United States Patent

[11] 3,623,539

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[54] **IMPACT SAND MOLDING MACHINE**
3 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **164/173**
[51] **Int. Cl.** **B22c 15/08**
[50] **Field of Search** 164/39, 37, 173, 171

[56] **References Cited**

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Assistant Examiner—V. K. Rising
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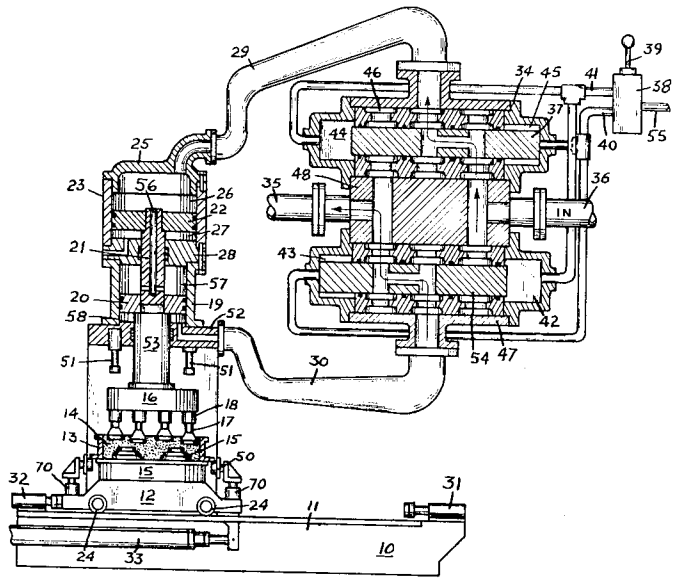
ABSTRACT: The present disclosure is directed to a machine for making green sand molds by an impact mechanism which imparts an impact from an impact head driven by the explosive force of suddenly released compressed air in such a way that the molding head strikes the sand and imparts its kinetic energy by way of an impulse to the sand, thereby packing the sand around the patterns. It has been discovered that by using the impulse principle in molding, the sand is uniformly packed and uniform mold hardness results.



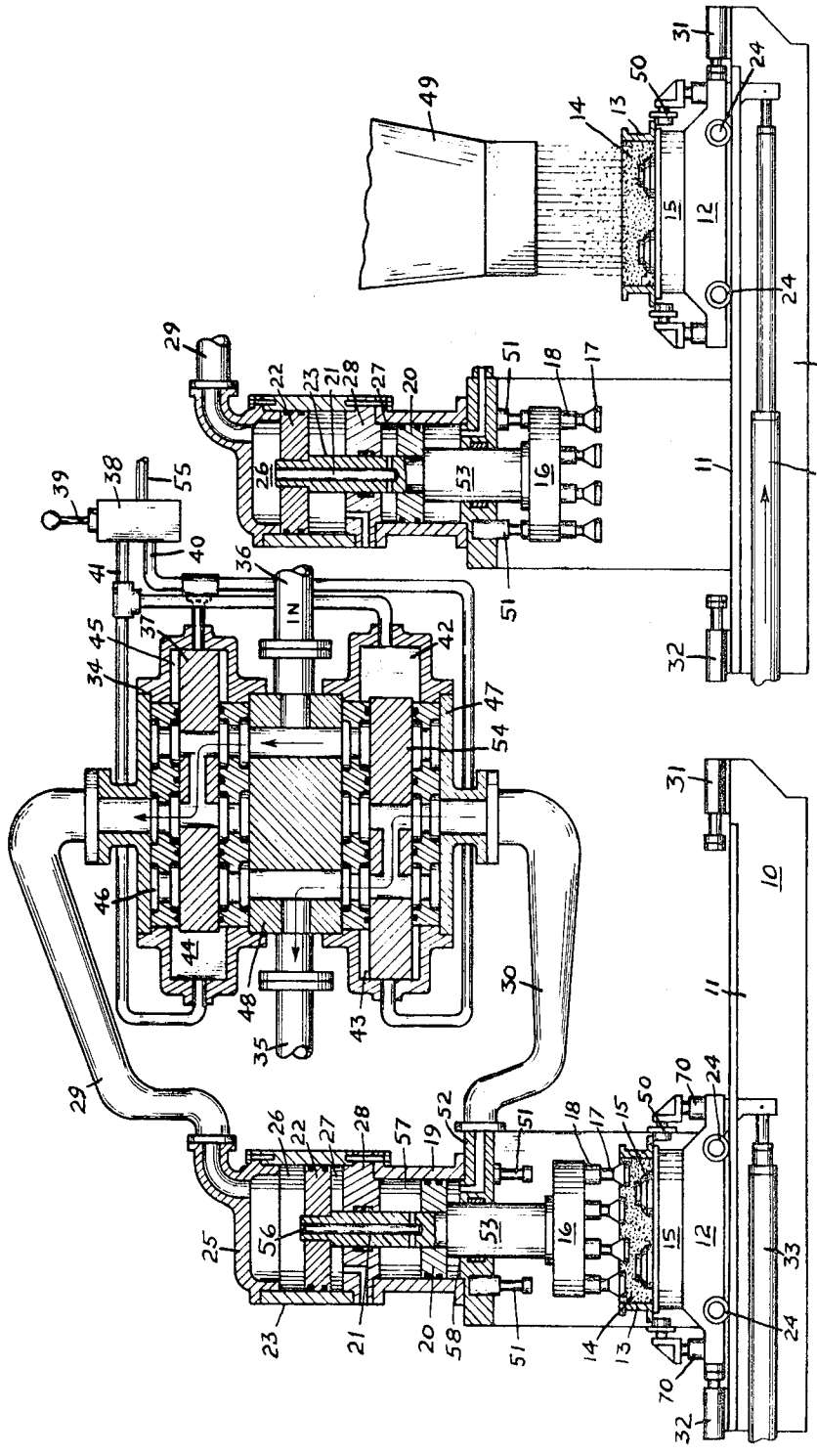


Fig. 1

Fig. 2

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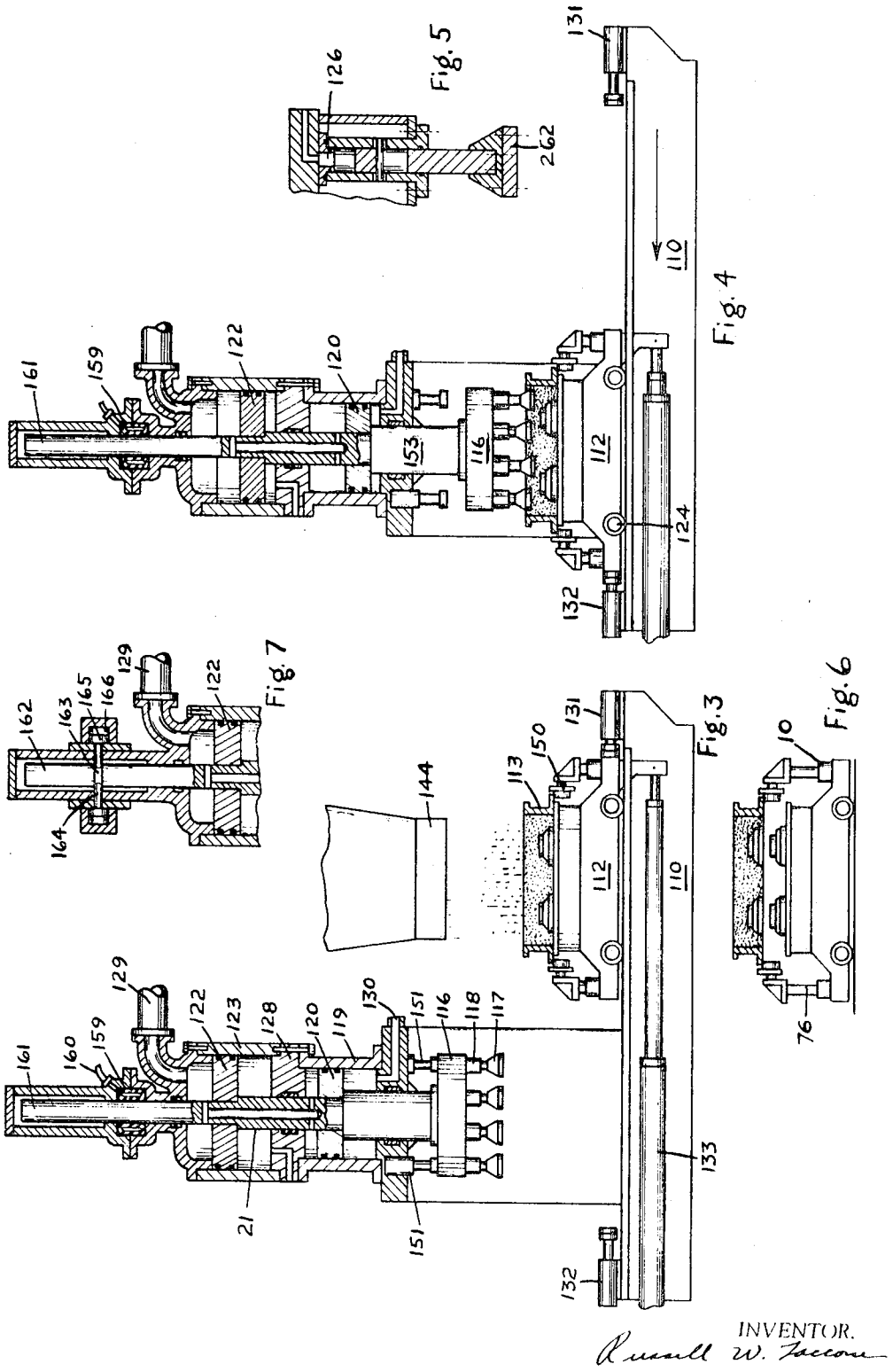

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IMPACT SAND MOLDING MACHINE

PRIOR ART

The impact principle has been used successfully in high-energy forging machines and in deep-draw machines, but it has never been used successfully in the part of green sand molding.

STATEMENT OF INVENTION

This invention relates to green sand molding and more particularly to making green sand molds impacting a molding head on a body of loose molding sand.

BACKGROUND OF INVENTION

Through the centuries that man has been ramming sand, or other substances, into boxes and calling them "molds," he has sought means for making them better, faster, and cheaper.

Today, there are many machines of various manufacture on the market used daily in the production of thousands and thousands of duplicate green sand molds.

One of the best, developed several years ago, is the flexible diaphragm molding machine. This machine marked the beginning of high-pressure molding. The phenomenal success of the diaphragm molding machine depends on releasing a large volume of compressed air behind the diaphragm, above the mold. The expanding air is like an almost instantaneous explosion. This high-velocity impact action produces molds that have excellent permeability.

However, there are some serious drawbacks and disadvantages to diaphragm molding: soft edges, inability to squeeze effectively around bars, limited mold depth and, of course, wear and tear on the diaphragm itself.

Efforts to surmount these difficulties resulted in various mechanical and hydraulic combinations, such as the hydraulic squeeze machine, the hydraulic squeeze with jolt and several "shockless" jolters.

Also, many arrangements of squeeze heads, platens and peen blocks have been developed, and used in many combinations, but high-velocity impact has been neglected in favor of slow moving high pressure for pressure's sake.

These approaches to the problem of making the perfect mold have raised a whole new set of difficulties and disadvantages. Jolting by itself is impractical as the resulting mold lacks uniformity of hardness. Jolting takes much power and time, requires a heavy duty foundation and is rough on flasks and pattern equipment causing a scouring action on the patterns. It is one of the major sources of noise in foundries.

Squeezing alone even with peen blocks or contoured squeeze boards, is usually unsatisfactory because the hardness varies with the depth of sand in the mold over the patterns. The usual solution is a combination of jolt and squeeze having most of the disadvantages of both.

Another approach meeting with indifferent success is the high pressure hydraulic squeeze. Hydraulic units are often complicated and expensive and are subject not only to a bad environment in foundries but in many cases abuse by poorly trained operating and maintenance personnel. Proper design and the use of fire-resistant mediums can overcome the safety problems of hydraulic systems, but leaks and other imperative maintenance can cause costly downtime.

Pressure applied to molding sand is transmitted most in the direction of the applied force, except in the initial moment of contact when the flowability of the sand is at its absolute maximum and transmits the most pressure in all directions. In this instant the sand must flow with the pressure, resulting in almost perfect uniformity of density and hardness. If the pressure applied is very small the internal friction of the sand grains on each other and the forces of inertia will quickly dissipate it. However, if the force is great enough, the pressure is transmitted to all extremities of the sand configuration in equal amounts.

Working on this premise, applicant has developed "Hi-Impact" molding. It consists of two large diameter pistons connected by a center ram to a compensating head which is all supported above the flask which has already been filled with sand. Compressed air accelerates this assembly downward to the point of impact with the sand.

Forty to 60 p.s.i air pressure is sufficient to operate the Hi-Impact machine; by regulating the air pressure to the hardness of the mold can be better varied. The control of the unit is as simple as the machine itself using either two three-way valves or one four-way valve. Impacting the mold requires less than 1.5 seconds. The compensating head and the sand in the flask absorb the energy of the downstroke, and on the upstroke two 2½×4 inch deceleration cushions absorb the energy.

This high-production unit is adaptable to all types of pattern equipment, and standard flasks of any reasonable depth can be used with bars in almost any arrangement. No special foundation is required, the machine can be installed on floor level, above ground, or supported on I-beams above a conveyor pit.

The molding machine has many technical advantages: Some of these are as follows:

1. Convenient and economical repetitive operation
2. Automatic cycling with relatively simple controls
3. Reduces maintenance problems associated with more complicated automatic molding machines
4. No elaborate foundation necessary
5. Low air pressure required (40–60 p.s.i.)
6. Fast circling (1–2 seconds)
7. Uniform density on all surfaces.

This versatile machine has successfully overcome most obstacles to high production—high pressure molding.

OBJECTS OF THE INVENTION

It is an object of the invention to provide an improved green sand molding machine.

Another object of the invention is to provide an impact machine for forming green sand molds.

Another object of the invention is to provide an impact-type molding machine in combination with a double-acting piston arrangement for operating the molding head to provide the impact.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal cross-sectional view of the molding machine according to the invention.

FIG. 2 is a view similar to FIG. 1 showing the flask-carrying car moved out from the under the molding head into a filling position.

FIG. 3 is a view similar to FIG. 2 of another embodiment of the machine.

FIG. 4 is a view similar to FIG. 1 of another embodiment of the machine.

FIG. 5 is a longitudinal cross-sectional view of another embodiment of the molding head.

FIG. 6 is a partial view of a flask supported over a molding car in stripped position.

FIG. 7 is a view of a part of the machine shown in FIG. 3.

DETAILED DESCRIPTION OF THE DRAWINGS

Now with more particular reference to the drawings, the machine as shown in FIGS. 1 and 2, has a base **10**, which supports a track **11**. A car **12** is supported on the track, and it rolls from a position under the head **16** to a position under the hopper **49** on wheels **24**. The cushion **31** is supported at one end of the track, and cushion **32** is at the other end, so that the car will be decelerated to a stop when it comes into engagement with the cushions.

The flask **13** is supported on the car, and it may be filled with sand **14** from hopper **49** in the conventional manner. The car **12** is then moved under the head **16** into engagement with the cushion **32**. The flask is supported on pattern plate **15** that has the patterns shown.

The compensating head **16** has feet or shoes **17** supported in small cylinders **18** attached to the head. The head **16** is in turn

attached to the center ram, which is fixed to the recocking piston **20** and to the ram piston **22**. These pistons are fixed together and move as a unit, and the recocking piston **20** slides in recocking cylinder **19**, while the ram piston **22** slides in ram cylinder **23**. The cylinder head **28** is clamped between cylinder **19** and cylinder **23**.

An air supply is connected to inlet **36**, and this air is directed by the valve arrangement shown through valves **29** and **30**, as the case may be, to the respective cylinders and pistons.

The cylinder head **25** is connected to the air line **29**, and the cylinder head **52** is connected to the air line **30**.

A source of air at a pressure between 40 to 60 p.s.i. is available at air line **55**. The flow of air is controlled by a valve **38** having an actuating handle **39**. By moving handle **39** the pressurized air available in line **55** can be directed as desired to line **41** in which case the ram impacts the sand or to line **40** in which case the ram is raised above the surface of the sand.

The valve spools **37** and **54** are shown in position to drive head **16** downward to form a mold in flask **15**. When it is desired to form a mold in the flask **13**, the handle **39** is moved to connect air from source **55** to the line **41**. This will shift the valve spool **37** to the position shown to connect the air supply line **36** to the line **29**, and thence to the space **26** above the ram piston **22**. Air will flow from this space **26** through the port **56** to the space **57** above the recocking piston. This force on top of the recocking piston **20** will act in series with the force on piston **22** and will aid in driving the head **16** downward to impact on the sand in the flask.

At the same time, valve spool **54** will be in the position shown in FIG. **1**. Air from the inlet **36** will be shut off by spool **54** and pipe **30** will be connected through the valve spool **54** to the outlet **35** so that there is no pressure in space **58** below the recocking piston **20**.

Moving the handle **39** actuate the valve **38** to connect the air pressure from air line **55** to air line **40** which will cause the air to be connected to the space **45** and space **43**. This will shift the valve spools **37** and **54** from the position shown so that the air in space **26** and **57** is exhausted through lines **29** and **35** and air from line **36** will be admitted through line **30** to the space **58** shown below piston **20**, thus, raising the head **16** to the position shown in FIG. **2**. This will lift the ram to the position shown in FIG. **2**. The upward movement of ram **16** will be checked by hydraulic cushion **51**. Flask **15** can then be moved on car **12** to the position shown in **2** to be refilled with sand. The completed mold can be stripped from the pattern by cylinder **70** as shown in FIG. **6**.

In the embodiment of the invention shown in FIGS. **3** and **4**, the machine is supported on a base **110**, and the molding car **112** is supported by means of wheels **124** on the tracks shown. The car moves from one side from a position under the ram head **116** to a position under loading hopper **144** and into engagement with the cushions **131** and **132**, which bring the car to a smooth stop.

The molding head **116** is supported on the ram **153**, which is in turn supported on the recocking piston **120**.

An air supply will be connected by a suitable valving arrangement similar to that shown in Fig. **1** to the pipes **129** and pipes **130**. The upward movement of the ram will be cushioned by cushioning members **151**, which are similar to cushioning members **51** in the embodiment of the invention shown in FIG. **1**. The car will be moved from side to side by means of the car cylinder **33**, which has a piston **133**, which has piston rods shown which are similar to the car moving rods **33** in the embodiment of FIG. **1**.

In the embodiment of the invention shown in FIGS. **3** and **4**, the head may be held up in cocked position by means of a brake mechanism, which is in the form of an inflatable collar and is supplied air from line **162** to cause the collar to grip the shaft **161** and thereby hold the head up in position.

In the embodiment of the invention shown in Fig. **7**, the shaft **162** has a groove **163**, which will receive the detents **164** on the other ends of the piston rods of pistons **165**. Thus, air may be inserted into the space **166** above the pistons and hold them in the groove **163** to clamp the rods **163** and hold them in an upward position.

FIG. **5** shows an embodiment of a ram having a flat plate **262**, which engages the sand. This ram is driven up an down by air in space **126**.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A molding machine comprising a base to support a flask adapted to contain sand,

a flask,

a pattern plate on said flask,

a molding head having a compensating head attached thereto adapted to be disposed in spaced relation to said sand,

said compensating head having a plurality of sand engaging feet fixed thereto whereby the force of said impact of said head on said sand is distributed uniformly throughout said sand,

a cylinder,

a molding piston and a recocking piston mounted on a common piston rod and being slidably supported in said cylinder and connected to said molding head to drive said molding head into engagement with said sand whereby an impact results on said sand sufficient to pack said sand around said pattern to form a sand mold,

a first cylinder head between said pistons defining a first space in said cylinder above said recocking piston and a second cylinder head defining a second space above said molding piston,

means to connect said first space to said second space whereby said piston rod is driven downward by air pressure on both said molding molding piston and on said recocking piston,

a compressed air source valve means connected to said cylinder above said molding piston and above said recocking piston driving said head into engagement with said sand,

valve means for exhausting air from above said molding piston and above said recocking piston and admitting air below said recocking piston to move said head to recocked position,

an opening in said second cylinder head through which said piston rod extends, and

brake means disposed on said machine adapted to engage said piston rod extension to hold said piston rod in recocked position.

2. A molding machine comprising a base to support a flask adapted to contain sand,

a flask

a pattern plate on said flask,

a molding head having a compensating head attached thereto adapted to be disposed in spaced relation to said sand,

said compensating head having a plurality of sand engaging feet fixed thereto whereby the force of said impact of said head on said sand is distributed throughout said sand,

a support frame having a cylinder mounted thereon,

a molding piston and recocking piston mounted on a common piston rod and being slidably supported in said cylinder and connected to said molding head to drive said feet into engagement with said sand whereby an impact results on said sand sufficient to pack said sand around said pattern to form a sand mold,

a first cylinder head between said pistons defining a first space in said cylinder above said recocking piston and a second cylinder head defining a second space above said molding piston,

means to connect to said first space to said second space whereby said piston rod is driven downward by air pressure on both said molding piston and on said recocking piston,

a compressed air source valve means connected to said cylinder above said molding piston and above said recocking piston driving said head into engagement with said sand,

and valve means for exhausting air from above said molding piston and above said recocking piston and admitted air below said recocking piston to move said head to recocked position.

3. The machine recited in claim 1 wherein said flask is supported on a car,

and said car is disposed on a track,

a sand hopper spaced from said molding head,

means to move said car from a position under said molding head to a position under a sand hopper.

* * * * *

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,623,539 Dated November 30, 1971

Inventor(s) Russell W. Taccone

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

Front page of the patent, change date patented "Nov. 30, 1970" to -- Nov. 30, 1971 --;

front page of the patent, change assignee "Bangor Punta Operation, Inc." to -- Bangor Punta Operations, Inc.--;

column 1, line 5, of the patent, change "deep-draw" to -- deep draw --;

column 1, line 6, of the patent, change "part" to -- art --;

column 1, line 12, of the patent, after "molds" insert -- by --;

column 2, line 47, of the patent, after "from" delete -- the --;

column 3, line 46, of the patent, after "shown in" insert -- Fig. --;

column 4, line 5, of the patent, change "an" to -- and --;

column 4, line 34, of the patent, after "said molding" delete -- molding --;

column 4, line 52, of the patent, after "a flask" insert -- , --;

column 4, line 72, of the patent, after "connect" delete -- to --.

Signed and sealed this 5th day of September 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents