June 29, 1954 L. L. LUCIER ET AL 2,682,185

FORGING MACHINE

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FIG. 1

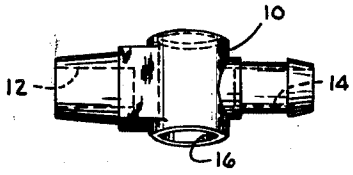


FIG. 3

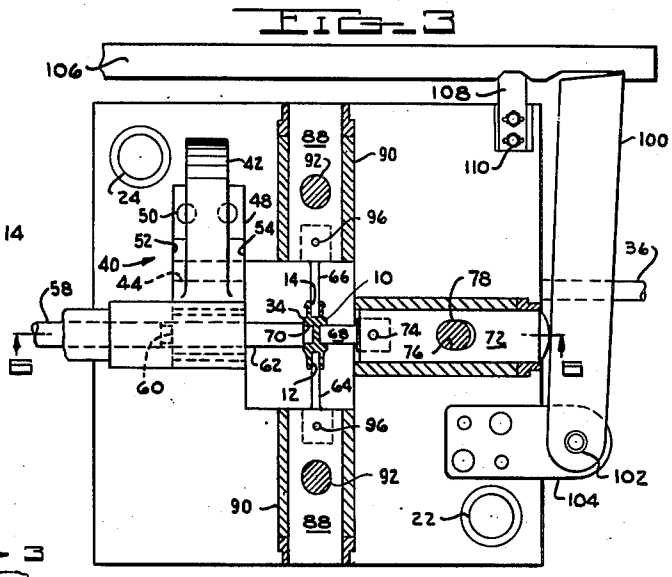
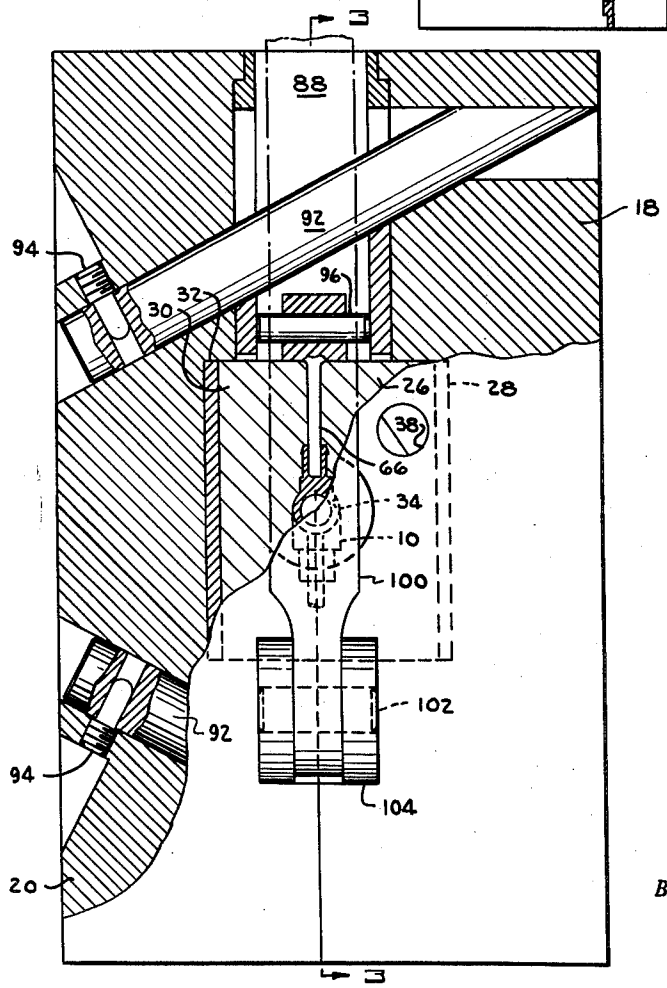


FIG. 2



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FIG. 5

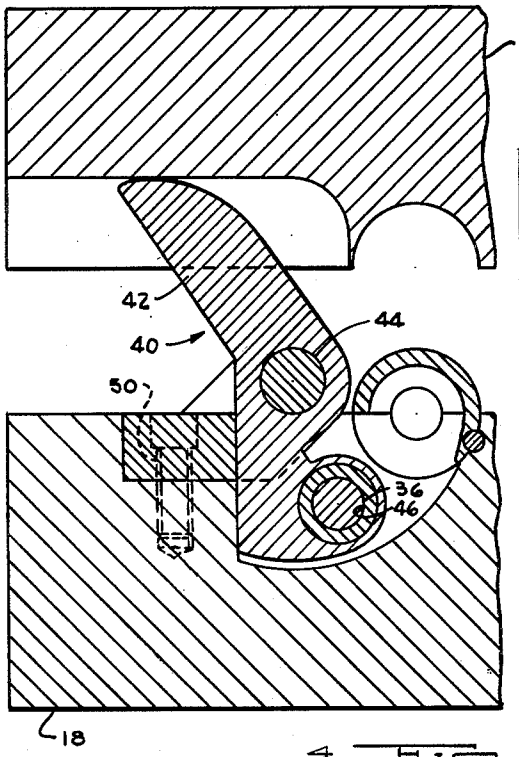


FIG. 4

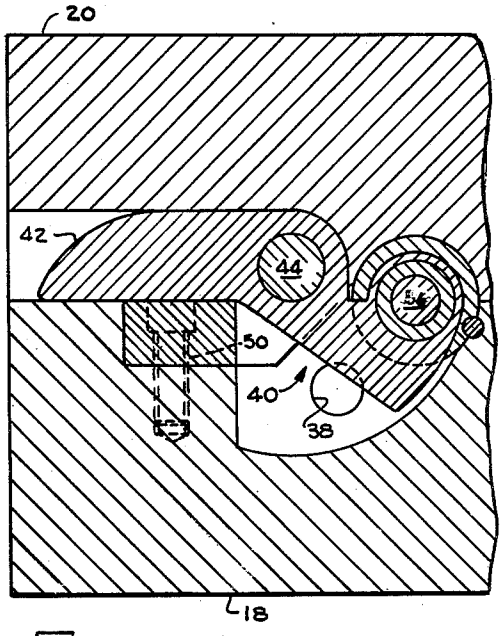
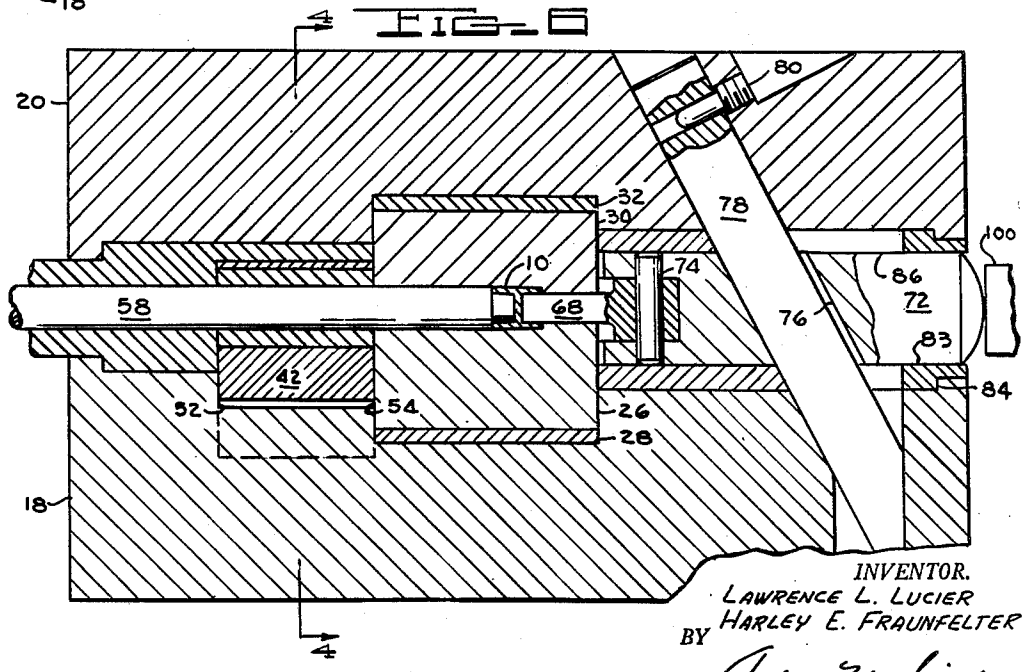


FIG. 6



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2,682,185

FORGING MACHINE

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5 Claims. (Cl. 78—18)

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The present invention relates to a forging machine which is principally, but not exclusively adapted for use in manufacturing multi-apertured fittings or the like, preferably from bar stock of a suitable non-ferrous metal.

The conventional apparatus heretofore used in manufacturing multi-apertured fittings generally has employed piercing tools for forming the various apertures in the workpiece. This type of apparatus is not entirely suitable for use when it is desired to manufacture large numbers of these workpieces on a mass production schedule.

One of the defects of the latter type of apparatus is that each of the various piercing tools must be assembled in the machine so that it can be pressure-actuated into the workpiece to form the holes. When a large number of holes are to be formed therein, the cost of building the machine is relatively high, because it then is necessary to have pressure-actuating equipment for each of the piercing tools. Continuous operation of such pressure-actuating equipment and piercing tools causes greater wear of the component parts and increases the maintenance costs. Further, when it becomes necessary to use such a large amount of pressure-actuating equipment, the cost of operating the machine is increased.

In order to avoid some of the shortcomings of the conventional apparatus heretofore used, the present invention has been developed so that the multi-apertured fittings can be produced without using piercing tools in the forging machine. In place of the piercing tools, stationary aperture-forming elements are employed and the forging operation is carried out so that the bar-stock is forged by each of the elements whereby the latter are embedded in the stock to form apertures therein when the elements are subsequently withdrawn.

Efforts have been made previously to develop a forging machine having stationary aperture-forming elements, but forging machines developed as a result of such efforts are not suitable for the present needs. One such forging machine can be seen in the United States Letters Patent to Criley, No. 2,038,165, issued April 21, 1936.

The type of machine shown in Criley cannot be used satisfactorily to carry out the present needs for mass production work, since in this machine the die members must be separated before the stationary aperture-forming elements can be removed from the forging. Thus, the webbing remaining between the apertures formed in the forging cannot be removed therefrom except in a later operation carried out in a separate machine. Also, there is no adequate means provided in this forging machine for cutting bar-stock during the closing operation of the die member, and thereafter feeding the stock into the cavity between the die member so as to facilitate rapid production of finished forgings.

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It is among the principal objects of the present invention to provide a forging machine which is an improvement over such machines heretofore known and which is constructed and arranged to permit rapid production of multi-apertured metallic fittings, which fittings are characterized by their accurate dimensions, finished surfaces and sturdy constructions, said forging machine being adapted to form any desired number of apertures in the fittings with the machine having a minimum of moving elements, thereby reducing wear of its component parts and minimizing its maintenance and operational costs.

It is another object of the present invention to provide a forging machine adapted to cut bar-stock to a suitable size by closing of the die carrying members thereof and thereafter completing an entire forging operation while the die carrying members are closed including forming apertures in the forging and removing any undesired webbing and the like therefrom which may be formed during the forging operation, whereby multi-apertured fittings, or the like, can be produced on a mass production schedule and at a minimum of cost per fitting.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

In the drawings:

Fig. 1 is an enlarged perspective view of a workpiece forged in the present forging machine;

Fig. 2 is a plan view of the present forging machine with portions in section showing a workpiece therein at the completion of the forging operation;

Fig. 3 is a sectional view, drawn to a reduced scale, taken on the line 3—3 of Fig. 2 showing the dead die carrying member with the workpiece therein;

Fig. 4 is a fragmentary sectional view taken on the line 4—4 of Fig. 6 showing the bar-stock cutoff mechanism and with the die carrying members of the forging machine in a closed position;

Fig. 5 is a fragmentary sectional view similar

to that of Fig. 4, but with the die carrying members in an open position; and

Fig. 6 is a fragmentary sectional view taken on the line 6—6 of Fig. 3 and also showing the live die carrying member in its closed position.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Referring to the drawings, Fig. 1 shows a multi-apertured fitting 10 produced from the present forging machine. The fitting can have apertures 12 and 14 extending inwardly thereinto from opposite ends and an aperture 16 extending transversely therethrough. It should be understood, however, that this invention is not limited to a forging machine for producing a multi-apertured fitting such as fitting 10, but is intended to cover a forging machine which can produce fittings having a plurality of apertures extending thereinto from various angles.

The present forging machine has a dead die carrying member 18 and live die carrying member 20. The latter has a pair of holes (not shown) which are fitted over the posts 22 and 24, Fig. 3, of the former and on which the latter can be separated from the former to an inoperative position or closed to an operative position.

The dead die carrying member 18 includes a die 26 and shim 28, and the live die carrying member 20 likewise includes a die 30 and shim 32. Each of these dies can be made an integral part of its die carrying member, but it is preferred to make it separate so that the forging machine can be easily converted for manufacturing multi-apertured fittings of other shapes, merely by substituting other dies for the ones shown. The shims 28 and 32 are employed so that the dies 26 and 30 will have their adjacent surfaces flush with the adjacent surfaces of the remainder of the die members 18 and 20. The shims 28 and 32 are also used so that the adjacent surfaces of the dies 26 and 30 can be recut when they have become worn and thereafter the dies 26 and 28 can be properly fitted into their respective die members.

As can be seen in Figs. 2 and 3, each of the dies 26 and 30 has a portion cut away therein to form the cavity 34 in which the multi-apertured fitting 10 can be forged to shape. Heated bar-stock 36, from which the forging is made, is fed into the forging machine through a conduit 38 in the dead die member 18 to a cutoff device 40, Figs. 3, 4 and 5, which is designed to cut a blank from the bar-stock 36 of the proper length to form the multi-apertured fitting 10 and to position the blank for feeding it into the cavity 34.

The cutoff device 40 includes a lever member 42 pivotally mounted in the dead die carrying member 18 by the shaft 44, and it has a bushed hole 46 into which the bar-stock 36 can be fed from conduit 38 when the live die carrying member is moved to its inoperative position shown in Fig. 5. As can be seen, the shaft 44 is secured to the dead die carrying member 18 by the bracket 48 in which the shaft is journaled and which bracket 48 is screwed to the dead die carrying member 18 as at 50.

When bar-stock 36 is fed into the cutoff device 40, it will be fed sufficiently far to abut against

the wall 54, and when the live die carrying member 20 is closed to its operative position shown in Fig. 4, the lever member 42 will be pivoted by the live die carrying member 20 to the position shown in Fig. 4 thereby shearing the bar-stock adjacent the opposite wall 52 to form a blank 56, Fig. 4, of proper length to be forged into the multi-apertured fitting 10. The cutoff device 40 can later be returned to the inoperative position by any suitable means, as, for example, by having the lever member 42 weighted more heavily at the right end.

If desired, a mechanism (not shown) may be utilized for varying the length of bar-stock which may be cut off. This can be accomplished by having an adjustable screw (not shown) extending through wall 52 in axial alignment with bar-stock 36 and against which bar-stock 36 must abut. A limited clearance must then be provided between lever member 42 and side wall 52 so that the latter will not engage the adjustable screw (not shown). Thus, by varying the position of the screw (not shown) the amount of stock fed to the cutoff device 40 will be varied.

After the blank 56 has been moved to the position shown in Fig. 4, it is in alignment with the reciprocable ram 58, Fig. 3, which ram is then in the position shown in phantom at 60. Thereafter, the ram 58 is advanced into the cavity 34 to the position at 62 shown in solid lines in Fig. 3, resulting in the blank 56 being forged into the multi-apertured fitting 10.

The apertures 12 and 14 are formed in the fitting 10 by a pair of cylindrical rods 64 and 66 which extend into the cavity 34 when live die carrying member 20 is moved into its operative position. These rods 64 and 66 are held stationary in cavity 34 during the forging operation, and the blank 56 which will be in a heated state, is caused to flow around said rods 64 and 66 due to the pressure exerted thereon by ram 58. Thus, it can be seen that there occurs no piercing operation by rods 64 and 66, but rather, the heated blank is swaged or forged over said rods 64 and 66 to cause the latter to be embedded in the forging. Similarly, one end of aperture 16 is formed in blank 56 by the cylindrical rod 68. The other end of aperture 16 is formed by the cylindrical end portion 70 of the ram 58. It is believed apparent from the above description that the apertures 12, 14, and 16 formed in the fitting 10 are made without employing movable piercing elements, and thus, no pressure-actuating mechanism is required in the present machine with the exception of that used to actuate the ram 58. It can be seen that additional rods can be employed for making additional apertures in the fitting 10, if desired.

In order for the multi-apertured fitting 10 to be removed from the forging machine after the live die carrying member 20 has been separated, it is necessary that each of the cylindrical rods 64, 66 and 68, as well as the cylindrical end portions 70 of the ram 58 be removed from the fitting 10. Each of the cylindrical rods 64, 66 and 68 are removed from the fitting 10 by similar mechanisms.

The cylindrical rod 68, Fig. 6, is mounted in a piston member 72 and held therein by the pin 74. Angularly disposed in the piston 72 is a hole 76 through which a shaft 78 extends. The shaft 78 is secured at its one end to the live die carrying member 20 by a set screw 80. The other end of the shaft 78 passes into a slot 82 which has an outwardly flared portion for re-

ceiving the other end of shaft 78. The piston 72 is journaled in a bushing 83 which is secured to the dead die carrying member 18 by any suitable means and which is retained in place by the annular shoulder 84.

The bushing 82 has a longitudinal slot therein as at 86 through which the rod 78 extends. When the live die carrying member 20 is separated from the dead die carrying member 18, the rod 78, which is secured thereto, will be withdrawn with the result that the piston 72 will be moved to the right as seen in Fig. 6. Thus, it is believed understood, that merely by separating the live die carrying member 20 from the dead die member 18, the cylindrical rod 68 will be removed from the multi-apertured fitting 10.

The mechanism for removing each of the cylindrical rods 64 and 66 from the multi-apertured fitting 10 are similar to that previously described for the cylindrical rod 68. Each of the mechanisms for the rods 64 and 66 include a piston member 88 which is journaled in a bushing 90, which in turn is secured by any suitable means to the dead die carrying member 18. Each of the bushing members 90 have angularly disposed slots therethrough through which angularly disposed shafts 92 can be extended. The angularly disposed shafts are secured to the live die carrying member 20 by suitable means such as the set screws 94. Each of the cylindrical rods 64 and 66 is connected to its piston member 68 by a suitable pin connection as at 96. Any conventional type of ejector pin (not shown) may be employed, if desired, to free the forging 10 from the cavity side walls when the die carrying members are separated, permitting the finished forging to drop into a hopper, or the like, (not shown).

During the forging operation of the multi-apertured fitting 10, a relatively thin wafer or webbing will be formed between the cylindrical rod 68 and the cylindrical end portions 70. The present forging machine is constructed and arranged to facilitate easy removal of this wafer or webbing. In order to carry out this operation, the ram 58 is withdrawn from the fitting 10 while the latter is retained within the cavity 34. Thereafter, the cylindrical rod 68 is moved further into the cavity, thereby punching the wafer out of the aperture 16. The cylindrical member 68 is moved inwardly by means of a lever arm 100, Fig. 3, which is pivotally connected as at 102 to a supporting member 104 on the dead die carrying member 18. The lever arm 100 is actuated by a drawbar 106 which can be drawn to the left as seen in Fig. 3 simultaneously with the withdrawal of ram 58 so that the lever arm 100 will push the piston 72 inwardly into the machine. As can be seen in Figs. 3 and 6, the hole 76 is enlarged to provide limited clearance so that the piston 72 can be moved to the left, Fig. 3, without moving the shaft 78, and thereby enabling rod 68 to act as a punch to remove the wafer in fitting 10. Any suitable spring mechanism (not shown) can be used to hold lever arm 100 in its operative position shown in Fig. 3.

A cam 108 is secured to the dead die carrying member 18 by a plurality of screws as at 110. The cam 108 is adapted to disengage the outer end of the drawbar 106 from the lever arm 100 after the piston 72 has been pushed sufficiently far into the cavity 34 to punch out the wafer in the fitting 10.

From the above description, it is believed to be clear that the present invention permits a forging operation to be carried out whereby a plurality of apertures can be formed in a fitting and that the operation can be carried out by a single stroke of a forging ram. Further, it is believed clear that the present invention provides a novel arrangement whereby the bar-stock can be fed into the forging machine, and the latter will cut the bar-stock the proper size prior to carrying out the forging operation. The machine is also adapted to remove any undesired webbing, wafers or the like, which may be formed in the multi-apertured fitting.

The present forging machine is constructed and arranged so that it can produce a relatively high number of forgings per unit of time, which forgings will have accurate dimensions, finished surfaces and sturdy constructions. Further, it is believed readily understood that this forging machine is not limited to making aperture fittings of the type shown in the present application, but can be used for making any type of multi-apertured fittings.

Having thus described our invention, we claim:

1. In a forging machine for making multi-apertured forgings, the combination comprising two opposite die carrying members each having a die therein formed with a cavity of predetermined shape, a plurality of aperture-forming elements extending inwardly through the side walls of said cavities from a plurality of directions, a duct formed in one of said die carrying members opening into said cavity through which bar-stock of predetermined size can be fed into said cavity, a conduit abaxial of said duct for feeding bar-stock into one of said die carrying members, a cut-off device mounted in one of said die carrying members in communication with said conduit and operable on closing said die carrying members to cut a blank of desired size from said bar-stock and to transfer the blank to the open end of said duct, a ram mounted to reciprocate into and out of said duct for feeding said blank through said duct and into said cavity under pressure, said aperture-forming elements being mounted so that they will be embedded in the forging to form apertures therein, and mechanisms connected to said aperture-forming elements and said die carrying members so that when said die carrying members are being separated each of said aperture-forming elements will be withdrawn in the direction from which each extends solely by the separating of said die members.

2. In a forging machine for making multi-apertured forgings, the combination claimed in claim 1 and including means to advance one of said aperture-forming elements further into said cavity substantially simultaneously with the removal of the ram for removing webbing which may remain at the inner end of the aperture formed by the last named aperture-forming element.

3. In a forging machine for making multi-apertured forgings, the combination claimed in claim 1 wherein one of said aperture-forming elements is mounted coaxially in a plunger, said combination including a lever arm engaging one end of said plunger and being cooperatingly connected with said ram to advance the said one aperture-forming element further into said cavity substantially simultaneously with the removal of the ram for removing webbing which may re-

main at the inner end of the aperture formed by such aperture forming element.

4. In a forging machine, the combination comprising a dead die carrying member and a live die carrying member each having a die therein formed with a cavity of predetermined shape, a duct formed in said die carrying members and opening into said cavity through which bar-stock cut to predetermined size can be fed, a conduit abaxial of said duct for feeding bar-stock into said die carrying members, a pivotal cut-off device mounted between and on one of said die carrying members and having a bar-stock receiving portion adjacent one of its ends in alignment with said conduit, said device being in engagement with the other die carrying member and operable solely by closing of said die carrying members to be pivoted to cut a blank of desired size from said bar-stock and to transfer the blank to the open end of said duct, and a ram mounted to reciprocate into and out of said duct for feeding said blank through said duct and into said cavity under pressure.

5. The combination as defined in claim 4 wherein said pivotal cut-off device has its bar-stock receiving end portion more heavily weighted than its other end so that on opening said die carrying members said end portion will pivotally return to a position in alignment with said conduit.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,038,165	Criley	Apr. 21, 1936
2,124,529	Lester et al.	July 26, 1938
2,266,463	Korsmo	Dec. 16, 1941
2,396,995	Friedman	Mar. 19, 1946
2,542,864	Friedman	Feb. 20, 1951

FOREIGN PATENTS

Number	Country	Date
362,055	Germany	Oct. 20, 1922
624,871	Great Britain	June 17, 1949
770,246	France	June 25, 1934