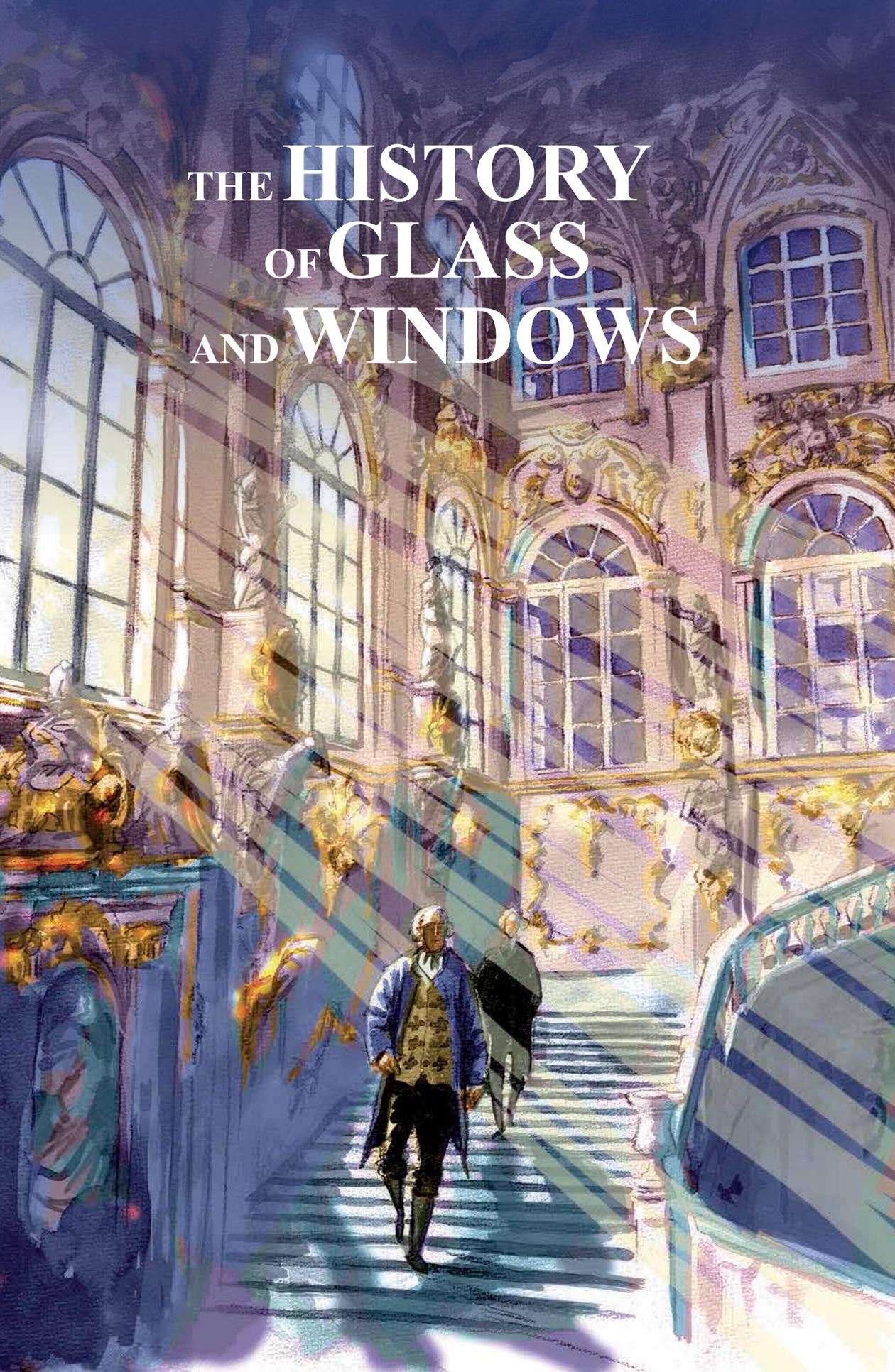


THE HISTORY OF GLASS AND WINDOWS

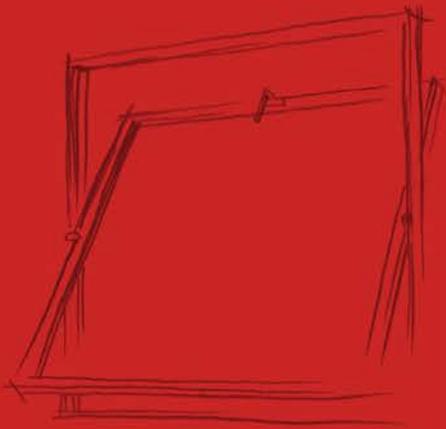




THE HISTORY OF GLASS AND WINDOWS

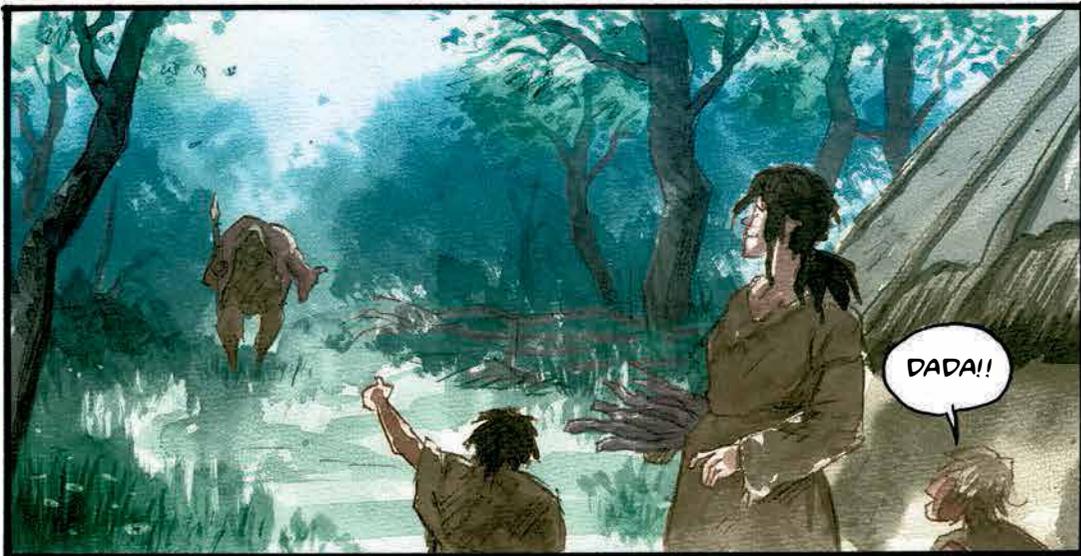


A Graphic Novel
Written by Troels Rasmussen and Craig Frank
Art by Palle Schmidt





A LONG TIME AGO IN NORTHERN EUROPE, HUMAN TECHNOLOGY AND DOMESTICATION DEVELOPED TO A HIGHER STANDARD OF LIVING.



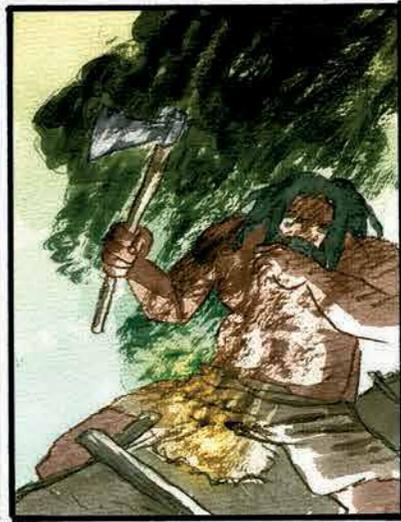
DADA!!



I CAN'T BREATHE!!

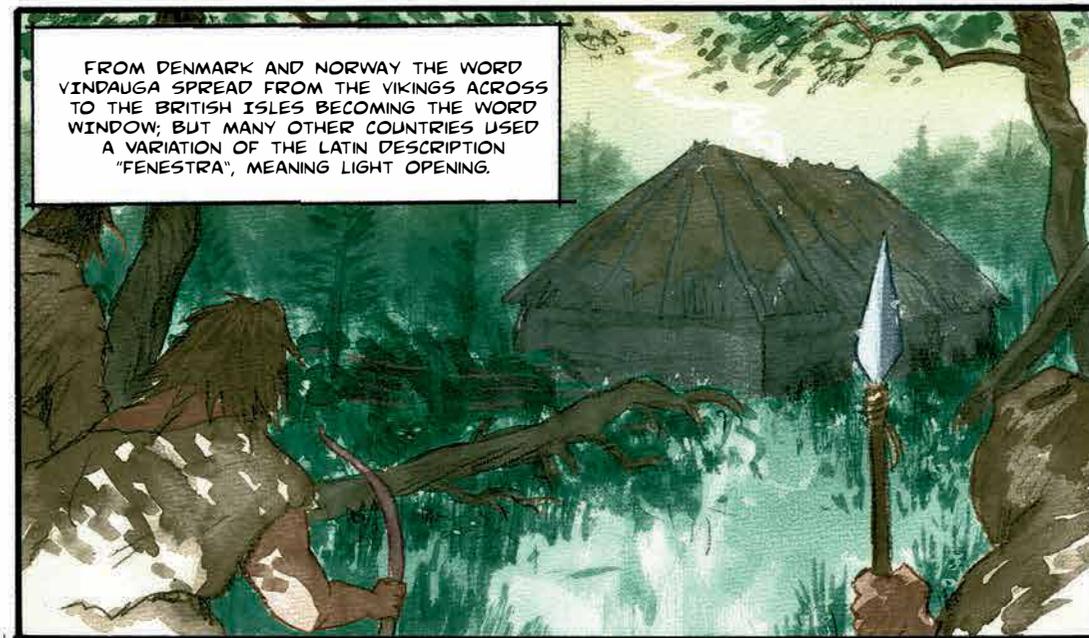


IT WAS A SLOW MOVEMENT BUT ESSENTIAL HOME IMPROVEMENT WAS ON THE RISE.

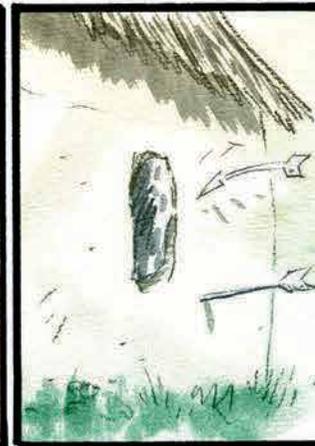
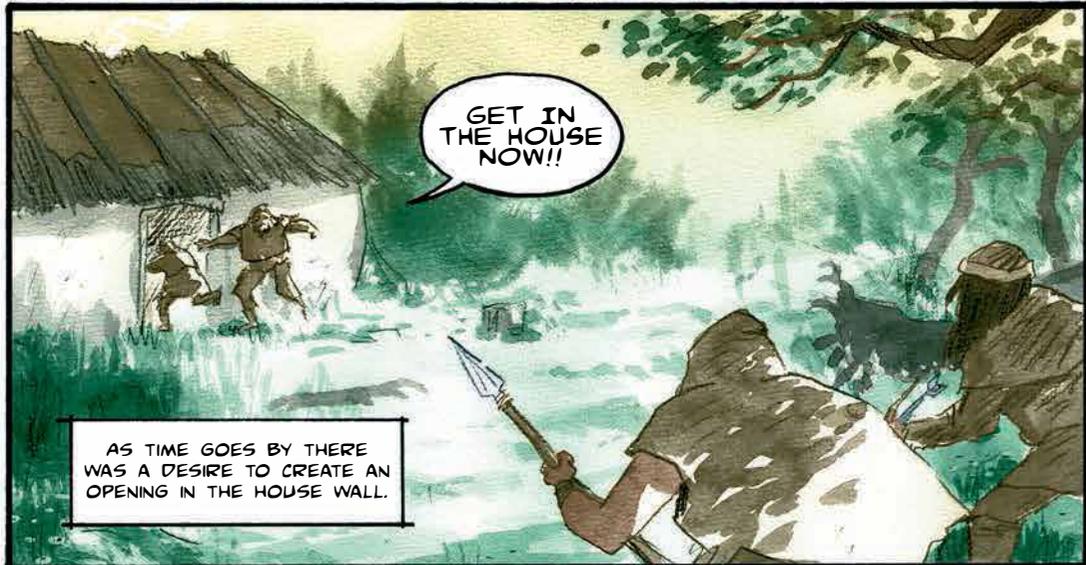
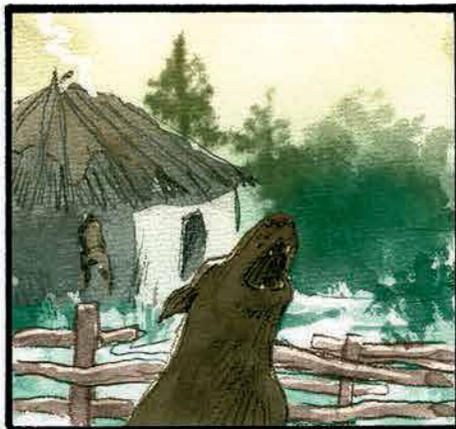


I CAN SEE THE SKY!

THE ANCIENT NORDIC WORD "VINDAUGA" MEANS WIND FOR ROOF AND EYE FOR OPENING, LITERALLY TRANSLATED AS ROOF'S EYE, ROOF OPENING OR WIND'S EYE.

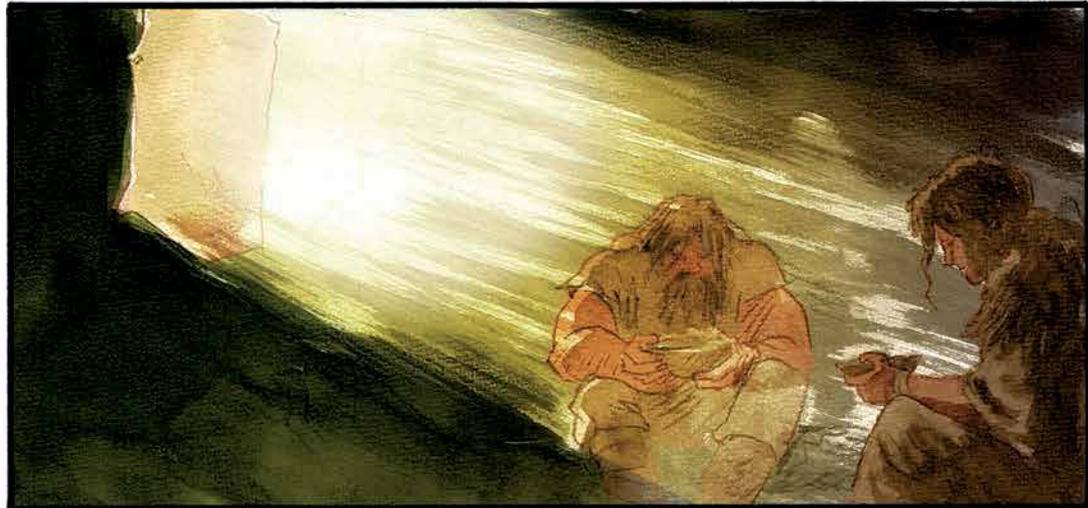
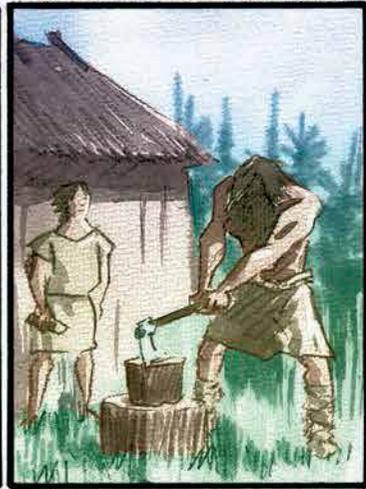


FROM DENMARK AND NORWAY THE WORD VINDAUGA SPREAD FROM THE VIKINGS ACROSS TO THE BRITISH ISLES BECOMING THE WORD WINDOW; BUT MANY OTHER COUNTRIES USED A VARIATION OF THE LATIN DESCRIPTION "FENESTRA", MEANING LIGHT OPENING.

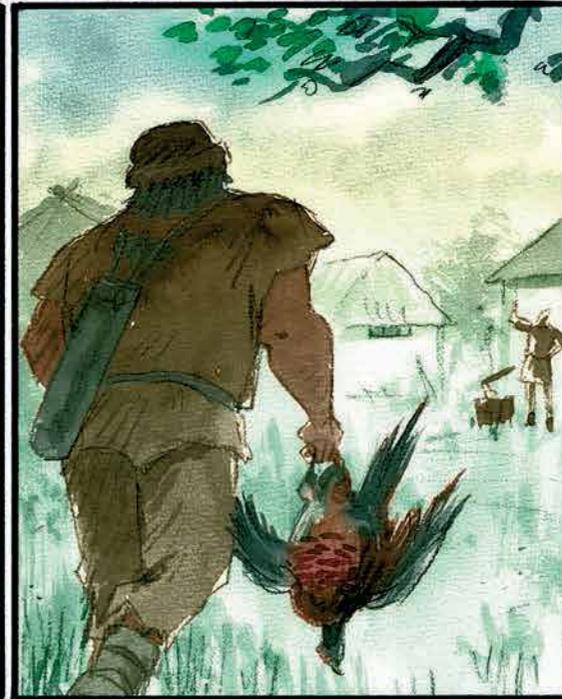
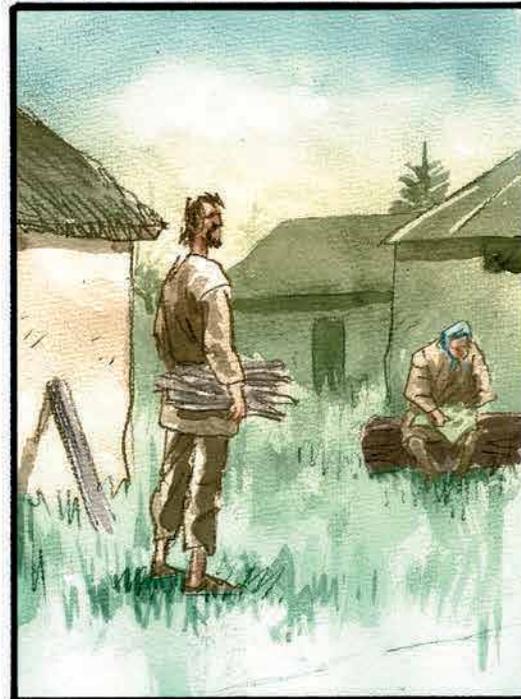




TO COVER THE PEEP HOLE THE DWELLERS HAD TO BE CREATIVE. EVENTUALLY, TRANSPARENT MATERIALS SUCH AS ANIMAL HIDE, SHEETS OF OX HORN, OR LINEN WERE USED FOR LIGHT TO PENETRATE INTO THE HOUSE.



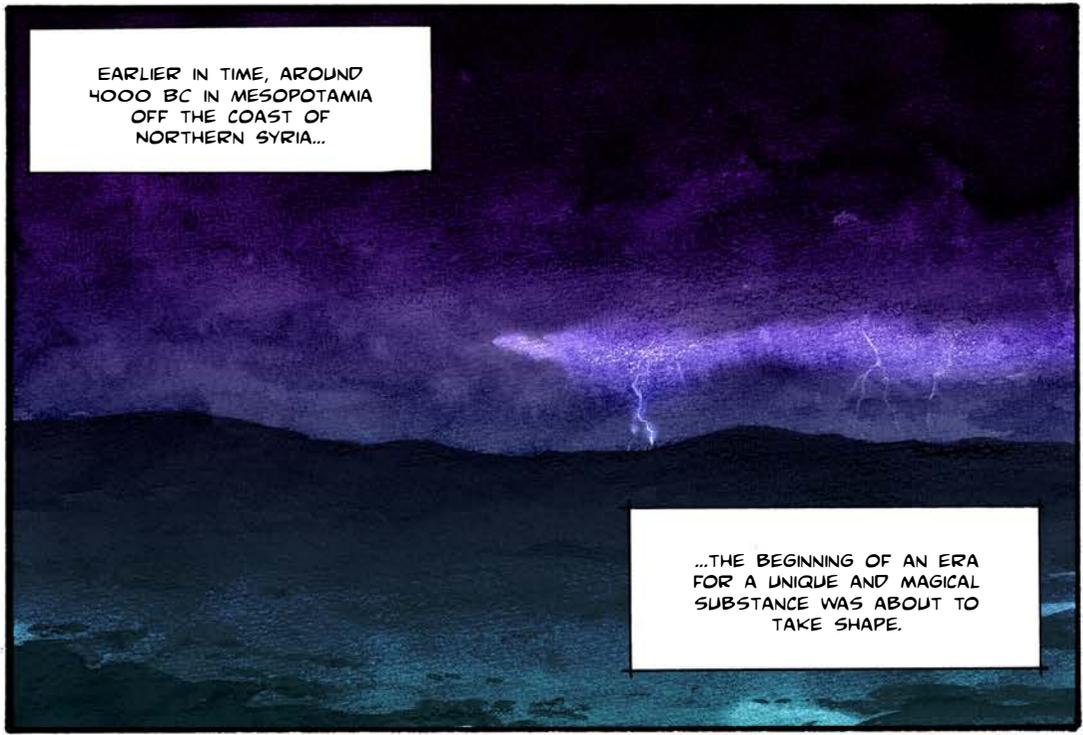
EXPERIMENTS IN ROOF OPENINGS AND HOUSE DESIGNS MADE LIFE EASIER AND MORE COMFORTABLE.



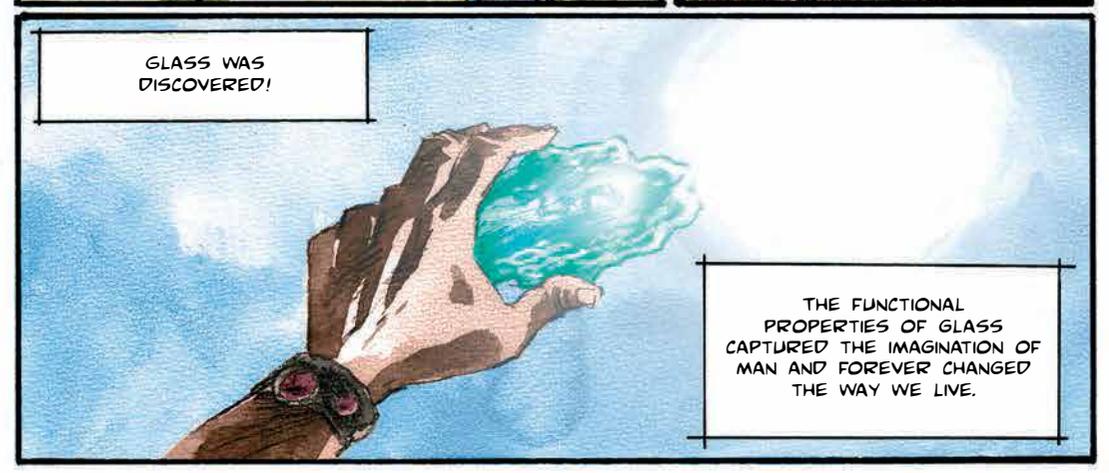
IN NORTHERN EUROPE, PEEP HOLES AND ROOF OPENINGS BECAME MORE COMMON BUT ALSO MORE ADVANCED.

EARLIER IN TIME, AROUND
4000 BC IN MESOPOTAMIA
OFF THE COAST OF
NORTHERN SYRIA...

...THE BEGINNING OF AN ERA
FOR A UNIQUE AND MAGICAL
SUBSTANCE WAS ABOUT TO
TAKE SHAPE.



GLASS WAS
DISCOVERED!



THE FUNCTIONAL
PROPERTIES OF GLASS
CAPTURED THE IMAGINATION OF
MAN AND FOREVER CHANGED
THE WAY WE LIVE.



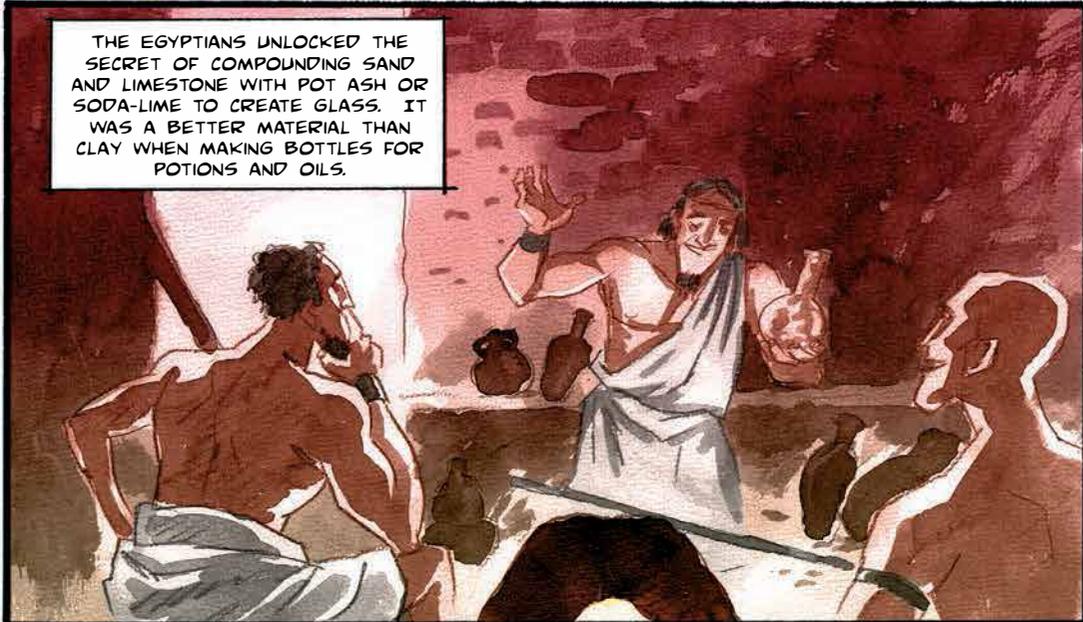
AROUND 2800 BC, EGYPTIAN GLASS WAS USED FOR MORE THAN JUST DECORATION.



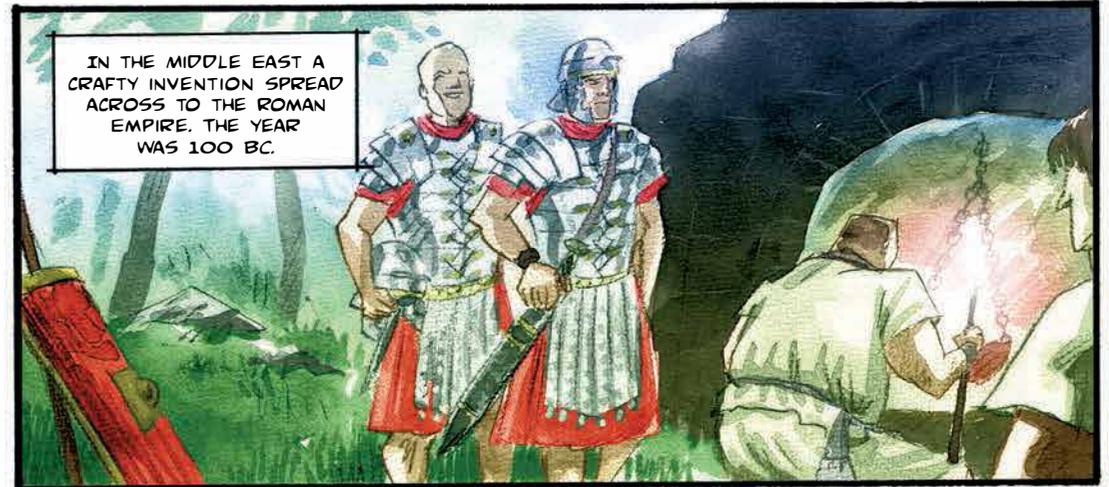
WHAT ARE YOU DOING?



NO, NO, I'M NOT FINISHED.



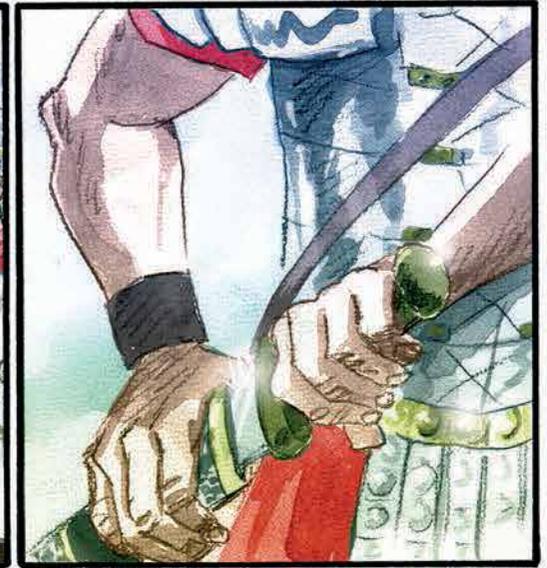
THE EGYPTIANS UNLOCKED THE SECRET OF COMPOUNDING SAND AND LIMESTONE WITH POT ASH OR SODA-LIME TO CREATE GLASS. IT WAS A BETTER MATERIAL THAN CLAY WHEN MAKING BOTTLES FOR POTIONS AND OILS.



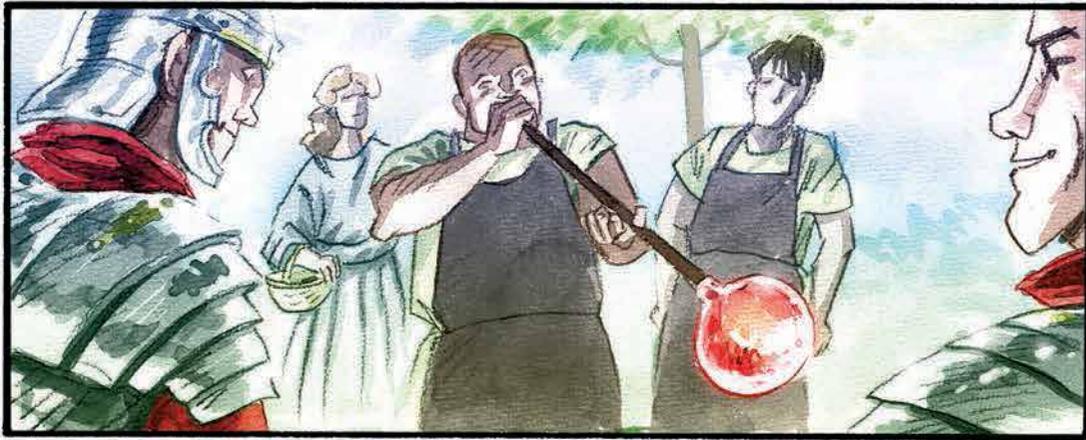
IN THE MIDDLE EAST A CRAFTY INVENTION SPREAD ACROSS TO THE ROMAN EMPIRE. THE YEAR WAS 100 BC.



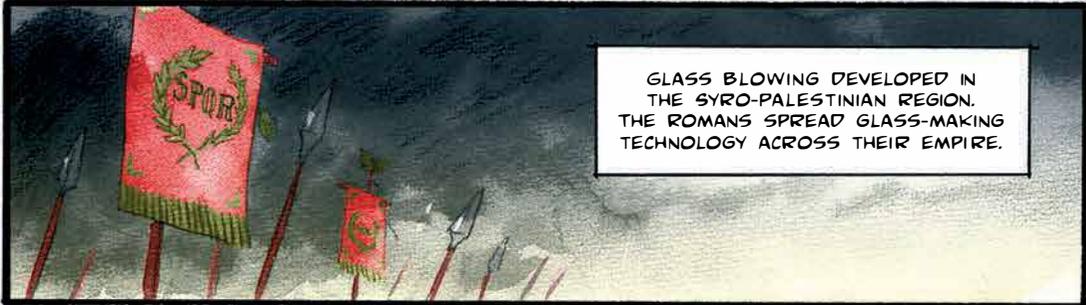
WATCH THIS, YOU WON'T BELIEVE IT.



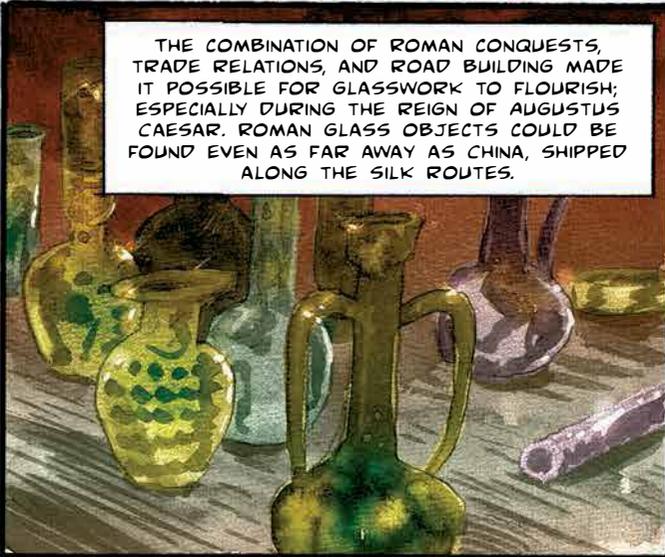
NO! DON'T TOUCH IT... WATCH..



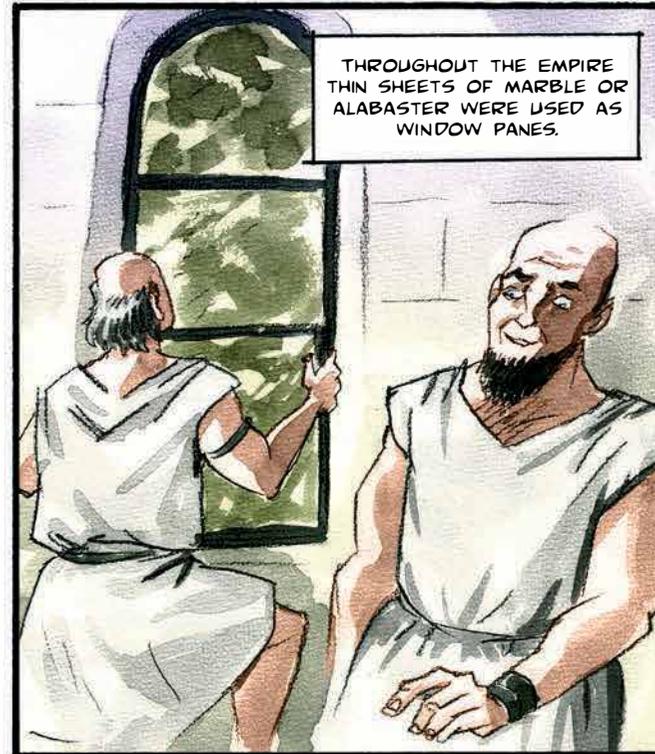
GLASS BLOWING DEVELOPED IN THE SYRO-PALESTINIAN REGION. THE ROMANS SPREAD GLASS-MAKING TECHNOLOGY ACROSS THEIR EMPIRE.



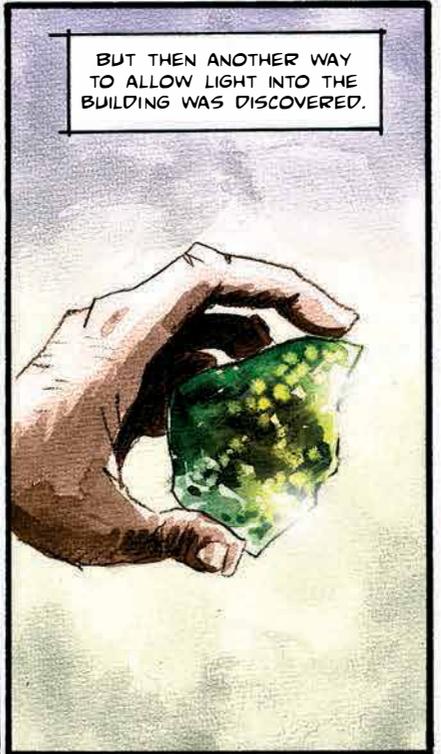
THE COMBINATION OF ROMAN CONQUESTS, TRADE RELATIONS, AND ROAD BUILDING MADE IT POSSIBLE FOR GLASSWORK TO FLOURISH; ESPECIALLY DURING THE REIGN OF AUGUSTUS CAESAR. ROMAN GLASS OBJECTS COULD BE FOUND EVEN AS FAR AWAY AS CHINA, SHIPPED ALONG THE SILK ROUTES.



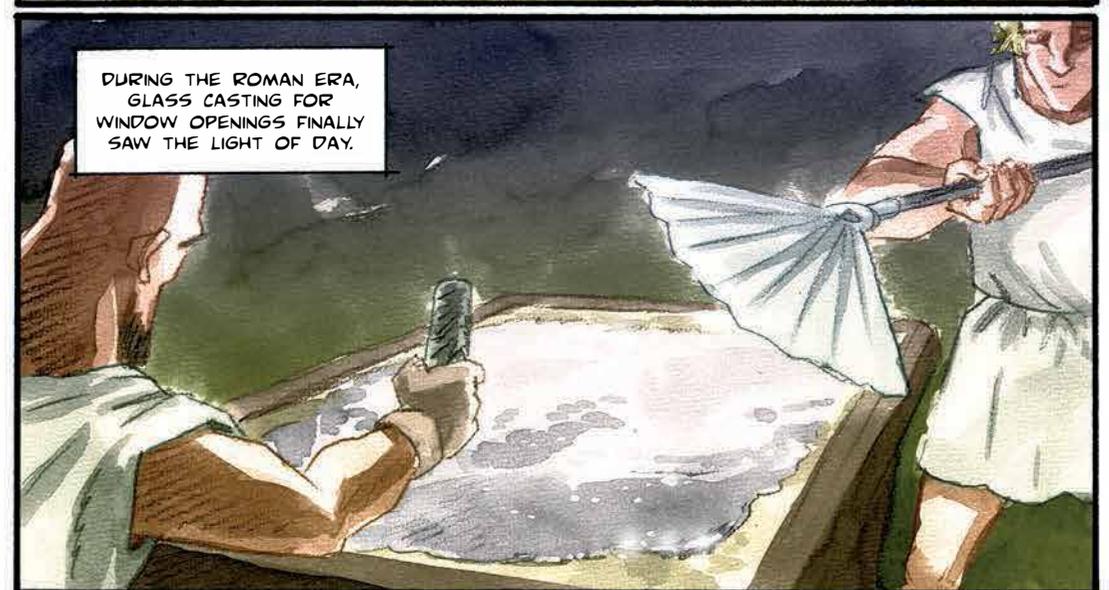
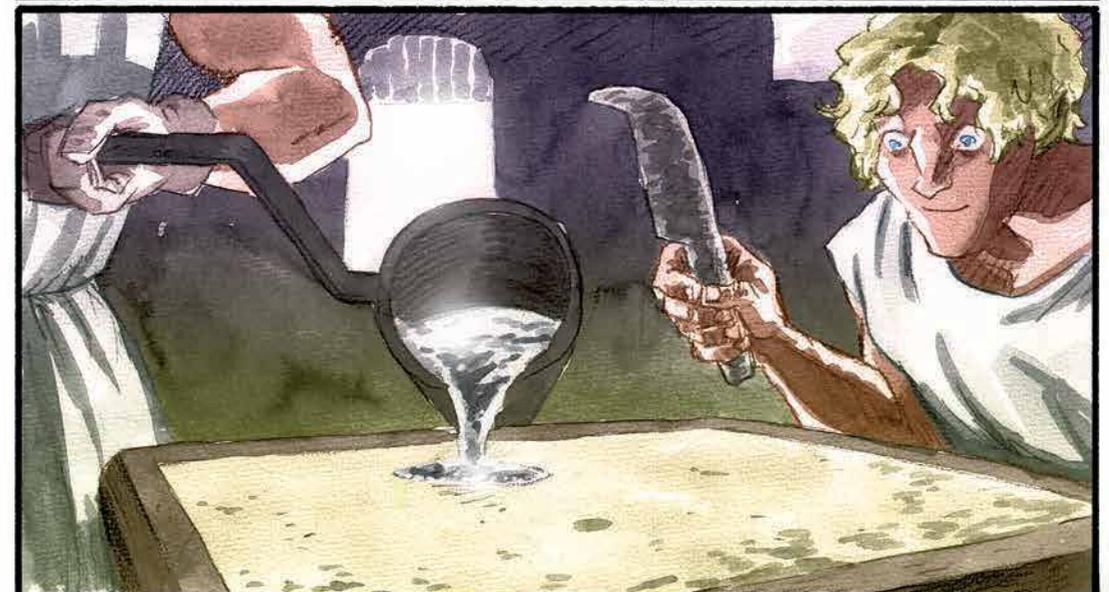
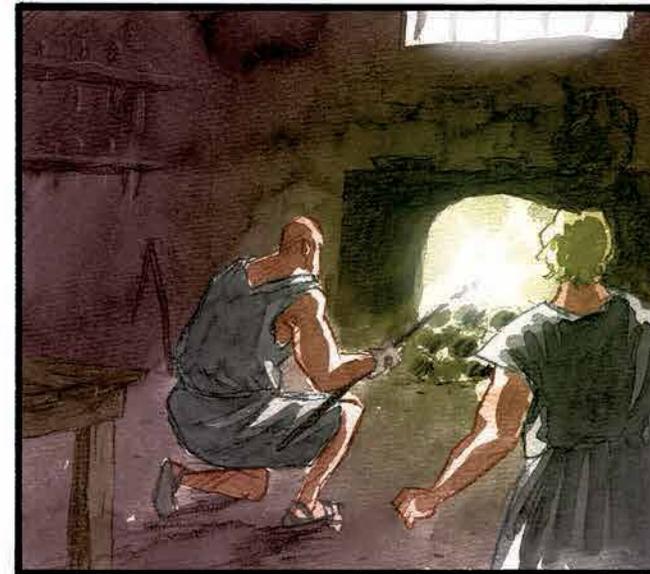
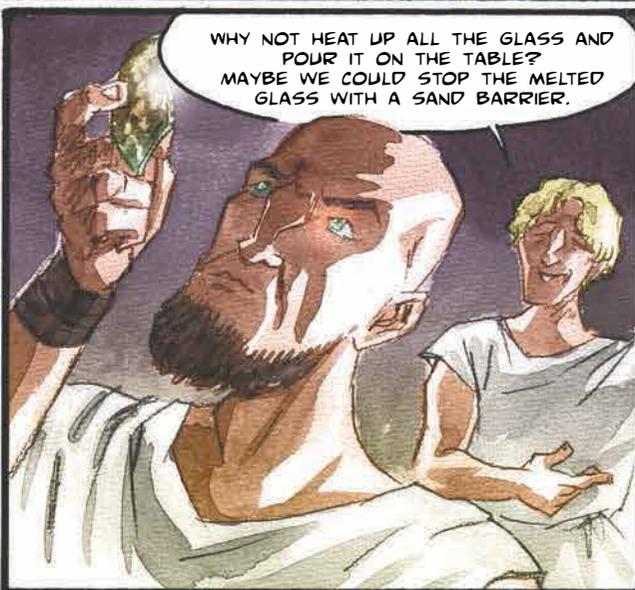
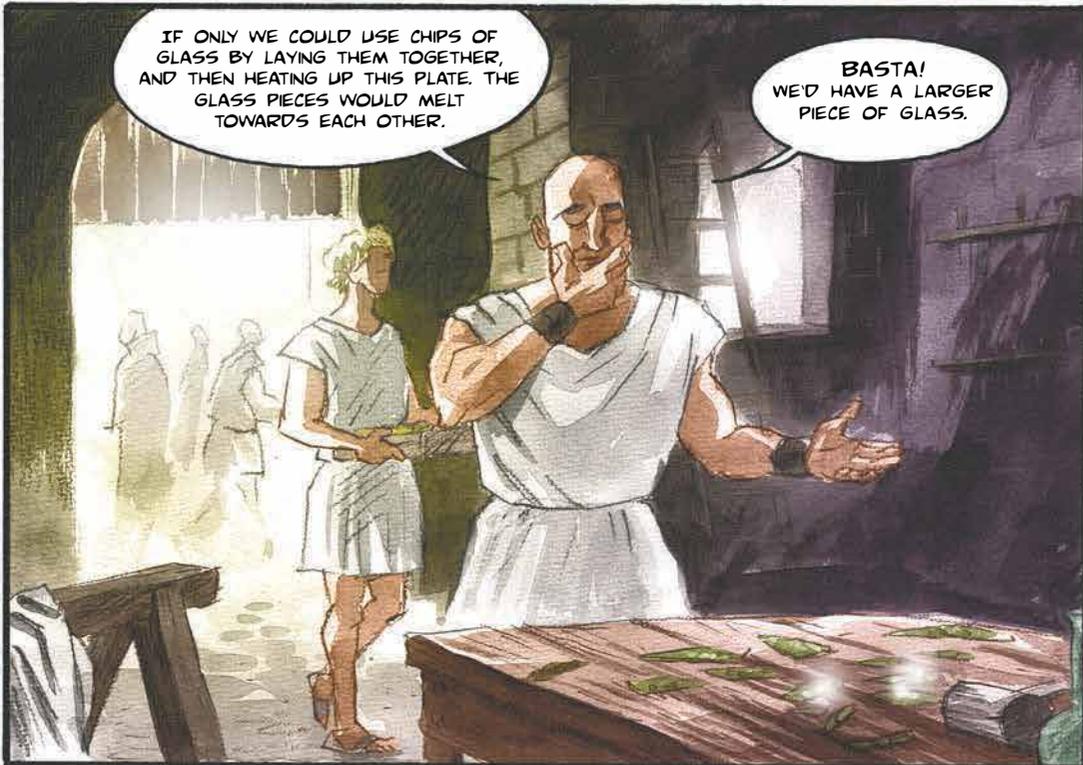
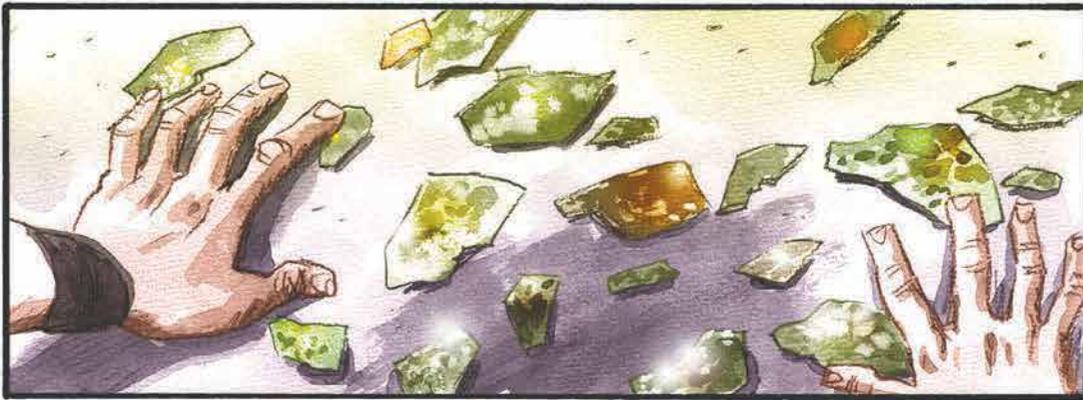
IN POMPEII A MECCA FOR ARTISTS AND CRAFTSMEN PROSPERED.

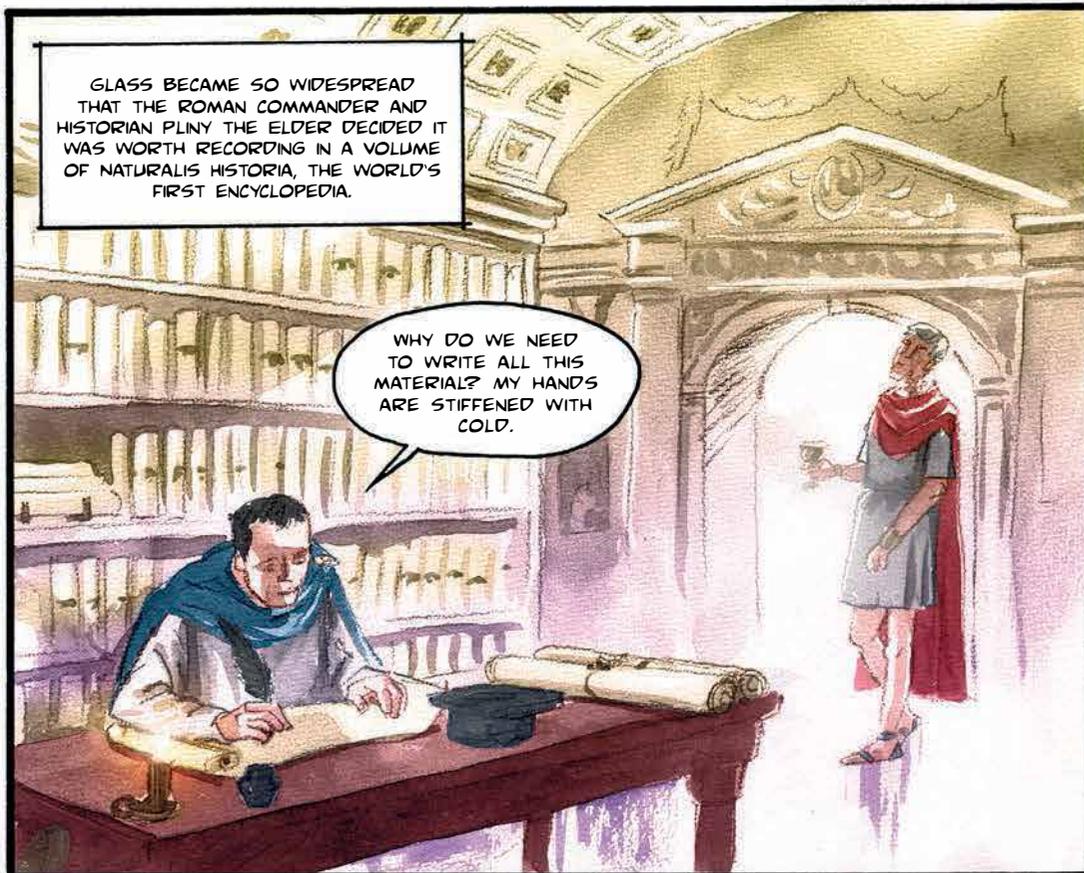


THROUGHOUT THE EMPIRE THIN SHEETS OF MARBLE OR ALABASTER WERE USED AS WINDOW PANES.



BUT THEN ANOTHER WAY TO ALLOW LIGHT INTO THE BUILDING WAS DISCOVERED.





GLASS BECAME SO WIDESPREAD THAT THE ROMAN COMMANDER AND HISTORIAN PLINEY THE ELDER DECIDED IT WAS WORTH RECORDING IN A VOLUME OF NATURALIS HISTORIA, THE WORLD'S FIRST ENCYCLOPEDIA.

WHY DO WE NEED TO WRITE ALL THIS MATERIAL? MY HANDS ARE STIFFENED WITH COLD.



WE ARE GOING TO RECORD THE ENTIRE FIELD OF KNOWLEDGE.



KNOWLEDGE GIVES MAN HOPE.

HOPE IS THE PILLAR THAT HOLDS UP THE WORLD. HOPE IS THE DREAM OF A WAKING MAN.

BUT PLINEY THE ELDER NEVER FINISHED HIS AMBITIOUS QUEST.



MOUNT YESUVIUS HAS ERUPTED!

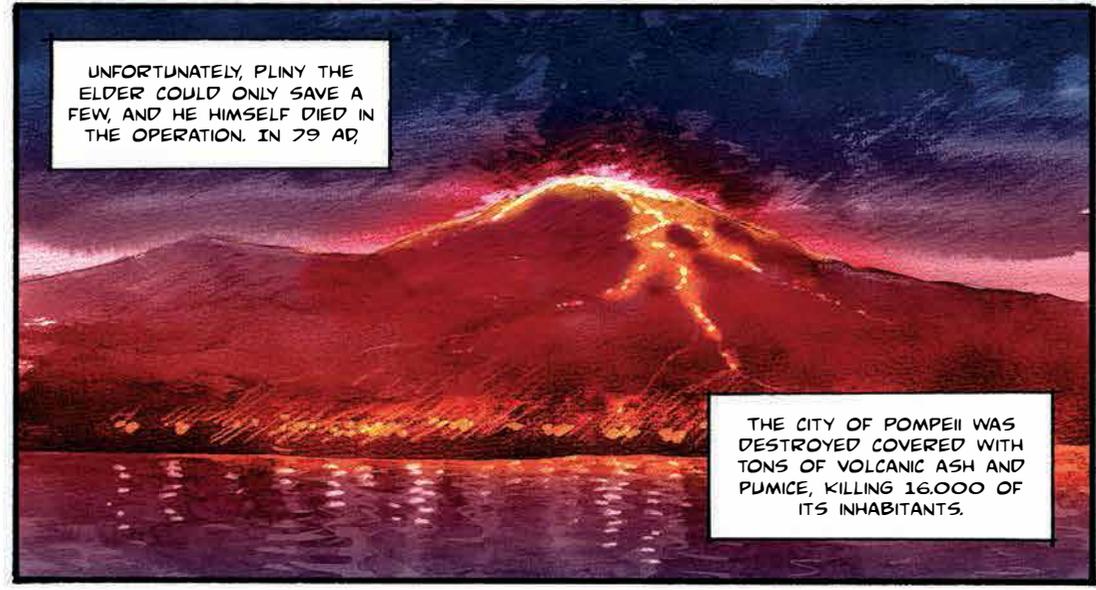
WHAT?!! I MUST LEAVE AT ONCE; TELL MY NEPHEW I'LL BE BACK!



SIR, I UNDERSTAND YOU'RE THE NAVAL COMMANDER, BUT WE MUST TURN BACK, IT'S TOO DANGEROUS!

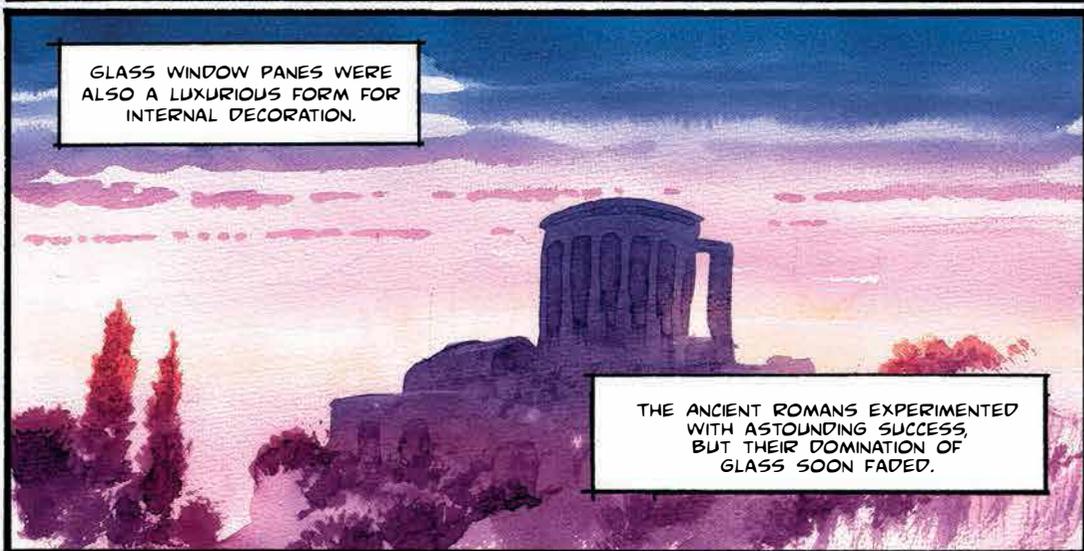
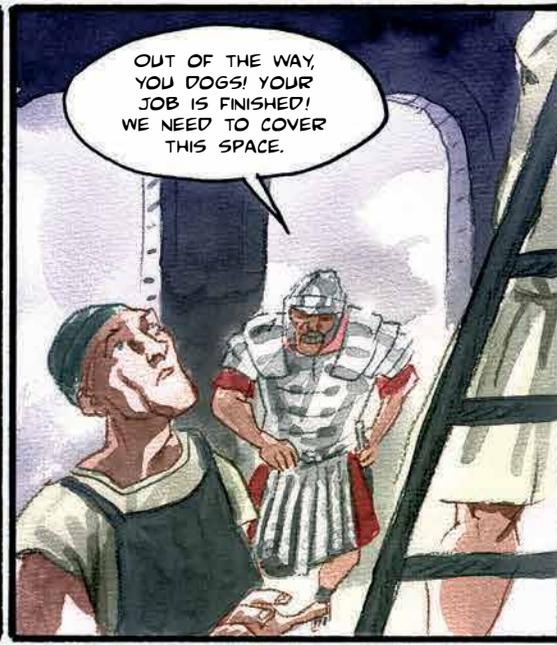
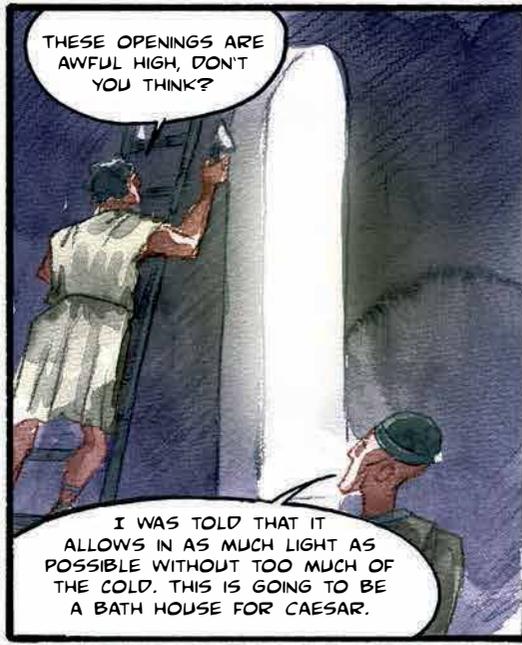


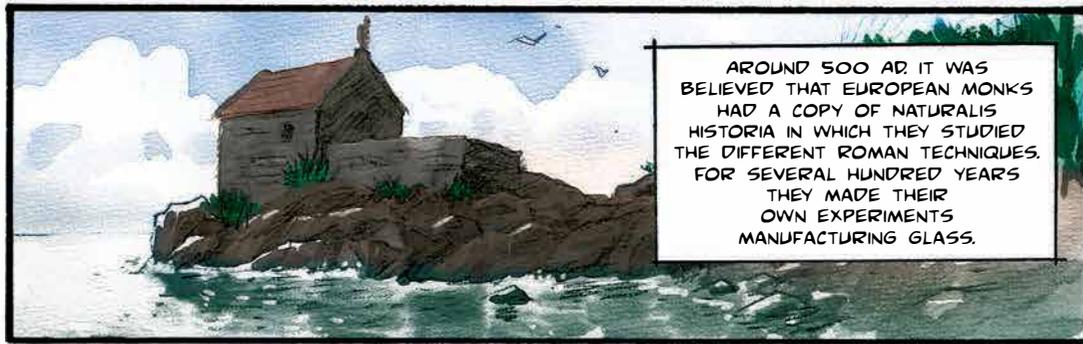
FORTUNE FAVORS THE BRAVE! STEER TOWARD'S THE SHORELINE, THERE ARE MANY WHO NEED OUR ASSISTANCE.



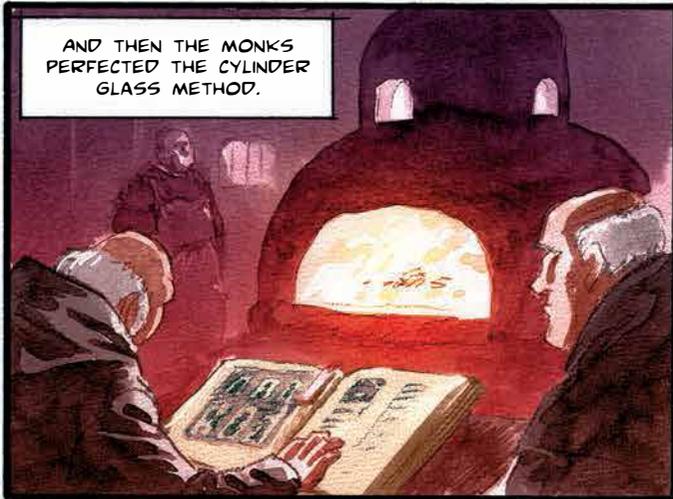
UNFORTUNATELY, PLINEY THE ELDER COULD ONLY SAVE A FEW, AND HE HIMSELF DIED IN THE OPERATION. IN 79 AD,

THE CITY OF POMPEII WAS DESTROYED COVERED WITH TONS OF VOLCANIC ASH AND PUMICE, KILLING 16,000 OF ITS INHABITANTS.





AROUND 500 AD IT WAS BELIEVED THAT EUROPEAN MONKS HAD A COPY OF NATURALIS HISTORIA IN WHICH THEY STUDIED THE DIFFERENT ROMAN TECHNIQUES. FOR SEVERAL HUNDRED YEARS THEY MADE THEIR OWN EXPERIMENTS MANUFACTURING GLASS.



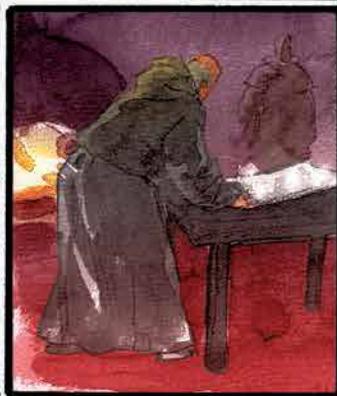
AND THEN THE MONKS PERFECTED THE CYLINDER GLASS METHOD.



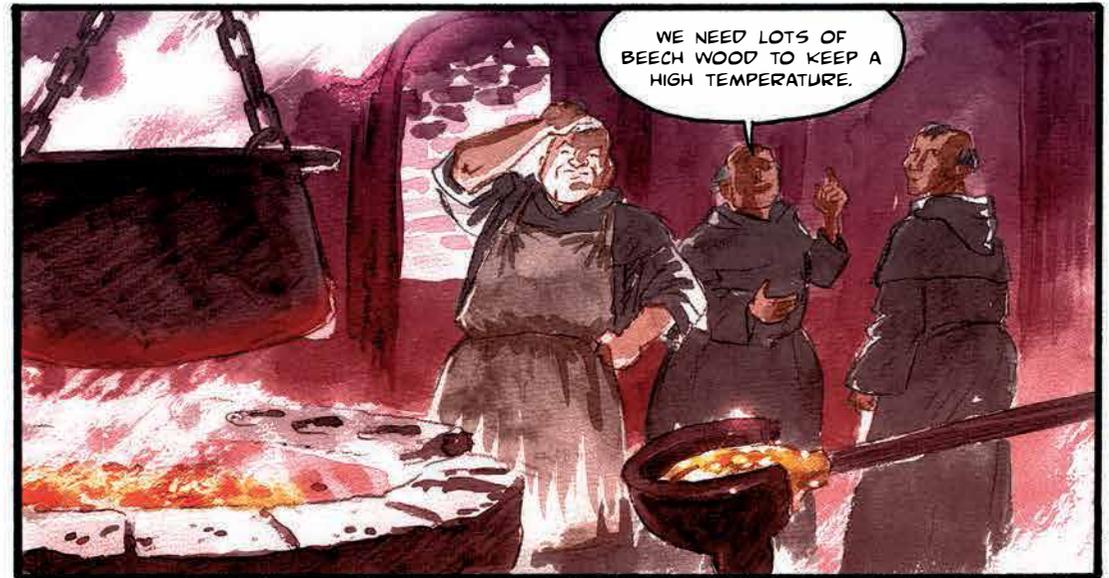
IT TAKES A CERTAIN AMOUNT OF SKILL AND THE RESULT IS REMARKABLE.



WE SLICE THE GLASS WHILE IT'S WARM.



AND THEN FLATTEN IT OUT LIKE SO.



WE NEED LOTS OF BEECH WOOD TO KEEP A HIGH TEMPERATURE.



A FASCINATING METHOD, BUT VERY TIME CONSUMING.



NO, DON'T TOUCH! IT MUST COOL.



NOW I'LL SHOW YOU WHY IT'S WORTH OUR TIME. WE'VE FOUND THAT IRON MAKES THE GLASS GREEN, COBALT AND NICKEL MAKES IT BLUE, COPPER AND A BIT OF GOLD DUST MAKES IT RED AND SILVER NITRATE TURNS IT YELLOW.

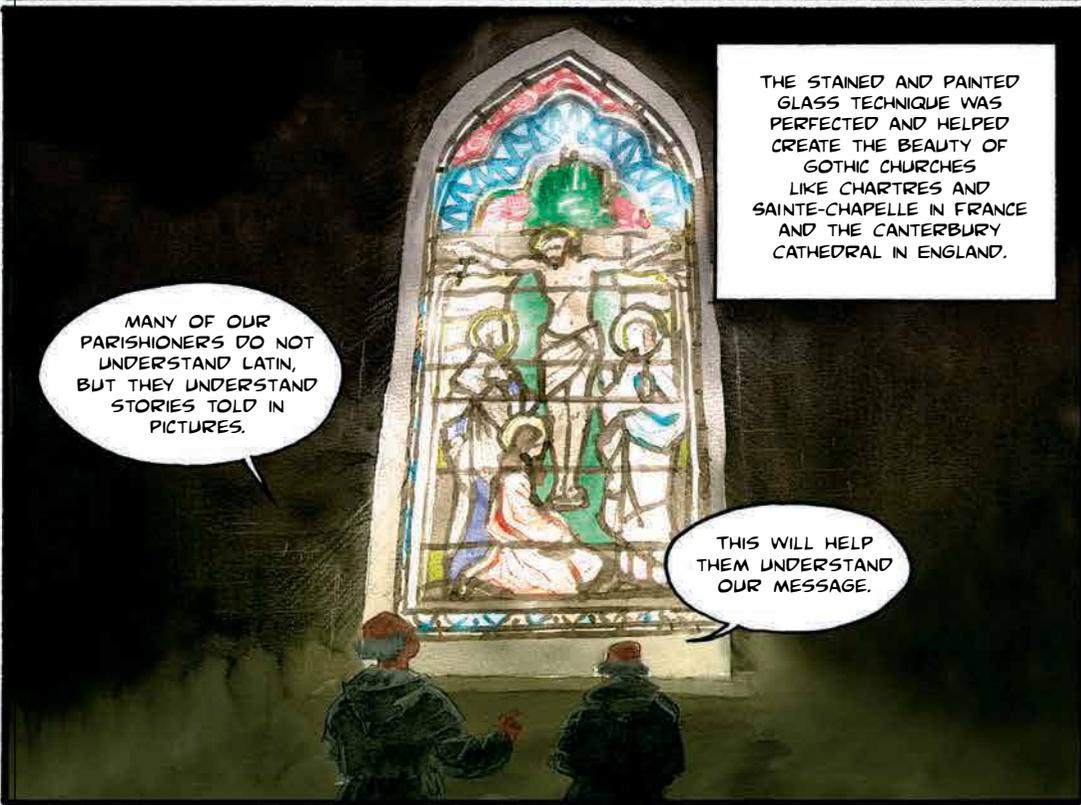
WE THEN FIT THE COLORED GLASS PIECES IN LEAD BARS TO HOLD THEM TOGETHER.



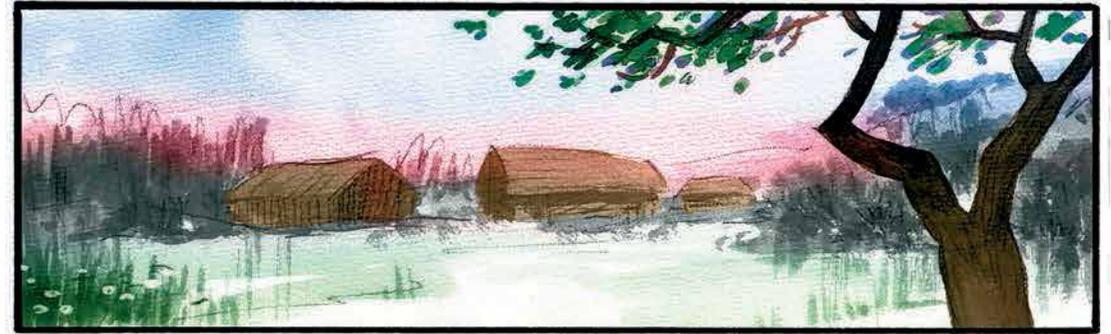
THE STAINED AND PAINTED GLASS TECHNIQUE WAS PERFECTED AND HELPED CREATE THE BEAUTY OF GOTHIC CHURCHES LIKE CHARTRES AND SAINTE-CHAPELLE IN FRANCE AND THE CANTERBURY CATHEDRAL IN ENGLAND.

MANY OF OUR PARISHIONERS DO NOT UNDERSTAND LATIN, BUT THEY UNDERSTAND STORIES TOLD IN PICTURES.

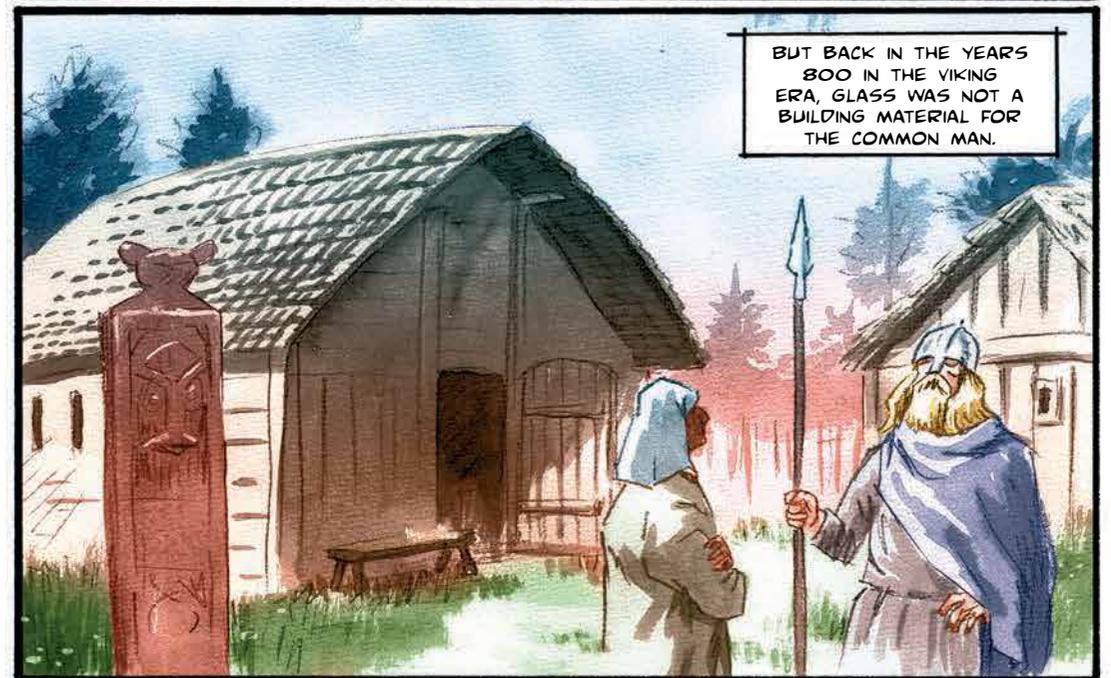
THIS WILL HELP THEM UNDERSTAND OUR MESSAGE.



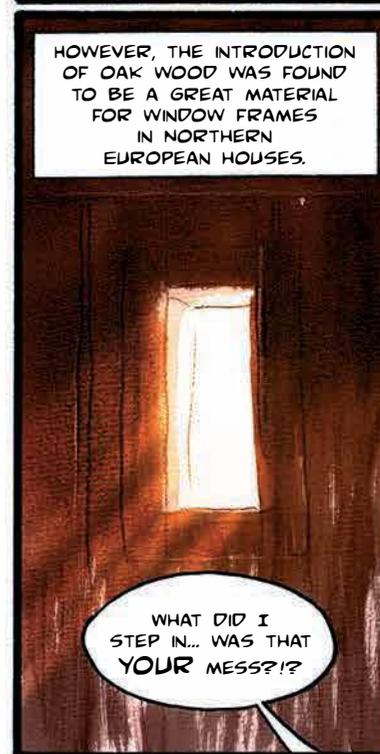
ADORO TE DEVOTE, LATENS DEITAS, QUAE SUB HIS FIGURIS VERE LATITAS; TIBI SE COR MEUM TOTUM SUBJICIT, QUIA TE CONTEMPLANS, TOTUM DEFICIT.



BUT BACK IN THE YEARS 800 IN THE VIKING ERA, GLASS WAS NOT A BUILDING MATERIAL FOR THE COMMON MAN.



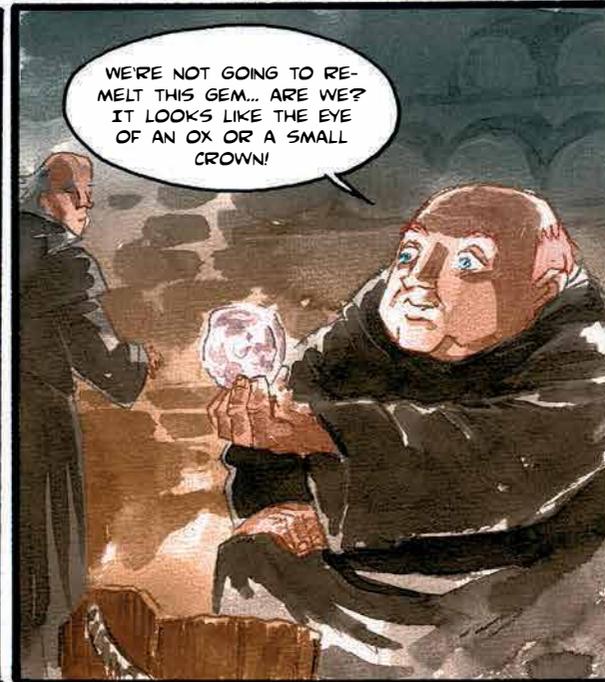
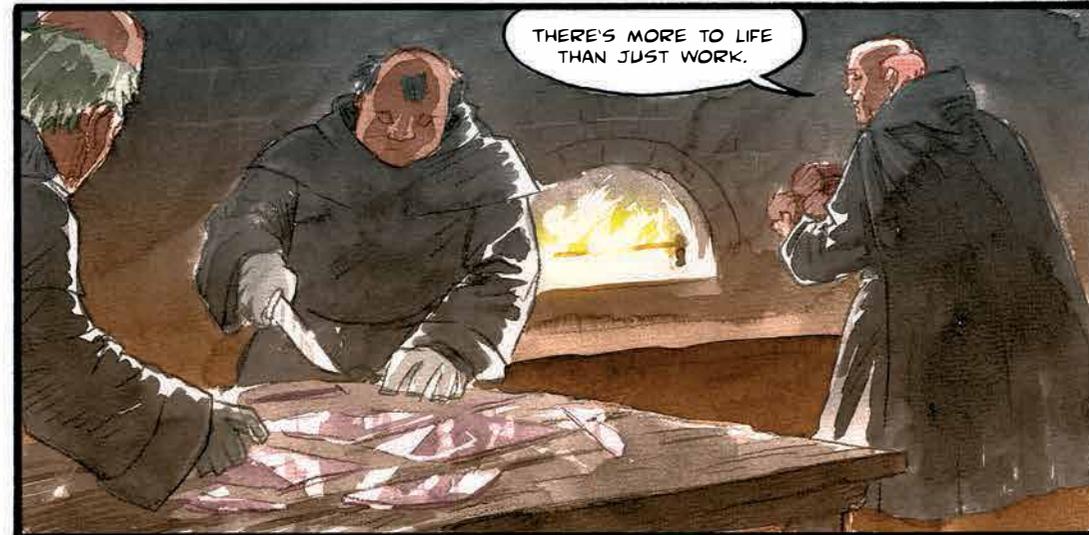
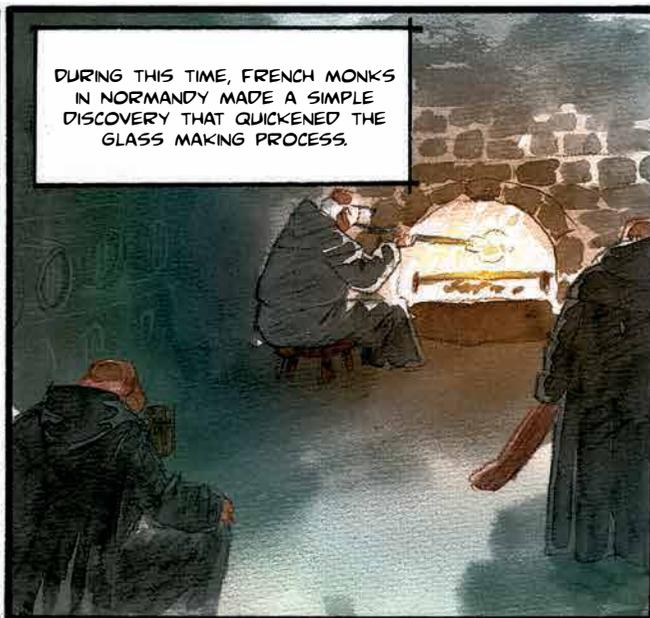
HOWEVER, THE INTRODUCTION OF OAK WOOD WAS FOUND TO BE A GREAT MATERIAL FOR WINDOW FRAMES IN NORTHERN EUROPEAN HOUSES.



WHAT DID I STEP IN... WAS THAT YOUR MESS!?



IN THIS PERIOD DOMESTIC ANIMALS WERE MOVED OUT OF THE HOME TO GAIN MORE SPACE FOR THE INHABITANTS.

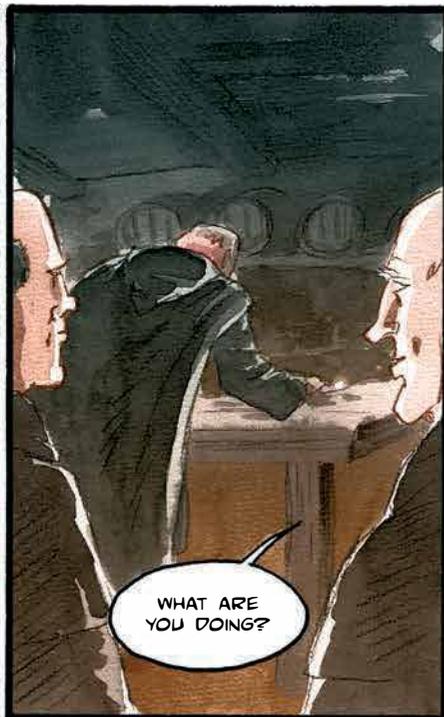




YOU MUST UNDERSTAND, THIS IS AN EXPENSIVE PROCESS; WE DO NOT THROW OUT THE WASTE. IT ALL GOES BACK IN THE MELTING POT.



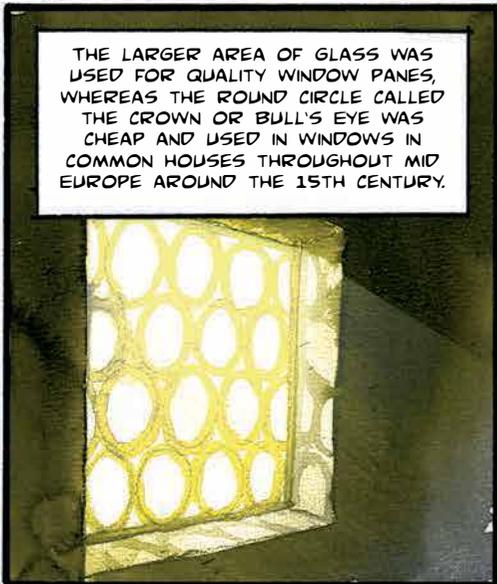
DON'T BE ABSURD, THERE MUST BE A PLACE FOR THIS PRECIOUS JEWEL.



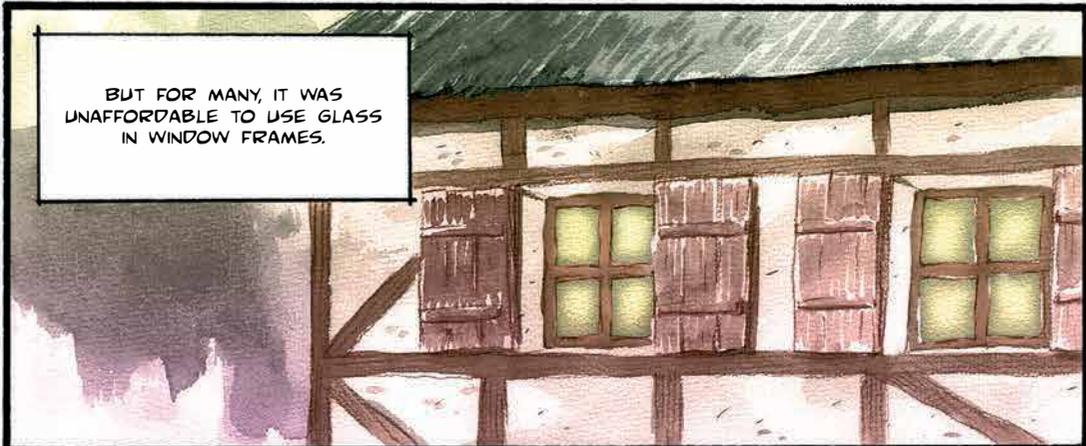
WHAT ARE YOU DOING?



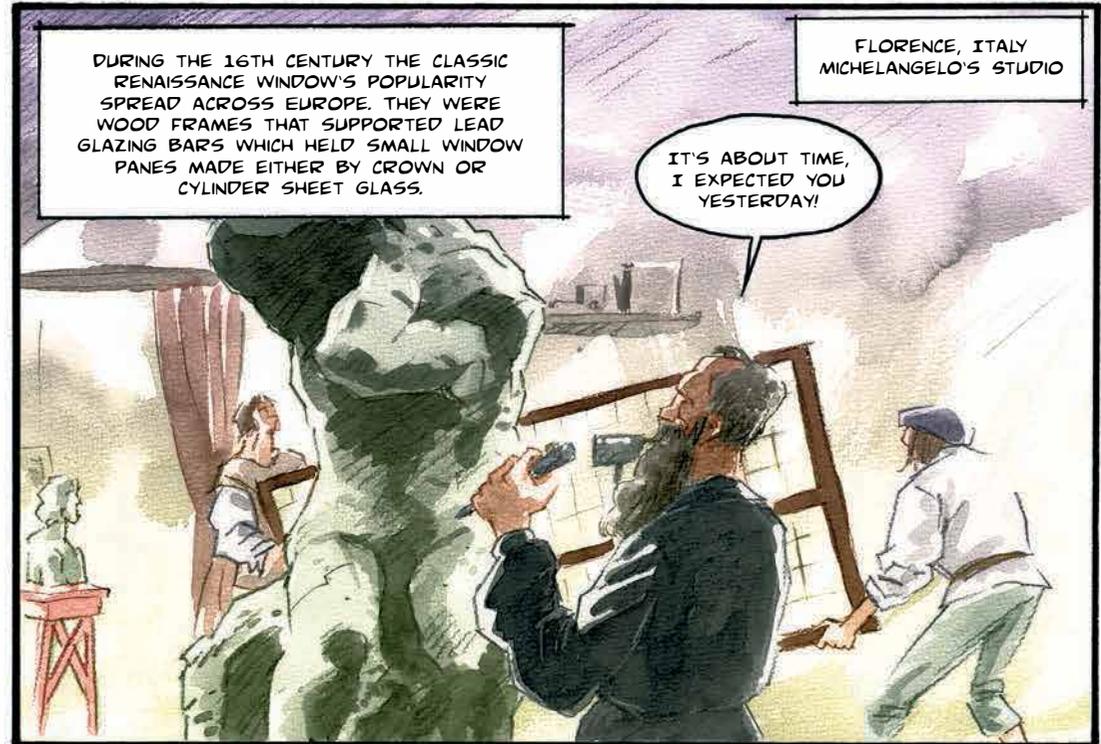
THE CROWN GLASS METHOD OPENED A NEW POSSIBILITY TO PRODUCE CHEAPER GLASS WINDOWS.



THE LARGER AREA OF GLASS WAS USED FOR QUALITY WINDOW PANES, WHEREAS THE ROUND CIRCLE CALLED THE CROWN OR BULL'S EYE WAS CHEAP AND USED IN WINDOWS IN COMMON HOUSES THROUGHOUT MID EUROPE AROUND THE 15TH CENTURY.



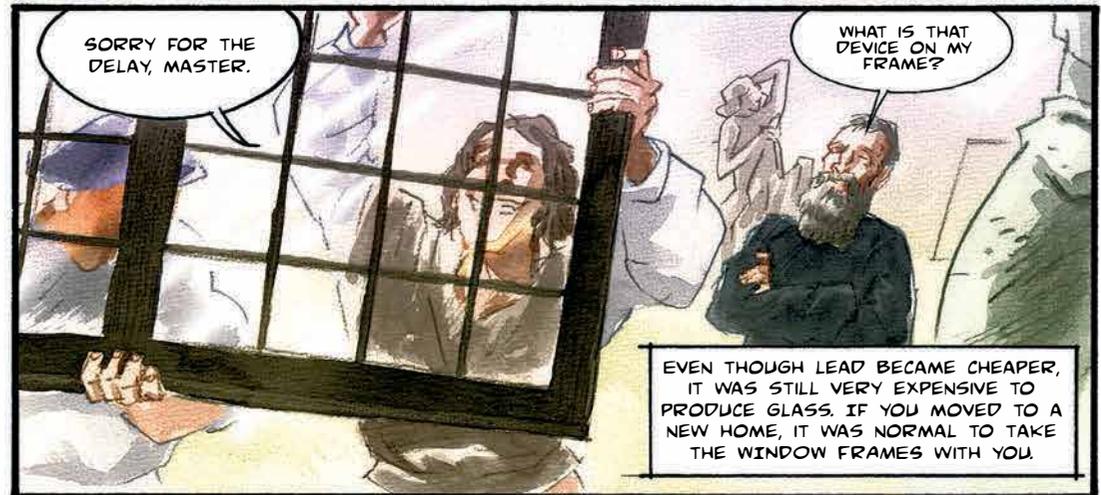
BUT FOR MANY, IT WAS UNAFFORDABLE TO USE GLASS IN WINDOW FRAMES.



DURING THE 16TH CENTURY THE CLASSIC RENAISSANCE WINDOW'S POPULARITY SPREAD ACROSS EUROPE. THEY WERE WOOD FRAMES THAT SUPPORTED LEAD GLAZING BARS WHICH HELD SMALL WINDOW PANES MADE EITHER BY CROWN OR CYLINDER SHEET GLASS.

FLORENCE, ITALY
MICHELANGELO'S STUDIO

IT'S ABOUT TIME, I EXPECTED YOU YESTERDAY!



SORRY FOR THE DELAY, MASTER.

WHAT IS THAT DEVICE ON MY FRAME?

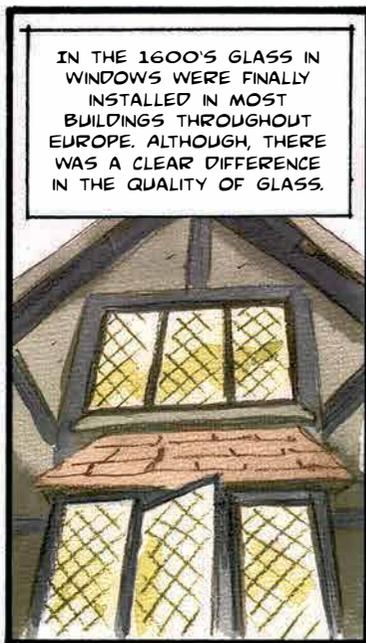
EVEN THOUGH LEAD BECAME CHEAPER, IT WAS STILL VERY EXPENSIVE TO PRODUCE GLASS. IF YOU MOVED TO A NEW HOME, IT WAS NORMAL TO TAKE THE WINDOW FRAMES WITH YOU.



AH, CLEVER!

IT ALLOWS THE WINDOW TO OPEN!

AROUND THIS TIME, SIDE HINGES WERE BECOMING COMMON. IN SOUTHERN EUROPE, THE WINDOWS OPENED INWARD'S BECAUSE OF THE WOODEN SHUTTERS. BUT IN NORTHERN EUROPE THEY OPENED OUTWARDS.



IN THE 1600'S GLASS IN WINDOWS WERE FINALLY INSTALLED IN MOST BUILDINGS THROUGHOUT EUROPE. ALTHOUGH, THERE WAS A CLEAR DIFFERENCE IN THE QUALITY OF GLASS.



GERMAN GLASS WAS THE CHEAPEST, BUT NOT VERY CLEAR.



THEREFORE NOBLEMEN AND RICH MERCHANTS FROM THE NORTH PREFERRED HIGH QUALITY FRENCH AND ITALIAN GLASS.

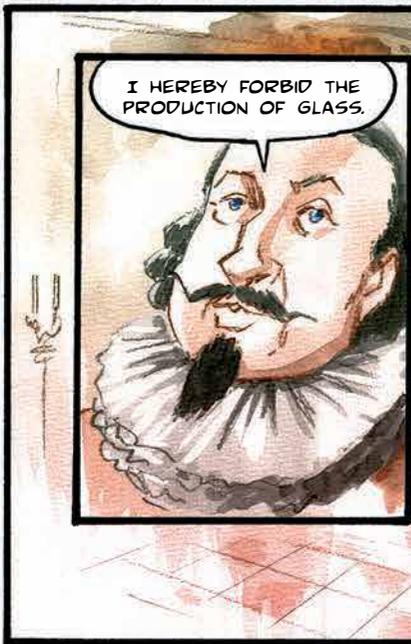


PRODUCING GLASS WAS ALSO A MATTER OF PRIORITY AS WAS DISCOVERED IN DENMARK AROUND 1608 UNDER KING CHRISTIAN THE 4TH.



STOP WHAT YOU'RE DOING IMMEDIATELY!

WHAT'S WRONG? WE PAID OUR TAXES.



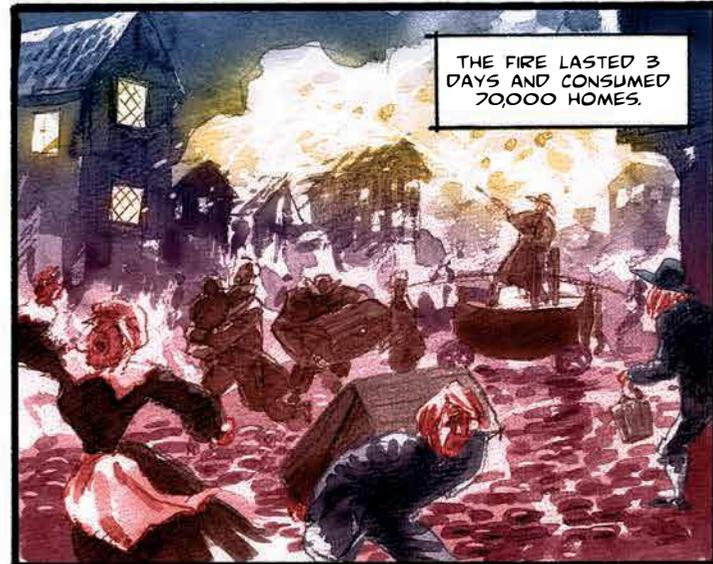
I HEREBY FORBID THE PRODUCTION OF GLASS.



OUR OAK FORESTS ARE TO BE USED FOR THE FLEET SO WE CAN DOMINATE THE BALTIC SEA! IT IS NOT TO BE USED ON EXPENSIVE GLASS PRODUCTION! ANYONE WHO WANTS GLAZING FOR WINDOWS CAN IMPORT THEM!



SHORTLY AFTER MIDNIGHT ON SEPTEMBER 2ND, 1666 A FIRE BROKE OUT IN A BAKERY IN LONDON.



THE FIRE LASTED 3 DAYS AND CONSUMED 70,000 HOMES.



HELP! WE CAN'T GET OUT!!



IT HAS BEEN RECORDED THAT THE FIRE REACHED A TEMPERATURE OF 1700 °C. THE HEAT CREATED MANY VICTIMS LEAVING NO RECOGNIZABLE REMAINS.



IN THE AFTERMATH OF THE GREAT LONDON FIRE, ROBERT HOOKE A BRILLIANT ARCHITECT AND PHILOSOPHER PERFECTED THE IDEA OF THE SASH WINDOW INSPIRED BY DUTCH, FRENCH AND ITALIAN VARIATIONS.

THE IDEA IS THAT THE WINDOW IS ABLE TO OPEN, AND CLOSE NATURALLY WITH THE EASE OF HAND. THE WEIGHTS HANGING ON THE PULLEY COUNTER THE BALANCE AND A STURDY CASEMENT AROUND THE WINDOW PANE WILL WITHSTAND THE STRONG WINDS.

PLEASE ALLOW ME TO INTRODUCE THE BENEFITS OF THIS DEVICE.



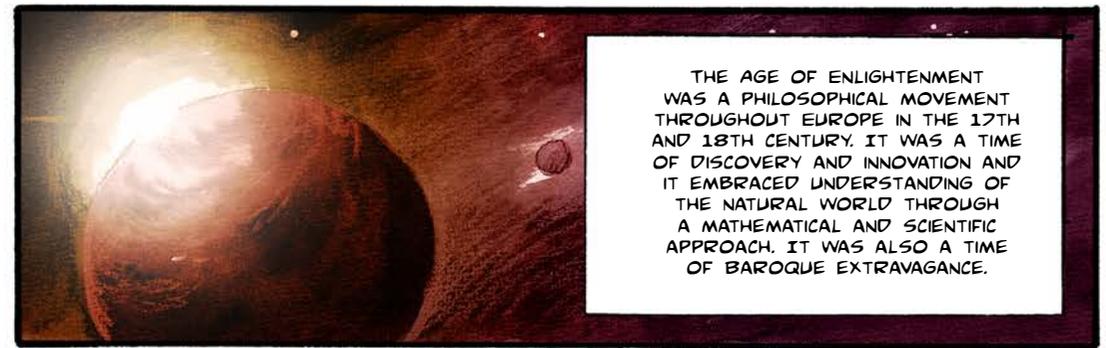
AN OPEN WINDOW GIVES YOU FRESH AIR WHENEVER YOU NEED IT.



AND AS YOU CAN SEE, IT CAN ALSO BE USED TO EXIT THE BUILDING; A SORT OF FIRE ESCAPE DEVICE.



THE WORD "SASH" DERIVES FROM THE FRENCH WORD CHASSIS MEANING FRAME.



THE AGE OF ENLIGHTENMENT WAS A PHILOSOPHICAL MOVEMENT THROUGHOUT EUROPE IN THE 17TH AND 18TH CENTURY. IT WAS A TIME OF DISCOVERY AND INNOVATION AND IT EMBRACED UNDERSTANDING OF THE NATURAL WORLD THROUGH A MATHEMATICAL AND SCIENTIFIC APPROACH. IT WAS ALSO A TIME OF BAROQUE EXTRAVAGANCE.



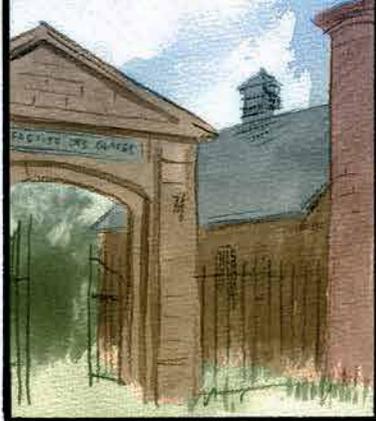
FINISHED IN 1684, THE HALL OF MIRRORS AT VERSAILLES WAS A FINE EXAMPLE OF HOW AN INTELLECTUAL MOVEMENT INSPIRED ARCHITECTURE.

THE INFINITE IS AN IDEAL IN OUR SOCIETY. LOOK AT WHAT HAS BEEN ACHIEVED!



WE HAVE A PERFECT COMBINATION OF MIRRORS AND LARGE WINDOWS THAT REFLECT THE LIGHT IN ALL DIRECTIONS. A SENSE OF INFINITY HAS BEEN CREATED FOR YOU MY KING.

LOUIS LUCAS DE NEHOU CAME FROM A FAMILY OF GLASS SMITHS. HE PERFECTED THE MANUFACTURING OF CASTED PLATE GLASS IN LARGE DIMENSIONS.



IN THIS NEW METHOD, LARGE PLATE GLASS WAS CASTED AT SAINT-GOBAIN IN PARIS; GRINDED AND POLISHED WITH FINE SAND AND FELT TO MAKE THE GLASS SMOOTH AND PERFECT FOR MIRRORS.



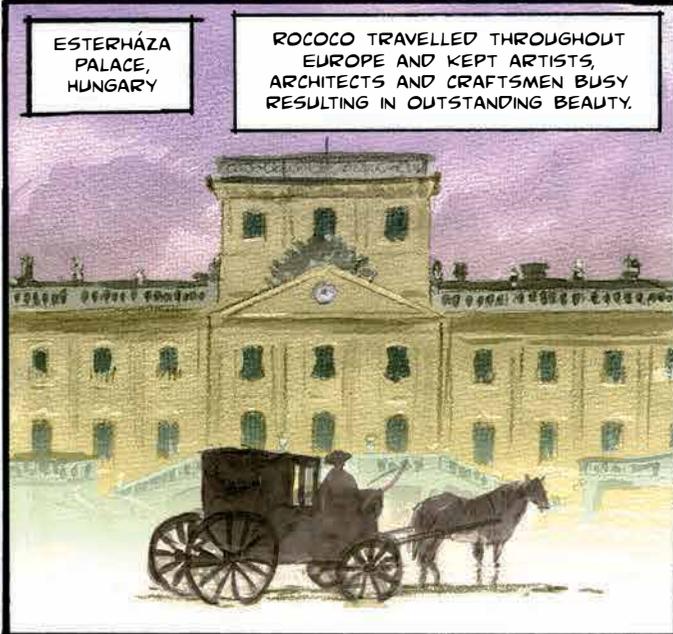
GDANSK, POLAND



IN THE 1700'S THE FRENCH ROCOCO WINDOW WAS INTRODUCED. ROCOCO COMES FROM THE FRENCH WORD ROCAILLE MEANING CLAM OR ORNAMENTAL ROCK. THE STYLE USES DECORATIVE DETAILS AND IS KNOWN FOR PLACING THE TRANSOM UP HIGH FOR BETTER VIEWING POSSIBILITIES.

ESTERHÁZA PALACE, HUNGARY

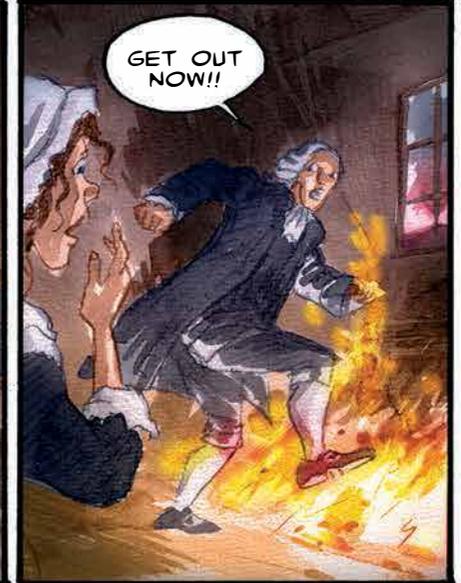
ROCOCO TRAVELLED THROUGHOUT EUROPE AND KEPT ARTISTS, ARCHITECTS AND CRAFTSMEN BUSY RESULTING IN OUTSTANDING BEAUTY.



IN COPENHAGEN, WEDNESDAY THE 20TH OF OCTOBER 1728, AROUND 7:30 PM A RESTAURANT OWNER MADE A TERRIBLE BLUNDER.



GET OUT NOW!!



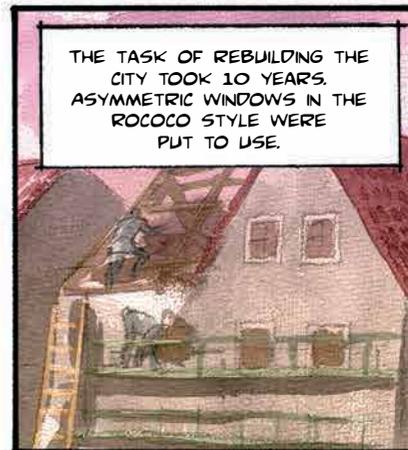
FIRE! FIRE!!



MANY ATTEMPTS TO STOP THE FLAMES FAILED, EVEN SHOOTING CANONS TO DESTROY BUILDINGS WERE PUT TO REST AND THE HORRENDOUS FIRE LASTS 3 DAYS, DESTROYING NEARLY A THIRD OF THE CITY. COUNTLESS LIVES WERE LOST.



THE TASK OF REBUILDING THE CITY TOOK 10 YEARS. ASYMMETRIC WINDOWS IN THE ROCOCO STYLE WERE PUT TO USE.

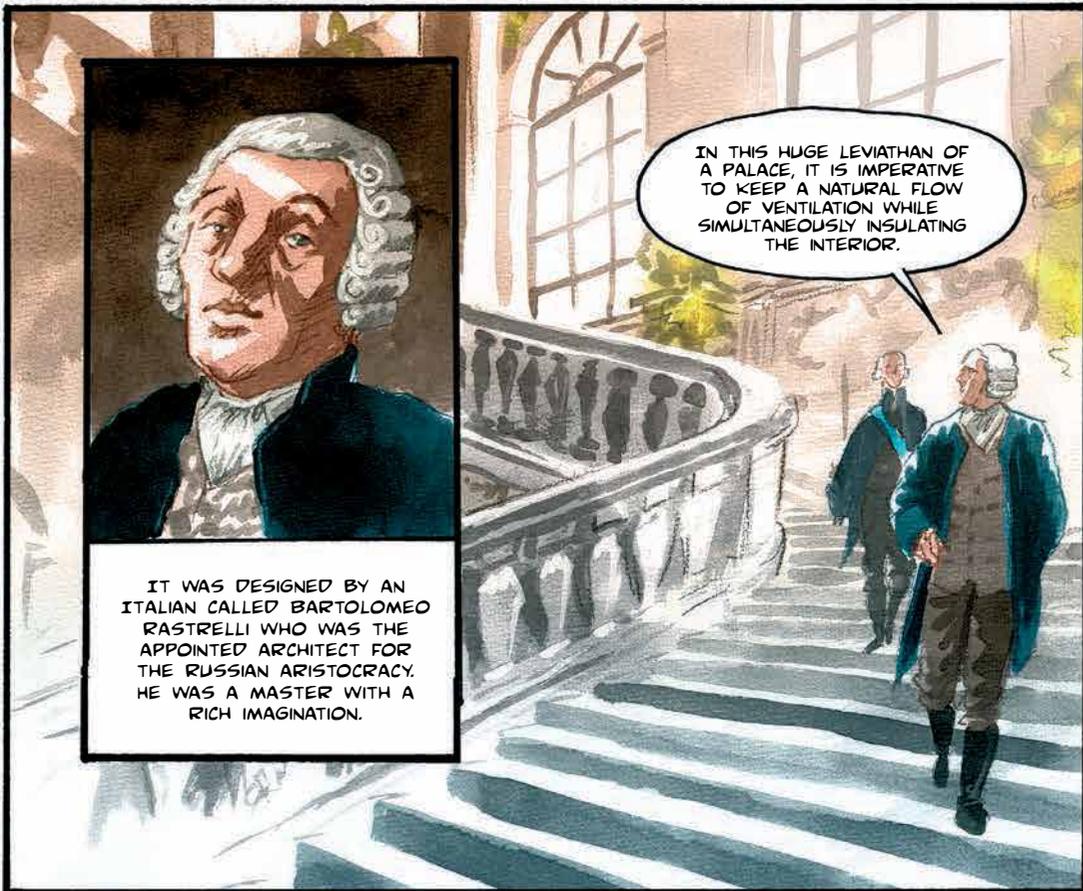


IN THE 1750'S, AMALIENBORG PALACE WAS BUILT AND WAS KNOWN TO BE A TREASURED EXAMPLE OF THE ROCOCO STYLE. IN 1794 IT BECAME THE RESIDENCE OF THE DANISH ROYAL FAMILY AFTER CHRISTIANSBORG PALACE BURNED DOWN.



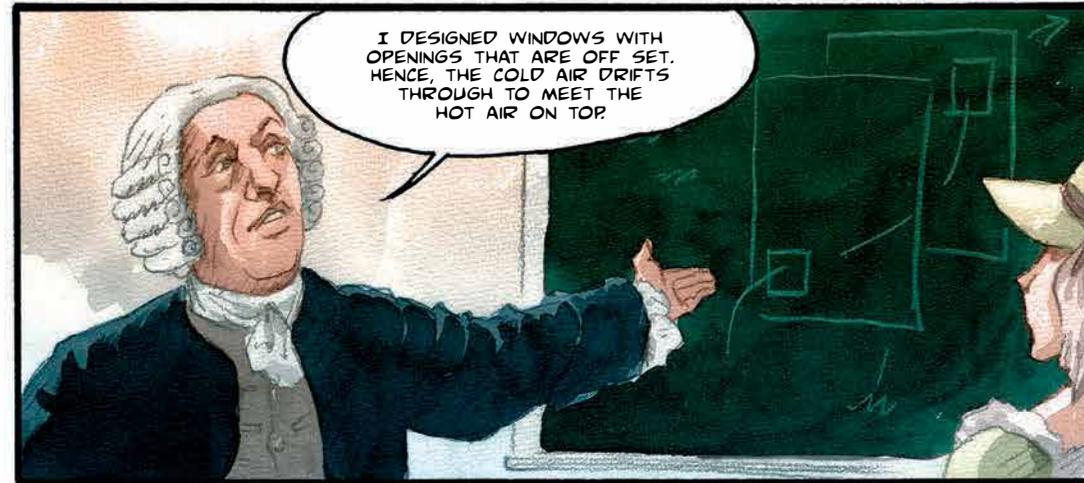


AROUND 1754 THE RECONSTRUCTION OF THE WINTER PALACE IN ST. PETERSBURG BEGAN



IN THIS HUGE LEVIATHAN OF A PALACE, IT IS IMPERATIVE TO KEEP A NATURAL FLOW OF VENTILATION WHILE SIMULTANEOUSLY INSULATING THE INTERIOR.

IT WAS DESIGNED BY AN ITALIAN CALLED BARTOLOMEO RASTRELLI WHO WAS THE APPOINTED ARCHITECT FOR THE RUSSIAN ARISTOCRACY. HE WAS A MASTER WITH A RICH IMAGINATION.



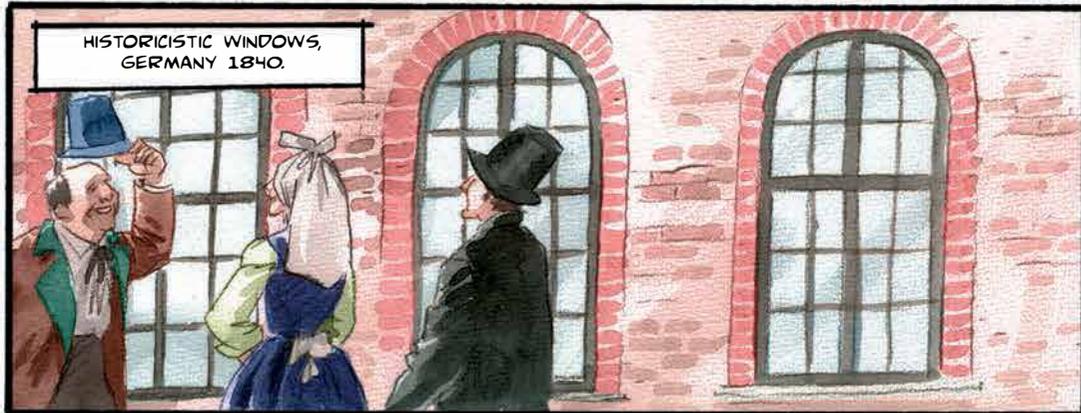
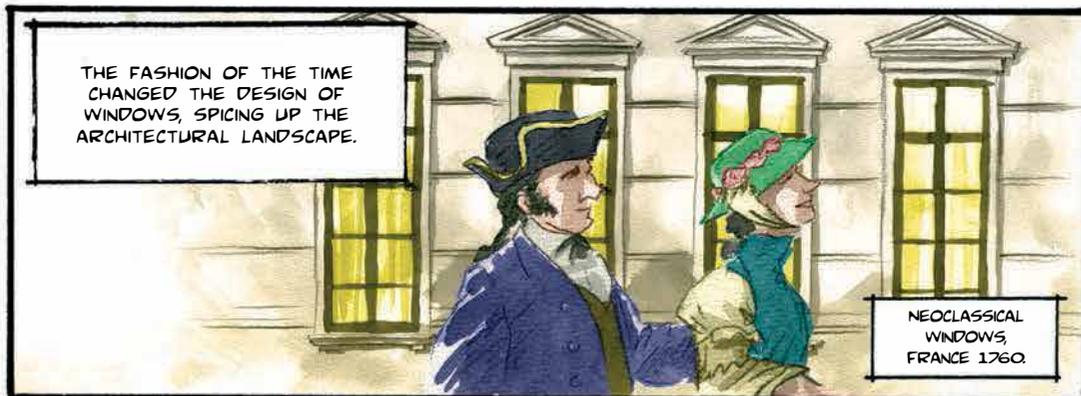
I DESIGNED WINDOWS WITH OPENINGS THAT ARE OFF SET. HENCE, THE COLD AIR DRIFTS THROUGH TO MEET THE HOT AIR ON TOP.



THIS NATURAL DRIVING FORCE, ALLOWS CIRCULATION OF AIR KEEPING ITS OCCUPANTS COMFORTABLE AND HEALTHY.

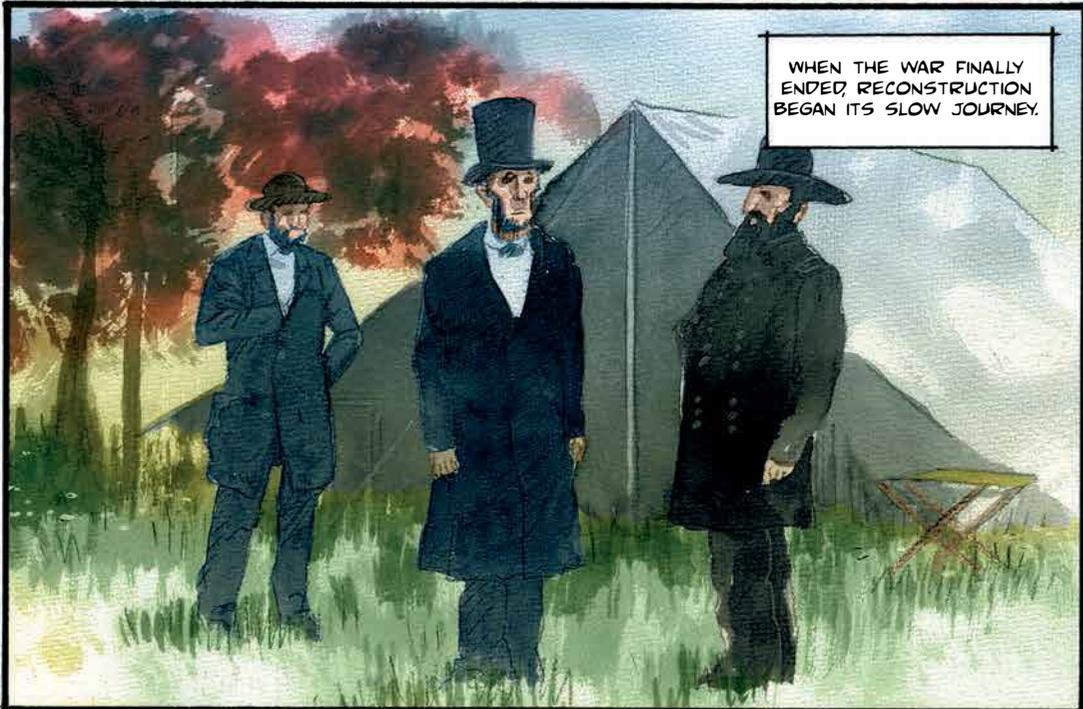


IN RUSSIA, RASTRELLI'S VENTILATION WINDOW WAS CALLED "FORTOCHKA". EVERYONE ELSE CALLED IT THE "RUSSIAN WINDOW". ITS ADVANCED AIR SHAFT TECHNIQUE HAS SINCE BEEN REDISCOVERED IN MODERN ARCHITECTURE.

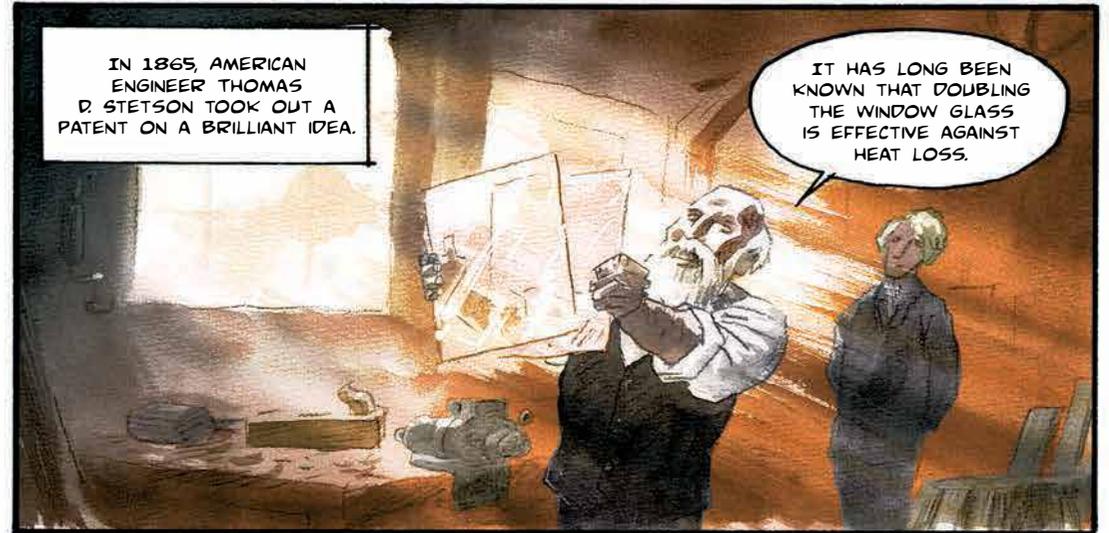




BUT DURING THAT PERIOD, USA WAS IN THE MIDST OF A CIVIL WAR.



WHEN THE WAR FINALLY ENDED, RECONSTRUCTION BEGAN ITS SLOW JOURNEY.

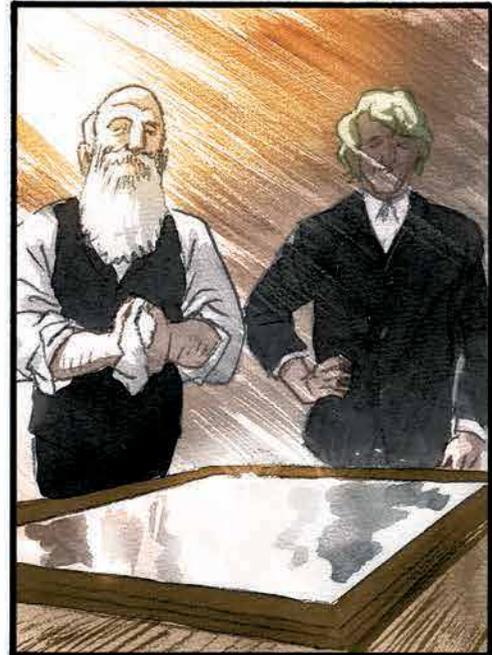
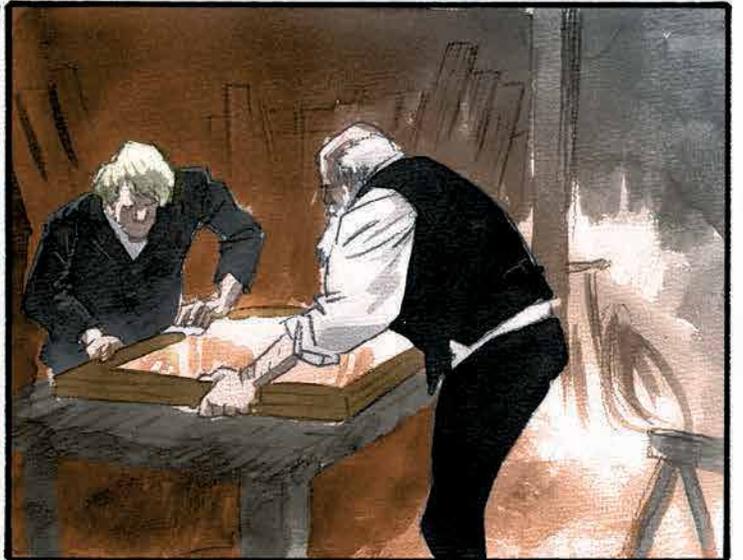


IN 1865, AMERICAN ENGINEER THOMAS D. STETSON TOOK OUT A PATENT ON A BRILLIANT IDEA.

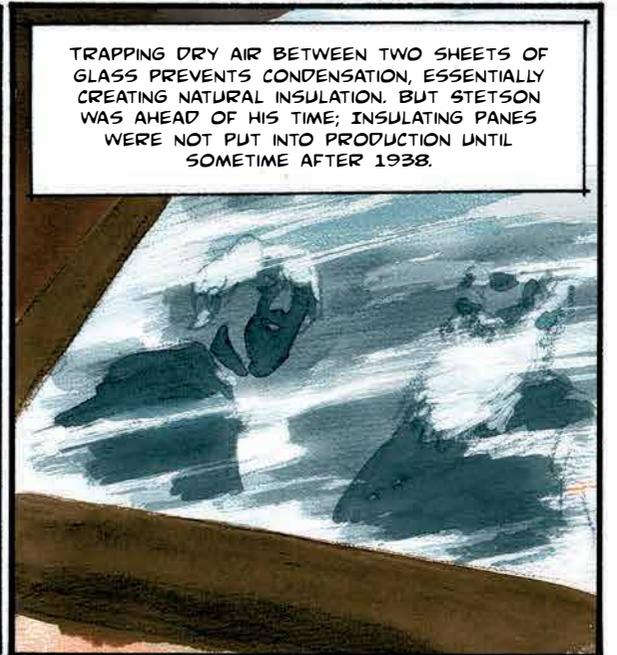
IT HAS LONG BEEN KNOWN THAT DOUBLING THE WINDOW GLASS IS EFFECTIVE AGAINST HEAT LOSS.



BUT IF WE COULD SECURE THE GLASS AND TRAP THE AIR INSIDE, ENSURING THE SHEETS ARE SCRUPULOUSLY CLEAN ON THE INNER FACES, THEN WE WOULD HAVE A SINGLE PANE THAT ALSO BLOCKS OUT INTRUSIVE SOUNDS.



TRAPPING DRY AIR BETWEEN TWO SHEETS OF GLASS PREVENTS CONDENSATION, ESSENTIALLY CREATING NATURAL INSULATION. BUT STETSON WAS AHEAD OF HIS TIME; INSULATING PANES WERE NOT PUT INTO PRODUCTION UNTIL SOMETIME AFTER 1938.



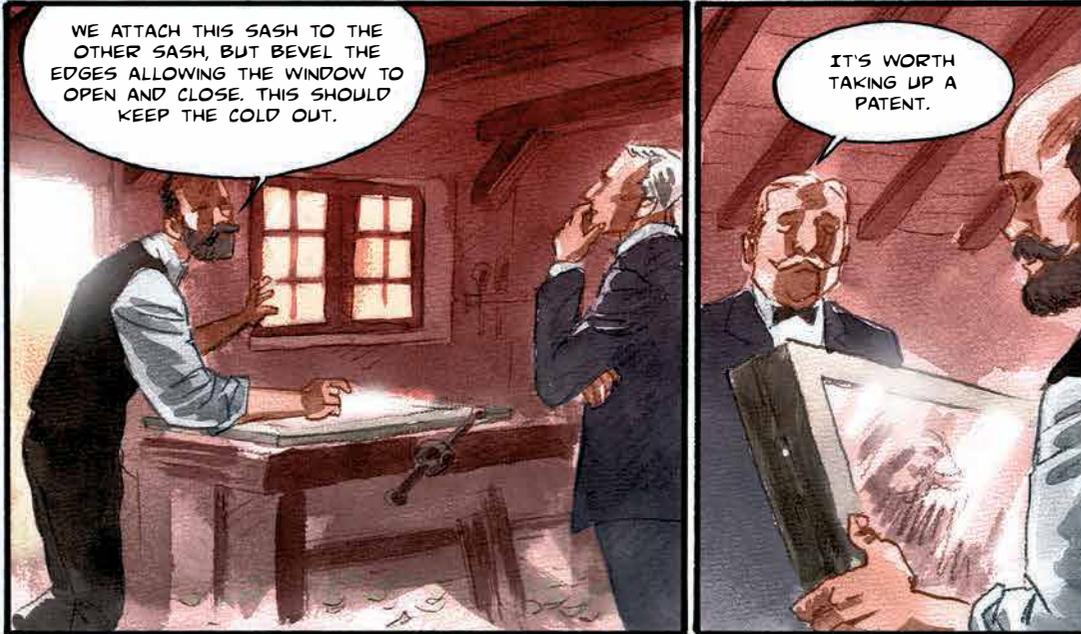
SWEDEN, 1889.

C.G. HALLBERG AND C.A. FLODQVIST DIDN'T KNOW ABOUT STETSON'S IDEA. THEY CAME UP WITH THEIR OWN INVENTION TO FIGHT THE COLD WEATHER.



WE ATTACH THIS SASH TO THE OTHER SASH, BUT BEVEL THE EDGES ALLOWING THE WINDOW TO OPEN AND CLOSE. THIS SHOULD KEEP THE COLD OUT.

IT'S WORTH TAKING UP A PATENT.



DURING THE WINTER MONTHS IN SCANDINAVIA, MANY FAMILIES BENEFITED FROM THE CASEMENT WINDOW WITH COUPLED SASHES AND TWO LAYERS OF GLASS.



FROM THE TURN OF THE CENTURY, IN USA, THERE WAS A SURGE OF SKYSCRAPERS BEING CONSTRUCTED USING THE CURTAIN WALL CONCEPT. THE MOVEMENT WAS CALLED THE CHICAGO SCHOOL OF ARCHITECTURE.



IN THE BIG CITIES, THIS ACTIVITY KEPT A FORCE OF FEARLESS WORKERS BUSY AT EXTREME HEIGHTS.

NOT ANOTHER TUNA SANDWICH!



WHAT DO YOU GOT?

I GOT "NONE OF YOUR FREAKING BUSINESS!"



YOU CAN GET A SALAMI SANDWICH RIGHT OVER THERE IN THAT DELI.

SEE THE DOTS DOWN THERE, THOSE ARE PEOPLE.



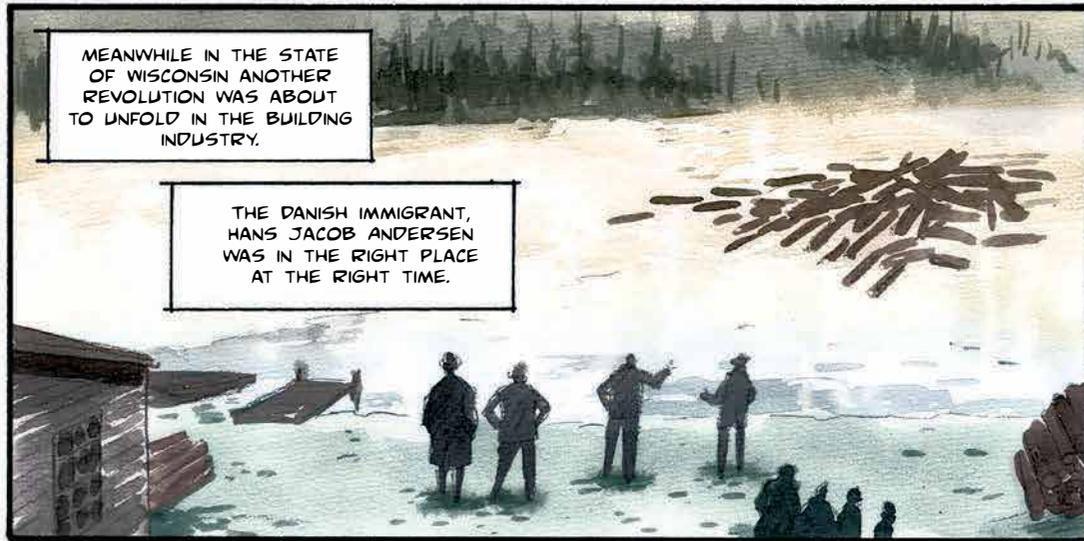
C'MON RALPH, LET'S TRADE.



NOT TODAY, I GOT SALAMI!



THE EARLY SKYSCRAPERS BROUGHT LIGHT INTO THE OFFICES LIKE NEVER BEFORE.

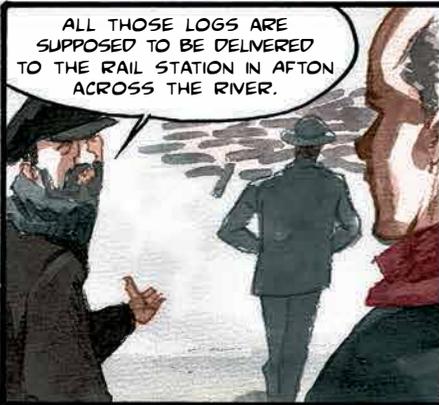


MEANWHILE IN THE STATE OF WISCONSIN ANOTHER REVOLUTION WAS ABOUT TO UNFOLD IN THE BUILDING INDUSTRY.

THE DANISH IMMIGRANT, HANS JACOB ANDERSEN WAS IN THE RIGHT PLACE AT THE RIGHT TIME.



WHAT'S WRONG?

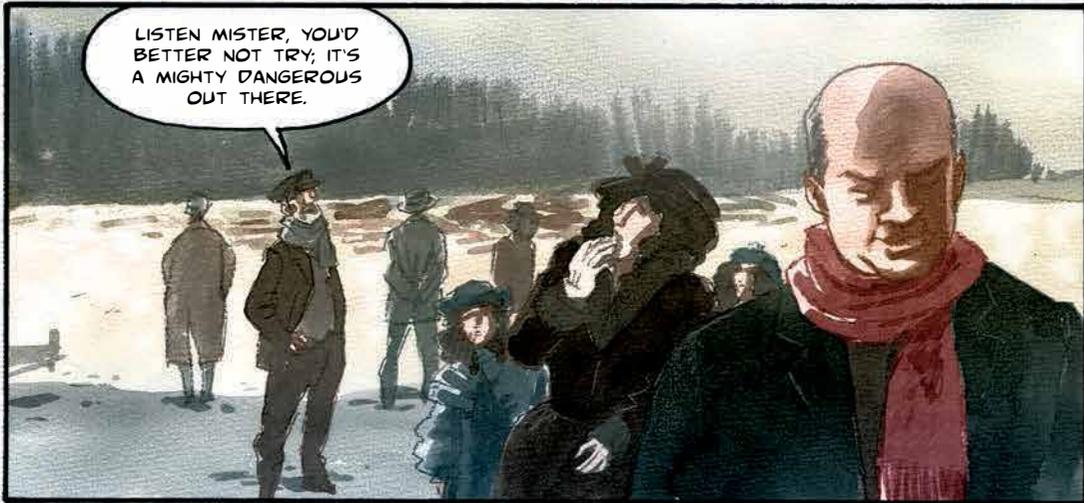


ALL THOSE LOGS ARE SUPPOSED TO BE DELIVERED TO THE RAIL STATION IN AFTON ACROSS THE RIVER.



NO ONE'S GONNA TOUCH 'EM CAUSE OF THAT DARN THIN ICE. IT'S A COCKTAIL OF TROUBLE.

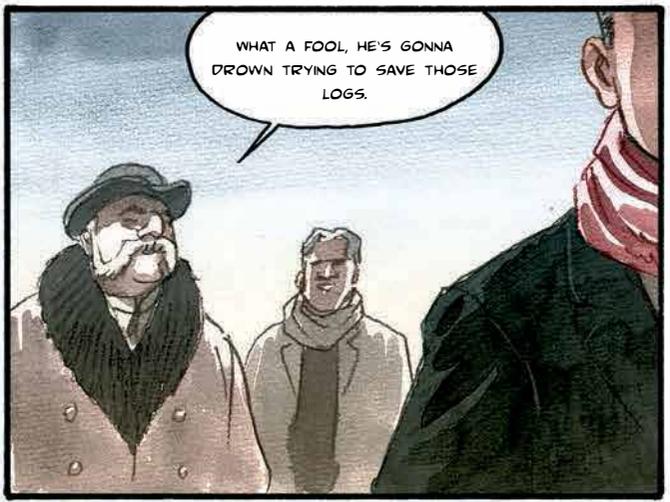
I THINK I KNOW HOW TO MOVE IT. WHO OWNS THE WOOD?



LISTEN MISTER, YOU'D BETTER NOT TRY; IT'S A MIGHTY DANGEROUS OUT THERE.



HANS JACOB ANDERSEN BOUGHT THE LUMBER AT A CHEAP PRICE.



WHAT A FOOL, HE'S GONNA DROWN TRYING TO SAVE THOSE LOGS.



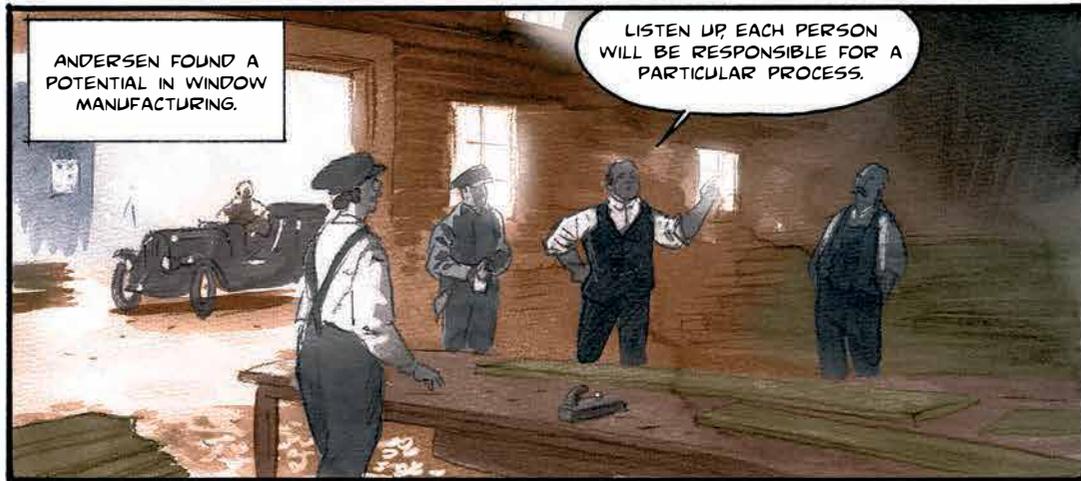
ANDERSEN BUILT A TEMPORARY BRIDGE AND SAFELY TRANSPORTED THE WOOD TO THE OTHER SIDE.



THE IDEA WAS A SUCCESS AND HE WON THE HEARTS OF MANY OF THE TOWNSPEOPLE.

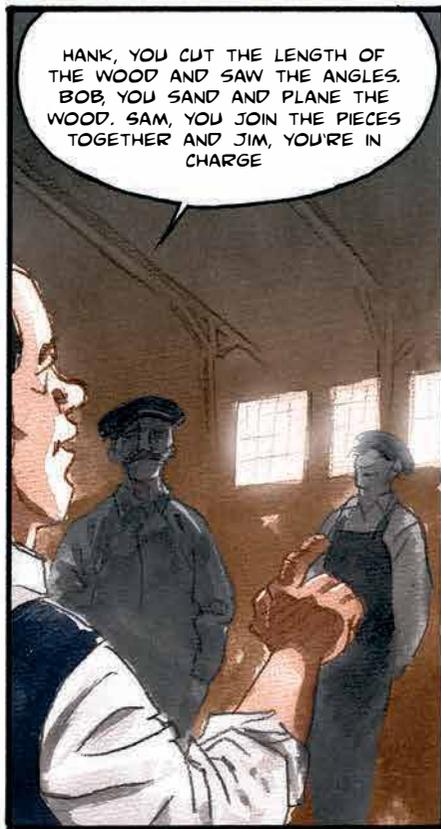


ANDERSEN BECAME LEADER OF THE LOCAL SAWMILL AND IN 1903 ESTABLISHED HIS OWN COMPANY SPECIALIZED IN WINDOWS AND DOORS.

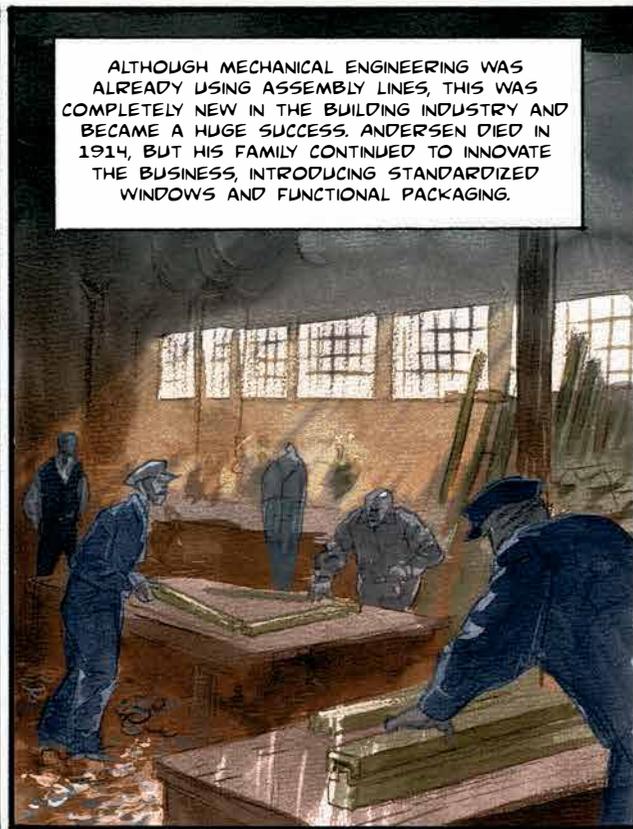


ANDERSEN FOUND A POTENTIAL IN WINDOW MANUFACTURING.

LISTEN UP, EACH PERSON WILL BE RESPONSIBLE FOR A PARTICULAR PROCESS.



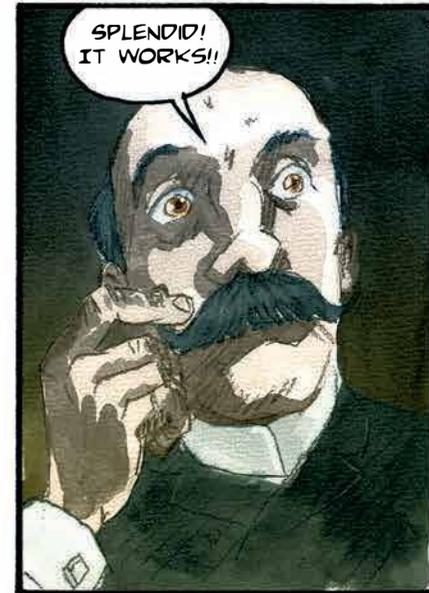
HANK, YOU CUT THE LENGTH OF THE WOOD AND SAW THE ANGLES. BOB, YOU SAND AND PLANE THE WOOD. SAM, YOU JOIN THE PIECES TOGETHER AND JIM, YOU'RE IN CHARGE



ALTHOUGH MECHANICAL ENGINEERING WAS ALREADY USING ASSEMBLY LINES, THIS WAS COMPLETELY NEW IN THE BUILDING INDUSTRY AND BECAME A HUGE SUCCESS. ANDERSEN DIED IN 1914, BUT HIS FAMILY CONTINUED TO INNOVATE THE BUSINESS, INTRODUCING STANDARDIZED WINDOWS AND FUNCTIONAL PACKAGING.



IN BELGIUM, EMILE FOURCAULT TOOK OUT A PATENT IN 1904 THAT OUTMATCHED THE CYLINDER GLASS PROCESS WHICH BY THEN WAS MACHINE DRIVEN.



SPLendid! IT WORKS!!



PULL, YOU MUST STRETCH THE MOLTEN GLASS THROUGH THOSE ROLLERS AND THEN THE CERAMIC DIE IS SUPPOSED TO SHAPE THE GLASS INTO A LONG SHEET. YES THAT'S IT!



I'M LOSING MY GRIP.

PLEASE HELP HIM! KEEP PULLING!



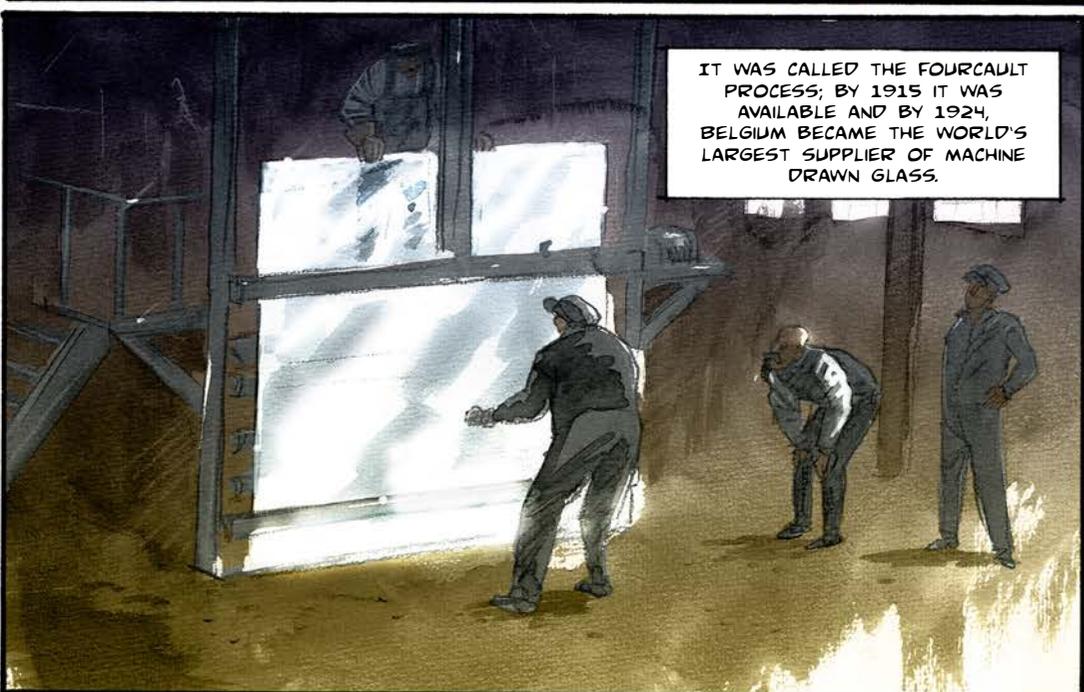
AMAZING, IT'S ONE LONG RIBBON OF GLASS!! IT KEEPS COMING! WE COULD MAKE HUGE GLASS SHEETS WITH THIS SYSTEM!



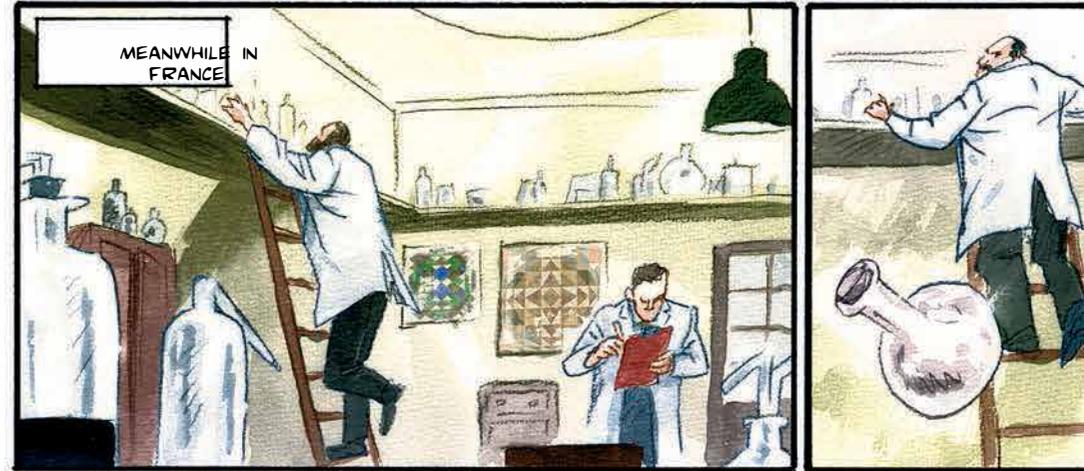
THE NEW TECHNOLOGY MADE IT POSSIBLE TO DRAW MOLTEN GLASS DIRECTLY FROM THE MELTING TANK. THE GLASS WENT THROUGH A PROCESS OF COOLING AND REHEATING BEFORE BEING CUT INTO SHAPE.



GOOD JOB GENTLEMEN! THIS IS TRULY IMPRESSIVE!



IT WAS CALLED THE FOURCAULT PROCESS; BY 1915 IT WAS AVAILABLE AND BY 1924, BELGIUM BECAME THE WORLD'S LARGEST SUPPLIER OF MACHINE DRAWN GLASS.



MEANWHILE IN FRANCE



MONSIEUR, DO YOU SEE? THE BOTTLE HAS NOT SHATTERED.



PECULIAR INDEED, THERE MUST BE AN EXPLANATION.



THE BOTTLE WAS FILLED WITH CELLULOSE NITRATE.

OF COURSE, THE CHEMICAL HAS BONDED WITH THE GLASS, CREATING A THIN FOIL THAT KEEPS THE GLASS FROM SHATTERING.

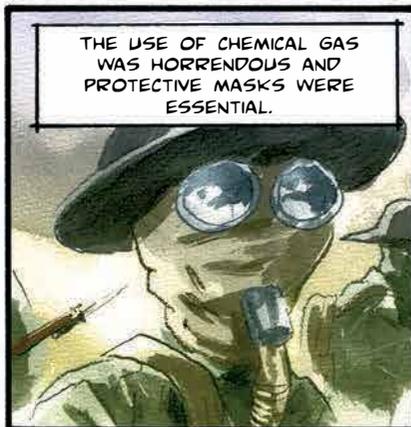


IN 1909, THE ACCIDENT LED EDOUARD BENEDICTUS TO PATENT AND PROCESS LAMINATED SHATTERPROOF GLASS AS A SUPPLEMENT TO THE TEMPERED GLASS ALL READY DEVELOPED IN 1900. HE BELIEVED HIS NEW DISCOVERY COULD BE IMPLEMENTED IN THE AUTOMOBILE INDUSTRY.

HOWEVER, THE INVENTION OF USING TWO PLATES OF GLASS WITH A PLASTIC LAMINATION IN BETWEEN WAS FIRST APPLIED ON GASMASKS DURING WWI.



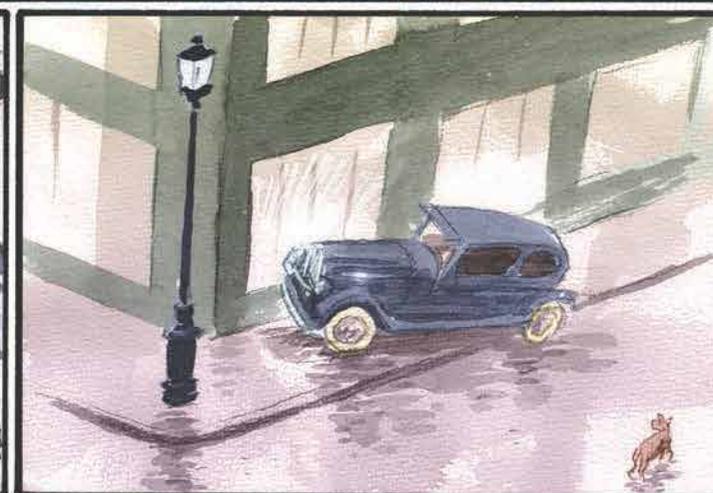
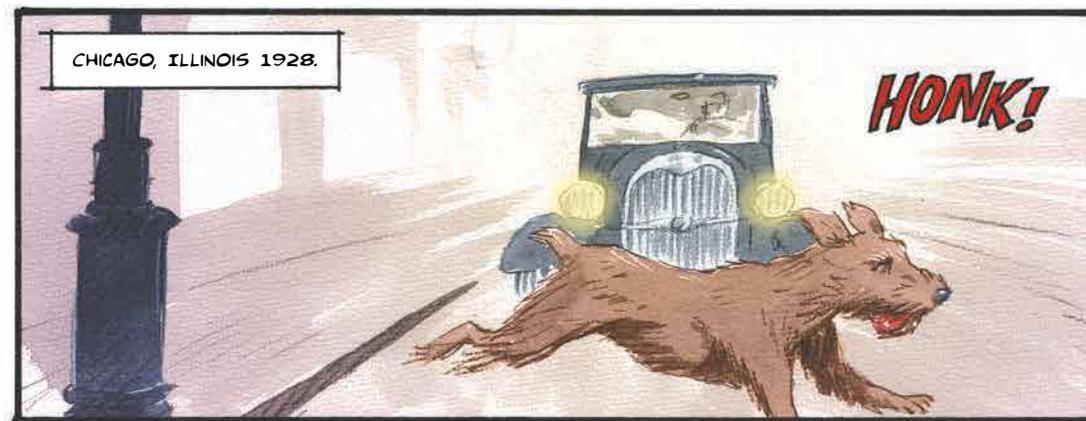
THE USE OF CHEMICAL GAS WAS HORRENDOUS AND PROTECTIVE MASKS WERE ESSENTIAL.



C'MON GET UP!
THE TANKS
ARE COMING!



CHICAGO, ILLINOIS 1928.

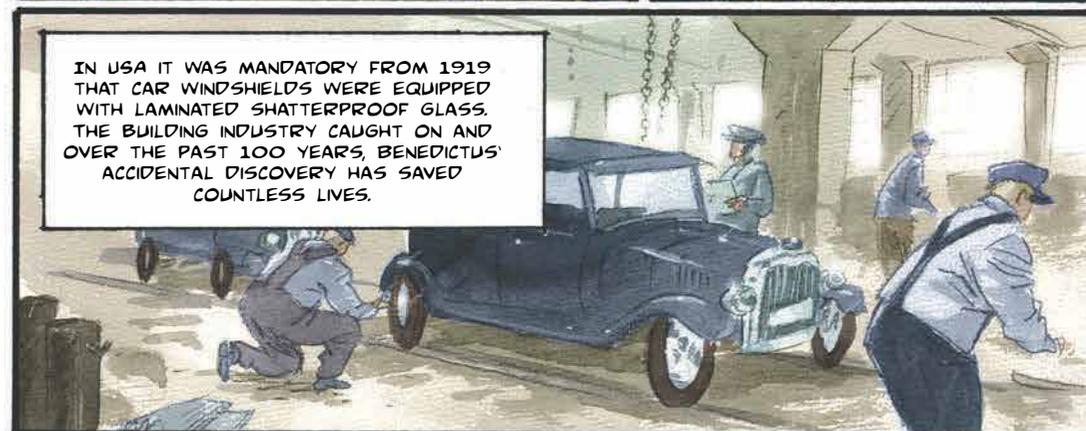


ARE YOU OK?

I GUESS I'M LUCKY, IT COULD'VE BEEN WORSE.

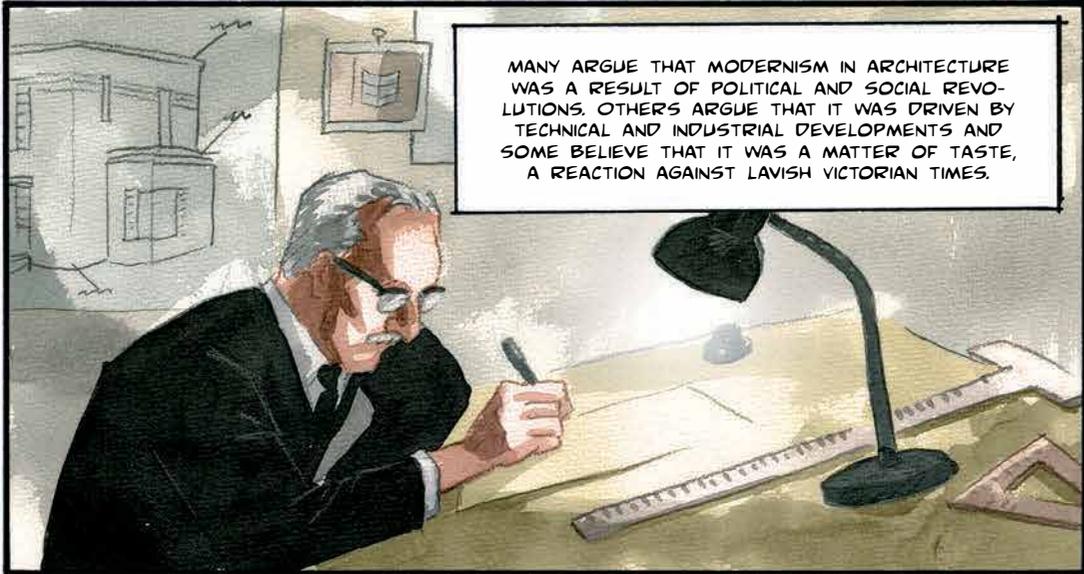


IN USA IT WAS MANDATORY FROM 1919 THAT CAR WINDSHIELDS WERE EQUIPPED WITH LAMINATED SHATTERPROOF GLASS. THE BUILDING INDUSTRY CAUGHT ON AND OVER THE PAST 100 YEARS, BENEDICTUS' ACCIDENTAL DISCOVERY HAS SAVED COUNTLESS LIVES.

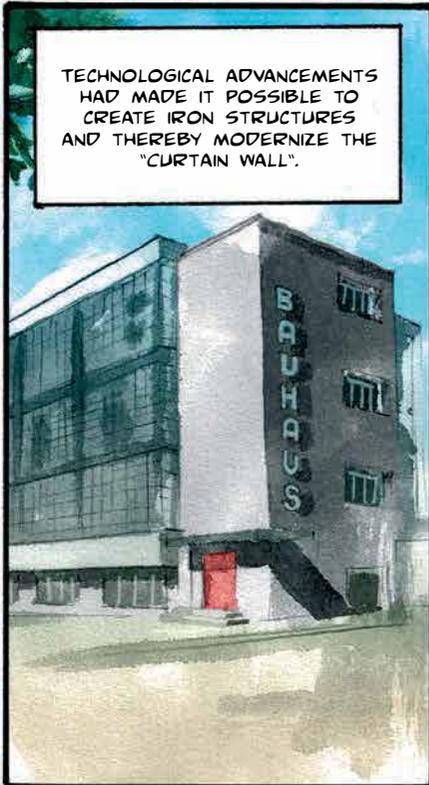




PIVOT WINDOWS WERE PATENTED AROUND 1910 IN EUROPE AND NORTH AMERICA AND BECAME WIDESPREAD ABOUT 1930 ESPECIALLY IN SWEDEN DURING THE MODERN ERA.



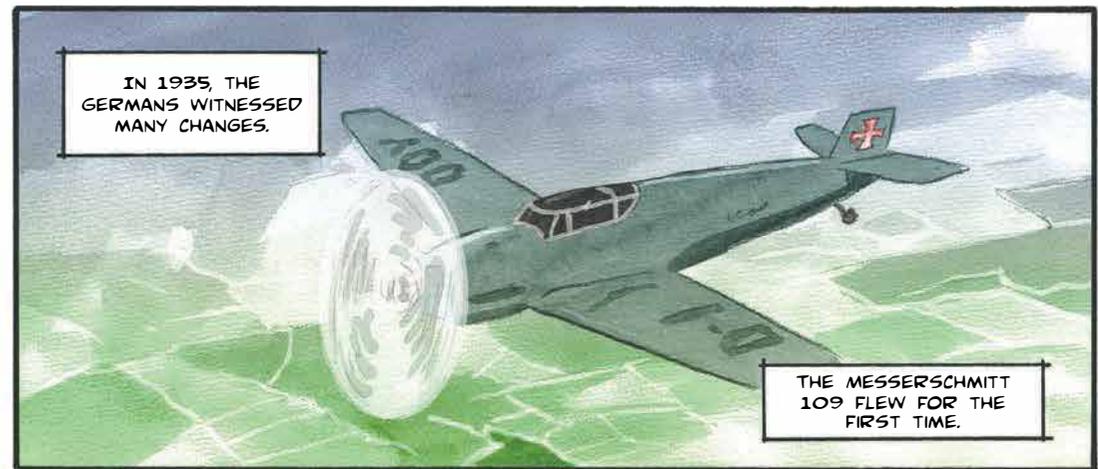
MANY ARGUE THAT MODERNISM IN ARCHITECTURE WAS A RESULT OF POLITICAL AND SOCIAL REVOLUTIONS. OTHERS ARGUE THAT IT WAS DRIVEN BY TECHNICAL AND INDUSTRIAL DEVELOPMENTS AND SOME BELIEVE THAT IT WAS A MATTER OF TASTE, A REACTION AGAINST LAVISH VICTORIAN TIMES.



TECHNOLOGICAL ADVANCEMENTS HAD MADE IT POSSIBLE TO CREATE IRON STRUCTURES AND THEREBY MODERNIZE THE "CURTAIN WALL".



IN THE 30'S CORNER WINDOWS WERE QUITE THE RAVE.



IN 1935, THE GERMANS WITNESSED MANY CHANGES.

THE MESSERSCHMITT 109 FLEW FOR THE FIRST TIME.



GERMAN REARMAMENT WAS ANNOUNCED.



THE FIRST TELEVISION PROGRAM WAS BROADCAST FROM BERLIN.



AND A FAIRLY UNKNOWN ENGINEER FROM STUTTGART NAMED WILHELM FRANK DEVELOPED A HINGE THAT BECAME THE MOST COMMONLY USED WINDOW IN GERMANY TODAY.



I MADE A HINGE THAT MAKES IT POSSIBLE FOR THE WINDOW TO TILT AND TURN, SEE.

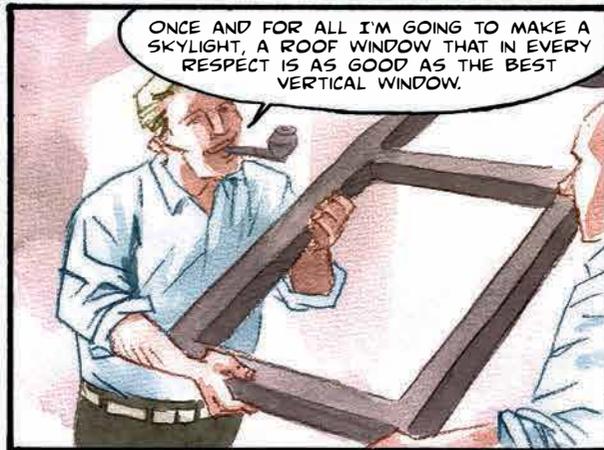
THAT'S QUITE INTERESTING.



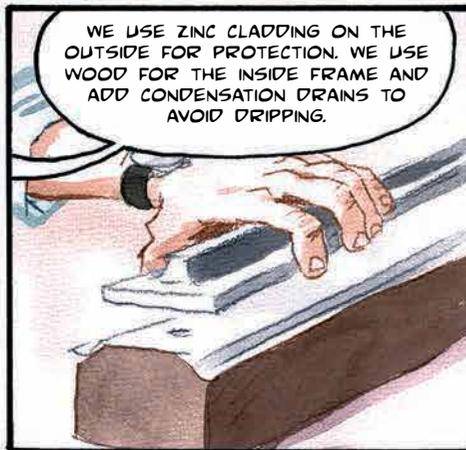
SO, WHEN YOU TURN THE HANDLE THIS WAY, THE WINDOW OPENS AT THE TOP, SO YOU CAN VENTILATE YOUR HOME AND AVOID INTRUDERS.



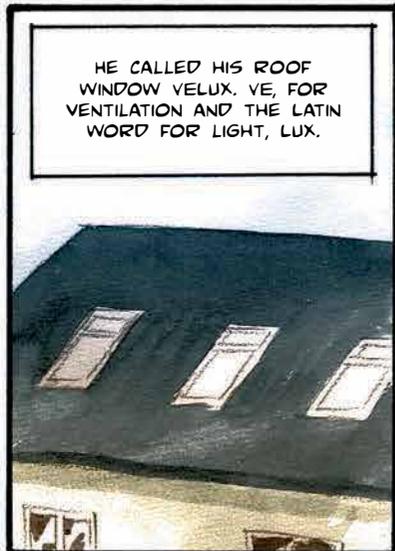
IN 1942, IN THE MIDST OF WWII, VILLUM KANN RASMUSSEN, A YOUNG DANISH CIVIL ENGINEER, STRUGGLES TO KEEP HIS COMPANY GOING. RATIONS AND LIMITED CONSTRUCTION WORK WAS TYPICAL OF THE TIME. HE UNDERSTOOD THIS WHILE DEVELOPING ROOF WINDOWS FOR A SCHOOL.



ONCE AND FOR ALL I'M GOING TO MAKE A SKYLIGHT, A ROOF WINDOW THAT IN EVERY RESPECT IS AS GOOD AS THE BEST VERTICAL WINDOW.



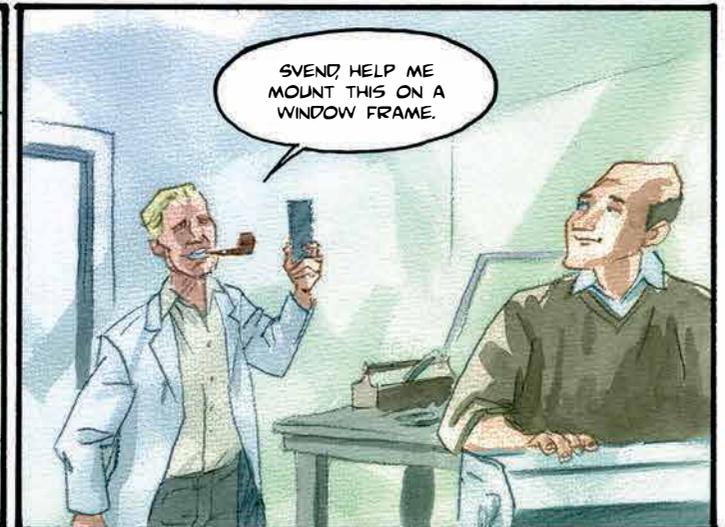
WE USE ZINC CLADDING ON THE OUTSIDE FOR PROTECTION. WE USE WOOD FOR THE INSIDE FRAME AND ADD CONDENSATION DRAINS TO AVOID DRIPPING.



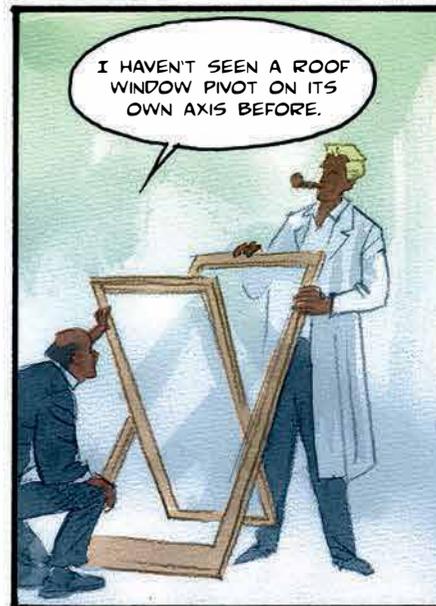
HE CALLED HIS ROOF WINDOW VELUX. VE, FOR VENTILATION AND THE LATIN WORD FOR LIGHT, LUX.



CONSTANT IMPROVEMENTS WERE MADE TO THE ROOF WINDOW.



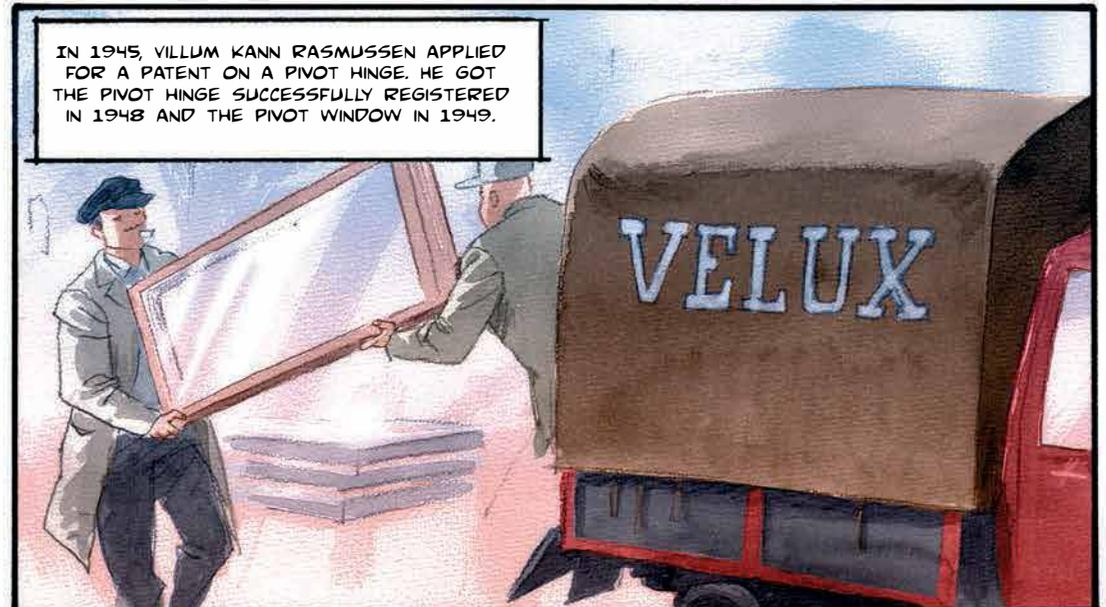
SVEND, HELP ME MOUNT THIS ON A WINDOW FRAME.



I HAVEN'T SEEN A ROOF WINDOW PIVOT ON ITS OWN AXIS BEFORE.



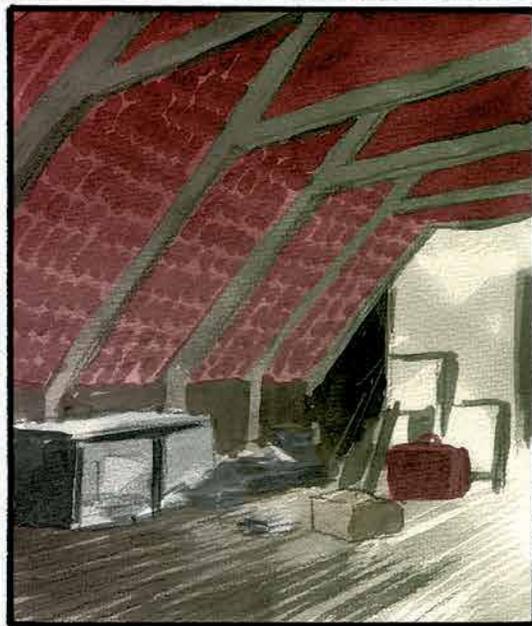
OF COURSE, IT'S FOR VENTILATION BUT IT ALSO ALLOWS YOU TO CLEAN THE WINDOW ON BOTH SIDES.



IN 1945, VILLUM KANN RASMUSSEN APPLIED FOR A PATENT ON A PIVOT HINGE. HE GOT THE PIVOT HINGE SUCCESSFULLY REGISTERED IN 1948 AND THE PIVOT WINDOW IN 1949.



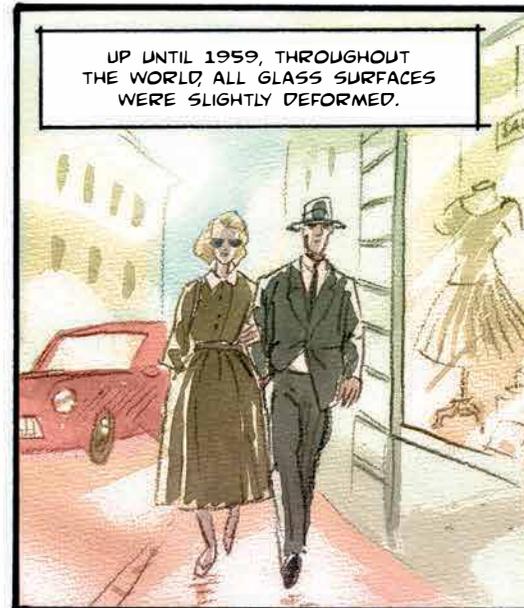
THE WAR HAD ENDED AND EUROPE WAS IN DESPERATE NEED FOR AFFORDABLE HOMES.



THE ROOF WINDOWS HELPED TURN UNUSED ATTIC SPACE INTO MODERN LIVING QUARTERS WITH ACCESS TO PLENTY OF LIGHT, FRESH AIR AND A BETTER VIEW.



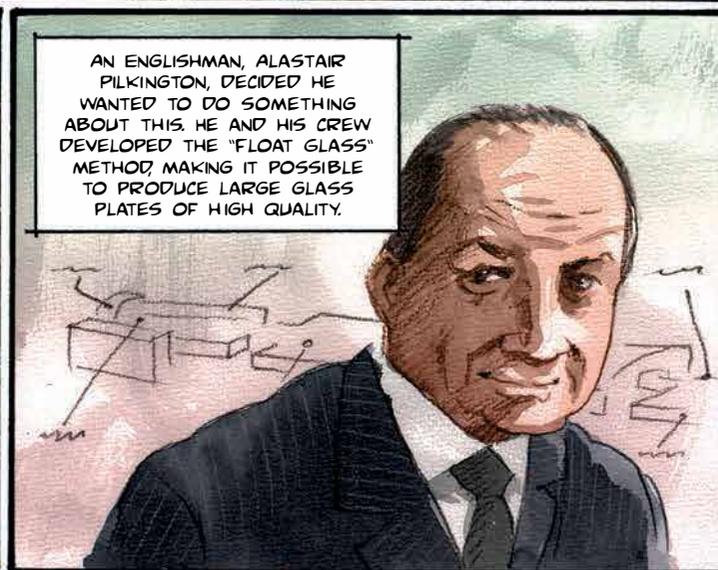
DURING THE NEXT DECADES, VELUX ROOF WINDOWS COMPLETELY CHANGED THE ARCHITECTURAL LANDSCAPE IN EUROPE.



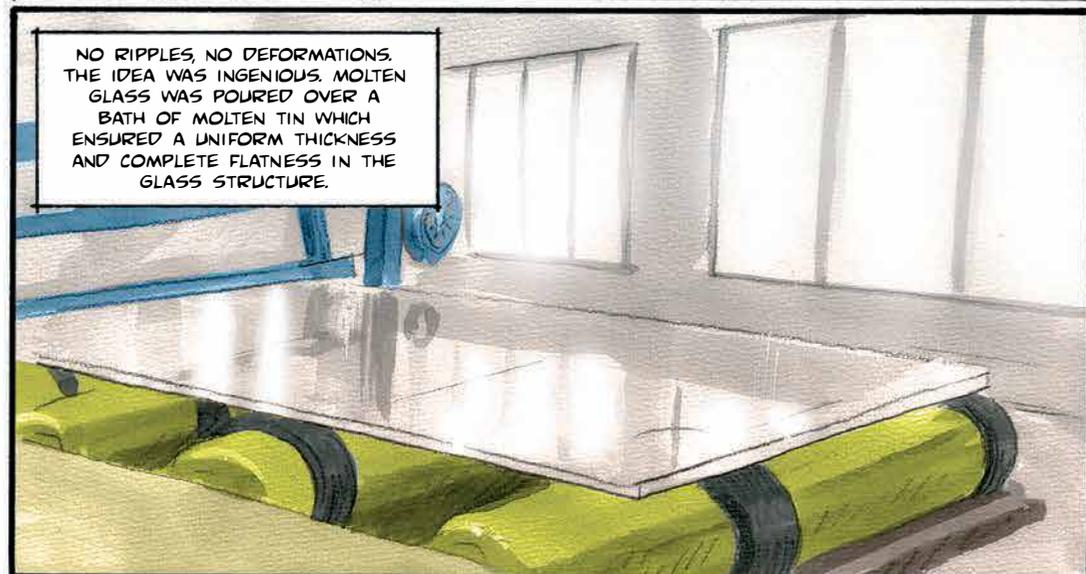
UP UNTIL 1959, THROUGHOUT THE WORLD, ALL GLASS SURFACES WERE SLIGHTLY DEFORMED.



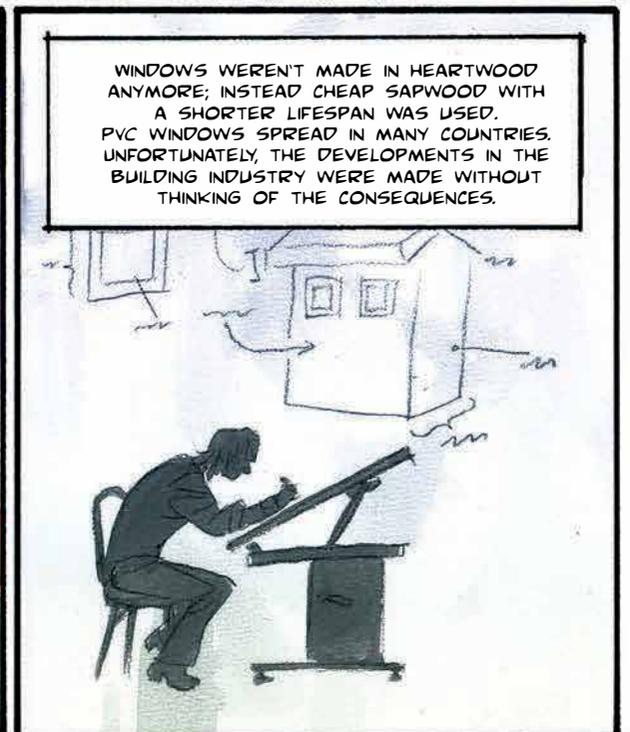
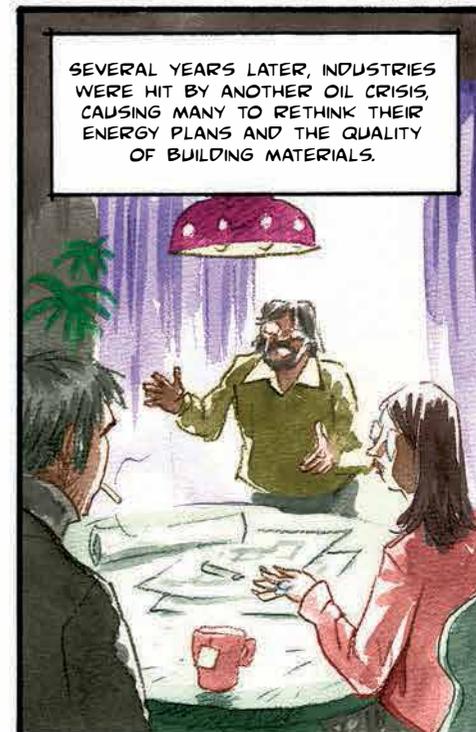
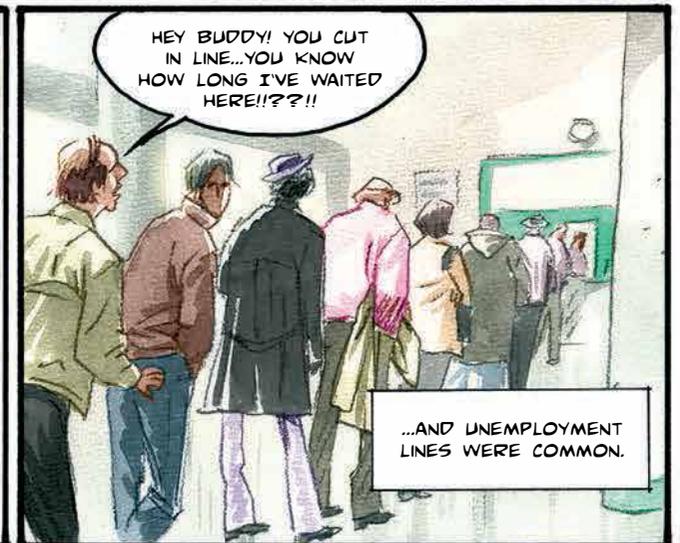
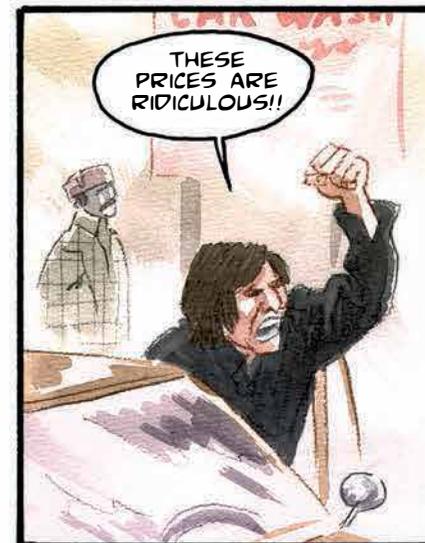
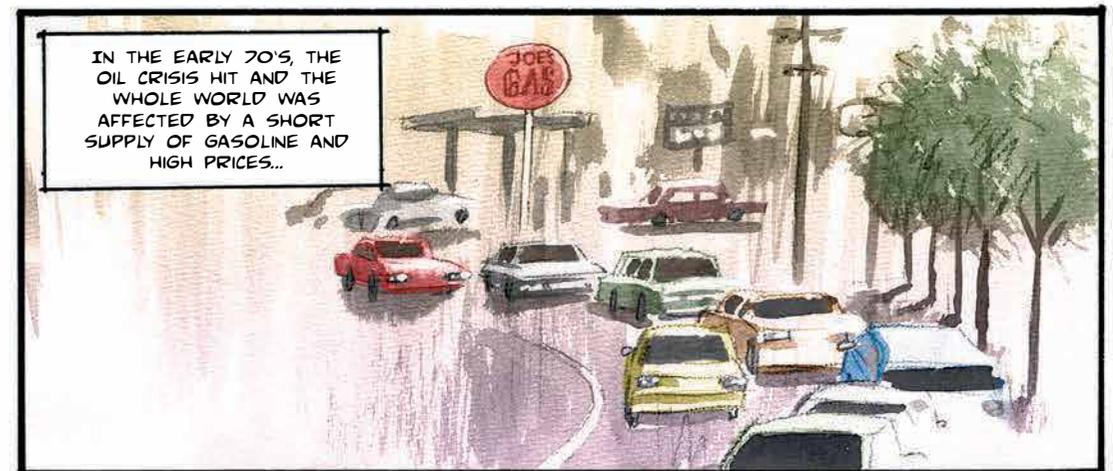
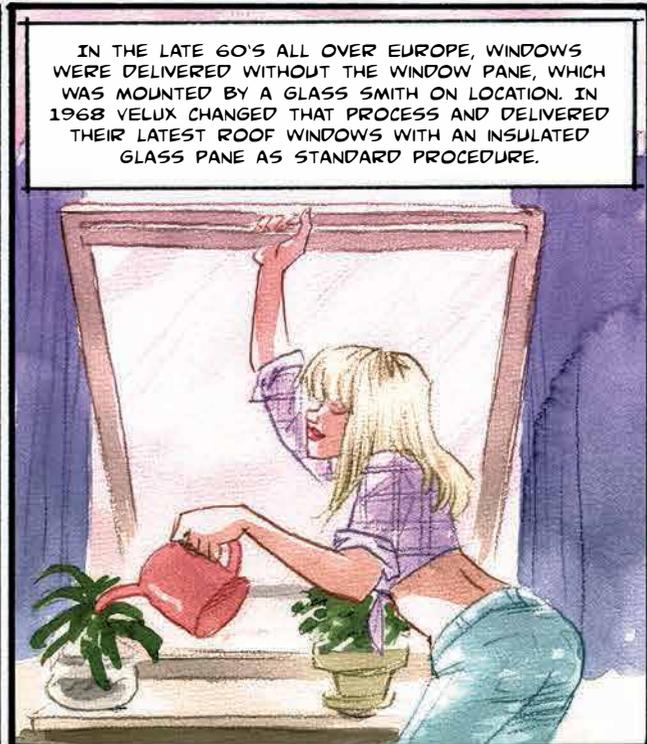
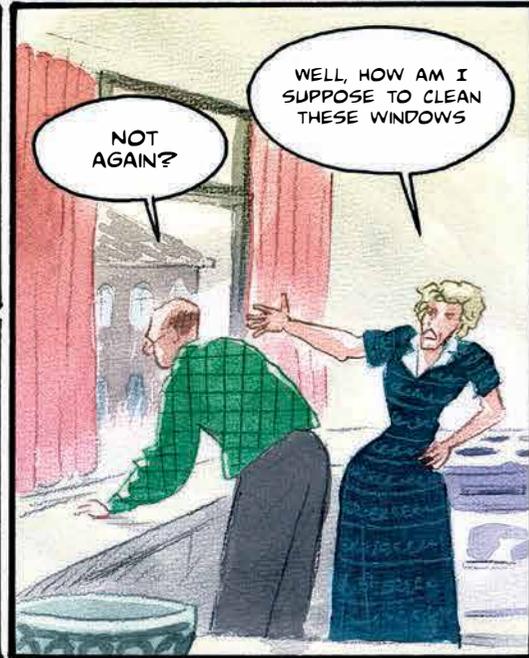
THIS CAUSED AN UNAVOIDABLE RIPPLE EFFECT.



AN ENGLISHMAN, ALASTAIR PILKINGTON, DECIDED HE WANTED TO DO SOMETHING ABOUT THIS. HE AND HIS CREW DEVELOPED THE "FLOAT GLASS" METHOD, MAKING IT POSSIBLE TO PRODUCE LARGE GLASS PLATES OF HIGH QUALITY.



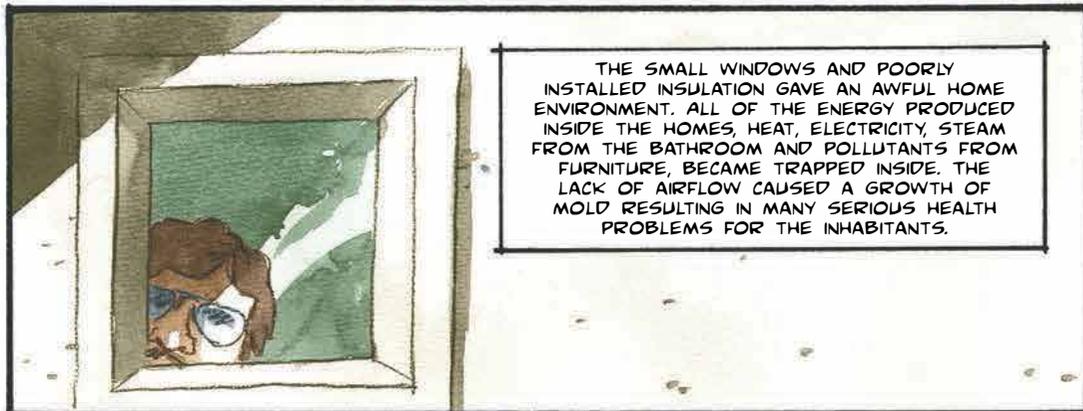
NO RIPPLES, NO DEFORMATIONS. THE IDEA WAS INGENIOUS. MOLTEN GLASS WAS POURED OVER A BATH OF MOLTEN TIN WHICH ENSURED A UNIFORM THICKNESS AND COMPLETE FLATNESS IN THE GLASS STRUCTURE.





LISTEN MAN, HERE'S WHAT WE'RE GONNA DO TO FIGHT THE COLD AIR. WE'RE GOING ON A FULL FRONTAL ATTACK.

THESE WALLS WILL BE THICK! MONSTER THICK! LOTS OF INSULATION! AND SMALL WINDOWS; NO HEAT LOSS IN THESE HOMES! SAVING ENERGY, THIS IS THE FUTURE MAN!

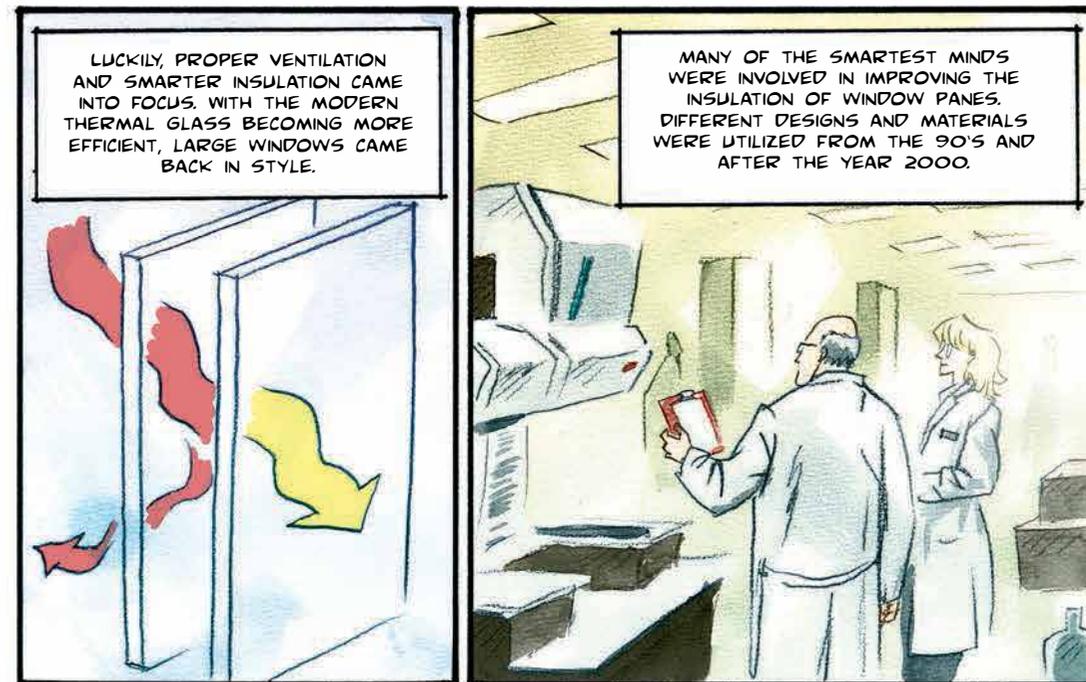


THE SMALL WINDOWS AND POORLY INSTALLED INSULATION GAVE AN AWFUL HOME ENVIRONMENT. ALL OF THE ENERGY PRODUCED INSIDE THE HOMES, HEAT, ELECTRICITY, STEAM FROM THE BATHROOM AND POLLUTANTS FROM FURNITURE, BECAME TRAPPED INSIDE. THE LACK OF AIRFLOW CAUSED A GROWTH OF MOLD RESULTING IN MANY SERIOUS HEALTH PROBLEMS FOR THE INHABITANTS.



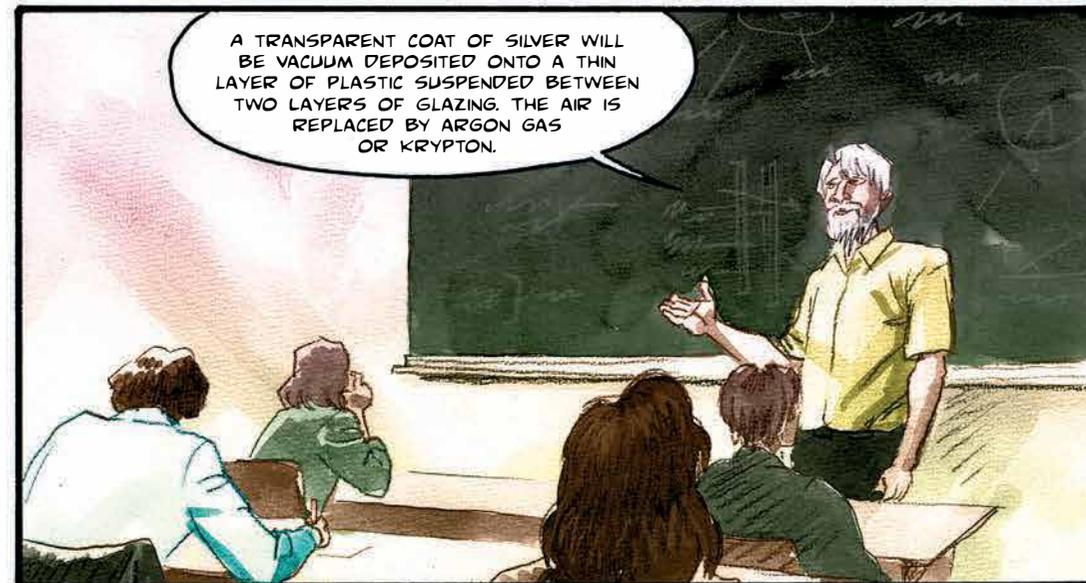
CAN'T WE MOVE, DAD? PLEASE?

UGH, I CAN'T BREATHE IN THAT HOUSE.

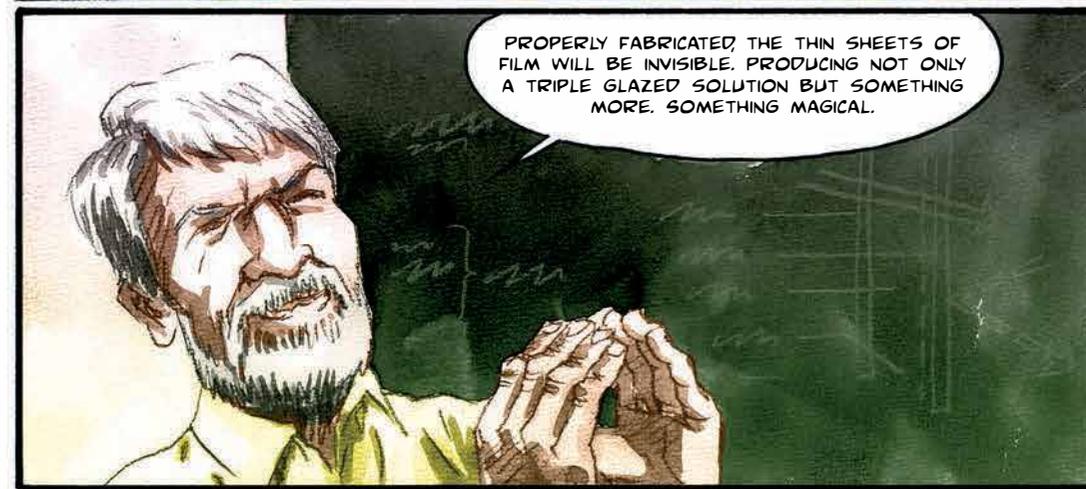


LUCKILY, PROPER VENTILATION AND SMARTER INSULATION CAME INTO FOCUS. WITH THE MODERN THERMAL GLASS BECOMING MORE EFFICIENT, LARGE WINDOWS CAME BACK IN STYLE.

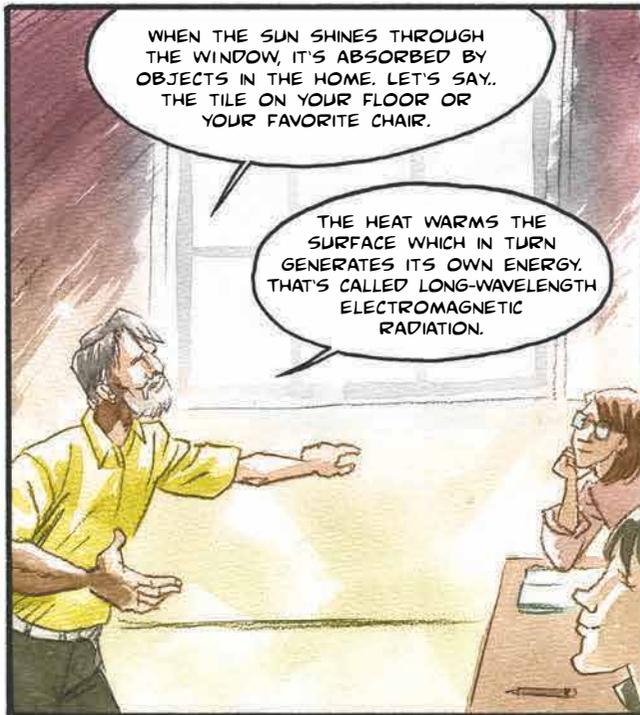
MANY OF THE SMARTEST MINDS WERE INVOLVED IN IMPROVING THE INSULATION OF WINDOW PANES. DIFFERENT DESIGNS AND MATERIALS WERE UTILIZED FROM THE 90'S AND AFTER THE YEAR 2000.



A TRANSPARENT COAT OF SILVER WILL BE VACUUM DEPOSITED ONTO A THIN LAYER OF PLASTIC SUSPENDED BETWEEN TWO LAYERS OF GLAZING. THE AIR IS REPLACED BY ARGON GAS OR KRYPTON.

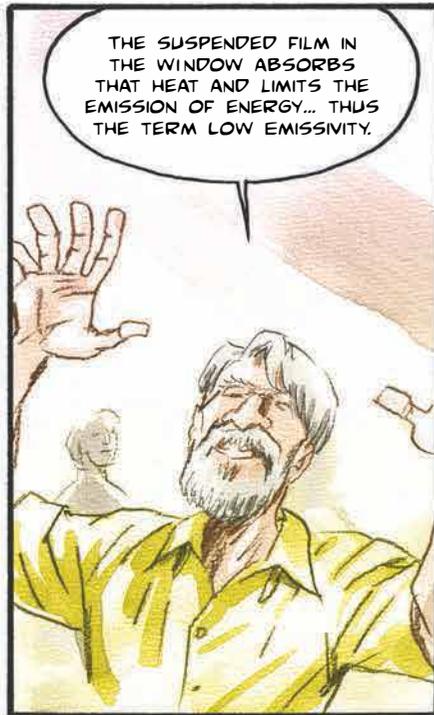


PROPERLY FABRICATED, THE THIN SHEETS OF FILM WILL BE INVISIBLE. PRODUCING NOT ONLY A TRIPLE GLAZED SOLUTION BUT SOMETHING MORE. SOMETHING MAGICAL.

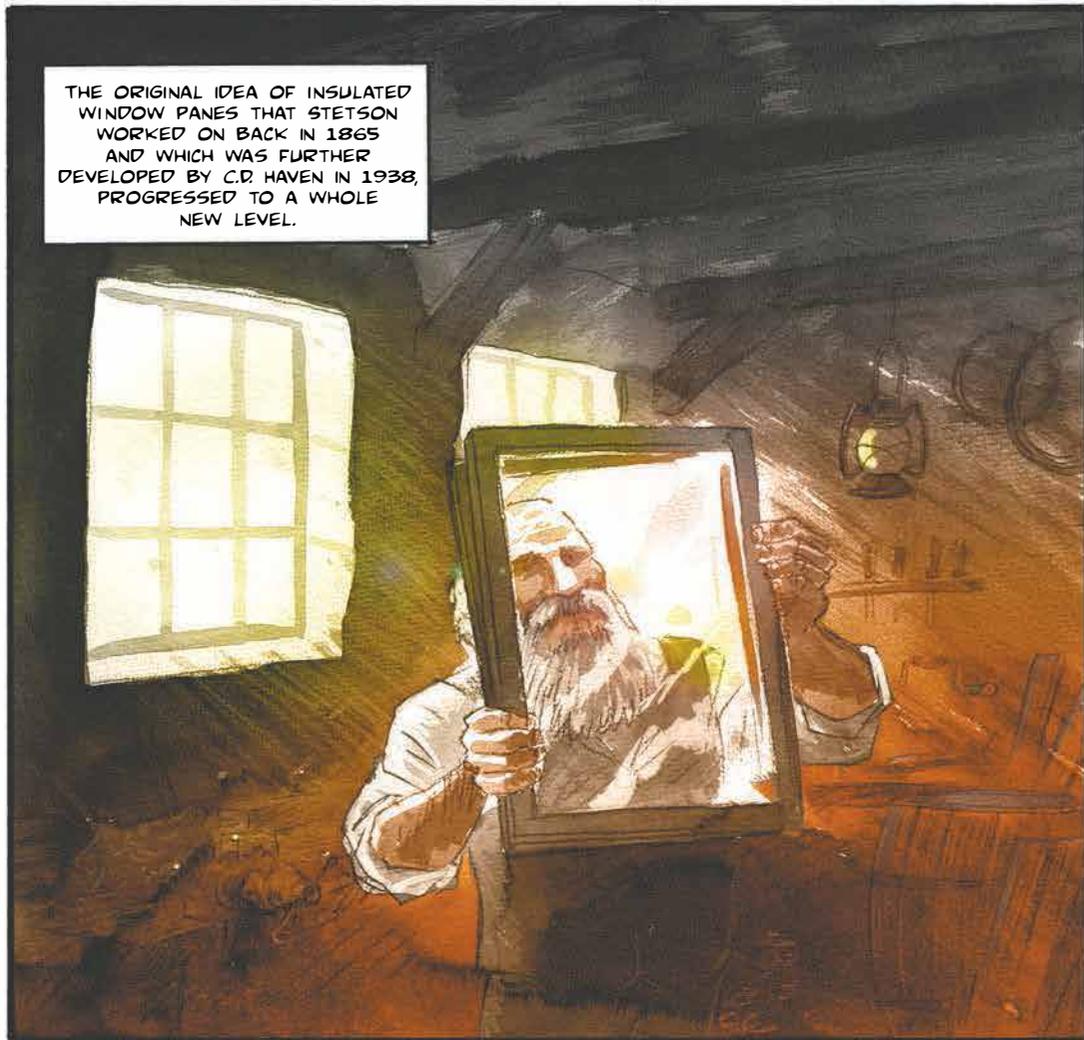


WHEN THE SUN SHINES THROUGH THE WINDOW, IT'S ABSORBED BY OBJECTS IN THE HOME. LET'S SAY.. THE TILE ON YOUR FLOOR OR YOUR FAVORITE CHAIR.

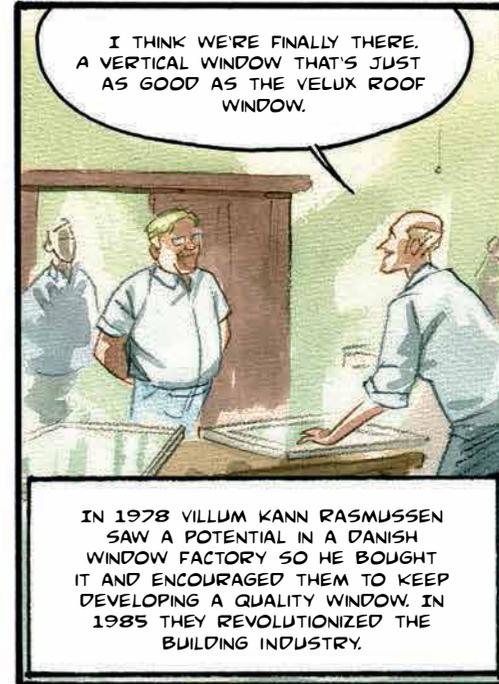
THE HEAT WARMS THE SURFACE WHICH IN TURN GENERATES ITS OWN ENERGY. THAT'S CALLED LONG-WAVELENGTH ELECTROMAGNETIC RADIATION.



THE SUSPENDED FILM IN THE WINDOW ABSORBS THAT HEAT AND LIMITS THE EMISSION OF ENERGY... THUS THE TERM LOW EMISSIVITY.

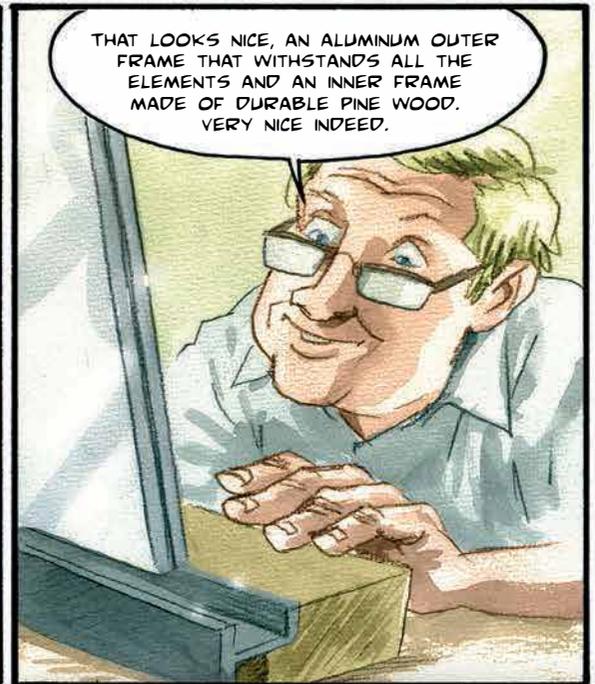


THE ORIGINAL IDEA OF INSULATED WINDOW PANES THAT STETSON WORKED ON BACK IN 1865 AND WHICH WAS FURTHER DEVELOPED BY C.D. HAVEN IN 1938, PROGRESSED TO A WHOLE NEW LEVEL.

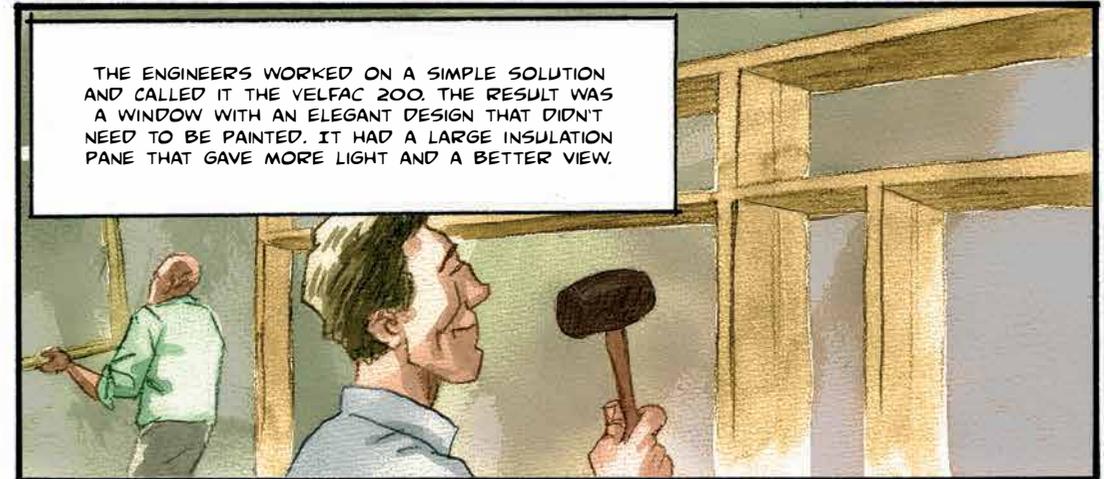


I THINK WE'RE FINALLY THERE. A VERTICAL WINDOW THAT'S JUST AS GOOD AS THE VELUX ROOF WINDOW.

IN 1978 VILLUM KANN RASMUSSEN SAW A POTENTIAL IN A DANISH WINDOW FACTORY SO HE BOUGHT IT AND ENCOURAGED THEM TO KEEP DEVELOPING A QUALITY WINDOW. IN 1985 THEY REVOLUTIONIZED THE BUILDING INDUSTRY.



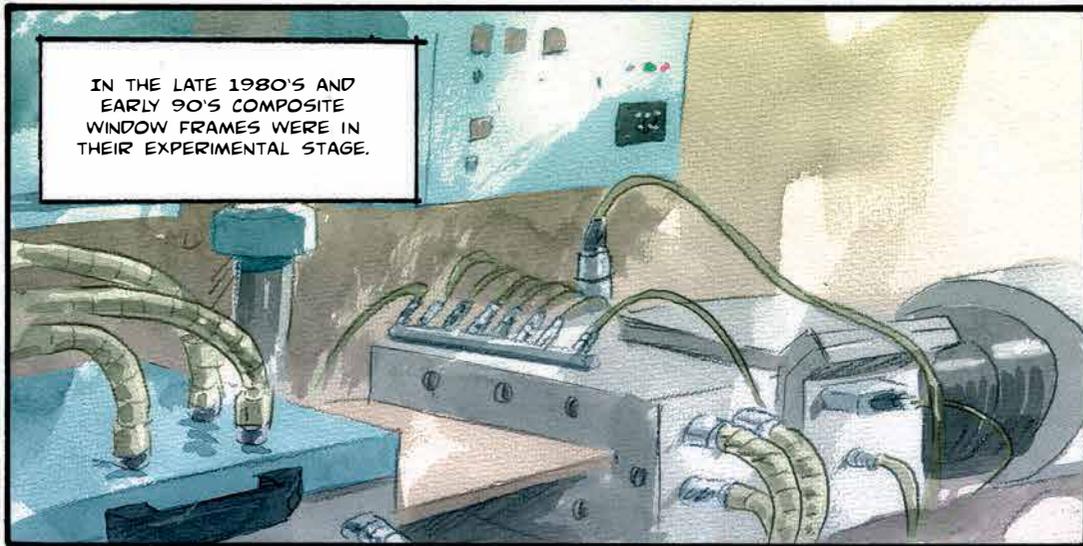
THAT LOOKS NICE, AN ALUMINUM OUTER FRAME THAT WITHSTANDS ALL THE ELEMENTS AND AN INNER FRAME MADE OF DURABLE PINE WOOD. VERY NICE INDEED.



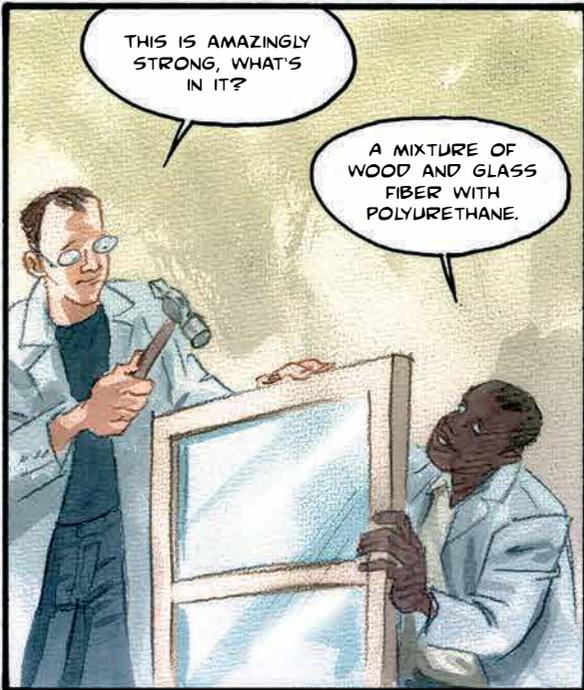
THE ENGINEERS WORKED ON A SIMPLE SOLUTION AND CALLED IT THE VELFAC 200. THE RESULT WAS A WINDOW WITH AN ELEGANT DESIGN THAT DIDN'T NEED TO BE PAINTED. IT HAD A LARGE INSULATION PANE THAT GAVE MORE LIGHT AND A BETTER VIEW.



ALTHOUGH IT TOOK MANY YEARS TO CATCH ON, IT BECAME THE STANDARD FOR VERTICAL WINDOWS IN NORTHERN EUROPE.



IN THE LATE 1980'S AND EARLY 90'S COMPOSITE WINDOW FRAMES WERE IN THEIR EXPERIMENTAL STAGE.

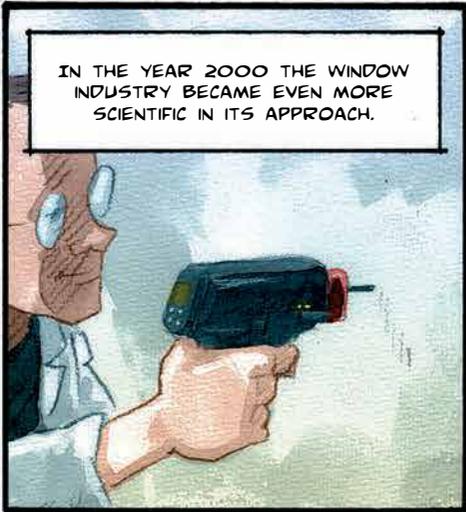


THIS IS AMAZINGLY STRONG, WHAT'S IN IT?

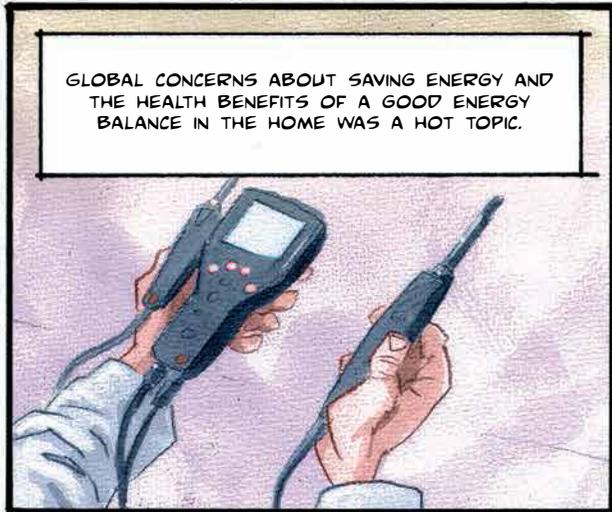
A MIXTURE OF WOOD AND GLASS FIBER WITH POLYURETHANE.



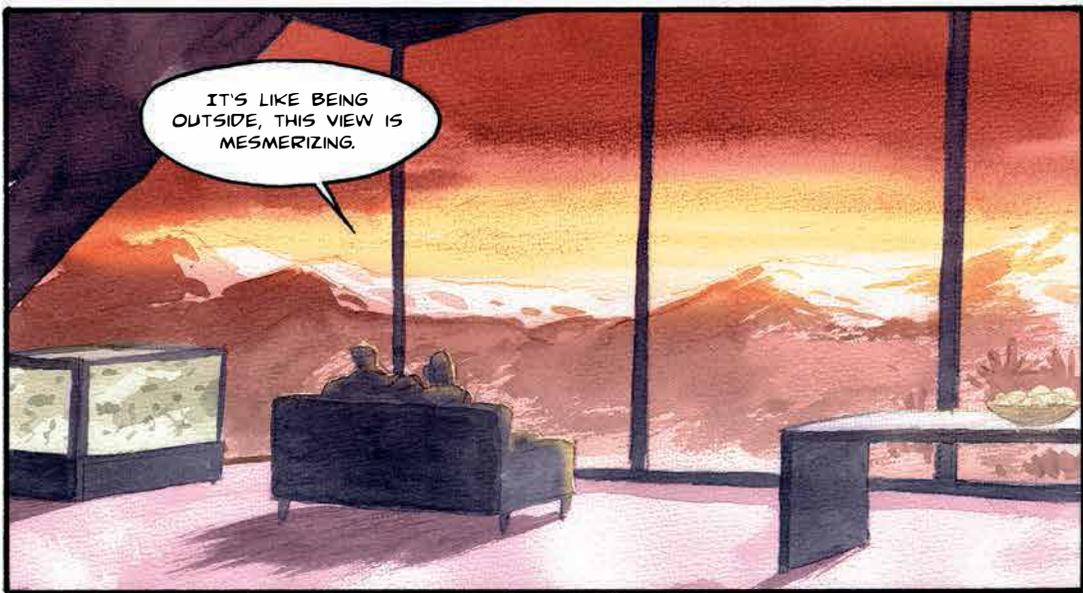
IT'S RATHER LIGHTWEIGHT.



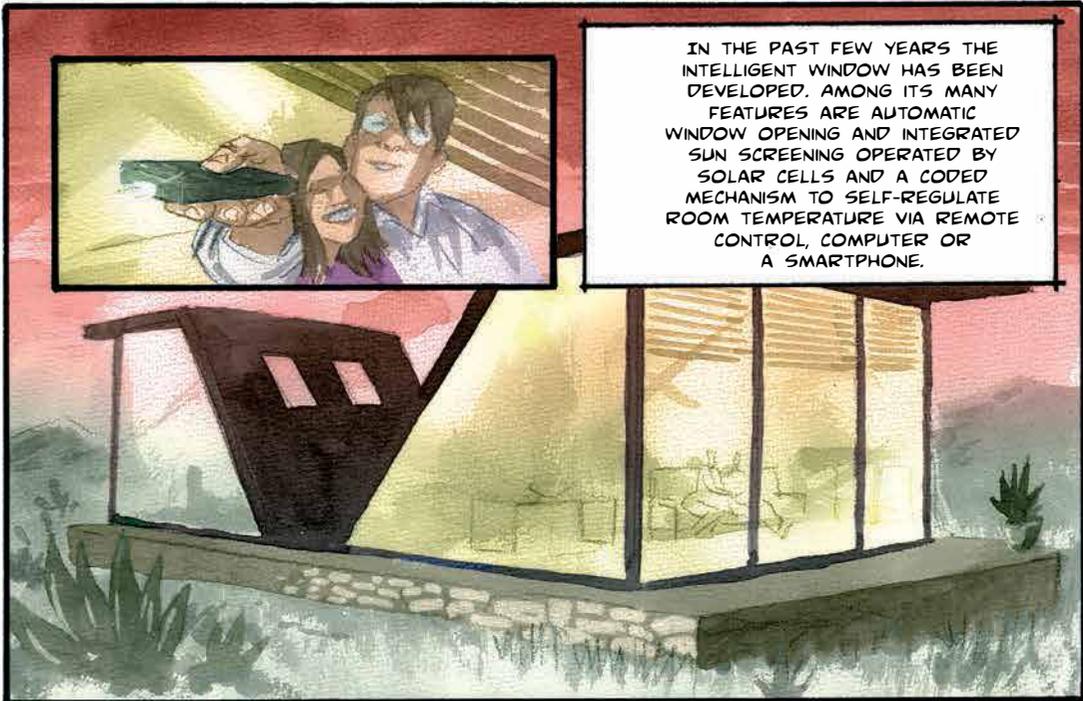
IN THE YEAR 2000 THE WINDOW INDUSTRY BECAME EVEN MORE SCIENTIFIC IN ITS APPROACH.



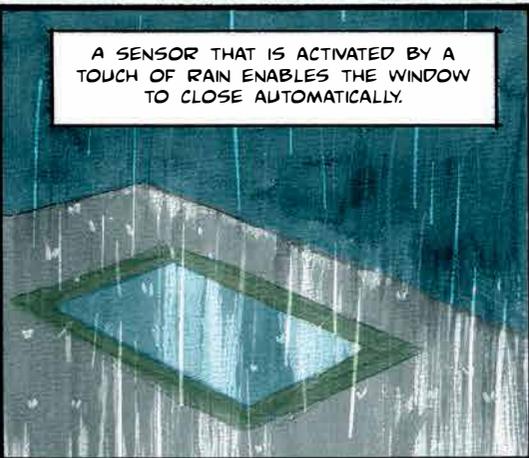
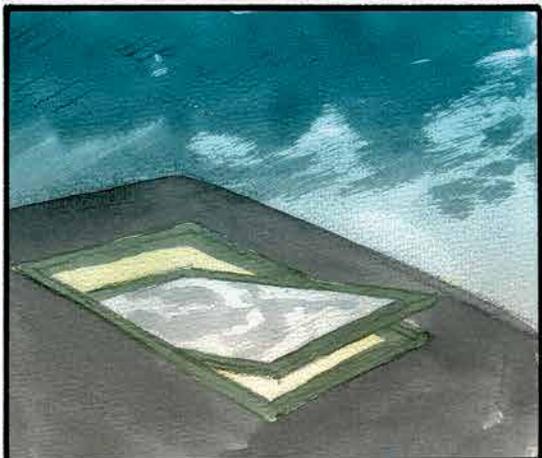
GLOBAL CONCERNS ABOUT SAVING ENERGY AND THE HEALTH BENEFITS OF A GOOD ENERGY BALANCE IN THE HOME WAS A HOT TOPIC.



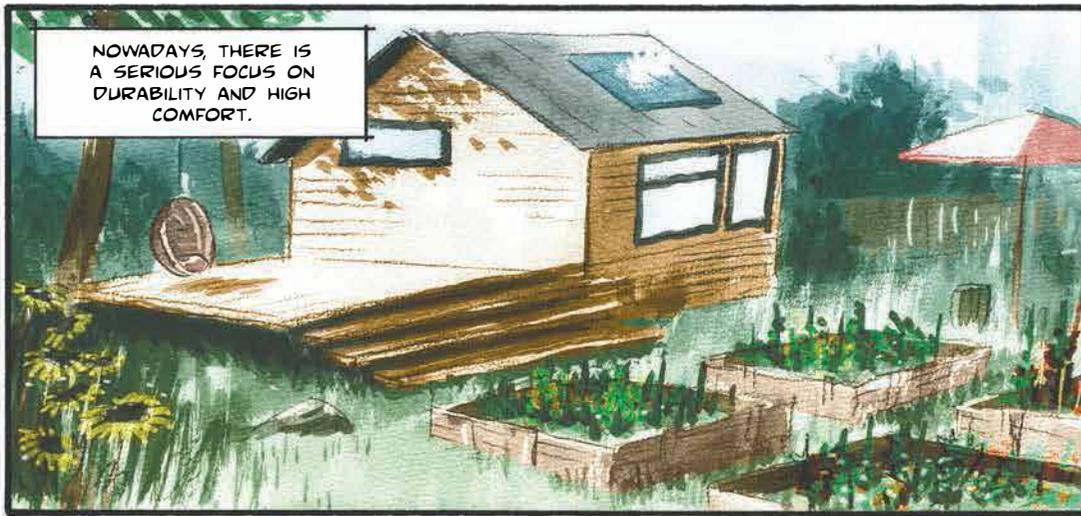
IT'S LIKE BEING OUTSIDE, THIS VIEW IS MESMERIZING.



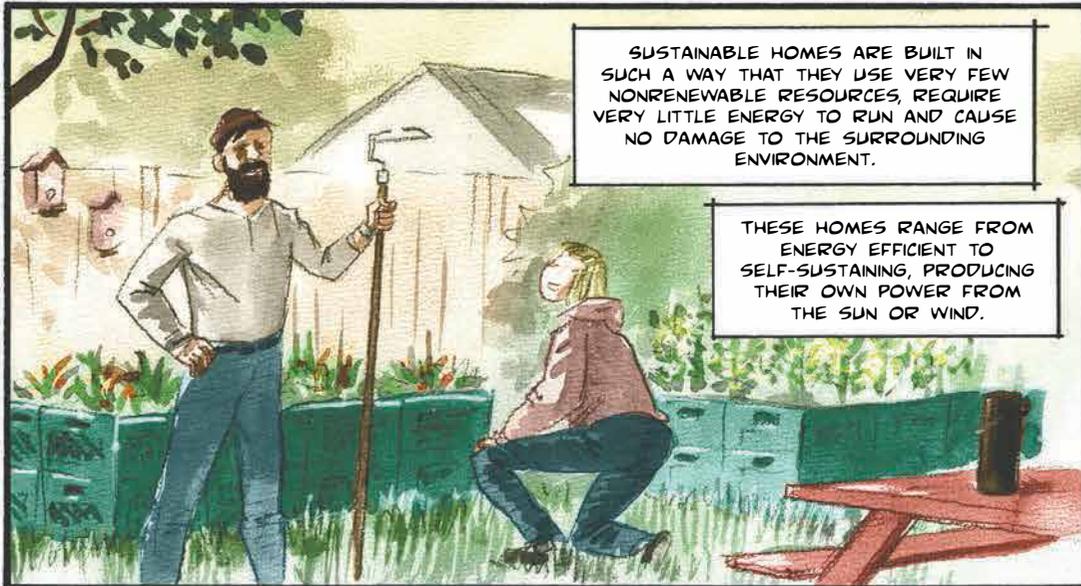
IN THE PAST FEW YEARS THE INTELLIGENT WINDOW HAS BEEN DEVELOPED. AMONG ITS MANY FEATURES ARE AUTOMATIC SUN SCREENING AND INTEGRATED SUN CELLS AND A CODED MECHANISM TO SELF-REGULATE ROOM TEMPERATURE VIA REMOTE CONTROL, COMPUTER OR A SMARTPHONE.



A SENSOR THAT IS ACTIVATED BY A TOUCH OF RAIN ENABLES THE WINDOW TO CLOSE AUTOMATICALLY.



NOWADAYS, THERE IS A SERIOUS FOCUS ON DURABILITY AND HIGH COMFORT.

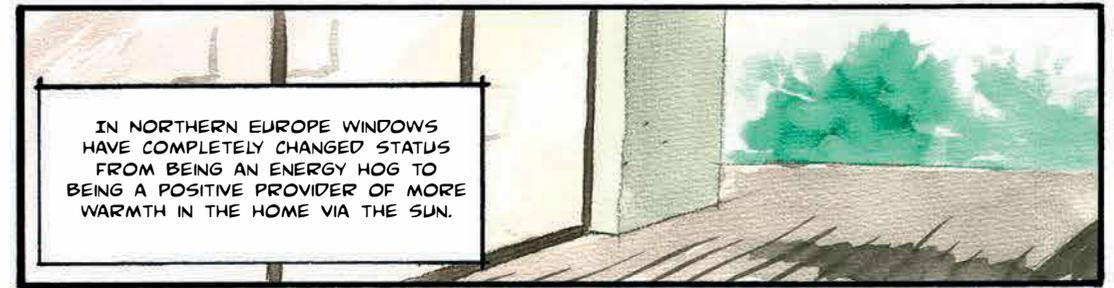


SUSTAINABLE HOMES ARE BUILT IN SUCH A WAY THAT THEY USE VERY FEW NONRENEWABLE RESOURCES, REQUIRE VERY LITTLE ENERGY TO RUN AND CAUSE NO DAMAGE TO THE SURROUNDING ENVIRONMENT.

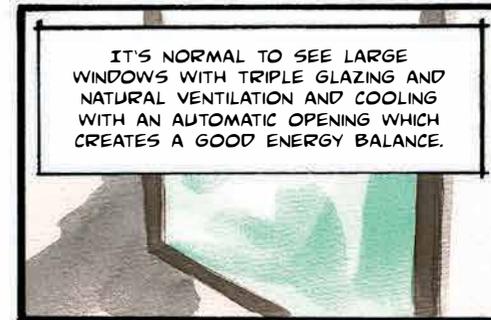
THESE HOMES RANGE FROM ENERGY EFFICIENT TO SELF-SUSTAINING, PRODUCING THEIR OWN POWER FROM THE SUN OR WIND.



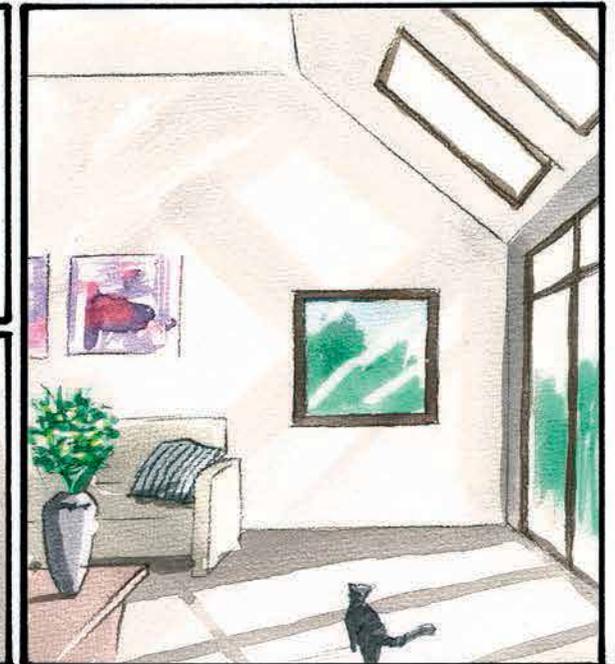
ACTIVE HOUSES ARE A SIMILAR MOVEMENT TO SET A NEW STANDARD OF LIVING. IT'S BASED ON A VISION TO DEVELOP HOMES THAT ACTIVELY PRODUCE MORE ENERGY THAN THE BUILDING USES AND CREATE A HEALTHY LIVING ENVIRONMENT. A VERY AMBITIOUS IDEA THAT IS STILL IN DEVELOPMENT TODAY.



IN NORTHERN EUROPE WINDOWS HAVE COMPLETELY CHANGED STATUS FROM BEING AN ENERGY HOG TO BEING A POSITIVE PROVIDER OF MORE WARMTH IN THE HOME VIA THE SUN.



IT'S NORMAL TO SEE LARGE WINDOWS WITH TRIPLE GLAZING AND NATURAL VENTILATION AND COOLING WITH AN AUTOMATIC OPENING WHICH CREATES A GOOD ENERGY BALANCE.



A LONG, LONG TIME AGO MAN SETTLED IN PERMANENT DWELLINGS; HUNTING AND GATHERING FOR FOOD.



HUMAN BEINGS DEVELOPED A STANDARD OF LIVING TO MEET THEIR EVOLVING NEEDS.



SINCE THEN, TECHNOLOGY HAS COME A LONG WAY. WE'VE COME A LONG WAY.



FOR THE NEXT THOUSANDS OF YEARS HUMANS WILL KEEP ON DEVELOPING THEIR LIVING QUARTERS, AND THE FUTURE CREATION OF GLASS AND WINDOWS WILL CERTAINLY CONTINUE TO EVOLVE, THANKS TO THE CREATIVE IMAGINATION OF MANKIND.

Written by Troels Rasmussen and Craig Frank

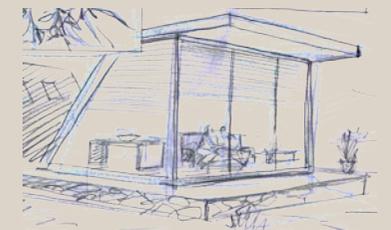
Art by Palle Schmidt
Lettering by Jesper Andersen

Published by VKR Holding A/S
Typeset in VELUX Gothic and Comic Book Commando
Printed in Hungary

© VELUX and VELFAC are registered trademarks used under license by their respective companies

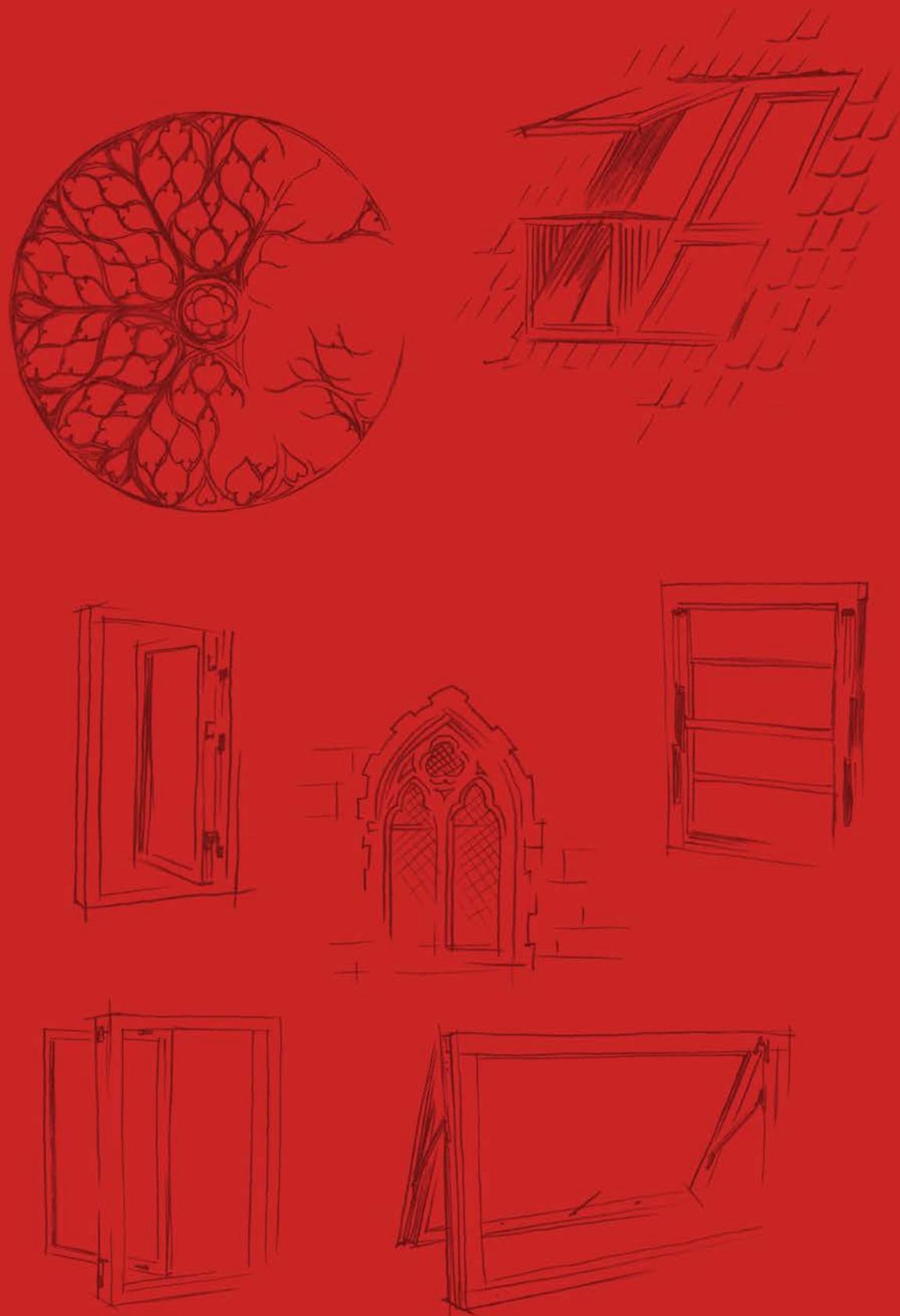


All rights reserved. No part of this book may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, without the prior permission in writing of the publishers.



© VKR Holding A/S
Frank Productions ApS

NOT FOR SALE.
FOR PROMOTION ONLY.



In a dramatic and lively fashion, this Graphic Novel unravels the history of glass and windows, from the discovery and development of glass and the first opening in the roof to the energy saving intelligent windows. The reader is taken on a visual time travel that shows how mankind optimized their homes to create access to enough light, fresh air and open views to better their everyday life.

