional view of this extractor on a scale larger than that of FIG. 4; FIG. 6 is a partial sectional view taken along line 6—6 of FIG. 5, and FIG. 7 is a partial sectional view, similar to FIG. 5, of the extractor in the operative condition of the latter. 

With reference first to the embodiment shown in FIGS. 1—3, in FIG. 1 the invention is shown to be applied to a centrifugal pipe-casting machine. This machine comprises, as known per se, a tiltable casting ladle A which pours the molten metal into a channel B. The latter pours the metal into a shell or mould D carried by a carriage C which travels between the points a and b of a runway. Movable in the axial extension of the mould and runway, is an extractor E according to the invention. The latter is carried by an extractor carriage F. This movable carriage moves on a runway between the forward extreme point c and rear extreme point d. 

The extractor E is secured to the carriage F by a rigid fixed axial support 1 having an axis X—X and for example the general shape of a cylindrical sleeve. This support thus defines an axial conduit 2 for supplying fluid under pressure, as compressed air. The conduit 2 is enlarged at one end in the form of a screw-threaded chamber 3 for connection to piping (not shown) supplying compressed air. A cylindrical jaw-carrying body 4 is rotatably mounted on the support 1 through a conical rolling bearing 5 and a thrust ball bearing 6. Pivotally at one end at 7 to the jaw-carrying body 4 are jaw structures or jaws 8 which are interconnected at their other ends by springs 9. These jaws 8 normally bear in a first position of rest against the outer face of the body 4. Attached to the end of this body by screw threading or other means is a plate or end member 11. Fixed to the latter in a fluidtight manner, for example on a shoulder 12, is a fluid-actuable device comprising an expansible core in the form of a hollow elastic bulb 13. This core is suitably constructed, for example in a composite manner with wall means comprising an inner wall 14 of rubber or other deformable material covered with a stratified heat-insulating protecting wall 15, for example of mineral wool. 

A sealing element 16 is interposed between the end member 11 and a tubular extension portion 17 on the support 1 which opens into the interior or chamber defined by the wall means comprising the composite wall 14, 15 and end member 11. 

This core has normally an outside diameter not exceeding that of the jaw-carrying body 4. However, when it is inflated, the core 13 has a diameter exceeding that of the body 4. 

The jaws 8 have such length that their ends opposed to the pivotal connections 7 bear on the core 13, at least when the core has started to expand if not when it is deflated. 

The extractor according to the invention operates in the following manner: 

After casting, the extractor E is introduced in the usual manner into the centrifugally cast pipe T in the mould. Air or other fluid under pressure is thereafter supplied to the inner
This extractor operates in the following manner:

After casting a pipe T, the extractor E' is introduced inside the centrifugally cast pipe in the mould D. The fluid under pressure is supplied by way of the axial conduit 2*, the distributor 26 and the radial bores 24. The pistons 25 spread apart and outwardly shift the jaws members 8* in opposition to the action of the springs 9*.

When the jaws 8* come in contact with the inner wall of the pipe, the extractor, freely rotatable relative to the sleeve 1*, is driven in rotation by the pipe which is driven in rotation by the rotating mould D until the latter stops completely.

Each jaw member 8* is applied against the wall of the pipe with a force which is proportional to the pressure of the fluid and to the section of the bore 24. This force is the same for all the jaw members 8* even if the extractor E' is not perfectly on the axis of the mould or if the inner wall of the pipe T is not perfectly circular or has surface unevenness. The jaw members 8* therefore grip the pipe perfectly so as to extract it in a sure manner.

When the carriage F is drawn rearward, that is from c to d, the extractor E' draws along the pipe T and disengages it from the mould or shell D.

In the course of extraction, the pulling forces are supported solely by the levers 27 whereas the radial pistons 25 merely exert radial gripping forces. These pistons 25 are therefore not subjected to any bending force and do not seize or jam. They therefore operate under ideal conditions corresponding to minimum wear.

When the pipe T has been stripped, the conduit 2* is connected to the discharge. The springs 9* return the levers 27 of the jaw structures 8*, 27 which urge the pistons 25 towards the axis X—X. The extractor E' is then disengaged from the pipe which can be discharged.

The number of pistons 25 and corresponding jaw members 8* is not critical. The number is small for pipes of small diameter and great for pipes of large diameter. As already mentioned, the force applied by each jaw member 8* against the pipe can be increased for a given pressure of fluid by increasing the section of the bores 24 and pistons 25.

It must be understood that the invention is applicable to the extraction of pipes of plastic materials, concrete, asbestos-cement or other organic or mineral materials, from their centrifugal casting moulds or shells. It is applicable to the extraction of partially solid moulded parts which have a hollow portion.

Having now described our invention what we claim and desire to secure by Letters Patent is:

1. An extractor for extracting a tube or other hollow part having an inner face from a mould, the extractor comprising a fixed support, a jaw carrier mounted on said fixed support, a plurality of jaw structures carried by said jaw carrier and arranged symmetrically about an axis, each jaw structure being moveable away from said axis from a first position to a second position independently of the others of said jaw structures, a fluid-actuating device mounted on said jaw carrier and comprising wall means defining a chamber, portions of said wall means being respectively engageable with said jaw structures, each of said wall means portions being moveable radially of said axis independently of the others of said portions of said wall means between an inner position in which the corresponding jaw structure is arranged to move to said first position and an outer position in which the corresponding jaw structure is in said second position, resiliently yieldable means combined with said jaw structures to bias said jaw structures toward said first positions, and means for supplying fluid under pressure to said chamber whereby said portions of said wall means are exposed to the pressure of said fluid and urged toward said outer positions and urge the jaw structures toward said second positions against said inner face for extracting said tube from said mould.

2. An extractor as claimed in claim 1, wherein said device is a core having a wall defining said chamber and including wall portions which are respectively engageable with said jaw structures and are expansible independently of each other.
3. An extractor for extracting a tube or other hollow part having an inner face from a mould, the extractor comprising a fixed support, a jaw carrier mounted on said fixed support, a plurality of jaw structures carried by said jaw carrier and arranged symmetrically about an axis, each jaw structure being movable away from said axis from a first position to a second position independently of the others of said jaw structures, a fluid-actuated device mounted on said jaw carrier and comprising a hollow bulb having a deformable elastic wall defining a chamber, portions of said bulb wall being respectively engageable with said jaw structures, said bulb being elastically expandable radially of said axis and each of said portions of said bulb wall being movable independently of the others of said portions of said bulb wall between an inner position corresponding to an unexpanded bulb in which the corresponding jaw structure is allowed to move to said first position and an outer position in which the corresponding jaw structure is in said second position, resiliently yieldable means combined with said jaw structures to bias said jaw structures toward said first positions, and a supply conduit communicating with said chamber for connection to a source of fluid under pressure for inflating said bulb.

4. An extractor as claimed in claim 3, wherein each of said jaw structures has one end pivoted to said jaw carrier and another end freely movable and capable of bearing against said bulb.

5. An extractor as claimed in claim 2, wherein said core wall is of an elastomer.

6. An extractor as claimed in claim 5, wherein said core wall has an outer heat-insulating covering.

7. An extractor for extracting a tube or other hollow part having an inner face from a mould, the extractor comprising a fixed support, a jaw carrier mounted to rotate relative to said fixed support, a plurality of jaw structures carried by said jaw carrier and arranged symmetrically about an axis and capable of spreading away from said axis, a fluid-actuated device mounted on said jaw carrier and engageable with said jaw structures for spreading said jaw structures away from said axis, said device comprising a plurality of radially extending means each of which comprises a cylinder and an axially movable piston in the cylinder, there being as many piston and cylinder means as there are jaw structures, the cylinders of said means being arranged at the end of said jaw carrier and having ends communicating in parallel with a single conduit of fluid under pressure located inside said jaw carrier, said pistons having outer end portions engageable with said jaw structures for spreading said jaw structures, and resiliently yieldable means combined with said jaw structures to bias said jaw structures toward said axis and into individual bearing relation to said pistons.

8. An extractor as claimed in claim 7, wherein each jaw structure comprises a lever pivoted to said jaw carrier in such manner as to be movable away from the latter in longitudinal radial planes containing the axis of said jaw carrier, and jaw members pivoted to said levers for direct engagement with said inner face.

9. An extractor as claimed in claim 8, wherein each of said end portions of the pistons has a crowned bearing face in bearing relation to the corresponding lever.